Gravel and yellow sand from 20 to 30 feet
Very pure yellow sand from 30 to 35
Blue clay with finer and coarser very smooth pebbles from 35 to 70
Blue clay with fine sand from 70 to 72
Blue clay very fine and tenacious from 72 to 93.
At 93 bedrock of 30 feet thickness, a very hard dark blue rock called limestone, but on inquiry I found it to be very probably the calcareous sandrock of laminated structure, fragments of which are so very abundant in the drift there.
From 123 to 310 ft. soapstone of blue color (100 ft), this subsequently changes to red and then again to blue until near the underlying sandrock where it is brown.
From 310 to 410 blue and grey sandrock.
From 410 to 415 rock very hard, flinty with gaseous pungent odor.
Water very strong salt brine.
415 to 450 softer shaly rock.
450 to 460 rock still softer.
460 to 500 rock still softer.
500 to 510 rock very hard quartzose, water with drops of oil.
510 to 520 rock softer.
520 to 630 dark black shales readily inflammable.

Evolution of inflammable gases from the bore hole. Bottom of bore hole the man reporting to me asserted that he boiled of the salt brine a quart to dryness and had a pound of salt as residue - a perfect impossibility.

The well is now used as a mineral well. It is analyzed by Prof. McKenzie of Lansing. Its taste is not at all salty and very little differs from ordinary hard well water. The pump reaches only a short down in the bore hole and probably only pumps the surface water mixed with very little of the brine of the lower strata. Or else the story of strong brine must be a humbug.

There is another spontaneous well near by which deposits some iron rust and has more mineral taste than the deep well. The persons there make the assertion that this well has in summer time a temperature of 35 degrees Farenheit and in winter much as 20 degrees again an incredible story. At the time of my presence its temperature was 52 degrees Farenheit.

From Constantine to White Pigeon a distance of 4 miles, a perfectly level country extends with a splendidly rich farming soil, and fine farms (a sandy loam). White Pigeon is situated as even as on a floor and is for many miles in all directions surrounded by such land of great beauty and fertility. To the south I notice a depression and undulations of the ground probably the valley of some water current or creek.

Saturday Aug. 30. From White Pigeon to Sturgis a most pleasing level fertile farm country.

From Sturgis to Burr Oak after some miles distance traversed by the road the country becomes undulating hill land but equally fertile. In the depressions between the hills are clear lakes, some larger [illegible] through generally both hills exhibit a large [illegible] of sandstone and argillaceous [illegible] shale [illegible].

From Burr Oak to Bronson the land is more level again. A large tamarack swamp is traversed, but beyond it again good farming country extends as far as Coldwater. Near Branch Station a Dr. [illegible] has two years ago bored to the depth of about 300 feet.

Dr. Bennet [illegible] some specimens and a record of the boring but I could not meet him this forenoon. The specimens which I saw in his office are a dark bluish sandy argillaceous shale. Besides he kept some fragments of brachiopod shells and crinoid stems as coming up from the bore hole.

Boring at Branch near Coldwater. Record of Dr. Bennet.
22 feet drift clay gravel etc.
177 ft. argillaceous shale total depth 199½ ft.
15 ft. hard argillaceous rock, pyrite [illegible], abounding in fossils particularly crinoid stems. I notice also a Chonetes.
4 ft. soft shale
1 ft. hard blue lime rock with quartz portions. total depth [illegible] ft. from surface.
10 inches soft shale.
10 inches. hard calcareous sandrock. [illegible] ft. below surface.
4 inches soft finely stratified sandrock. Rise of water 7 feet.
2 ft. [illegible] inches hard argillaceous calcareous sandrock. Copious amount of shells.
2 ft. soft shale.
7 inches hard shaly and pyritous strata.
4 ft. 5 inches argillaceous shale finely stratified with abundance of shells (Shells at [illegible] ft. total depth).
1 ft. [illegible] inches. hard blue stone, argillaceous, shale [illegible] last drill.
1 ft. [illegible] inches argillaceous limestone, blue hard. Abundance of shells [illegible] ft. total depth.
2 ft. argillaceous shale. No shells.
2 ft. [illegible] hard argillaceous and sandy rock.
2 ft. 10 shale soft like clay with hard streak at top and with shells
1 ft. hard [illegible] sandrock with crinoid stems and shells in abundance.
[illegible] ft. 1 inch shale hard and shells. total [illegible] ft. 1 inch.
[illegible] ft. shale hard [illegible] pyrites, crinoid stems and shells.
[illegible] ft. [illegible] inches shale pyrites and shells, crinoid stems.
1 ft. 7 inches shale, [illegible] shells, abundant crinoids.
[illegible] ft. shale pyrites, shells and crinoids.
Continues the same [illegible] feet below.
1 ft. hard blue limestone with pyrites [illegible] shells and crinoids and salt water (298 total depth).

11 ft. [illegible] shale sand and fine bivalve shells. Brine.
1 ft. 6 inches. Hard argillaceous limerock blue colored with shells
22 ft. 4 inches soft shale, some sand and pyrites. Black bituminous particles mixed. Water continues saline. Total 51[illegible] ft. [illegible] inches. This continues to a depth of 447 feet always being about of the same character as the last stratum. Sometimes layers of limerock between.

In the above record the specimens show that most of the strata are a blue shale with calcareous strata and some pyritous portions besides a good number of shells, chonetes and crinoid stems recognizable.

In the evening I went 3 miles west from Coldwater along the railroad, and then a ½ mile south across the creek there, where a brickyard is opened on the hill. The clay is a stratified shale with kidnet iron ore nodules and some harder arenaceo-calcareous thin ledges which belong to the subcarboniferous series but at which horizont I can not determine by the total absence of all fossils. The strata are partly horizontal, partly very much flexured by lateral pressure

Diagram of above.

Only a ½ mile northwest of this place is the locality where the above described boring has been made at a deeper level. The east side of the hill does at a lower position right below the brickyard not exhibit any strata. It is there all drift gravel.

In a cut of the railroad about 2 miles from Coldwater the upper strata of the drift contain many of the fossiliferous kidney iron ore nodules and ferruginous limestones, which resemble much the nodules of the brickyard but these latter in spite of their great abundance do not contain a single fossils and must represent another horizon. In other localities near by, the drift does not contain any of the iron nodules.

The brickyard of Coldwater is in Sec. 30. T. [illegible] S. R. [illegible] W.
Railroad cut with fossiliferous kidney ore is in Sec. 20 of same town.
The Artesian well boring is Sec. 25, northeast quarter, in the town of Batavia R. 7, T. [illegible].
Plain outcrop of argillaceous sandstone in bed of creek on land of Merrit, Sec. 1[illegible]. T. 5 S, R 7 W. Union Township. In this latter locality the plastic shale with kidney ore forms the top portions of the ground and is found scattered all over it. So the sandstones would follow most below this.

In south part of Sec. 2[illegible], in Coldwater town at Warren's brickyard the same plastic shale is dug, and at the base of the shale this gritstone is again making its appearance. (Argillaceous sandstone).

[illegible] mile further north in Sec. [illegible] of the same township a large outcrop of the [illegible] shaly sandstone and [illegible] beds [illegible] along the banks of the creek. This shale seems to [illegible] the surface [illegible] surrounding country but [illegible] it is [illegible] not very thick drift covering. The outcrop at this creek in Sec.[illegible] is exhibiting about 50 feet of the strata. Light blue colored arenaceous shales some harder, some indurated to regular [illegible] sandstone beds or [illegible] prevail, and a sandy limestone forms seams in the series. Besides these a large number of iron [illegible] internally all with a limestone nucleus are forming seams or are dispersed through the shale. Usually they do not contain any fossils but some of them contain a large number of them correspondent in kinds with those found at [illegible]. In the same strata among others I found a large Nautilus.

The fossils appear to be more abundant in the limestones and nodules of the top strata. In the lower beds I did not observe any. Also the shales and sandstones do not contain any. The fossils are connected with the calcareous or ferruginous beds.

About 1 mile north of Larrandines farm we crossed a depression in which Round Lake is situated. In digging a ditch from the lake a great many sandstone slabs which belong to the higher Marshal sandstone are thrown out with the drift, and some of these arenaceous pieces contain fossils identical with those of the ferruginous limestones. It appears to me that the fossiliferous beds of the Marshal group and the iron geode beds with fossils are not very far apart and in immediate succession to each other.

Near the village of Allen (north of it) south of railroad the drift contains many thin-bedded sandstone slabs but I do not see there any actual outcrop of sandstone.

Subsequently I found a Lingula and Chonetes in the arenaceous shales thrown out from the well and in the calcareous nodules of the same strata. 3 miles south and 2 west of Mr. Larrandines farm is another similar outcrop of the shales and arenaceous sandstones.

In railroad cut about 1 mile west of Jonesville the Marshal sandstone of usual brownish color and thinly laminated beds make an outcrop. Otherwise the surface exhibits only coarse boulder drifts.

Wednesday Sept. 3. Railroad to Osseo. Once near Hillsdale opens the strata of the sandstone. The remainder of the cuts exhibit only very gravelly drift of considerable thickness.

[illegible] from Osseo village one traverses [illegible] high hill ranges composed of gravel. The third row on the east and west line separating towns Jefferson and Adams a [illegible] of very good outcrops of the sandstone with characteristic fossils [illegible]. In [illegible] places a thickness of 40 to 50 feet of the sandstone may be seen. At the [illegible] of the outcrop a strong spring of good water issues.

[illegible] of [illegible] cylindrical [illegible] very [illegible] similar [illegible].

The land [illegible] is apparently equally hilly like the land [illegible] north of the railroad. Very good agricultural district.

Following from Hillsdale the road west on the south side of Southern Michigan rd (RR) a high hill is ascended. Its first elevation exhibits a deep cut composed of drift almost entirely composed of slabs of the Marshal group and some few geodes of the fossiliferous iron ore group. Higher up the drift is almost destitute of these sandstones and consists of pebbles of the metamorphic series with more or less limestone pebbles of the Hamilton, Helderberg and Niagara group.

At the foot of the southern slope of this hill is a brickyard working up a very fine bed of drift clay. The Fort Wayne road is ½ mile south from there. Its cuts are unstratified gravel, boulder and clay accumulations.

About 10 rods west of the depot the Marshal sandstone is uncovered in the cut to the depth of 3 feet. Thin sandstone beds greenish or partly reddish brown of color containing in seams the usual fossils and concretionary nodules. In going to the depot, I notice outcrops of the sandstones in the street and on both sides of the bluffs over which the railroad bridge is expanded.

To North Adams many cuts through gravel. No more rock ledges seen. Near North Adams drift with much clay beds used for brick making. A mile before arriving at Jerome Station a cut through coarse unstratified gravel with many sandstones slabs. The following cut is all fine gravel without such slabs.

Near Somerset Centre all fine gravel and clay in stratified beds. Many marshy flats between the gravel hills, apparently the beds of former lakes. Somerset large drift hills with clay beds and gravel.

Near Woodstock large cut through stratified gravel. Marshy flats between the gravel hills continue. Same character of the surface prevails all the way to Ypsilanti.

Grass Lake mineral spring is only a well dug in the drift. No deep boring ever made there. A bore hole was sunk at Michigan Centre of which I am told that the same strata was penetrated which are found in Jackson borings.

At Brown's Station near Bridgeman's Station 12 miles north of New Buffalo an outcrop of brown sandstone about ½ mile from the lake shore. At Grass Lake many fossiliferous slabs of the Marshal sandstone in the drift.

At the mentioned locality I [illegible] the strata rising in a bubble and forming a hill from which the ledges dip away in various directions. In all about 10 feet of the strata are [illegible] have all [illegible] and the same lithological character. The [illegible] living there call them sandstones but use the purer kinds of it cropping out at the [illegible] of Ottawa Lake for lime burning.

Diagram.

N.B. In all the sinkholes the rock is to be found close under the surface only covered by a thin coating of soil.

No fossils of any kind observed, but I suppose the strata to be inferior to any we have hitherto seen on this trip. The rock differs considerably from the lower brecciated limerock and the connected beds cropping out in the more eastern localities. It is a very durable building stone for ordinary purposes, much better than any of the Monroe strata.

Sunday Sept. 14. Visited the quarry near Ottawa Lake again. The locality is one of the above described sinkholes. At the deepest spot of it the brecciated limestones of Monroe are plainly recognized as cropping out. On a higher level only 10 steps further west the ledges of the arenaceous limestone described above as being the quarry stones are found and according to their dip southwest, while the limestones come out at the northeast side of them, proves sufficiently the lower stratigraphical position of the brecciated limestones.

The arenaceous rock contains fish remains and some layers of it are perfectly similar to the glass sandrock whom they represent.

Diagram.

Exposure on Mr. James Cummins land in town of Whiteford in Sec.1 east half of southeast quarter of Sec.2, T. 3, R. 6 East. 2 big sink holes on an extended marshy flat, rock of calcareous nature much fractured and geniculated cylindrical holes. Some of the layers are a hard arenaceous looking rock like the beds at Ottawa Lake. In the big sink the rock is in big heavy blocks with large fissures extending down to considerable depth through which the water escapes. The sinkholes are now perfectly dry but in spring sometimes 15 and more feet of water are over the space forming big lakes.

Ida stone quarry.
[illegible] ft. drift clay.
[illegible] ft. of sandstone in very thick solid ledges.
[illegible] feet of variegated limestone under it as far as visible.

[illegible] miles east of Ida close to railroad a large [illegible] which [illegible] feet of white crystal [illegible] limestone [illegible] any [illegible] [illegible] particular [illegible] are [illegible] for lime burning.

Island.

[illegible]

[illegible]

[illegible]	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	1.
	[illegible]

Carb. limestone [illegible]	
Insoluble residue	[illegible]
Iron and alumina	.7
Carb. lime	[illegible]
Carb. magnesia	1.
	[illegible]

Carb. limestone [illegible]	
Insoluble residue (quartz)	4.
Iron and alumina	1.
Carb. lime	[illegible]
Carb. magnesia	1.
	100

Carb. limestone Parma	
Insoluble residue (silicious)	[illegible]
Iron and alumina	1.1
Carb. lime	[illegible]
Carb. magnesia	[illegible]

Ferruginous brown limestone forming the top layers of Carb. limestone near Parma

Insoluble silicious residue	2.9
Iron and alumina hydrate	12.4
Carb. lime	[illegible]
Carb. magnesia	11.4
	[illegible]

Water

Ferruginous limestone in the same position Bellevue.

Silicious residue	9.
Iron and alumina	5.5
Carb. lime	36.
Carb. magnesia	23.
	93.5

Calcareous sandstone below Carb. limestone Bellevue

Quartz	69.
Iron and alumina	0.5
Carb. lime	30.

Limestone Plaster quarries Grandville

Argillaceous residue	18.
Iron and alumina	4.1
Carb. lime	48.
Carb. magnesia	27.
	97.

Calcareous concretions in black shale Big Traverse Bay.

Insoluble bituminous and silicious	7.5%
Carbonate of lime	89.
Carbonate magnesia	2.
Iron and alumina traces	
	98.5

Limestone Hamilton group-upper horizon Little Traverse Bay.
smooth conchoidal fracture.

Insoluble bituminous and silicious	.5
Carbonate of lime	92.
Carb. magnesia	1.
Iron and alumina traces	
	99.5

Yellow Dolomite above the former Little Traverse Bay

Insoluble	.5
Alumina with some iron	1.5
Carb. lime	53.
Carb. magnesia	50.
	55

Dolomite Hamilton Group, Big Traverse Bay near Norwood immediately below black shales.

Insoluble residue	.1
Alumina and iron	2.5
Carb. lime	71.
Carb. magnesia	22.
	95

Oolithic limestone Plum Creek Monroe

Insoluble residue silicious	.5
Iron and alumina traces	
Carb. of lime	51.
Carb. magnesia	37.
	98.5

Mottled limestone from Ida Township, Sec. 11. Below [illegible] beds.
Equivalent to the above oolithic

Insoluble residue	4.
Carb. lime	54.
Carb. magnesia	42.
Scarcely traces of iron and alumina	

Acicular limestone quarries near Ida Station.
Insoluble residue insignificant, not weighed
Iron and alumina only traces.

Carb. lime	55.
Carb. magnesia	30.

Upper [illegible] limestone [illegible]

Insoluble quartzose residue	2.
Iron and alumina traces	
Carbonate of lime	98.5
Carb. magnesia	10.1

1877

Cleveland.

Black Shales and Superincumbent Waverly Group.

Name. Cleveland, Leonard House. A.E.Ewing, Richfield Ohio.

Diagram

Thursday Sept. 18. Left Ann Arbor for Cleveland. Arrived Friday morning at 6. Mr. Newberry was not at home but was expected during the day so I waited for him. Could not make any acquaintance which helped me in any way to pass away the forced inactivity of the day.

Saturday. Visited Dr. Newberry. Afternoon went with him to see the outcrops of the Waverly formation forming the hills and terraces south of the city. The exposures are most beautifully distinct and exhibit the sequence of the strata as delineated in Newberry's 1 volume. Evening went to Berea.

Sunday Sept. 21. In the morning I saw the extensive quarries opened above and below the village of Berea. The quarry stone is overlaid by dark blue almost black shales which are said to contain Lingula and Discina but I did not find any. These shales are seen in the thickness of about 12 or 15 feet. Then follows the Berea sandstone whose thickness I estimate to 50 feet. It is in places a solid mass, beautifully stratified coarse grained sandstone in beds of 5 feet thickness. In other places the same strata are full of ripple marks and separate in flag stones of large size. Other times the rock is thin bedded and of discordant stratification. Also wedging out of the beds is noticed and in place of sandstone a lenticular mass of arenaceous shales may be interposed. The upper beds are very pyritous. Also in the lower horizon are pyritous beds.

Following the river down across the railroad the Berea grit forms for a while high cliffs along the valley. Then red shales, Bedford shale, break out from under them 40 or 50 feet thick with (a) few thin sandy micaceous layers and some calcareous ferruginous concretionary layers.

Under the red shale follow dark blue almost black shales, Cleveland shales, also with arenaceous and calcareous beds interlaminated. The latter contain in certain layers numerous bivalve shells and Lingula and Discina. The black shales apparently are 50 or 60 feet exposed. They [illegible] the black shale (Cleveland Shale) above the Erie shale at Cleveland but I did not observe an equivalent of the fine grained quarry stone of Cleveland interposed between the red shales and the black shales. In the afternoon I found an abundance of Lingula and Discina in the shales above Berea grit.

Monday Sept. 22. [illegible] Medina via Grafton. Near [illegible] I notice in the creek the Berea sandrock. In Medina in the bed of a small creek a layer of extremely fossiliferous sandstone forms the surface.

A number of fossils [illegible] collected [illegible] and a [illegible] water number [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. Remained at Medina [illegible].

Tuesday. Took a horse and buggy with a man [illegible] for Bagdad, Weymouth and Richfield where similar fossiliferous rock beds are pointed out to me.

Near Bagdad the river bed and hillsides are composed of [illegible] shales with occasional limy banks and nodular ferruginous calcareous concretions. And beds of sandstone throughout the whole thickness which amounts to about 150 feet. Some traces of fossils may be found. But certain seams are very rich in them, the same species as at Medina besides several others not found by me there, also crinoids, Bryozoa, many fucoids (caudagally(?) type). In somewhat higher strata Chonetes are quite abundant.

Near Weymouth the same strata are exposed also in great thickness below some sandstone banks which are used for ordinary building purposes. Land very hilly with deep valleys.

Towards Hinkley and Richfield the ground rises still higher and the formation is exposed in a thickness of about 200 feet, all shales and thin slabs of sandstone, partly hard calcareous and with ferruginoo-calcar. Kidneys. Fossils same as at the other places with several others not noticed before. Crinoids found on the east and west side of village but rare and strata not well opened. Returned Wednesday evening to Medina. Packed two boxes and shipped them by express.

Thursday Sept. 25. Returned to Cleveland. Rainy day. In notices of yesterday I forgot to remark that above the Cuyahoga shales which are fossiliferous to the very top, heavy beds of the conglomerate sandstone are spread out on the hill on which Richfield is situated. The creeks have eroded vertical chasms into the rock which forms walls of 50 feet hight on both sides of the narrow fissures through which the creeks run. The sandstone is partly a coarse grained sandstone of white color or rose colored or stained with brown ferruginous seams or it is a regular conglomerate with quartz pebbles of the size of a pea up to a walnut.

4.3 in the afternoon went to Bedford. At Bedford commencing near the railroad bridge which reposes on Berea sandstone in following the creek downwards through the narrow fissure-like valley with perpendicular walls. First below is seen the Bedford shale in a thickness of about 70 feet composed of shales with thin sandstone ledges and occasionally with nodular or concretionary calcareous beds which contain in some places many bivalves and Brachiopodes, Orthoceras ectr. but only in nests. Otherwise scarcely a trace of fossils can be seen.

Below the Bedford shales follow 15 or 20 feet of black shale and under it are the Erie shales opened. Their upper terminal beds are evidently gritstone. Below them follow a soft greenish shale with very calcareo-arenaceous beds irregularly containing immense numbers of a fine branching fucoid. No fossils could be found in them.

Diagram of above.

Returned to Cleveland on Friday noon and proceeded to Columbus with 2:70 train.

Expenses at Bedford	2.
to Cleveland	.50
to Columbus	1.50
Supper	.75
to Cincinnati	1.
at Cincinnati	2.
to Portsmouth	2.

Friday night went to Cincinnati. Arrived there Saturday morning. Went with Lohr over Sunday to Barton (?). Left Cincinnati at 5 in the evening Tuesday, Sept. 30. Arrived at Portsmouth Thursday morning at 5 o'clock Oct. 2. Went by railroad to Scioto ville.

Close to village an outcrop of sandstones and shaly sandrock layers, from the bed of the river to the top of hills 200 feet high. Below thin bedded shaly sandstone with immense numbers of Sandagalli fucoids and some calcareo-arenaceous bands with iron-oxyd, containing a few Productus and Rynchonella. Above shaly sandrock without any fossils 100 feet about. Then sandrock in thicker beds which in the upper regions contains lenticular nodules of ferrugino-calcareous rock which are filled with fossils. Otherwise fossils very scarce. Above this some hard shining sandrock layers and then yellow sandstone in thin slabs. Above this the hill top is formed by about 50 feet of shales and fireclay containing Ligillaria and calamites. Also a coal seam 6 inches thick. This upper shale is evidently belonging to the coal measures and had nothing to do with the underlying fossiliferous sandstone.
at Scioto ville 2 dollars. to Cincinnati 4 dollars.

Diagram in back of book of Berea shale

Memorandum in back of book. Waverly localities, Ohio.
Base Bedford C. 13 miles fr. Cleveland Pittsburg R.R.
Typic(al) section. page 197, Geology of Ohio.
Upper Waverly. Cuyahoga Falls Junction on same road 32 miles from Cleveland. Section at Cuyahoga Falls.
1. Coal measures, hills 1 mile back of river.
2. Carbon. conglomerate. Banks of river 100 feet.
3 Cuyahoga shale bed and banks of river. From Cuyahoga Falls to Peninsula. 200 feet.
Berea grit extr. at Peninsula and below
More fossiliferous localities of same strata are to be found in Medina Co. Vide subj. pages.

Loc. for fossils of Waverly. Upper Waverly. Medina in the bed of stream in town under a bridge. Other towns nearby Bagdad. Richfield and Lodi. Weymouth.

Good loc. for Waverly is Berea. In base of Cuyahoga shale above. Very few fossils in Berea sandstone. And some in calcareous bands in the red shale under Berea grit.

In central and southern Ohio. Newark and Sciotoville.

Maxville. limestone best shown at Newtonville in Muskingum County.

Minster garden 5 Apr.
Portsmouth to Lancaster. From there to Junction City. From there to Newark. or from Logan to Maxville.

Diagram

[illegible] Holbrook, Lebanon, Warren Co. Ohio.

300 Pearl

Berea Grafton Medina C. red

From Medina by wagon to Richfield.

(Medina, Bagdad, Weymouth all very fossiliferous)

Check 844 from Sciotoville to Cincinnati.

C. Rominger Expense account 1873

Received for Expenses of Geological Survey			
May 21, 1873	1 draft of	$500.00	
Aug. 12	"	300.00	
" 25	Drawn from bank for travel expense	50.00	
April	Expenses for Geological Survey.		
" 24.	Journey to Lansing		8.00
May 12	" " Detroit		4.00
16	" " to Geol. Board meeting		4.50
21	" "		4.50
	Tent		10.00
	1 compass		3.50
	Maps		5.00
24	R.R fare to Jackson for two		2.30
	Dinner		1.00
	Matraze		5.00
	Supper		1.00
	Room 3 days per week		6.00
24	Eastward traveling expenses		1.50
	" "		2.00
	Supper		.50
25	Up to Portage R. driving back by buggy to carry the load and meals		3.00
26	To Schoemakers Farm at noon to Walkers mines. In the evening arrival of student offering his services. Expenses during the day for him and me		2.50
27	Out to Walkers mine and to Huberts mine, expense		1.00
	Meals to noon		1 50
	To Ann Arbor		1.15
28	Days expenses		3.00
29	R.R. fare to Napoleon and back		.70
	R.R. fare to Albion		.75
	Hotel expenses during the day		2.00
	Hotel expense at Albion		2.00
30	Return to Jackson ectr		2.00
31	Traveling expense by R.R. and meals		3.50
1	Sunday home		3.00
2	To Eaton Rapids R.R. fare		2.00
	Meals		1.00
3	Hotel bill Eaton Rapids		2.25
4	Traveling expense R R		3.00
5	Hotel bill at Bellevue		3.50
5..	Traveling expense to Grand Rapids		4.00
6	Hotel Friday to Sat.		5.50
	To Jackson		3.00
	At " dinner		1.00
	To Ann Arbor		1.15
	Transportation and freight of specimens		1.00
June 16	R R. fare to Battle Creek		
	Dinner		.75
	Hotel bill at " "		3.00
17	Battle Creek to Bellevue		.50

June 17	Hotel bill at Bellevue	3.00
	To lansing	1.00
18	Hotel bill at Lansing	3.00
	Omnibus	.25
	To Grand Ledge	.50
19	Hotel bill at Grand Ledge	5.00
20	Man for packing	2.00
	Transportation of specimens and omnibus	.50
	R.R. fare to Ann Arbor	3.25
	Meals at Lansing	.75
27	Mason Hotel bill	2.00
	Dinner at Jackson	.75
	Ommibus at Ann Arbor and transportation of specimens	.50
22	At Ann Arbor	
23	R.R fare to Owosso	5.00
	Incidental expense for persons assisting me in the investigations at Owosso	5.00
	Hotel bill at Owosso from 23 to 28th	12.00
	Team to Flint for 2 days	8.00
	Team to 6 mile creek	2.00
	Expense to Flint , hotel bill and for driver	5.00
	Paid for mending a broken spring on carriage	2.00
	Expenses from Owosso to Ann Arbor	3.00
	Transport of specimens	1.00
30	Monday left Ann Arbor for Saginaw	
	To d Detroit	1.15
	At " expense	1.00
	To Saginaw	4.60
	Expenses at Williamstone	2.00
	For the miners	1.00
	Dinner at Lansing	.75
	Hotel bill at Saginaw 3 days	9.00
	Additional expenses	
July 4	To Bay City	.75
	Hotel expense	3.00
	Additional exp. for persons assisting the survey	2.00
5	To Alabaster	3.00
	Per boat to Tawas	1.50
	Hotel	3.00
6	To East Saginaw	2.00
	At " "	1.50
	Stage to Vassar	1.50
	At "	2.50
	To Caro	1.50
	From Caro horse and buggy to Cass City	6.00
	A man as guide for 2 days	5.00
	Expenses for him and me	6.00
	Box for specimens	.50
	Hotel bill at Caro	3.00
	Stage to Saginaw	2.00
	Saginaw hotel expense	1.50
	R.R. fare to Ann Arbor	4.00
	Hotel bill at Jackson	2.00
	Freight for boxes	2.00

July	Ann Arbor to Port Huron	4.00
	To White Rock	2.00
	Meals	.50
	Expense at White Rock	2.50
	Stage to Port Austin and intermediate points with meals	4.00
	Hotel bill At Huron City and Grindstone quarries	3.00
	Hotel bill at Port Austin, Fri. Sat. and Sun.	5.00
	Carrying specimens -	
20	Horse and buggy to Willow Creek	3.00
	For meals and horse feed	1.00
	Specimen of goniatite	.50
21	Mon. To Carsonville and Wild Fowl Bay	2.50
22	Tues. Hotel bill	2.00
	Stage to Caseville	1.00
	Transportation of specimens and box	1.00
23	Wed. Excursion to Oak Point and Hat Point, man and boat	3.50
	Hotel bill at Caseville	3.00
	Steamboat to Bay City with meals	3.00
	R.R. fare to Owosso	1.50
	Hotel bill at " one day	3.00
	To Ann Arbor, R.R. and other expense	4.50
	Freight for specimens	2.25
	" "	.75
29	To Monroe	2.35
	At " (either ditto or ectr).	1.00
	Horse and buggy	3.00
	Hotel bill	3.00
	To Adrian	1.25
	Hotel bill	1.50
	To Jonesville	1.25
	At "	2.00
	Fri. To Hillsdale and back	.75
	Dinner	.50
	To Albion	1.00
	To Geygers - buggy	2.00
	Hotel bill at Albion	2.00
	Dinner Marshal	1.00
	R.R. fare to Kalamazoo and omnibus	1.75
	Expenses at Kazoo 2 days	6.00
	Horse and buggy ½ day	2.00
Aug. 4	R R. fare to Holland	1.50
	At Holland	3.00
15	To Grandville	.60
	At "	1.50
6	Return to Kazoo	2.00
7	Hotel bill at Kazoo	3.00
	Expense to Ann Arbor	4.00
8	Freight for specimens	1.50
	To Detroit and back	5.00
12	Tues. To Grand Rapids	4.00
	At " "	3.00
	To Ada	.50
	At "	1.50
	To Ionia	1.00
	At "	3.00

Aug.	Thurs. From Ionia to Howard City	1.25
	At " "	.75
	To Big Rapids	.65
	To Clar Lake	1.25
	Ommibus	.25
	At " " dinner	.75
	To Traverse City	1.45
	Hotel bill at Big Rapids	2.00
	" " " Traverse City.	4.00
	To Norwood	1.00
	At " hotel bill	1.50
	To Traverse City	1.00
18	Tues. At Traverse City	1.50
	To Reed City	2.45
	To Saginaw	2.70
	dinner	.50
	East Saginaw	3.00
22	Thurs. to Otsego Lake Friday back again	8.00
	meals	2.00
	East Saginaw, dinner and ommibus	1.25
	Return fare to Ann Arbor	5.00
	Additional expenses	.75
26	Tues. Dowagiac, hotel	1.00
	Wed. Michigan City, breakfast	.50
	R.R. to Michigan City	5.50
	At " " hotel bill	3.00
	R.R. fare to Niles	1.00
	At " hotel bill	3.00
	To Three Rivers	1.00
	To White Pigeon	.50
	Dinner at Constantine	.75
	Hotel bill at White Pigeon	2.00
	R.R. fare from " " to Coldwater	1.20
	At Coldwater Sat., Sun., and Monday. Hire of buggy for 2 days and expense for traveling with Dr. Bennet	12.00
	Allen - buggy, and hotel with Bennet	4.00
	To Hillsdale	.50
	At " hotel 2 days	4.50
	R.R. to Osseo and back	.50
	Return to Ann Arbor, Cincinnati, Dayton & Hillsdale R.R	2.00
	To Grass Lake and back	1.80
	dinner	.50
Sept. 9	Left Ann Arbor with horse and buggy, expense on Tues.	3.00
10	Wed. From Flat Rock to Trenton, expense	.75
	To Newport, Hotel bill	2.00
	Thurs. to Stony Point and Monroe	7.00
	At Monroe for horse	1.00
	At " hotel	2.50
	other expense, boxes actr.	.50
	Friday hotel bill	3.00
	for horse	1.00
	Trip to Ottawa Lake with Mr. Bartlett	4.50
	Sunday with horse	3.00
	Monday to Milan	3.00

Sept.	At Milan Monday over night	1.50
	For horse and buggy 8 days	16.00
16	Tues. arrived at Ann Arbor.	
	Thurs. For Detroit and Cleveland	5.00
	Kennards Hotel Fri. and Sat.	6.50
	To Berea	.50
	At "	3.50
	Mond. to Medina	.95
	From Medina to Richfield	12.00
	At "	3.00
	Boxes and delivery	.50
	Thursday morning left	
	To Cleveland	1.40
	Ommibus	.25
	At Cleveland dinner	1.00
	To Bedford - Cincinnati.	
	Freight for specimens paid to express Co.	5.25
	To Detroit twice	

Notes in book following expense account of 1873

C. Rominger

Prof. Marsh, Yale College, New Haven. Corals and Sponges.

Art(esian) well at Albion 285 feet. Drift 10 feet, Sandstone of varying hardness 271 feet. Under blackish shale 4 feet. The lowest 40 feet looked much like Lake Huron grindstones. Another well nearby found the same thickness of sandstone & shale 100 feet.

Expenses for geological survey Apr. 24,25, 1873. Trip to Lansing going and coming $4.50, Hotel $3.00.

Chr. Frey paid interest due Jan. 18, 1873, $25.00

At Marengo borings. First also sandstone but not so thick, 60 feet drift above sandstone. Sandstone 200 feet, then shale also about 200 feet. Below a kind of chalky formation of soft constituency.

Wild Fowl Bay. Lowest 4 feet of greenish sandstone opened, No.1. Above No.2 limestone even bedded with thin seams of flint, 1 foot. No. 3, 6 inches of limestone separated from No. 2 by a shaly seam. No. 4, thin seam of sandstone. No.5 and 6, 1 foot of limestone, 6 inches thin laminae. No. 7, limestone bituminous 8 or 10 inches. No. 8, 1 foot bituminous limestone. No. 9, 2 banks of 1 foot limestone. No. 10, Similar 1 foot bank with white columnar seams(or stems). No.11, arenaceous looking limestone with allorisma, 2 feet. Top of embankment.

On Pine Bog Creek at the house of Mr. Smally. Strike for the lake limestone west of Hat Point.

Tompkins, Photographer, Grand Rapids.

Morgan's mortgage on Block No.3 north in Range 14 in the city of Ann Arbor.

Possibly intended for diagram of above location

Erid. strict. Ed.(Canad.Journ.) gemat calcinae Diameter of larger corall is 4 to 5 lines.

Diphyphyllum arundinac Bill. 3 to 4 lines in diameter. Usually distinct from 1 to 3 lines. Radial septae from 40 to 50 rarely reaching the centre.

Diphyphyllum Stramin. About 2 lines in diameter. caeterium like the former. Erid. simcoense. Diameter 2 to 3 lines (usually straight) or flexuose.

In McCoys synopsis of Carb. Fossils Aulopora from Louisville similar to Fania(or Ionia) antiqua

Diagram of above.

For Bryozoa of Carb. Strata, vide (see) McCoy. Vincularia ectr.

Fungites patellatus, Hisinger is usual from Dixon, Trenton

Scyph. costata, Goldf. Tb. 2 plus 16. Diagram of same.

Sc. articulata, Goldf. Tb 3 plus 8 Diagram of same

C. nim - nimulos Diagram of same

C. nem - stell(shell or stem) diagram of same

Cyathophyllum plicat. Goldf. from Kentucky is

1 Zaphrentis gigantea small

Cyathophyllum turbinat. typical example 2 Kentucky

4 pages of German

Hardware merchants Woodward or Jefferson Ave. 2 brothers Prentiss

I saw from the bore hole at Thunder Bay Cyathophyllum distortum, Favosites reticulatum ?, Spirifer mucronatum, Spirigera concentrica which are said to be brought up from the depth of 700 feet. Salt brine is struck at the depth of 1200 feet.

Apr. 28, 1874 To Lansing R.R. fare 2.25. Hotel Lansing $3.00. Jackson dinner $1.00, return $2.25, total $8.50

Monday May 4. To Detroit by order of Governor expenses $3.50

Mason southwest of village. Discovered coal under the sandstone.

R.R. Ann Arbor to Jonesville $1.95, May 7th Jackson, dinner .75 Jonesville Hotel $2.00. Return ticket to Ann Arbor $2.00. Dinner at Jackson .75.

May 19 to Detroit $1.10. Transportation of baggage at Ann Arbor and Detroit .75. Expense at Detroit $3.00.
May 20 with Marine City to Alpena $5.00

Left Detroit 10 o'clock at night Thursday. Left Port Huron entry morning at 9 o'clock. Came to Lexington at noon. Writing home not to forget India rubber blanket and pillow.

The shore line from Port Huron up to Point aux Barques is all along inhabited and few places are seen where not houses are met with at every miles distance. The immediate shore is sometimes quite sandy but generally short distance back from this belt good arable soil exposed. The elevation of the land as far as seen from the steamboat is considerable. The lake bluffs generally are not over 25 feet high with few exceptions and further inland the ground may rise to the hight of 60 or 70 feet but no more. Timber either hardwood or mixed with pine. Very few clean pine forests, but plenty of saw mill establishments.

Friday morning arrived at Sauble 7 o'clock. The place has considerably grown since I saw it last. Many lumber docks, back of Harrisville. For the first time the ground rises into hills visible from the lake but their elevation is not considerable. The bottom of the lake on the dock is formed of large stone boulders and fragments. The ledges of rock are probably underlying it.

Arrived at Harrisville Friday half past eleven. Left afternoon. A lighthouse half way between Harrisville and Alcona. Spur north of Alcona dock composed of limestone pebbles. Left Alcona at 3.

At Alpena, sundry expenses to Monday 25th 75 cts.
Limestone 65 ft. light colored grey. Continued to about 125 ft. At 400 feet blue shale with many shells, Hamilton, continued for 65 feet, Hard lime(stone) down to 535 feet. specimens. Grey, blue and white lime(stone) all the way down to the depth of 1025 feet. There first salt water. First water at 480. Seemed to be a broken rock down to 600 feet.

Diagram of shore line at Alpena

Fungites rimosus, Hisinger Leth. Sulciae, Tb 28 plus 4.

Figures without explanation 38,144,388, 43.

Two page diagrams

Diagram and one several pages on further.

Red Bridge boring. Between 30 and 40 feet drift. Then an alternation of dark shales and sandstone layers to the depth of 120 feet. Then 3 feet of coal. Under it a white fine grained sandstone and some fire clay to the depth of 154 feet.

Spring Arbor Station. On several places along the road small outcrops of the sandstone. Spring Arbor village northeast of the station on a hill underlaid by sandstone but the surface of drift. ¾ mile west and ½ mile north of Spring Arbor lime kiln and quarries on top of the elevated hill land. Above ferruginous limestone, below a bluish hard crystalline limestone sometimes with green spots, sometimes brecciated. Lower a calcareous sandstone, hard. Lowest a greenish nodular sandstone. German notation

½ mile north and 1 mile east of this place on the road, in a spring, limestone outcrops. This is in a line straight north of Spring Arbor on a higher level than the village. Near Spring Arbor Mills after continuous drift hills, signs of the sandstone outcrops of usual soft whitish aspect. 160 steps from where the road crosses sandstone Creek a patch of limestone seen resting on sandstone. Little distance further across the river 100 rods north of the road is a lime kiln and lime strata nearby. Soon after the principal road turns north towards the coal mine locality.

Pt. aux Barques. 1. visible 6 to 7 feet blue shale.
2. Hard pyritoud and partly conglomeratic sandrock with numerous fucoid-like elevations and contains brachiopodes, rhynchonella, orthis, spirifer, streptorhynchis, crinoid stems 2 feet, turbo. ectr.
3. Smooth shaly sandstones and shales similar to Grindstone containing few of the same shells. Several feet forming the surface of the shore level. Further back a terrace about 40 feet high is composed of sandstones in thin slabs and occasionally conglomeratic

German notation.

Fossils of Europe

1. Plasmopora follis, Niagara Group, Charleston Landing
2. Plasmopora spinipora, Pauls Station, Indiana
3. Plasmopora spinipora Lockport
4. Heliolites, minute, Niagara group, Masonville
5. Heliolites tubis mediocribas, Masonville
6. Heliolites interstincta, Masonville, Iowa
7. Lyellia americana, Pt. Detour
8. Lyellia papillosa, Pt. DeTour
9. Calapoecia anticosti.
10. Calapoecia Huronensis, Drummonds Island
11. Thelostegites Bouchardis, Louisville, Niagara Group. Is not different from Lyellia Charlestonensis.
12. Thecia, Niagara group. Pt. of Barques. Extra Schoen (beautiful)
13. Thecia Charleston Landing. extr.
14. Thecia, smaller variety, Louisville, Niagara group.
15. Cladopora reticulata, Niagara group, Louisville.
16. Cladopora laminata, Niagara group Pt. Detour
17. Alveolites stellatus Pt. Detour.
18. Favosites venustus Pt. DeTour
19. Favosites Niagarens, spinulose tubes, Pt. DeTour
20. Quenstectia, Niagara group, Masonville, small.
21. Favositoid, Chaetetes like with free tube ends. Niagara Group, Masonville Iowa
22. Favositoid similar to former from Corniferous limestone drift.
23. Quenstectia umbellifera, corniferous limestone.
24. Cladopora Fischeri, Billings, Hamilton Group, Widder.
25. Cladopora Fischeri, smaller tubes, Hamilton Group, Widder.
26. Alveolites Goldfussii, Hamilton Group, Widder.
27. Cladopora labiosa, Billings, corniferous.
28. Cladopora Roemeri, Billings, Hamilton group, Widder.
29. Striatopora lineana, Hamilton group, Widder.
30. Striatopora rugosa, Hall, Hamilton group, New Buffalo, Iowa
31. Cladopora pulchella, corniferous, Port Colbourne
32. Striatopora sp. ind. Port Colbourne
33. Trachypora elegantula, Billings, Hamilton group, Widder
34. Trachypora ornata, Hamilton group, Darien
35. Striatopora insignis, corniferous limestone drift.
36. Protaraea vetusta, Hudson River group, Richmond Indiana
37. Syringopora Hisingeri, Billings corniferous.
38. Syringopora tabulata, M. Edw. Kelleys Island.
39. Orthoceras with farben. Lower Trenton, St. Josephs Island
40. Favosites Niagarensis, large tubes.)
41. " middle large tubes) All from Masonville, Iowa
42. " small tubes)
43. Favosites favosus, 3 specimens Masonville
44. Favosites limitaris, corniferous limestone, Colborne.
45. Favosites perplexus corniferous limestone drift.
46. Favosites fruticosus, corniferous limestone drift.
47. Favosites canadensis, Billings corniferous.
48. Favosites radiciformis, casts, corniferous, Vernon Indiana.
49. Casts of Favosites to show the variability of the tube canals.
50. Fragment of Favosites epidermatus with finely developed radial organs.
51. Michelinia convexa

53. Michelinia (Emmonsia cylindrica,Edwards).
54. Chonostegites Clappii, M. Edw. Corniferous drift
55. Favistella stellata columnaria, Hudson River group, Madison
56. Thecia ? Darien, Hamilton group.
57. Fragments of Thecia from falls of Ohio.
58. Ceriopora nuciformis, Hagenow.
59. Astylospongia inornata,Hall, Calamopora fibrosa,Roem. Tennessee
60. Astylospongia stellatim sulcata Roem.
61. Astylospongia imbricata articulata, Roem.
    3 specimens Archaeocyathys, Billings
    Ditto globular form
62. Astylospongia cratera, Roem.
63. Astylospongia premorsa, Roemer
64. Astraespongia meniscus, Roemer
65. Astraeospongia Hamiltonensis, Worth. Independence, Iowa
66. Tetradium cellulos, drift.
67. Tetradium, St. Joseph
68. Tetradium madisoni.
69. Stromatopora compacta, Billings, St. Joseph
70. Stromatocerium rugosa, drift.
71 Stromatocerium and Tetradium ? drift
72. Foraminiferon, small coral.
73. Spongia Hudson River group.Tennessee or Kentucky
74. Scyphia ? Cincinnati.
75. Orthoceras granulosum, St. Joseph.
76. Spongia, Dixon, Illinois.
77. Spongia, Dixon, Illinois.
78. Eozoon canadense
79. Huronia
80. Huronia
81. Huronia
82. Discosorus conoidens
83. Orthoceras ? Helderberg lower group, Clarksville,
84. Cornulites, Niagara group.
85. Ovoid bodies of problematic nature, Niagara group. Drift.
86. Discosorus conoidens
87. Orthoceras Hudson River group, Cincinnati.
88. Orthoceras drift, Trenton. With farben
89. Orthoceras drift. Trenton
90. Orthoceras drift, Trenton.

Miscellaneous notes from back pages of book. 1871 Dubuque Meeting A.A.S.

Pension Mankel 8 o'clock.

Diedreich & Boessacher, 72 Congress St. Detroit.

Saturday 4:30 Miss. Amerin, Aug. Str.

Adams, well borer at Port Austin bored well at White Rock.

J.O. Cornelius, 117 Washington St. Hoboken

Reed City situated on S.½ of Sec. 9, T. 17 N.,R. 10 W.

Deposit in Savings Bank Ann Arbor to the order of my wife $19.00,91,00, 20.00 $100. order to Gov. Baldwins for expenses of Geol. Survey,dated May 20,1871. Coupon of interest from $1000. bond on Burlington & Missouri R.R. Due May 1. Dividend of bank stock due July 1, 1871.

Took from home of my own money $400. and paid the current expenses with it. Received by draft on Gov. Baldwin $200.00 July 8, 1872

Page of German.

Sec. 6,7,8. T. 41, R. 23. Sec. 17,20,29 and 32. Fossils of Escanaba.

Summ of expenses to July 13 about $262.00

Several diagrams

Louis Bruckmann, 74 Beaver St.
Zimmermans Express recommended by L. Bruckmann.
Adler No. 8, Black.

Notes from front of book dated 1871, Dubuque meeting A.A.S.
Brooks, Box 43, Marquette.
Prescott House 531 Broadway.
G.W Bittman
Mrs. Leischner
Capt. E.H Beebe, Geneva Ill.
Samuel Calvin, Dubuque Iowa
T.H. McBride, Hopkinton, Iowa
A.H Sabin, Mason City, Iowa

[illegible] Diary [illegible] 1[illegible]. [illegible]

[illegible] from [illegible] page [illegible].

[illegible] A.M.	[illegible]
[illegible] A.M.	
11:[illegible] A.M.	[illegible] about 3/[illegible] [illegible]
[illegible] P.M.	Standard barometer. Elevation of standard barometer [illegible] ft. [illegible] above sea
[illegible] P.M.	Above Lake Huron [illegible] ft.
[illegible] P.M.	
[illegible]:34 P.M.	[illegible] ft. [illegible] inch.

[illegible] L. [illegible], [illegible] City.

Lauf [illegible] (from) [illegible] Bay River on the [illegible] [illegible] (it [illegible]) [illegible] [illegible].
[illegible] [illegible] [illegible] Alpena [illegible] (northwesterly).
Strasse(street) [illegible] (over) [illegible] (the) [illegible] [illegible] northwesterly.
[illegible] [illegible] either on Sec. [illegible] or [illegible] of Alpena town.
Up to Friday June [illegible], [illegible] absent at [illegible] meals, [illegible] nights.
Saturday and Sunday 4 additional meals and one night.

Fred [illegible], Rogers City. Surveyor Co.
Harris, Dr.
John McArthur Sheriff
[illegible] R. [illegible], Sec. [illegible].

Mr. McArthur, Smith and Co. Cheboygan.

Half a mile from shore at Rogers City on steamer about 10 feet above water can see the top of highest hill behind, about 3 miles distant over the tree tops abridging(averaging) about 20 feet.

while

division in upper non-fossiliferous beds and lower fossiliferous sandstone strata is contrary to nature. The fossils are preeminently abundant in certain layers which are frequently covered by a more or less considerable thickness of non-fossiliferous rock beds, but the quarries of Stony Point evidently belong to these upper (Napoleon) strata and are containing the same species of fossils as the lower Marshal beds. Also lithologically a distinction of two groups or a marked subdivision of the group is not to be made. In the evening went to Jonesville and returned next day to Ann Arbor.

The 8th day of May for the first time this year warm weather sets in and continues so. On the morning of the seventh(May) the last heavy frost was noticed in Ann Arbor.

Wednesday 20. left Detroit for Alpena. The shoreline up to Saginaw Bay all along inhabited and with exception of a sandy belt along the shore all good farmlands. Timber generally hardwood mixed with pine, rarely pine alone.

Friday morning at Sauble. No elevated lands seen from the lake. At Harrisville for the first time hills are seen back from the shore. At Alcona the bottom of lake rocky and limestone pebbles along the shore. Arrived at Alpena Friday evening.

Saturday made an excursion north of town along Lake shore in Sec. 13, 14 and 24. Limestone is exposed at the surface and a few quarries opened on the localities. The limestone which appears to be the highest stratum is full of silicious concretions and the corals and Stromatoporas in it are partly silicified. The beds are easy weathering in irregular uneven slabs. Some are of rough sandy crystalline fracture, others are of argillaceous aspect with numerous bryazoa and crinoid stems besides some broken Brachiopod shells, Favosites and half silicified Stromatopora Northeni, Str. plana, Str. monticulifera.

At the limekiln and on a place about ¼ of a mile south of it, lower beds of semi-brecciated nodular structure in large bulky layers form isolated projecting hills of bubble shape, the ledges elevated under an angle of about 20 degrees and falling away from the top of the hills in all directions.

This lime has a smooth conchoidal fracture but is not homogeneous, of a light whitish green or blue mottled color containing a great abundance of Stromatopora, Favosites and some brachiopods, acervularia. It resembles considerably the limestones at the Broadwell Mills but is not interstratified with clay beds as it is there. The visible thickness of this lower limestone is about 18 feet and the superincumbent strata of various kind may be in the described localities 25 feet. The lower brecciated beds are quite free of silicious seams and are used for lime burning. For building purposes the superficial beds of it are too much shattered.

Small diagram

Sunday May 24. Rainy day. In the forenoon went up the river passing the graveyard to its west end and there striking north on a road leading to a farm with a lesthouse on and situated close to a big bend of the river. Surface generally sandy and overgrown with Pinus Banksiana or Norway. River banks on the bend about 30 feet high, sandy Opposite bordering lands low, cedar swamps . On the farm there is a marly subsoil with many helices and planorbis which promise fertility, but at present it is not cultivated and the surface is overgrown with rumex instead of grass.

Little distance further up the river Carters quarries are said to be from which in the Ann Arbor museum black bituminous limestone with many Strophodontas, Favosites ectr. are preserved (Thunder Bay Island rock) but I did not find the spot. I followed the river on my return. Saw its high sandy embankments but no outcrops of rock which appears farther down after the river has made another big bend.

In the afternoon revisited the environs of the limekilns on the road to Long Lake. The limestones of the Hamilton group are over a considerable space comprising several sections (13,14,15,11) exposed on the surface. Various strata differing in structure and grain are seen on the undulating surface which corresponds with undulations of the strata rising occasionally into bubble like hillocks which exhibit on top the lowest beds and the successive higher strata are gently dipping away in all directions.

The lowest limestone beds are light colored with smooth conchoidal fracture. The layers are unhomogeneous nodular bulky rock masses full of fine fissures with seams and veins of spar and sometimes of silex. They are full of large masses of Stromatopora Northeni, monticulifera ectr, also acervularia and fine celled Favosites are forming abundantly part of the fossil contents. And occasionally Atrypa reticularis, Terebratula romingeri, Strophodonta demissa, many crinoid stems and rarely crinoid heads, Cladopora and Cyathophylloid Cystiphyllum ectr. are observed. Thickness not to be seen. Super incumbent but generally on lower level are hard crystalline bluish green limestones in well stratified beds of 8 or 10 inches in thickness and eminently adapted for foundation walls. They contain a profusion of crinoid joints, some Stromatoporas and Favosites Bryazoa and occasionally a crinoid head.

Next above are less compact limestones, easy splitting in irregular uneven shelly fragments and containing a great number of half silicified fossils. Stromatopora various kinds equal with some of the lower beds. Strombodes two kinds identical with those from Broadwells mills. Cladopora, Favosites, acervularia certain layers are crowded with Cyrtina shells silicified and all single, also some other brachiopods, Atrypa reticularis, Spirifer mucronatus, Spirifer (large), Strophodonta, Syringopora, Heliophyllum ectr. are found.

The ledges containing certain species in abundance are not strictly defined from others which do not contain them and perhaps are replenished with certain other species.

The faunal character of all the various beds seen in this part of rocky surface is essentially the same. And the distribution of fossils is such that in places the whole mass is an agglomeration of fossils while other portions of the same stratum are comparatively very poor in them. The entire complex of exposed rock is not comprising more than 50 or 60 feet of strata perhaps much less than that. There is no connected vertical section to be seen which is over 8 or 10 feet in all.

Monday May 25. Morning rainy. Afternoon went to the salt well near the dam. First 125 feet limestones of various color. At 400 feet to 480, blue shales with thin limestone beds containing an abundance of fossils, crinoid stems, Favosites, Spirigera concentrica, Spirifer, Atrypa reticularis.

From 480 to 535 and to 600, grey hard lime alternating with softer beds. At 480 first strong flow of water containing hydro-sulphuric gas and some epsom salt. At the lower depth unto 1025 feet hard light colored limestone under which at the named depth the salt rock is struck, probably solid salt.

While I was there they commenced working the pump. For the first five minutes weak bitter mineral water was pumped. Then came brine getting stronger and stronger. After 9 minutes pumping it got weaker again and subsequently very weak brine was pumped. Bore hole continues 100 feet deeper.

In the evening went to Stony Point. Collected many fossils, particularly fine specimens of Stromatopora monticulifera. These strata seem to be lower than the limestones northwest of the town. The Stromatoporas form large spherical masses several feet in diameter, also 2 or 3 other species of Stromatopora are found there.

Thuesday (Tues.) May 26. Walked to Partridge Point. Followed the state road about 6 miles and struck an Indian trail leading down to Squaw Point. The road leads continually over a sandy pine land elevated about 50 or 60 feet above the lake. On the lakeside continuous low swamplands. About a mile before reaching Squaw Point under the roots of fallen trees black shales are seen. The whole of the point is likewise black shale.

A large bay with very low inundated marsh borders separates this point from Partridge Point and in order to get there, not finding any boat, I had to walk 4 or 8 miles through the water from one to 2 feet deep. Arrived about 2 o'clock at Partridge Point.

The south side of the point is low, swampy. In the water hard limestone slabs without fossils are seen all along the southwest side. On the northeast side the same limestones form the top of bluffs from 10 to 12 feet high. Under these hard limestone slabs are outcrops of 10 feet of shaly limestones with intercalated shale beds of greenish color, very fossiliferous particularly Bryazoa and fine crinoids.

Made rich collections during the afternoon and next morning. In order to get there one has to stand knee deep in the water and this can only be done in very calm weather.

At 10 or eleven o'clock a sailboat which came for me from Alpena brought me over to Sulphur Island, which is entirely covered by the black shales as seen at Squaw Bay. Returned to Alpena at 2 o'clock. The boat was liking(leaking) very bad and could only be kept afloat by constant dipping out the water.

After dinner visited again Trowbridge Point making additional collections.

As far as I understand at present the geology of the place, the massive nodular bulky limestones protruding near the limekilns northwest of Alpena and in several other places of this neighborhood containing a profusion of Stromatopora monticulifera, plana, Wortheni, Favosites various kinds acervularia, Strombodes Johani and a peculiar cyathophylloid coral besides some brachiopods ectr. are the lowest beds near Alpena.

Above are hard limestones in beds from 6 to 8 inches in thickness which make a good building stone, containing the same species of Stromatopora, very many crinoids stems, Favosites ectr.

Still higher are easy weathering limestones with Stromatopora plana and Wortheni, Heliophyllum, Cystiphyllum, Cladopora, Striatopora, many species of Favosites, Cyrtina, Atrypa reticularis, several Spirifers and Strophodontas acervularia besides Bryazoa, crinoid stems ectr. cyathophyll. cystiphyllum. The strata all have a slow dip to the south. The fossils in these upper beds are all half silicified.

On the south side of Alpena on Stony Point I think the next higher strata are exposed. Also limestones with very large masses of the typical form of Stromatopora monticulifera, of(Str. Wortheni, varietas plana) and Plana, Cyathophyllum rectum, Heliophyllum Hallii, Favosites Hamiltonensis, F. mamillatus and several other species, Alveolites, Aulopora, new sp., some Brachiopods, Bryazoa ectr, rarely acervularia These beds are closely related to the black Thunder Bay island beds but are not black colored. Some of the beds are argillaceous, easy weathering, marl-like. A Stromatopora internally resembling monticulifera bot of the structure of textilis is also found abundantly in these beds.

Next above must follow the Partridge Point beds which on the point have a dip to the southwest and immediately above the shales of Squaw Point follow. But the immediate contact of the two is not seen. The thickness of this whole series is not known because the strata are all separated by wide intervening spaces and no deep sections are existing. It may be calculated to about 100 or 150 feet but perhaps their thickness is much larger.

Diagram

Thursday May 28. Gave the Hotel keeper 200 dollars for save(safe) keeping. Made arrangement with a boatmen for a trip along the north shore of the bay to Thunder Bay Island ectr. at 4 dollars per day. Left in the morning after breakfast.

Landed at noon on Campells Fishery on north point. The shore all the way along is either sandy or pebbly. No rock ledges seen. Afternoon we sailed to Thunderbay Island. All around except on its south end the rock ledges are close at the surface. It is a dark grey limestone with uneven nodular surface and shaly seams colored black by bituminous and carbonaceous matter. Some of these black seams are more calcareous than argillaceous. They contain a great number of fossils, so also the grey limestone. But in one place of the same exposed bed they are much more crowded than in another and a few layers of the limestone contain very few.

The most obvious and abundant fossil is Stromatopora monticulifera in large sub-spherical masses from 2 to 4 feet in diameter and some still larger. Also some specimens of Str. plana are found. Most of the Stromatoporas have a more or less obsolete structure but in (a) few it is excellently preserved. The next frequent fossils are Acervularia Davidsoni, Favosites Hamiltonensis, Favosites (ramose). Except those are found Cyathophyllum, Syringopora, Fistulipora(few) Strophodonta erratica, Spirifer, Atrypa reticularis, Terebratula Pentamerus.

There seems to be a great similarity between the rock beds of Stony Point south of Alpena and the Thunderbay Island strata. On the north end of the islands a great number of seagulls have nests on the ground made of straw. We collected 3 dozen of eggs one or two in a nest. The inhabitants of the islands eagerly collect them every day for their family use.

Friday May 29. Looked some more over the island which is all uniformly underlaid by the dark grey or partially black limestones. At noon crossed over to Sugar Island where the same rock with the same fossils is found. On the southeast side of the island, part of the shore is covered by gravel but the rock beds are close under it. Several other small islands are of the same geological structure and the intervening lake bottom is formed by rock ledges, partly by gravel.

The rock in the lake bottom northwest of Thunderbay Island is full of Stromatopora and Acervularia. Landed in the evening on 9 Mile Pt. west of Middle Island. This point is formed by black bituminous and shaly limestone beds containing a great number of a short expanded species of Cyathophyllum, also Favosites Hamiltonensis and Acervularia Davidsoni, Stromatopora Northeni in flat expansions, Str.(ramose kind), Favosites reticulatus.

Immediately above these ledges are less carbonaceous grey limestone (s with black shaly thin seams in which Acervularia, Favosites reticulatus and Stromatopora Northeni ? in large masses are very abundant while the Cyathophyllum is restricted to the black beds below which contain very few of the Stromatopora and Favosites.

The thickness of the strata seen is not over 8 feet. Its position is I suppose not far from the Thunderbay Island beds, probably below. The fossils in both as far as Favosites acervularia and Stromatopora Northeni are concerned are the same in both, but the Thunderbay island beds have Str. monticulifera which is not found here, and a number of Brachiopods which are also not found on 9 mile point. Six miles north of this place is the locality of the abandoned quarry of a Detroit company. Landing place on 9 Mile Point in Town 32, R. 9 East, Sec. 34. Quarry above in Sec.6.

Saturday May 30. Left 9 Mile Point in the early morning and coasted northwards. On the first small promontory about 1½ miles north of 9 Mile Point and about the same distance south of Middle Island a small river comes out in strong rapids flowing over rock ledges in climing(climbing) towards the lake. For several 100 rood(rods) the rock is cropping out on the shore and bottom of the lake. It is the black limestone of 9 Mile Point with Cyathophyllum, acervularia in great abundance, besides Favosites and some Stromatopora in flat expansions with an epitheca below. This Stromatopora is in structure the same with monticulifera but differs in this expanded growth. Also similar expansions of the structure of Str. Northeni occur. This however also occurs in globular form. Many of the Stromatopora specimens have an obsolete structure, also Syringopora specimens are seen. The rock disappears further north under large boulder deposits and the shore is pebbly unto the next larger point. This river is said to be the outlet of Long Lake and the map of Farmers is incorrect placing the outlet in Thunderbay.

Landed on Sec. 6 of same township, where the quarry of a Detroit Co. was established, about ¼ of a mile from the shore. The shore is low cedar thicket and some distance from it a rock bluff of about 15 feet hight rises abruptly extending in a direction from northwest to southeast. The bluffs consist of very unhomogeneous nodular limestones with thin seams of black shaly matter and segregating in entirely irregular uneven fragments. The limestone almost consists only of Stromatopora several forms with Favosites and fewer acervularia and it is entirely unfit for any ornamental or architectural purpose.

The exposed thickness of the Stromatopora limestones is 15 feet. Under it are blue calcareous shales containing Cyathophyllum, Atrypa reticularis, several Spirifers, Rhynchonella, Orthis, Strophodonta demissa, many Bryazoa and have in general a great resemblance to the blue acervularia shales of Little Traverse Bay. These shale beds continue for about 40 or 50 feet, to which depth a shaft has been sunk in the locality in search of marble.

A mile further south close to the sandy shore hills of about 50 ft. are rising which very probably are formed by the same limestone as in this mentioned failure of a marble quarry. Some experiments are reported to me which proved the rock in these hills identical with the former. In an outcrop on the shore on Sec. 27, T. 32, R. 9, the rock beds are very perceptibly dipping into and under the lake bottom

From Sec. 27 down to Little Thunder Bay the shore is gravelly but few ledges of rock visible. Little Thunder Bay is a recess with very sloal water but with abrupt sinkholes of about 100 feet depth. At the furthest west end of it the shore, which is generally low swamp, rises into bluffs 25 feet high which present at their upper margins a rock escarpment of Stromatopora limestone similar to that on Sec. 6, T. 32. It contains Cyathophyllum Acervularia and Favosites in great beauty.

In front of the bluff large rock masses separated from the horizontal layers have separated and lean against the declivity in steeply inclined position. Between them and the undisturbed rock large sinkholes are observed. The probable explanation of these(this) condition is to me a underwashing of the rock beds which are underlaid by the blue clays seen in Sec. 6, T. 32 and a consequent sinking of the shattered and fissured rock masses. Above Little Thunder Bay appears to be such a large sunken pot hole.

The limestones of Little Thunder Bay are more intersected by argillaceous seams than those at Sec. 6. 32 and its fossils therefore laying in shaly rock are better preserved. These districts of rock outcrops are all burnt out and full of windfalls. It is very tiresome to follow their entire extent and many localities of more highly instructive character may for this reason be overlooked. Returned to Alpena.

The outer point of Thunder Bay named on the maps Flatrock Point exhibits very little flat rock. It is principally formed of gravel and boulders. The rock beds cannot however be very far below the surface.

For agricultural purposes the district of the limestone outcrops is very unfavorable. Very little soil covers the solid rock and the shore is most generally arid sand or gravel accumulations.

Monday June 1. Went with Mr. Lockwood to Carters quarry on Sec. 20. A bluff in 3 terraces rises some distance from the river to the hight of about 50 feet above the river. The first terrace is formed by hard limestones in beds about 6 or 8 inches thick which contain few fossils of well preserved form. The strata of this limestone visible amounts to about 15 feet. From there the surface slowly rises unto another bluff, ascends to the hight of about 10 feet. This space is formed by soft shaly calcareous beds of earthy granular structure, dark grey color. Fossils are here in great abundance.

Strophodonta demissa, Atrypa reticularis, Terebratula, several Spirifers, Bryazoa, large lumps of a Chaetetes, Cyathophyllum, Heliophyllum, Eridophyllum, Cystiphyllum, various forms of Favosites, Stromatopora Northeni and monticulifera, Aulopora Syringopora octr.

The top of this second terrace is formed by nodular somewhat brecciated limestones almost wholly composed of Stromatopora with intercalated seams of a dark bituminous shale. Still higher are again harder limestones in thin beds which are comparatively poor in fossils. However there are on some of the slabs numerous bryazoa and crinoid points. The entire visible thickness of the exposed strata amounts to about 50 feet with few interruptions. These limestones are always on the surface over sections 18,19,20,29,30,28,32,and 33.

The bottom of Mud Lake is the same rock. Sometimes one or the other stratum is at the surface but the palaeontological difference of the strata is not perceptible. They all belong to one and the same fauna.

The limestones project in knolls or form the bottom of swamps. Some higher hillocks of sand rise in certain streaks. Spots of good land are dispersedly noticed but as a general thing the country is a desolate sand district or so rocky that farming is poorly rewarded. In spite of all these adversities there are everywhere clearings made in awfully unpromising cedar thickets or on barren ridges.

Diagram

Tuesday June 2. Went up to Crowbridges mills in Sec.2, T.31. R.7. On the road ½ a mile this side from the mill a knoll of limestone projects which is the massive smooth fracturing nodular white kind seen at Phelps' limekilns and also under Broadwells mill building. It contains Stromatoporas, various Favosites ectr.

Further on a few steps some hard limestone slabs containing few fossils are noticed. They can not be very thick. And soon after in the ditches of the roadside shaly strata intermingled with nodular limestone and full of fossils in fine preservation are forming the surface. Their color is grey more or less shading into yellowish by weathering.

These shaly limestones with fossils are seen in the thickness of about 5 feet. Below in the river bank a few ledges of blue sandy looking argillaceous limestones containing scarcely any shells are seen in the thickness of about 3 or 4 feet. They are used for burning cement of very excellent quality. Still lower are seen 5 feet of blue soft calcareous sandy looking shales with an occasional Cyrtina and fucoid-like stems of thinner and thicker kind. In the river bed finally this blue shaly rock assumes below a harder limestone-like nature like the waterlime strata above. Only very few organic remains in them except the fucoid-like relief forms. The thickness lower downwards is not to be seen but it cannot be much lower before we should expect to strike again on the massive Stromatopora limestone under Broadwells mills or at the before mentioned knoll.

Under the mill the horizon of the waterlime strata locally is quite silicious and a bed of it contains innumerable specimens of silicified Cyrtina and a few specimens of Spirigera concentrica and Atrypa reticularis.

In the afternoon looked over the same ground again starting from the mill. The top strata covered by alluvial clay are limestone beds with silicified Syrtina. Below them rock beds of calcareo-argillaceous concretionary character with seams of shale are seen in the thickness of 6 feet where they are hidden by the water. Further down the river the Syrtina is scarcely noticed and the corresponding beds are more argillaceous.

A section from the river bed to the top of embankment is as follows:

Argillaceous limestones and shale beds, the limestone in concretionary masses mingled with the shale 5 feet visible. The upper part is softer calcareous shale of blue color.

Next above is a more solid argillaceous limestone about 5 feet thickness segregating in uneven surfaced slabs and with fucoid-like projections rarely containing some shells.

On top of this is a marly shaly limestone dissolving on exposure in soft clay and calcareous nodules. This limestone or shale is very rich in fossils. It forms the entire surface along the river bank between Broadwells and Trowbridges mills, only overlaid with a thin coating of boulder drift, on a limited spot higher than the rest around a farmhouse on the road ½ mile south of Trowbridges.

Massive white weathering nodular limestones of fine conchoidal fracture with many fissures filled with spar lay on top of the fossiliferous shales and are themselves surrounded by a fine soft greenish clay. They contain very many Favosites specimens, Acervularia, Strombodes Johanni, crinoid heads, Syringopora, occasionally a Spirifer, Diphyphyllum, Eridophyllum, but no Stromatopora seen. They are entirely identical with the beds under Broadwells mill.

But the Broadwell mill strata are again overlaid by calcareous shales like the lower shales in appearance and containing also similar shells. There must be consequently this white limestone with conchoidal fracture a subordinate layer between the mentioned slate formation or two such beds exist, one at the base and another on top of the shales.

A section near Broadwells mills exhibits when the water is low, a remarkable undulation in the strata forming the river bed.

Diagram of above.

Wednesday June 5. In the afternoon went to Phelps Quarry to ascertain again the sequence of the strata. There is not the least doubt that the knoll of Phelps' lime kiln consisting of light colored variegated fine grained limestone with conchoidal fracture is the lowest stratum in this locality. Strat. A.

Its beds form an arch dipping in all directions. The beds as far as seen amount to about 8 or 10 feet. It contains numerous Atrypa reticularis, Terebratula, Spirifer granulifer ?, Acervularia Davidsoni, Favosites, ramose and massive species small and large celled, Cyathophyllum (several) Strombodes ? Cystiphyllum, various Stromatoporas quite abundantly.

Strat. B and C. In distinctly visible contact follow in ascending order hard crystalline limestones containing numerous crinoid joints otherwise fossils are not abundant except in some thin shaly seams. Acervularia Davidsoni, Cystyphyllum, Cyathophyllum, few Stromatopora, Atrypa reticularis and some other fossils similar to the former. The thickness of these beds is about 8 feet. The lower ones are dark blue, the upper ones bluish grey. Some silicious seams are not unfrequent or the fossils are hald silicified. This limestone is very compact and is a useful building stone for foundations ectr.

A layer on top of them of similar nature contains nodular earthy-looking waterworn ? limestone fragments which seem to be incorporated in the limestone plasma in semi-indurated condition.

Strat. D. is above in thin bedded slabs coarsely crystalline but of dull sandy fracture, ferruginous color, contains very few fossils but occasionally the same species are found in it as in the strata above. The thickness can only amount to a few feet.

Strat. E. is a limestone of the same appearance as Strat.A. Its thickness is inconsiderable. It contains likewise the same fossils as Strat. A, but generally in half or entirely silicified condition, while in A. the fossils are generally calcified.

Strat. F. Strat. E. gradually merges in F. which is darker more earthy in aspect of crystalline fracture. Some beds of it contain large numbers of Cyrtina, other beds are almost destitute of fossils, being partly in compact beds of about 2 or 3 inches in thickness, partly in thicker layers with harder silicious ? concretionary nodules incorporated with the mass. Certain beds contain silicified Cyathophylla, also few Favosites, Strophodonta ectr. The supposed thickness of these beds is about 10 feet.

Strat. G. is a silicious limestone containing in particular Stromatopora plana in great abundance, various Favosites, Cyathophylla, Striatopora, some Brachiopods, Cladopora. Thickness not positively known but not great.

Strat.H. Somewhat argillaceous easy shattering limestones containing many Bryazoa, besides Cyathophyllum, Cystiphyllum, Phaedops, some Brachiopods. This limestone is quarried near Trowbridges railroad not over half a mile from the point. The former stratum is likewise exposed in this locality and extends to the shore.

The supposed higher strata are the shales of Carters Quarry and on top of these follow the Stromatopora beds of Stony Point. To those with some probably intervening layers not seen the Partridge Point strata and over them the black shales of Sulphur Island.

If the lowest bed at Phelps Quarry is as I suppose identical with the strata under Broadwells mills, the fossiliferous shales and water lime of Trowbridges mill are the next lower series. The duplicity of these Broadwell mills strata I have mentioned in the diary of yesterday but I am in this matter not certain.

The layer on top I positively recognized in this highest position but the strata under the mill I cannot place to my satisfaction. At all events there are above shales and shaly limestones exposed at the mill and some steps further down the river where the shaly calcareous strata have a considerable dip down the stream.

Above the dam at Broadwells I recollect distinctly a dome-shaped elevation of the strata right in the bed of the river. But at present the water is too high to observe.

Diagram of above Strata

Thursday June 4. Went to south branch of Thunder Bay river marked on the map as Hubbards river coming from Hubbard Lake. After having passed the graveyard of Alpena which is yet all fine lake sand, the road leads over a swampy strip of land which is underlaid by ledges of limestone containing large masses of Stromatopora monticulifera and Northeni besides Favosites and Cyathophyllum and corresponding with the Stony Point strata of which they are an immediate continuation. After about a mile or more the road ascends again unto low sand ridges which extend over a wide space to the south and west. The dry portions of them are pine lands, the depressions between them cedar swamps. No more rock is seen on the whole way to the south branch which at the distance of 8 miles from Alpena is crossed by a bridge.

Mr. VanAlsteins tavern is close by the river. The river is a quite considerable stream. At present the floating of logs has slowed it up above its usual hight and the water flows on one side over its embankments for the distance of ½ of a mile. This whole distance is bridged over by a log road.

Mr. VanAlstein by digging a well to the depth of 17 feet struck the black shale formation and obtained an iron tasting water unfit to drink. The black shales are finely uncovered 2 miles farther west on a knoll over which the continuation of this road leads. The visibly exposed thickness of the shale there is 15 feet. It contains large geodes of cone in cone structure and composed of crystallized carbonate of iron spatheisentheia, besides nodules of iron pyrites. The geodes are exteriorly weathered to a considerable extent and are transformed in iron oxyd hydrate of light rusty ocher color. The central hard nucleus of the geode is in fresh crystalline condition.

The general direction of the river is north. Two miles below the tavern in Sec. 13, T. 31, R. 7 are rapids and the rock beds see exposed there are the Stony Point strata, not very rich however in the usual fossils and in poor preservation. The outcrops are inconsiderable and confined to the opposite bank of the river. Mr. VanAlsteins Tavern is in Town 31, Range 7 east, Sec. 21. The slate exposures on on Sec. 19.

On both sides of the road beyond the tavern are numerous lately built farmhouses and clearings which extend in this direction for a distance of 12 or 15 miles further west.

The soil is a light sand mixed with suf icient loam to make it productive.(Also pebbles and northern boulders are spread over the surface). On the locality where the shales are found the soil is considerably better and splendid maple trees and other hardwood timber are mixed with hemlock and pine trees. But much of this land is in the condition of low cedar swamps which have to be drained.

The general surface of the peninsula rises in very gradual ascent towards the central high plateau and in going there no abrupt hills are noticed. The elevation of this south branch at the bridge over the mouth of Thunderbay River may be about 80 or 100 feet.

About 3 miles from the tavern on the open pine plains in east direction a sinkhole of circular form, about 500 feet in diameter is noticed. Its edges have a funnel shape, are about 35 feet deep, inclining below the general surface and dry. The centre is filled with water which is said to be immeasurably deep. No inlet or outlet, but the water constantly remains there is clear and cold. Returned to Alpena Friday afternoon June 5.

Diagram of sinkhole.

Saturday June 6. Left Alpena for Long Lake. The road leads to a great extent over the Stromatopora beds of the Hamilton group. At the Narrows an extention of the outlet of long lake into a lake. The water we found 15 feet deep covering the flat rock in the bottom of this abruptly descending large sinkhole. At certain seasons this narrow lake is entirely dry. The water disappears in the crevices.

1½ miles east of it are the cascades which we saw on a former trip on the lake shore and which are the true outlet of Long Lake. Long Lake is 9 miles long and about 2 wide. Entirely surrounded with limerock ledges which seem to form one of the lowest members of the Hamilton group. They contain numerous Spirifers, Atrypa, Spirigera, Orthis, Cyathophyllum, Acervularia, Stromatopora Northeni, Strophodonta erratica and demissa, Productus, Favosites and several other fossils. It is a hard silicious limestone.

Above it are shaly layers with nodular limestones containing the same fossils. The thickness of this lower limestone is seen in-completely but amounts including the shales above to about 35 feet in all. On the shales are coarse earthy fracturing crystalline limestones largely composed of crinoid joints and containg the same fossils sparsely distributed. Higher are dark grey limestones containing large spirifers, Atrypa reticularis, Favosites, occasionally a Stromatopora and still hirher are black shaly limestones corresponding with the black strata on the lake shore in Sec. 27, T. 32, R.9. They form the top of a hill about 75 feet above Long Lake on the section line between Sec. 3 and 9, inff.32, R.8. They are directly west of the black strata on the lake shore. Their thickness is about 30 feet, perhaps more.

Diagram of above.

On my return on a locality which I suppose to be in Sec. 27, T.32, N.8 in ascending a small hill I found some indications of shale with Stromatopora along the declivity and on top the black shaly limestones forming the top of the hills near Long Lake. Further on are lighter colored limestones with many silicious nodules and generally few fossils. These insensibly merge into the grey limestones forming the plateau surrounding Phelps Quarry and being the second lowest stratum there.

Returned Sunday evening at 6 o'clock. Monday June 8 left with Propeller Menona for Crawfords Quarry at 8 o'clock. Arrived at 2 in the night. The shore near Crawfords village forms a number of gradually rising sand and gravel lake ridges something over ½ a mile wide. The gravel consists mostly of limestone pebbles with few metamorphic boulders mixed. Then ascends a limestone bluff of an abrupt hight of from 15 to 20 feet. The limestone right at Crawford village is a light grey limestone of somewhat earthy fracture containing a few Favosites and acervularia. In the continuation of the same bluff ½ mile north is Crawford's quarry.

Its top is from 40 to 50 feet above the lake and limestone ledges compose the whole thickness down to the water's edge with an intervening narrow plateau formed by the ledges of the first terrace which is about 15 feet high and ascends circa 10 feet further to the foot of the second bluff.

Crawfords quarry is only an exploring ditch of small dimensions. The rock is unhomogeneous, partly porous, partly compact containing a great quantity of Stromatopora monticulifera and rarely some other species of Stromatopora. Besides those is found Favosites, Acervularia, Diphyphyllum, Lucina, proavia. Certain layers almost wholly of Orthoceras, Stromatopora. Others are nearly destitute of fossils. The whole thickness of the 50 feet of limestone contains the same fossils but below they are not so abundant.

The lower strata are also more unhomogeneous, of nodular structure hard, compact, dark colored. The surrounding mass sub-porous, light colored. Small building stone for ordinary purposes may be obtained here for home consumption but there is not even a better class of ordinary building stone, far less marble. The delusion of marble is brought on by small lumps of Stromatopora which take a fine polish and have been sent abroad as test specimens highly pleasing the unacquainted. In the lower beds close to the shore a beer cellar has been dug.

Thursday June 9. Went up to Rogers City. 2 miles west the geological conditions there are the same as at Crawfords. Mr. Lark, an inhabitant of Rogers City promised me to accompany me Thursday to a high limestone ridge crossing diagonally Town 35, R. 4 east in a direction from northwest to southeast. He informed me also of outcrops of a marble-like limestone in Town 35, R. 2 East, Sec. 24 and 25.

The land in the immediate vicinity of the shore is a poor lake sand or gravel ridges not much superior to the sand in agricultural qualifications. From the nature of the rock and from the Stromatoporas and other fossils I conclude that between the Long Lake ledges and these strata there can not be a great vertical distance or difference in age.

Wednesday June 10. Went south 5 miles on the road which is followed by the telegraph to Alpena. At Blaks corner turned west two miles and thence 1 mile south to Mr. McArthurs farm. After ascending the rock bluff back of Crawfords quarry village the road leads through hardwood land with ledges of a grey dull fracturing limerock of bulky indistinctly stratified character and full of flaws and fissures depreciating its value as a building stone, but good for lime burning. Some beds are poor in organic remains. The upper portions contain more of them. Fragments of Stromatopora monticulifera are inclosed. More common is Stromatopora Northeni and a similar not papillose variety of the same structure besides Acervularia, Diphyphyllum. Favosites, Atrypa reticularis(small). The thickness of these beds from the bottom of the bluff may amount to 50 feet. Somewhat more compact beds seem to form the next sequent strata with similar fossils.

About 1½ miles from the village several lake ridges covered with waterworn limestone pebbles are traversed and about 3 miles from village a higher ridge composed of drift clay and metamorphic boulders is superimposed. Land of very good quality all covered with the finest hardwood timber.

This continues to Blacks Corner 5 miles from village. After going west one mile marly limestones form the surface containing a great abundance of Acervularia, less abundant Favosites, Cyathophyllum, Stromatopora Northeni, large specimens of Atrypa reticularis, Pentamerus aratus, Strophodonta erratica and demissa, Productus, small Spirigera, concentrica, Aulopora, Fistulipora, Fish remains. These beds are entirely corresponding with the strata of Long Lake and the Hamilton group consequently extends up to this place.

The lower strata towards Crawfords quarry including the quarry stone I adnumerate to the Hamilton group. Also it may be that at Blacks Corner the surface has an elevation of about 100 feet above the lake and consequently the concerned strata from the shore to there would amount to at least 100 feet. Considering the strata horizontal and calculating in their slow dip southward amount perhaps to much more.

Thursday June 11. Went to the high bluffs back of Rogers City in company with Mr. Lark. The lake terraces immediately back of Rogers City are composed of sand and pebbles prevalently limestones, fragments of the immediately subjacent strata.

Some distance back of the margin of the terrace the ledges come to the surface and are of the same nature as those in Crawfords Quarry.

The land for a distance of 5½ miles southwards is rolling and partly cedar swamp but the higher places are overgrown with fine hardwood and more or less hemlock. The soil is gravelly loam where the rock is not forming the surface. Everywhere clearings are in progress and the soil appears quite productive.

4 miles back from the shore stretching from southeast to northwest a drift bluff with steep sides and cut by many ravines rises to the hight of about 130 feet above the bed of Trout River which flows in front of it. These drift bluffs are prevalently composed of a rich clay soil with intervening sand gravel and stiff clay beds. The gravel and larger boulders composing it are mostly of metamorphic rocks with intermixture of a small proportion of debris from the Niagara and Helderberg group, also some of the local limestone beds.

The top of the bluffs forms a high plateau overgrown with most splendid hardwood extending for many miles southwards. Numerous clearings are made on top of this plateau and the aspect of the newmade farms is highly promising. They raise abundance of superior potatoes, oats, barley, some wheat, beans, peas, fine grass and even corn with success and there is every indication that these persons which came there in absolute poverty will in the course of a few years be in very comfortable circumstances. The persons are generally Germans of the Polonian provinces of Prussia(Danzig).

The whole district labours under the great disadvantage that the principal property holders have taken possession of all the county offices and manage the affairs to their selfish purposes in an exorbitantly unscrupulous manner, and amongst those Mr. Molitor plays the most prominent figure. He is intensely hated by every inhabitant and from all I learn he deserves it.

Saturday June 13. Arrived at Mackinak 9 o'clock in the morning. My boat was at the moment used from Mr. Bates and I could not see(use it but heard its being in good condition.

The lighthouse keeper of Spectacle Reef wants a boat. To write to Colonel Olfers, Detroit to inquire whether the lighthouse commissioners would not buy it. Weather intensely cold and stormy. The day before snow at Mackinak.

Sunday June 14. Hired a boat to Grass and Bear Island. Both are formed by limestone pebbles mixed with large metamorphic boulders. Bear Island connects with the mainland by very shallow water from which large boulders project.

Monday June 15. Barometer on Mr. Bulows farm at one o'clock P.M. 28.00 . 1400 or(1500)feet above Alpena. At Luces farm at 3 o'clock exactly 29 inch. barometer. At Davis' Camp, barometer 28.79 6 o' clock P.M. Davis Camp Town 30, R. 6, Sec. 29, southwest quarter. Morning ½ past 5, 28.85. Rained all day.

The shales continue to Luces farm. From there only drift deposits are seen on surface . Soil a sandy and gravelly loam all of fertile character and overgrown with hardwood or with mixed timber, pine, hemlock and norway. We went from Luces farm 1 mile west and then turned south and southwest. The land is beginning to be quite hilly, hills have an elevation of about 50 feet or 100 with steep sides. The soil is yet susceptible of agriculture but less good than near Luces farm in the slate district. At Davis Camp 7 A.M. 28.7

Tuesday June 16. Road to Gus Spratts camp. Pine land. 9 o'clock 28.49. Half a mile further 28.45. On that point south and southeast visible at distance of about 12 miles very high lands. Here also pine begins to be the predominant timber but some of the land is yet good loam soil. Descended to lower ground, 28.6,1 mile from former place. Outlet of Turtle Lake crossing at 12. Barom. 28.88 .

Arrived at Spratts Camps. Situated close to one of the branches of Thunderbay river. ½ past 12 P.M. Barometer 28.65. Evening 6-15 min Barometer 28.8 Situation of Pratts Camp Town 29,R. 4 east Sec. 14 On the whole route I did not see a rock bed after leaving Luces farm. The whole is drift which forms a quite broken country with hills of about 150 feet hight. All the land is dry and very few swamps seen. Soil generally good. Covered with hardwood timber mixed with more or less pine, only in places exclusively pine lands. The drift is loamy sand with fine gravel and in places containing large metamorphic boulders. Very little of more recent limestone pebbles mixed with it, however they are not entirely excluded. Some man spoke of having found ledges of a black ore like rock as hard as flint in a certain indicated locality which we hunted up but it is no trace of a rock ledge in these drift hills exposed and what he saw was probably a metamorphic boulder.

Wednesday June 17. Weather has finely cleared up. Barometer at Pratts Camp at half past 5 A.M. 28.78 At half past six A.M. 28.79 At 7 the same. High hill at 11 uhr(hour) Barometer 28.8.8 Dinner camping ground near head of the creek 28.7 at 1 P.M. Went west about 2 miles then southwest about 3 miles, about Sec. 31 in Town 29, R. 4 East where we lined. All the land we crossed is a very broken hilly pine land mostly Norway and in the beginning high flats a few miles wide, overgrown with small Banksian pine. All sandy drift with some gravel and here and there a large boulder. Hill top above camp 28.6 at 2 o'clock. Night camp in a ravine. Barometer 28.68 8 P.M.

Thursday June 18. Started ½ past 5 in northeast direction. For about 3 miles all fine hardwood with hemlock, then Norway pine lands.

On a high hill from which at a distance of about 6 or 8 miles in southeast direction a still higher hill is to be seen. Barometer at this place at ½ past 3, 29.75. Returned to Pratts Camp about 5 P.M. Observation of barometer at Pratts Camp at ½ past 4, 29.05. Other observations at same time 29.05. At 6 evening barometrical measurement of Turtle Lake 29.09.

On west side between our camp and the lake a ½ mile wide hill elevation of 40 feet hight lays between. The east shore is lined by hills which I estimate about 120 feet hight. They are overgrown with pine. All sandy soil on these hills. After return at 7 o'clock P.M. at camp 29.11 and 29.10.

Friday June 19. Prepared at 4 A.M. for return to Alpena. Weather fine, clear. 6 o'clock barometer 29.1 at camp. Outlet of Turtle Lake at ½ past 6 morning 29.1. High lands with view on distant mountains mentioned before at ½ past 8, 28.98. At Davis Camp at noon 29.12. Temperature about 75 to 80. Davis Farm on Town 30, R. 8 East, west half of southwest quarter of Sec. 20. Dulows farm near Hubbards River at 6 in the evening 29.22 Friday June 19. Saturday 6½ at VanAlstons morning 29.23.

Saturday morning June 20. Returned to Alpena 10 o'clock. On comparison of the barometrical measurements I noticed a considerable discrepancy between the aneroid and mercurial barometer. The aneroid was 0.240 of an inch lower than the standard barometer of the signal office at Alpena and this difference was not always the same. For comparison I copied the following data from the records of the office

June 15	barometer at	11 A.M.	29.51	June 16 at	7 A.M.	29.09
		2 P.M.	29.44		11 A.M.	29.06
		9 P.M.	29.26		4 P.M.	29.04
					9 P.M.	29.10
June 17	at	7 A.M.	29.21	June 18	7 A.M.	29.48
		2 P.M.	29.25		4 P.M.	29.46
		9 P.M.	29.35		9 P.M.	29.50
June 19		7 A.M.	29.04	June 20	7 A.M.	29.51
		11 A.M.	29.52			
		7 P.M.	29.48			

Sunday June 21. Left with Marine City at 10 for home. From south point to Harrisville. Hills of about 300 feet to 400 lining the peninsula at a distance of about 4 miles back from the shore. Some come nearer. Further south and near Sauble no hills are observed behind the lower lands of the shore. This district is almost in its original forest condition with scarcely any farming population while between Alpena and Harrisville here and there clearings are begun.

The nature of the soil in the valley district of Sauble River I have not yet ascertained. The shore portion is very little promising but the town itself is remarkable for its numerous finely constructed docks and a lighthouse construction at the mouth of the river offering a safe harbor for larger vessels.

Pittsburgh July 1 (Wednesday) left Detroit with Marine City.

Thursday July 2. Passed St.Clair in the morning at 8. The alluvial nature of the embankments of the St.Clair river conspicuous and decidedly later formed by the waters of the present lake.

Friday July 3. Arrived at Alpena

Saturday starting for sunken lake July 4 with a party of men.

W.E. Harston on Town 32, R. 8, Sec. 34. Sinkholes. Laminated limestone. Silicious limestone, shells and corals, dolomite. Upper limestone full of silicified Str. Northeni, Favosites and some other shells. Below bituminous laminated limestone with interspersed layer of cellulose flintrock. Below crystalline dolomite. In it large fissures where the water of the sinkholes disappears. Thickness of the exposed complex about 30 feet.

Saturday July. 4. Left Alpena at 10 o'clock. Passed bridge over north branch of Thunderbay river at noon. In the bed of this creek ledges of an argillaceous limestone very similar to that on Trowbridges mill form the bed of it. The embankments are made up by limestone pebbles of the drift formation. These argillaceous limestones contain Stromatopora,ramose forms, Favosites and Cladopora, Spirifer mucronatus and Spirifer granulifera, Strophodonta denissa, Cyrtina sptr., are a continuation of the Trowbridge mills beds.

Across the river the road leads parallel with the stream. In a few places rock comes to the surface but generally a sandy loam forms the surface. Limestone and metamorphic boulders are frequent in it.

In Mr. Harstons farm in the declivity of a sinkhole the following rock beds are observed. Highest some 3 or 4 feet of a silicious limerock full of Stromatopora Northeni, ramose Favosites, Syringopora gasteropod shells with flat spire sptr., all silicified.
Below this are about 3 or 3 feet of a laminated bituminous limestone containing a band of cellulose cavernose flint and quartz rock. Few fossils are only seen in it.
And below this a crystalline dolomite of grey color weathering brown makes its appearance.In the fissures of the rock, the water of the sinkhole disappears. There are very numerous sinkholes dispersed over all this region.

This locality is about 40 feet above the bed of the river in which the water runs in rapids over ledges of a dolomitic limerock containing some shells. This dolomite in the river seems to be the continuation of the series lowest on the surface of the sinkhole. Some light colored limestones apparently lying above the before mentioned series are seen on the highest point of the road leading from the farm to the rapids.

The farmland in this district is very productive. On Mr. Herstons place the stony hillside furnishes splendid crops. Further on in the burnt plains a most excellent sandy loam forms a wide extended undulating plain inclosing many square miles and fast settling up.

At the farm of Mr. - a well is dug to the depth of 81 feet. The first 9 feet are in the drift. All other depth goes through solid limerock of various nature and alternating with calcareous shales. Some beds are of a fine smooth conchoidal fracture, others are a crystalline dolomite, others an earthy fracturing unhomogeneous dark limestone containing many shells not different from the Trowbridge mills shells.

The farm we stay over night is in T. 33, R. 6, Sec. 28. Johnsons. Not far from the farmhouse there is a sinkhole about 30 feet deep in the bottom of which springs issue which disappear in a crevice at the bottom of it. On the line up to Sunken Lake more than 100 such sinkholes are found. Many of them with narrow fissures extending down to the depth of over 100 feet. 2 miles north of Sunken Lake is one narrow above and considerably expanding below which reaches the depth of 113 feet. At the bottom a wide space is in which a large stream of water flows and disappears. Some streams of water issue from the sides of the crevice and fall down to the bottom . The rock walls are variously colored limestones with some shaly intermediate layers. The rock of this region seems to be higher in geological position than the Trowbridge mill strata.

According to the statements of Mr. Mr. J.Jones with whom we stayed he raised for 5 successive years 100 bushel of oats from an acre of land and the bushels of oats weighed 35 pounds. Also his timothy grass is splendid and fine wheat and potatoes besides healthy growing fruit trees I noticed. He sold at the spot all his hay for 30 dollars a ton and for 33 bu. of his oats he got 1 dollar, all he had.

Diagram of Sunken Lake.

Sunday July 5. Left for Sunken Lake at 8 o'clock. Arrived there at 9.By a lumber road leading close to the lake on the way there is generally good agricultural soil. Partly hardwood, partly mixed with hemlock and some pine. The rock is frequently seen under the roots of fallen trees but no extensive outcrops. Pioneer farmers have settled almost everywhere in this district.

The lake is an abrupt sinkhole about 1½ miles long and only about 500 yards across. At the west end a vertical rock wall of about 15 feet with an abrupt dip of the ledges towards the sinkhole is observed. Its ledges are about 2 feet thick with narrow shaly seams between. The rock is partly dolomitic. Contains some fossils, spirifer granulifera, Atrypa reticularis, Strophodonta demissa, crinoid stems ectr. At present the water in the lake is 25 feet below high water mark.

Its total depth is said to be 80 feet. At times the lake is entirely empty and the water is seen disappearing in the crevices at the west end. On the south shore in several places massive concretionary limestones with Stromatopora Northeni, Acervularia Davidsoni, Str. monticulifera, Spirifer graniliferus, Spirifer mucronatus, Strophodonta demissa, Atrypa reticularis, crinoid heads are exposed, also with a brisk dip towards the lake. They seem to be the next higher strata above those at the west end. The water has to rise 20 feet before it has an outlet into the north branch of Thunderbay river and is at that high water period used for floating timber.

Returned to Mr. Marstons farm Sunday evening. Investigated the strata again and found the laminated bituminous limestone with the seam of silex to be the lowest seen stratum. Above it comes the dolomite which contains a cystiphyllum and the flat gasteropod shell. Highest are light colored limestones with Favosites, gasteropods ectr. and the top layers of it are almost entirely formed by lumps of stromatopora Northeni and some Favosites and Syringopora.

Monday July 6. Returned to Alpena.

Tuesday July 7. Excursion to False Presque Isle. Arrived at 3 o'clock at Middle Island. Strong wind against us. Middle Island is on the west side line by a gravel beach. The north and northwest side exhibit rock ledges and in the lake bottom. It is a dark grey limestone with ledges of uneven surface. Lime stone brittle and not good for building purposes. Some layers are mottled with more porous lighter colored dots. Also flint nodules are occasionally inclosed. The rock is in beds of 5 or 6 inches thickness. Contain no great abundance of fossils.

The most common is Enomphalus Deczewy, Lucina proavia, Atrypa reticularis with quite fine ribs, Pentamerus aratus small, Stromatopora textilis and Northeni, Strophodonta subdemissa. No Favosites or Cyathophylloid corals are seen. The Enomphalus has partly the shell on. Its spire (spine) is not elevated and from the upper side connects with the convex lower side under a sharp angle.

Diagram of fossil.

Also some cephalopode fragments and a Bellerophon are found. These limestone beds I consider as the highest of the Helderberg group. On the mainland not much over a mile west of the Island is the marble quarry of the Detroit Co. with the Stromatopora beds of the Hamilton group and the blue shales underneath.

At noon we had landed on the mainland (Misery Point) on the north entry of Little Thunder Bay where a most excellent harbor for boats is. In the gravel beach of this place I found a Phillipsiastraea, some specimens of Str. monticulifera and Northeni, Acervularia silicified with large diaphragms, Artypa reticularis and Pentamerus aratus entirely similer to the Long Lake specimens. There are however numerous Helderberg pebbles with characteristic fossils mixed with those of the Hamilton group which are prevailing.

Wednesday July 8. Sailed for False Presque Isle. Went to Grand lake which is only about 1½ miles distant from shore. The intervening belt of land between it and the shore is not of great elevation consisting of Lake terraces built up By limestone pebbles and a great many large metamorphic boulders strewn over the surface with large blocks of the Niagara group ectr. The bluffs surrounding part of the east side of Grand Lake are almost entirely composed of the Stromatopora limestone forming Crawford's quarry.

On higher ground above these bluffs this same limestone is found in ledges under the roots of fallen trees and some other natural outcrops. Str. Northeni and Str. monticulifera are more abundant besides Acervularia Favosites. The elevation of these ledges above the lake level may be 100 feet. The pebbles of the lake are identical in great measure with the pebbles of Middle Island and very probably similar strata form the Island of False Presque Isle which does not exhibit any rock ledges in any place of its shore. The shore is all pebbly.

In the evening we landed in the harbor of Presque Isle. In the hills which ascend to the hight of about 75 or 80 feet 3 lake terraces are perceptible. The lowest is prevalently formed by limestone pebbles of the underlying rock formation. On the higher terraces metamorphic boulders and Niagara and Helderberg limestones are abundantly intermingled. No rock cropping out in the belt separating Grand Lake from the Huron Lake but it is probable that the Stromatopora limestone seen at the lower end of the lake continues up to this place but is hidden by the drift. It is reported to me that the rock makes outcrops at the north end of the Grand Lake.

Thursday July 9. Visited lighthouse point. The higher surface of the point and in fact all the part above water level is covered by limestone debris and drift material which exhibits terraces of the lake.

On the north end of the point at the entry of the lighthouse harbor rock ledges form the bottom of the lake and are exposed at low watermark. It is a grey limestone much like the limestone of Middle Island but represents perhaps a little deeper beds.

Stromatopora textilis and Northeni, some few Cyathophylla and Cystiphylla, a Diphyphyllum, Atrypa reticularis, Pentamerus aratus, Acervularia, Favosites are the fossils found but they are not abundant. In the loose fragments on top of the Island some silicified fossils in poor preservation and abundant flint nodules(chert) are noticed. Cherty concretions are also not uncommon in the lower beds in the lake.

In digging the foundation of the lighthouse a few feet under the surface the solid rock ledges with chert nodules were struck. The limestone weathers easy and is unfit for building purposes.

Diagram

Made a landing on the point bounding Presque Isle river on the northwest side. The limestone is seen in the bed of the lake in ledges. The shore is only covered with fragments which are perfectly identical with the Middle Island strata containing Endomphalus dekewyi, Atrypa reticularis, Pentamerus arctus, Lucina proavia, Str. Northeni and some few Favosites and Cyathophyll also alveolites. Fossils are however quite scarce.

At the outer point of Presque Isle Island limiting False Presque Isle Bay, in the bottom of the lake large massive limestone ledges are seen at the depth of from 1 foot under water to 30 feet. The ledges form a sub-aquatic bluff in the lake and the water is quickly becoming very deep close to the shore.

Diagram of above.

The limestones are fissured by sub-parallel cracks running in northwest and southeast direction. Limestone pebbles forming the shore identical with those of Middle Island. Arrived at 6 in the evening on Middle Island.

Diagram of above

Friday July 10. Left the Island at 5 in the morning. Passing 9 mile point I observed the limestone ledges in large flats extending far out in the lake at a depth of from 5 to 30 feet below the surface. The ledges are divided by sub-parallel vertical fissures in large blocks 8 or 10 feet long and wide. The ledges above the waters surface at the point are described in my diary, from the first time I visited this spot. (Black bituminous limestones with favosites and Cyathophyll ectr.) At 2 o'clock in the afternoon took the boat Marine City for Cheboygan and arrived there Saturday morning at 5 o'clock July 11.

The land around the mouth of the river on which the town is situated is a low flat with clay soil having an elevation above the water line of from 5 to 25 feet. About 1 mile up the river a terrace of 12 or fivzen(fifteen) feet rises which is composed of fine red drift clay, the same as on the upper peninsula in many locations. It is used for brickmaking and furnished most excellent cream colored brick, but the preparation of it for that use is very negligently made.

The clay is not worked carefully into a homogeneous mass before moulding and also a admixture of sand is necessary to prevent too great shrinkage and cracking. The brick for these reasons has many defects. But from specimens burnt which accidentally have been better worked through and contain a proper proportion of sand it is evident that brick of most superior quality could be obtained by being only moderately careful in the manufacture. Rented a room for 3 dollars per week.

Sunday July 13. Started in company with a hired man and boat up Cheboygan river to Black Lake. The river divides a few miles above town in two arms, one coming from Mullet lake and unnavigable, the other coming from Black lake and equally large but not navigable on account of rapids in the river commencing 3 miles below the outlet of the lake and extending for three miles. We went up Black River. Its banks are generally from 30 to 50 feet high and composed of red alluvial drift clay underlain by very course boulders drift and gravel.

The rapids are running over this gravel and no rock ledges come to appearance. The last two miles near the lake have low swampy land. But lower down along the whole course of the river almost, a connected settlement of farmers lines the rover sides. They principally plant grass which is very vigorously growing.

The whole area of the inland lakes and the river coming out of them does not seem to be of greater elevation above Lake Huron than from 50 to 75 feet and is entirely formed and covered by drift material principelly clay of reddish color, but occasionally also sandy soil.

Character of the timber Hardwood with intermingled pine. Some almost clear pine woodlands growing on heavy clay soil are also noticed along the river banks.

Cheboygan or Black Lake is a very beautiful large sheet of water. Where we entered it, its banks are low overgrown with soft maple, populus, alder, ash, betr and in the shoal water grows a thicket of arundinaceous plants and water roses(?)and Sagittaria. Further south east and also on the southwest side the land becomes higher and the lake is everywhere in those directions surrounded by hill land with rapidly ascending declivities and partly regular bluffs.

Monday July 13. After breakfast we continued our journey in the boat towards the mouth of Mainy River. About 1 mile from our camping place we pass the mouth of Black River. (Airline ?). About 5 miles above its mouth there are considerable rapids flowing over flat rock.

After leaving camp we followed the shore to near the inlet of the first creek. After passing Black River the shore is all low, sandy and the lake near it very shallow with fine sandy bottom. Near this creek about 300 yards from the shore a brisk sand bluff rises to the height of 30 or 40 feet on top of which is a Norway pine plain. No rock of any kind observed unto here.

On a point in Town 34 (or 35) range 2 east, Sec. 17 suddenly the limestones of the Hamilton group form a vertical escarpment of about 40 feet. The layers lowest seen in the level of the lake are thin bedded light colored hard limestone slabs without any visible fossils.