Above them are in the first seen spot of the escarpment Stromatopora beds as on Crawfords quarry with the Stromatoporas however not very well preserved. Also Favosites, Strophodonta, Atrypa reticularis are found. Still higher are again grey brittle limestones in thicker beds which also are very poor in fossils. There are further on in the exposure more solid and massive forming a vertical rock wall of 30 feet and also containing there some fossils. Acervularia, Atrypa, Stromatopora Northeni and monticulifera. Under this rock wall limestones crowded with Acervularia, Favosites ectr. are seen and of these the lowest beds are interstratified with softer shaly clay rock in which Acervularia, Cyathophyllum, Favosites, Atrypa, Strophodonta are found in greater abundance and better preservation. This shaly layer is exactly corresponding with the shales seen in the marble experiment south of False Presque Isle.

Proceeding towards the mouth of Rainy river on entering Sec. 8 of the same town, the rock has disappeared and red drift clays or sand are forming the beach and the land joining the lake is low again.

Diagram.

Rainy river enters the lake with considerable curves.

Diagram of River

I left the boat at its mouth and went by a logging road up to a camp on the river where the beds exposed at the point on the lake shore are seen in the bed and the embankment ofthe river.

On the point I perhaps considered falsely some smooth fracturing limestones without many fossils as superior to the Acervularia and Stromatopora beds but in Rainy River it is clearly seen that they are under. Their thickness is not to be ascertained but is over 10 feet visible. Above come the shaly nodular limestones with many well preserved Acervularia, Favosites, Cyathophyllum, Cystiphyllum, Atrypa reticularis, Strophodonta demissa, Chaetetes ectr. Their thickness is not much over a few feet and on top of them are quite massive ledges of Acervularia and Stromatopora limestone but in some places Stromatopora and other fossils are quite rare. This upper limestone is not less then 20 feet thick. It is seen in exactly the same nature at the outcrops of little Thunderbay.

Tuesday July 14. Restless night from mosquitoes. Left camp at 5. A mile east of the river the shore is formed by bluffs 40 or 50 feet high, composed at the foot of metamorphic boulders as big as a mans head, most of them are a dark aphanitic greenstone. Above is red clay and gravelly sand. Timber small pine mixed with soft wood. Lake bottom quite shallow, sandy or gravelly. These bluffs continue in proximity of the lake shore for several miles. The north end of the lake has more swampy flat borders.

Between the lake and the mouth of Oqueok river a series of high hills is visible over which the state road to Alpena leads. These are all composed of clay, sand and boulders, no rock ledges visible in this district. The same is the case in the land intervening between Black lake and Mullet lake.

On our return to Cheboygan we were considerably impeded by timber floated on the river, perfectly obstructing it. We had to remain on Mr. Thomas farm 8 miles from Cheboygan unto next day when the river drivers broke the jam.

The land on both sides of Black river is heavy red clay soil of great thickness and underlaid by boulder drift containing a large proportion of limestone pebbles of the Niagara and Helderberg group. In some parts of the valley the bottom part is covered with a thick deposit of white calcareous marl containing terrestrial shells and Planorbis ectr. The timber floated on Black river is of inferior kind prevalently Norway. Returned to Cheboygan at noon.

Wednesday July 15. By boring through the drift which is red clay with gravel and sand beds underneath to the depth of about 40 feet, anywhere in the town of Cheboygan flowing wells of water are obtained. (Letters written to Canter and home).

Thursday July 16. Walked up to Mullet lake, a distance of 6 or 7 miles from Cheboygan. A good road leads to Dodges Point from which a fine view over the whole lake is to be had. The road leads over a rolling plain with red clay soil which in the ravines running towards the river is noticed to be of considerable thickness. Some more elevated knolls are formed by gravel and sand. All this land is good farm land and a number of settlers have located there, planting principally grass. But I saw also fine wheat, oats and rye, potatoes and corn in thriving condition and apparently about 3 weeks later than in the southern part of the state.

Mullet lake is a splendid water surrounded by sloping banks which at the waters edge are the red well stratified clay. Above it is a gravel deposit composed principally of limestone pebbles of the Helderberg group. Particularly obvious are the brecciated limestones of Mackinak, some of the lower dolomitic limestones with laminar structure, acicular limestone, also numerous Niagara limestone pieces and few of the Hudson river group, besides a small proportion of metamorphic rocks and some of the Hamilton group. All these pebbles are well waterworn.

The higher portion of the banks is sand. This same condition seems to exist all around the lake and from all appearances this whole district is good for farming purposes. Very little swamp land is noticed in the proximity of the lake.

From Dodges point in southwest direction at a distance of about 15 miles quite high hills are visible.

In the immediate borders of the lake I notice from this point about 6 or 8 clearings and houses. The forest is mixed timber and a principal occupation of the present settlers seems to be cutting cordwood which is taken to Cheboygan by small steam tugs and scows.

The elevation of Mullet lake above Lake Huron is probably not over 15 or 20 feet and the land between it and the Huron Lake cannot be over 100 feet in its highest elevation.

Friday July 17. Made arrangements for a trip by stage to Burts Lake and Little Traverse Bay. A man of Cheboygan informed me that in the shoreline intermediate between Ogueoh river and Cheboygan lighthouse, nearer to the lighthouse than to the river, in a certain point ledges of limerock similar to that of Crawfords quarry make on outcrop and are seen in the bed of the lake. The remainder of the shore is a sand beach with no visible rock ledges. (N.B. Every evening at 7 a train goes south from Little Traverse Bay).

Started Saturday July 18 from Cheboygan with mail carrier for Little Traverse. Passed Dodges Point on Mullet lake. The road further on leads over very fertile lands with loamy gravel soil and covered with fine beech and maple forest. Many settlers are found along the road to a distance of 14 miles from town until the Indian village road strikes the state road. From there no settlements are seen, but the land continues to be equally good unto the end of Burts Lake and the surroundings of Douglas lake.

When the road begins to turn southwestward passing Indian village and in approaching Maple River, the land is nice hardwood land again and fertile down to the shore of the little Traverse Bay. The general surface material is gravelly sandy loam but sometimes the red clays make their appearance.

After the road strikes the shore down to Traverse village the soil is found quite sandy and gravelly but covered with vigorous hardwood timber.

The point of Traverse Harbor is more sterile sand soil. The village is situated at the foot of high gravel bluffs of near 100 feet. From the top of these the highlands of Otsego Lake are visible at the distance but also the hills in the immediate vicinity of the shore reach an elevation which cannot be far below 400 or 500 feet.

At the mouth of Bear River a new village came into existence. Name Petoskey. 92 miles from Clam Lake. Trains leave 7:30 P.M. and 4:45 A.M. and arrive at Grand Rapids at 7:10 A.M. and 4:25 P.M. From Grand Rapids north they leave at 9:50 A.M. and 9:50 P.M. and arrive at Petoskey 9:30 P.M. and 7:55 A.M.

Stations from Petoskey

Melrose 8.6 miles distance Boyne Falls 15.7, Almira 23.3, Simons 29.5, Cascade 35.9, Mancelona 50.6. Total distance to Grand Rapids 199.7 miles

Sunday July 19. Fall of the water from the first railroad bridge to the surface of the lake 30 feet at a distance of ¼ of a mile. Went over to the railroad depot which is at the mouth of Bear River. Visited the locality of Stromatopora beds and made the following observations. Lowest are dark blue argillaceous limestones in slabs with only few fossils. Thickness not seen being the lowest beds in the water line.

Above are dolomitic well stratified yellowish grey limestones in thinner or thicker ledges brittle and somewhat absorbent, from 10 to 15 feet. Some seams contain ramified thick stems of Favosites and coaly fucoid-like impressions.

Above are some more smoothly fracturing limestones also quite brittle and with very few signs of fossils.

Then follows an argillaceous coaly dolomitic seam thinly laminated.

Above are absorbent dolomitic limestones in thick banks and amounting to 30 feet. Sometimes scarcely any fossils are contained in them except Atrypa reticularis, Spirigera concentrica, Pentamerus, Cyathophyllum and Cystiphyllum, Strophodonta erratica ectr.

Other times the limestone is a perfect conglomerate of Stromatopora in nests of larger extent. The lower beds contain almost exclusively Str. pustulifera. The highest beds Stromatopora caespitose and monticulifera besides Diphyphyllum, Favosites ectr. The whole series in this outcrop amounts to about 45 feet.

On Bear River at the sawmill on a somewhat higher level are in the river bed limestones with an abundance of Stromatopora monticulifera and Acervularia.

Higher up under Porters grist mill are about 6 feet of blue clay visible, some seams of which are rich in fossils. Acervularia, Favosites, Atrypa reticularis, Stromatopora erratica, Cyathophyllum

Above are again hard limestones with Stromatopora monticulifera and Acervularia visible about 6 feet. These clay beds seem to be the same as the Acervularia clay on the bay shore further out.

Monday July 20. Went along the shore west. The first lake terrace at the wood dock is composed of large waterworn fragments of various limestones of the Hamilton group intermingled with a few metamorphic boulders. Behind it rises a second one to the hight of about 60 or 70 feet which is formed by sand and gravel with some larger boulders, limestone and metamorphic.

A short distance above (west of) the wood dock blue hard limestones are seen in bed of the lake. They contain in certain places Cyathophyllum, Favosites, Acervularia, Stromatopora, Atrypa reticularis and occasional seams of black carbonaceous shale. Other times very few fossils are noticed in them.

Above these some hundred yards further on is a vertical wall of about 12 feet of strata well stratified. In places also this limestone is rich in fossils. Acervularia, Favosites, Cyathophyllum, Spirifer pinnatus and mucronatus, Atrypa, Strophodonta erratica and nucrea, Cyrtina Hamiltonensis. The direct continuation of these same beds near by may be entirely destitute of fossils. So also seams of shaly nature are interspersed more or less frequently and wedge out. Again a high drift bluff (75 feet) interrupts , then the outcrop. But at the other end of the bluff apparently the same strata crop out from underneath.

Only 100 yards further on the opposite side of a small point vertical bluffs about 25 feet high face the water. They have a somewhat different appearance from the former, are more of a dolomitic crystalline fracture, while the first mentioned are of a smooth fracture. But from their position I should be inclined to consider them merely as a locally differing horizontal continuation of the former beds.

In nests and in certain seams these limestones are full of Acervularia, Stromatopora monticulifera and Hortheni, Favosites, Atrypa reticularis and a number of other fossils, not differing in character in the whole thickness of 30 feet, the strata concerned. Above are a brittle somewhat crystalline and partly argillaceous limestone. Below this are a few feet of very fossiliferous blue shale which is in the exposure sometimes shrinking to less than 1 foot. Under it is a shaly calcareous bed jet black from bitumin and containing likewise many fossils, principally Stroph. erratica but pieces of the same rock found in the drift are real shell breccia of many different species common to this complex of strata. Under the shales are again limestones with Stromatopora and Acervularia scarcely distinguishable from the limestones on top of the bluff and in the water hard blue limestones with the same fossils are seen.

Diagram

It is very peculiar to see in such small distances so great and frequently changing variations in the appearance of the rock and the alternately great profusion of fossils or their sudden absence in the same strata.

The Stromatopora beds on the east side of Bear River are supposed to be under the Acervularia beds because no similar rock is seen in any other locality above the other exposed strata. But from mere contemplation of the exposures one should rather think they would be a higher stratum either, or an equivalent of the others with locally altered nature of the rock and some fossils peculiar to them, besides the others common to all the strata.

Thursday July 21 with Lt(enner) Dix to Buchhunk.

Diagram

Mr. Porter, Beaver Island. Sunday morning after next(Aug.2) a steamer going from Mackinack, or Tuesday evening after next Tuesday.

On Port Hugh rock exposures on the side nearest to Round Island. Several quarries seen in passing by to Cheboygan. Went with Steamer Harrington to Cheboygan. Wednesday remained at Cheboygan.

Thursday July 23. Excursion to McCulpins Point with horse and buggy. The state road leads there over a comparatively low sandy area partly overgrown with pine and cedar, partly with beach and maple, but the land in general is of very inferior quality.

At the point a few miles east of the lighthouse ledges of rock form the lake bottom but do not project. Further east at the so-called old mill there is no more rock as has been reported to me, and the fishermen can drive their pools(poles) to any depth. The pebbles of the shore at that place are partly angular fragments of the fossiliferous upper Helderberg strata as seen on top of Mackinak Island. A rock exposure is reported to me on the shore 4 or 5 miles the other side of Duncan City lighthouse.

By Mr. P. M. Simmons I learn that 4 miles south of Black Lake the black shales with Nagel calk(Nail-head calc) geoden(geodes) make an outcrop. Another outcrop of the same which was carefully inspected by him is found in Town 34, R. 3 West, Sec. 24. He says the shale crop out at the base of the high hills rising south of Burt lake. The higher ground of the hill land is all composed of drift material and no rock ledges are seen any more. This locality is about 8 miles up Sturgeon River which enters the stream between Mullet and Burt lakes.

Friday July 24. Sailed to lighthouse point intending to go 4 miles east to a point where rock ledges are said to appear in the water, but contrary wind did not allow a landing.

Saturday July 25. To Mackinack and thence to Petoskey. The land spur of Cross Village and middle village all stratified drift sand clay and gravel beds forming bluffs from 50 to 60 feet high. On top is good farm land but little of it in cultivation. Further back from shore the hills rise to an elevation of about 2 or 300 feet. On the inner side of the bay these bluffs are lower and of more sterile sandy nature.

Sunday 26. Followed Bear River up to Ingalls Mills. In the rapids above the mouth ledges of limestone are visible which seem to be identical with the bluff rock below the mouth. Further on no rock can be seen but below the mill an outcrop is seen below a thick covering of drift clays and gravel which contains Atrypa reticularis, Strophodonta macrea, Acervularia, Stromatopora. In still higher position under Porters mill are several feet of blue clay with fossils and above again thick bedded limestones with Stromatopora, Acervularia, Favosites ectr. The topographical position of these beds is higher than the bluffs of the lake.

Distance of bridge from Bear Lake 1 mile. Bridge at slate cuts 108 feet above the lake. Str. Bluffs, Town 33, Range 5 W. Sec.32. Course of bluff north 27 east. Light of bluff 44 feet below hotel.

Monday 27. Went to Melrose Station along railroad 8½ miles. The road runs after crossing the river 1 mile above its mouth, on the west side of it along the foot of hills of about 50 to 100 feet elevation. In all the cuts with exception of 3 only drift materials is struck upon.

The drift is in places prevalently sand with few larger boulders interspersed or it is mixed with clay and pebbles. Lowest is a heavy mass of boulders and gravel mixed with clay and sand. The boulders are all bearing marks of drift scratches. Few are metamorphic and those are large. Most of the material is limestone of the Hamilton group but also Niagara limestone is there not missing. The drift in some places appears superficially stratified but the bulk of it is in non-stratified condition, everything mixed without order. In some of the cuts 50 feet of drift are exposed. The land in the immediate vicinity of the road is inferior, partly cedar swamp, but on the east and west side some distance of splendid fertile hardwood lands are to be seen.

In the proximity of the second railroad bridge over Bear river where the road has an elevation of 108 feet above the lake, two cuts are made through the black shale formation with geodes of dolomitic limestone and spherical large masses of bituminous spar of cone in cone structure or of radiating fibrous arrangement in the limestones forming bands through the black shale. Some fossils are noticeable, brachiopods, pine wood, corals and stems of a Stromatopora could be recognized.

In connection with the drift boulders covering the slate exposures I mention that here are large lumps of drift marked Stromatopora limestones of identical character with the bluffrock at the mouth of Bear Creek. They are quite abundant and it awakens in me the question again, whether this Stromatopora limestone is not the next stratum below the black slate, instead of being considered to be at the base of all the little Traverse outcrops.

Tuesday July 28. Went with a boat to Whagoshewing Point(?). The outcrops along the shore are frequently interrupted and the relative position of each outcrop to the other is not exactly to be recognized. However the character of the fossils in all the strata does not indicate a great vertical range.

The fossils throughout are very unequally distributed, so that a stratum may for a good many yards may be almost destitute of them and at once a nest perfectly crowded with them is found in their horizontal continuation.

Also the rock character is subject to so many changes. It is sometimes a smooth fracturing limestone, other times the same strata are of crystalline dolomitic character. At Khago showing Point vertical cliffs about 30 feet high are extending for nearly a mile. The upper part is a yellowish crystalline dolomite partly of fine grained fracture, partly of coarser grain, and some of the upper beds full of crinoid joints also Khaeops bufr, Favosites, Atrypa reticularis and a few other shells are found in it but generally it is very poor in fossils. It may be used as a building stone but it is not very profitably to be quarried because much of the rock is not compact enough.

Below this dolomite are a few feet of a laminated limestone with blackish seams and beds of a smooth fracturing brittle limestone containing a few Acervularia, Favosites ectr. Lowest in the water line is a dark blue rough fracturing limestone with many Acervularia Favosites, Cyathophyllum, Cystiphyllum, Stromatopora Northeni, Atrypa reticularis ectr. The entire complex of these is not over 25 feet.

A little to the east of this outcrop other strata of various brittle partly smooth fracturing limestones are forming a vertical bluff of about 15 feet hight which appear to be situated below the dolomites. Acervularia quite common. These dolomites are most probably the equivalent of the Stromatopora beds near the mouth of Bear River. The outcrops furnishing the beautiful Acervularias is a blue clay bed, are still more east about midway between Bear River and Khagocheving Point. I consider them to be next lower to the mentioned outcrops.

A section of these localities is lowest exhibiting hard bluish limestones with black shaly seams. They contain in places a great profusion of Acervularia, Favosites, Cyathophyllum, Stromatopora Northeni and monticulifera, Atrypa reticularis and sometimes thick ramifications of silicious mass resembling Fucoids.

The upper portion is lighter colored limestone with many Stromatopora monticulifera and Acervularia, the stone is easy decaying into angular fragments.

Still higher the rock is more thin bedded very brittle with a layer of black bituminous shale on top which contains especially large numbers of Strophodonta erratica.

A few thicker ledges of limestone follow and they are then overlaid with the blue Acervularia clay rarely over 2 feet thick and not everywhere equally rich in fossils.

On top of them 12 or 15 feet of limestones more or less dolomitic and full of Stromatopora monticulifera, Northeni and Acervularia follow, also a few Chephalopods and a large Strophodonta is occasionally found besides Favosites. Estimating the total thickness of the strata seen in all the outcrops from Bear River to the Khagocheving Point I should not think they amount to more than about 100 feet in all, perhaps less.

Wednesday July 29. I visited the Stromatopora bluff near Bear River and the Acervularia beds west of it making many collections.

Diagram

Thursday July 30. Rainy day. Confined to the house.

Friday 31. Rainy again. Collections along the shore line.

Saturday Aug. 1. Sec. of Bear Creek bluff which is according to my present opinion identical with the Khagochewing Point bluffs.

1. Lowest blue coarse earthy fracturing limestones above 8 or 10 feet of
2. evenbedded easy weathering dolomite of drab color.
3. Drab colored dolomites with fine black laminating striae and poroso cellulose. 4 feet.
4. 5 feet of easy weathering dolomitic limestone of grey color and fine earthy fracture.
5. 15 inches laminated dark seamed easy weathering rock sometimes shaly.
6. Thick bedded easy weathering dolomitic limestone with darker colored maculose spots.

All these strata contain only exceptionally fossils, some indistinct bivalves, carbonaceous fucoid stems and here and there favosites or an Atrypa reticularis. Stratum No. 6 has a thickness of about 25 feet and is in certain spots entirely composed of Stromatopora. In its lower beds pustulifera is prevailing, in the upper beds monticulifera and cespitosa.

Lines without description.

In hotel at Mackinak from Sunday night to Thursday morning. All family for 2 full days of it. Employed a man for sailing the boat at 2 dollars per day.

Tuesday Aug. 4. Went to Round Island and Bois Blank. On the north west side of Bois Blank rock ledges of a semi-dolomitic limestone of hard brittle somewhat silicious nature and in layers of about 2 feet thickness are forming the top of some bluffs. Under them the strata are more thinly laminated slabs. Some of them of bluish mottled argillaceous aspect. No fossils seen in them. The pebbles of the shore are prevalently of the lower Helderberg group with acicular crystals of spar. The island has nowhere a high elevation and on the mentioned spot seems to be the only rock outcrop, all the rest is pebbly shore.

On the north side of Round Island bluffs of rock about 60 or 70 feet high are occupying half the length of the Island. The rock is a light colored somewhat porous dolomitic limestone. It is not brecciated as the opposite rocks of Robinsons folly.

Wednesday Aug. 5. Sailed out for Beaver Islands but had no good wind and had to take harbor at St. Helena. Helena is a low island overgrown with cedar, very stony soil and surrounded by a pebble beach, pebbles principally belonging to the lower Mackinak beds. No ledges visible anywhere.

Thursday Aug. 6. Left St. Helena with good light brise(breeze) which died away when we came near Lakeshang lighthouse. From there we had to row for over 12 miles until we reached Hog Island 9 P.M. where we found a rocky shoal shore with no opportunity for landing. We forced a landing, took supper and anchored out. All night very quiet. Hog Island is overgrown with cedar and in the more elevated portions with hardwood. Its shore is all pebbles and boulders of metamorphic rocks partly, partly of limestones of angular shape containing many Helderberg fossils, generally lamellibranches, brachiopods ectr. Besides those some Niagara limestones are noticed.

Friday Aug. 7. At half past seven we sailed out with a good light breeze for Beaver Island. No inhabitants on Hog Island. About 600 souls living on Beaver Island.

Saturday Aug. 8 left Beaver harbor for Mackinak. Beaver island does not show any rock exposures. A part of its shores is composed of pebbles very much like those of Hog Island. Among them are scattered specimens of the arenaceo-calcareous strata of the Hudson River group. The rest of the shore is sandy. The soil of Beaver Island is quite sandy, at the shore. More in the interior is gravel and loam mixed with it and offers a middling good opportunity for farming. Several lakes are in the island and a great many metamorphic boulders and large Niagara masses are strewn over its surface.

In one locality they found a large mass of Iron ore which the inhabitants supposed to be an outcrop of deeper Huronian strata but it is only a boulder. It is brown oxyd of iron. In the center of this are masses of whitish colored (drab) carbonate of iron from whose decomposition the brown iron ore originated. The mass is highly impregnated with fine crystals of iron pyrites.

On Trout and Whiskey Islands northwest of Beaver it is said rock ledges of limestone are seen in the bottom of the lake. The islands themselves like all the numerous others are merely composed of drift materials. On Garden Island some Indian inhabitants do some farming and the land there is said to be in part better than on Beaver Island The population of the different islands does not stand in very high credit and I suppose not with injustice.

Returned to Mackinak and from there with Steamer Dunlap to Bay City, from there to Ann Arbor by rail on Monday evening Aug.10.

Memo in back of book. Be Monday Evening at 7 in Lansing. Take there return tickets to Petoskey, sleeping cars. J. Reminger Mrs. Dr.J. Reminger, Ann Arbor.

Page diagram of Little Traverse Bay

Expenses for the Geological Survey during the year 1874.

Journey to Lansing and return to Ann Arbor Apr.28-29	
Railroad fare	4.50
Hotel expenses	4.
May 4. Journey to Detroit	4.
7-8 " Stony Point & Jonesville R.R. fare	8.25
11 " Detroit	"
19 " " Detroit	1.10
Baggage	.75
At Detroit	3.
20 to Alpena	5.
Baggage	.50
22 Friday arrived at Alpena Sundry Expense	.50
Monday to Sed. Boat 3dollars per day and man	15.00
At Partridge Pt. for lodging and board	2.00
Thurs.to Thunderbay I. Dinner	1.
At. Thunder bay Friday	3.
At Sugar Island dinner	1.
1 fish barrel	.70
At 9 mile Pt. over night	2.00
Wrapping paper	.35
Boat and man 4 days at $5. From 28 to 31.	20.
June 1. Pack carrier one day	2.
Meals	1.
2.To Frowbridges meals and night quarters	2.
1 man for 2 days	4.
Wrapping paper .25, barrel .50	.75
4-5. Buggy and horse to South branch	6.
At South Branch to Vanalstein for lodging and guidance	3.50
6-7.Sat.-Sun. excursion to Long Lake with Prof.Dowe.	
Expenses for us both with man and boat at LongL.	10.00
8.Monday Hotel bill for 17 days	51.
1 fish barrel	.75
To Crawfords quarry	2.
At " " Hotel bill 2½ days	5.
Extra meals	.50
At Rogers City for meals,lodging Thurs.& Fri.	3.50
For horses 2 one day	4.
meals	.50
To Mackinak	2.
At " for maps	2.50
Return to Alpena	4.
Baggage and transportation	.50
Sent 3 fish barrels and one box by Marine City.	
14.Sunday.Boat and man to Bear & Grass Island	5.
Hotel at Alpena	3.
Monday. Exploration with partie to the head of Thunderbay river to Sat.20,meals and transportation for the partie	75.
Horses, wagon and driver for 6 days	30.
Hotel bill Alpena	3.
Steamboat to Detroit	5.
To Ann Arbor	1.10
At Detroit	1.

June	Sundry	3.50
	Freight for specimens	4.
25	To Detroit	4.
	Packing straps	4.
	Packing straps	3.
	½ tea	2.
July 1	To Detroit	5.
	Coffee	.50
	To Alpena	4.50
	Servants	.50.
3.	Arrived Friday Alpena 5:00 victuals	4.
	Horse and wagon for 5 days	12.
	For meals and night quarters at Johnsons	3.
	" " " at Marstons	2.
	Man for 5 days, charged me 3½ per day	9.
	One fish barrel at Middle Island	.75
	Hotel bill at Alpena	3.
	Man and boat for 4 days	20.
	Provisions	4.
	To Cheboygan	3.50
	at Cheboygan, hotel bill one day	3.
	Excursion to Black lake with man and boat	.75
	Provision for 4 days, Sat. to Wed. 15,	4.
	One weeks board to Sat. (7 x 2) without dayly extras	5.
18	Sat. to Little Traverse Bay	4.
	Additional exp.	1.
	At Little Traverse, hotel bill)	8.
	And Petoskey 5 days from Sat. to Tues)	
	Tues. Return to Mackinaw and Cheboygan by steamer Dix	2.
	Mackinak Hotel	1.
	Return to Cheboygan	1.50
	Wed. paid board for current week	5.
	Thurs. Horse and buggy to McCulpins Pt.	3.
	Fri. Boat and man to Lighthouse Pt.	2.
	Sat. from Cheboygan to Little Traverse bay	5.
	Hotel bill at Petoskey to Aug. 2	15.
25	Thuesday. Man and boat to Wagoochewing Pt. 3 miles from Petoskey	4.
	Steamer Dix to Mackinak	7.
	Hotel at Mackinak	19.
	Boat supplies, rope and victuals	7.
	Saw	2.
	Man and sailor for 8 days	24.
	Hotel at Beaver Island	2.
	Steamer to Saginaw	8.
	From Saginaw to Ann Arbor	7.

D.	July 1	Check from Governorfor quarterly salary	500.00	
		Expenses for survey	500.00	
		Deposited through the hands of Mr. Diederich with Ed. Lanter.		
		Sent draft to Lanter for $500.00 to Savings Bank Ann Arbor.		
		Sold to F. W. Davis the survey boat for $80.00		
		Steamer John A.Dix leaves dayly Mackinak at 2 o'clock for Little Traverse.		
		Beaver Island 37,000 acres.		
		A lot of barometrical notes which were typed in the foregoing pages. Also the following names. Joe Willmet. Lieut. Bayes D.D. McDonald		

Diary August 1874, C. Rominger

Notes from front of book. 1 m. west, 1 m. south, _ west then south over to Greens.

Diagram of fossil

Summe(sum or summary) of exp(enses) up to Sept. 1, 650.00

Well bored for salt at Davisville 5 m. west of Lexington are 185 feet down and are still in the drift.

Thursday Aug. 13. Left Ann Arbor for Port Hope with St. Clinton. Detained to Aug. 14 afternoon 6 P.M. Arrived there Saturday evening Aug. 15.

The formation of the shoreline from Port Huron to Port Hope is everywhere of the same character, formed by a clay and gravel bluff which is immediately facing the lake and of about 12 or 15 feet up to 30 feet hight; or a strip of lower land strewn with large boulders forms the lake shore and a terrace of clay and gravel rises some distance back from the shore reaching in places the elevation of 50 ft. Only at White Rock the bluffs of the lake are partially formed by the shales of the Waverly group. At Rock Falls the ledges of sandstone with candagalli fucoids crop out along the shore and are close (to) the surface for a long distance over the flats west of the shore line.

Also at Port Hope similar sandstone ledges are making an outcrop on the waters edge near the salt block.

The terrace of drift on which the road leads from Port Hope to Huron City is at first mainly composed of sandy drift clay of light color with large boulders mixed into. In front of it is a low plain about ½ to one mile wide, is spread out, literally covered with boulders, most of them metamorphic but mixed with numerous limestones and cherty stones of the corniferous limestone and Hamilton and also Niagara group.

This lake terrace is becoming more abrupt and higher 4 or 5 miles beyond Port Hope and is found to be composed of the arenaceous shale layers of the Waverly group.

½ mile below the lighthouse this terrace approaches the shore and forms a perpendicular escarpment extending from the water. It is composed below of shales of dark blue color 12 to 15 feet of them. Exposed then comes a bank od sandstone full of iron pyrites and with spherical sandstone nodules and smaller white quartz pebbles. In certain spots numerous poorly preserved fossils are in it. In other portions scarcely any can be noticed. The thickness of this bank is from 15 inches to 3 feet.

But above the lighthouse where it sinks down to near the waters edge, at one place it dwindles down to a seam of only an inch but afterwards attains again a greater thickness. This bed is made by Winchell the dividing line between the carboniferous and Devonian rock series but it has no such importance. It is merely a very locally developed seam which does not in any respect indicate changes of conditions. The beds below and above are absolutely conform(able) in quality, fossils and stratification.

Above this sandstone ledge sandy shales amounting to the thickness of 15 or 20 feet form the top of the higher part of the bluff which is of 40 feet elevation. A short distance before the lighthouse is reached this upper shaly part recedes again from the shore and forms a second bluff further back. The lighthouse stands on the pyritous sandstone ledge.

The top of the bluff over which the state road to Huron City is laid out, is crowned with some 15 feet of sandstones overlying the before mentioned shales. This sandstone is identical with the grindstones of Grindstone City.

Fossils are generally very rare in the described shale beds above and below the pyritous sandstone ledge of the lighthouse, but what there is of them does not indicate a change in the character of the fauna. The land of this region may be generally considered of very fair agricultural quality.

Monday 17. Saw the outcrops of sandstone on the shore line about 1½ miles north of Port Hope. The beds are identical with those outcropping at the salt works and identical with the grindstones. They contain scarcely any fossils. I saw an impression of some bivalve. Globular masses of sandstone are also frequently seen imbedded in the mass.

The flats joining the lake are almost paved with metamorphic boulders of large size. Some of them are distinctly drift marked, some Niagara, Helderberg and Hamilton linestones are mixed in, besides fragments of the grindstones which rarely are fossiliferous. Only Chonetes? Productus and crinoid joints were observed. Fire in the woods prevented me from excursion in the afternoon.

Tuesday 18. Hired horse and buggy for the head waters of Cass River. Road leads first to Verona village in the northeast part of Verona township in Sec. 1 and corner of Sec. 12. The direct road from Port Hope to Verona was impassable by the fire and we had to go first to Sand beach. The state road from Sand Beach to Verona is laid out in straight west line through a burnt district of perfectly level surface. This level burnt country extends for a great distance north and south. At Verona the first hilly undulations begin and green trees are seen again, while on all the space from Sand Beach to Verona all arborescent vegetation is killed.

The soil is middling qualified for agriculture and by proper management furnishes satisfactory crops. Most of it is sandy clay. At Verona the soil is much better and may be called very good. The level burnt ground is only in few places swampy and easy drained. The rise of surface from the shore to Verona is very gradual and can not be estimated correctly, but I should not consider it over 100 feet above the level of the lake.

No rock outcrops known in these environs. The hills composed of drift material. Towards Bad Axe many large boulders found. Some brick made there fall all to small fragments, the clay being full of small limestone pebbles.

From Verona to Cass River Mills the land is rolling with good sandy and gravelly clay soil. Many farms are established. The timber is hardwood mixed with good pine but all this district has been burnt over and many trees killed. About half a mile before reaching Cass River Mills on top of a hill a large quantity of coarse sandstone is strewn about which seem to be identical with the coarse Port Austin rock or to Point of Barques.

From Cass River Mills we went along section lines making many angles to Cass River. Crossed that stream and struck the state road right where the north branch divides in two arms. In the bed of the stream large metamorphic boulders are seen, but close by on the road leading east towards Tyers, sandstone ledges are largely exposed on the flats. It is a coarse sandstone, apparently the Port Austin rock. We stayed there all night in a farmhouse in Town 14, Range 12, Sec.13

About 3 quarters of a mile from there up the creek at Williams dam, the sandstone is exposed in the river bed. The Indian Rapids are on the south branch of Cass river 6 miles from this farm. We go there in the morning taking a guide along.

The road from Cass River Mills to our night quarters are terrible. We had to lay down 5 or 6 fences, cross over logs and finally had to cross Cass river which is filled with logs. The horse had to be led over and came very near breaking its legs. After we crossed him we pulled the buggy over the logs and came through to the state road by a very much obstructed, unfinished road, full of tree trunks and paved with huge boulders.

Wednesday Aug. 19. Took a guide to Indian Rapids 6 miles distant, 3 miles following the state road towards Cass City and then south on the county line to the river through a swampy low land. The river flows over rock beds and some distance above the place where I struck it the ledges form a bluff of 15 feet hight along the waters edge. The sandstone is thinly laminated, greenish, micaceous with some coarse grained conglomeratic layers. Stratification quite irregular, wedge-like and discordant. A seam of black micaceous matter one or two inches thick is seen intercalated.

No fossils observed except in the black micaceous strata. Some vegetable stems or impressions thereof. This exposure I have no doubt corresponds to the rock beds of Point of Barques. The fossiliferous strata below Cass City undoubtedly lay above them and are approaching the sub-carboniferous limestone formation.

Afternoon returned towards White rock. The road is a very good one and the country all over settled with good farming population. To Thyers post office the land is rolling and continues to be so for several miles east when 8 or 9 miles from White Rock a flat plain is entered which extends to the shore. Near Thyers L.O. the coarse Pt. of Barques sandstone is seen outcropping in the ground. The swell of the hill on which the houses stand is drift. On the top of the sand rock ledges there are generally large metamorphic boulders in great profusion mixed with sandstone blocks. Near Thyers and in the depression between the rolling land are many swampy places, while on the flat plains bounding the shore portion of the land, the land is generally dry. All the district I have traveled over from Port Hope to Cass River and back to White Rock is totally burnt over by fires and all the timber is radically killed out. The dead trunks of former forest stand there and after some years wood and timber will be scarce in that country while it is now an incumbrance which is to be removed as speedily as possible.

The soil over all this country is a whitish sandy clay soil, principally bearing this character from the decomposed sandy shales of the underlying formation. Large metamorphic boulders and pebbles are everywhere frequent but limestone boulders and pebbles are comparatively rarer than other where although not missing. Arrived at 6 in the evening at White Rock.

Of the White Rock salt works I learn the following by statements of Mr. Thompson, the owner.1.The salt brine exudes from the walls of the borehole. No water is let into it from above.(2) The salt brine does not seem to be confined to the deeper sandstone strata but appears to come partly from the upper shaly beds because Mr. Thompson observed an increase of the brine as soon as he took the packing from the lower portions of the hole and lifted his tubes higher up. His pumps yield in well No. 1, depth 700 feet, 12 to 15 g. per minute but the pumps can only be worked 12 or 14 hours per day. Strength on salometer 85°.

The other well 350 ft. deep furnishes from 6 to 8 gall. per minute but can be pumped continually. Very little iron in the brine by the aspect of the vessels and tanks which are scarcely stained. His brine is evaporated in iron pans 20 feet wide by 50 feet long. He asserts that he can evaporate brine for a month or even double that time without letting of any motherli from them constantly, only renewing fresh lie in the pans and extracting the salt from them. The liquid in the pans has not the usual brownish color but is perfectly white, and in the salt or brine no traces of iron are present as he contends

The products of the saltworks are said to be 150 barrels a day, and the amount of fuel per day is 14 cords excepting some additional heat used from the boilers for warming up the brine.

The liquid in the evaporation pans is entirely colorless after they have been in constant operation for 3 months without removing any motherlie at all. The brine in the cisterns is first mixed with lime water.

The arches for the fire under the pans are about 4 feet high and every 8 or 10 feet an opening leads under the pans above.

Diagram of above.

Thursday Aug. 30. Left White Rock at 7. Stopped at Rock Falls and inspected the sandstones and shales along the beach and in the mouth of the river. The sandstones are intersperses in irregular thin layers between the shaly rock. Contain many fucoid impressions and here and there a Chonetes. Their thickness is from 5 to 8 inches and no quarry can successfully be opened for building stone. The same rock beds make a small outcrop in the mouth of the creek at Sand Beach. There Chonetes is in nests dispersed through the rock.

The level land extending for miles back from the shore and destitute of trees by the frequent fires is now transformed into nice wheat fields and meadows. The soil is a rich sandy loam soil and very productive.

The owners of the saw mill at Rock Falls have clear fields amounting to 514 acres which they offer for sale for 35,000 dollars, including numerous buildings, stables, barns, and some horses, cattle and farming implements. The mill property is excluded. The harvest for wheat ectr. seems here to be a few weeks later than in the south. Part of these crops is cut, another part is not perfectly ripe yet.

Port Austin Saltwell 1162 feet deep. This well furnishes a brine of 92 percent saloneter degrees and dayly 120 barrels of salt are made from it. But the quantity can be increased to 150 barrels, which quantity was for some time actually produced, and according to the statement of the foreman there would be brine enough for 200 barrels a day.

The evaporation of the briue is performed in cast iron kettles holding about 30 gallons of fluid. 50 of such kettles are walled in in two parallel rows and are heated by an arched flue about 3 feet high and with a large air opening in the top of the front door closing it from 30 to 40 cords of wood are dayly burned to make 120 barrels of salt with exclusion of the steam used for pumping the brine. The kettles are filled with brine and boiled down to such a degree that on the solid salt scarcely a thin sheet of liquid stands. The salt is then taken out into wooden baskets and about 2 gallons of mother lye are thrown away.

2 such sets of 30 kettles are at work for the production of the above mentioned amount of salt. The saltworks of White Rock use for the same quantity of salt only 14 cords of wood. The kettle system for itself requires more wood than the flat pans, but the enormous consumption of wood in the Port Austin works is considerably augmented by the great distance of the fire from the kettles and the large quantity of cold air entering between the flame and the kettles

12 men are constantly employed with the salt boiling. Part of them are paid 2 dollars a day, part 1.50 and 1.75. The value of barrels is about 35 cts a piece. Price of salt at the dock 1.35.

Diagram

The pumping of the brine is done by a separate engine which is fired by edgings and sawdust causing little additional cost except the man attending to it. (In pencil. The pumps can only work half the time.)

Cooper and Cryver well at New river is finished this spring. It furnishes a pure brine of from 84 to 86 degrees strength. The pump works all day and throws about 9 gallons per minute. Depth of the well 1029 feet. No record kept of the boring. The salt evaporating pans similarly arranged with the White Rock salt works but the fire is in 2 central canals and returns in 2 interior channels to the smoke stack. In White Rock the firing is in the exterior channels and returns through the interios ones.

Friday Aug. 21. Made arrangement with Mr. G.G. Skym to inspect his saltwell in the afternoon. In the morning went to Point of Barque and along the shore towards Grindstone quarries. For 2 miles further the Pt. of Barques sandstone retires towards Burnt Cabin Point from the shore and a sand beach lines the water but in places numerous sandstones fragments are thrown out which contain Rhynchonella and Centronella Julia. These beds undoubtedly are next below the Point of Barques sandstone and above the grindstones.

Proxy

New saltwell of Mr. Skene at Port Austin bored 1875 to the depth of 1224 feet. At 125 feet depth flow of sweet water rising to the surface. At about 300 feet water with saline taste, coming from a sandrock about 2 feet in thickness. At 317 feet very strong flow of sweet water from a conglomerate rock about 30 feet in thickness. At about 400 feet salt rock (sandstone with brine) 30 or 40 feet. From there all the way down shales. At 1130 feet a brown clay of about 40 feet thickness evolving a large quantity of gas with bituminous smell principal saltrock about 80 feet thick struck at 1165 feet. Under it shales again. From 400 to 500 feet no specimens preserved, the rock of this horizon is for 40 or 50 feet a sandstone containing brine.

On the east branch of Pine Hog River limestone in the river outcropping about 5 miles south of Port Crescent and about 7 or 8 miles east of Caseville. Ask for Mr. Thom. Greens farm. He can give more special information. The gypsum is frequently struck in the wells by farmers under a bed of limestone.

(1 page of pencil notes which had been typed in foregoing pages)

Saturday Aug. 19. Went with horse and buggy to Caseville and 4 miles further west turned south with the intention to come to Thomas Greens farm. I went about 8 miles south to the end of the road over a flat partly swampy country with very good soil, everywhere also with devasteted forests by the fire which helped much in clearing the farms.

I returned on the same road about 2 miles and stopped with a farmer in Town 17, R.- Sec.8. He has recently dug a well of about 25 feet in depth and found ample supply of water after striking in the bottom sandstone ledges similar in appearance to the grindstones. He tells me that all wells in his neighborhood go down to the rock beds which are uniformly found to be a sandstone and never limestone or gypsum as the report goes. The deepest well known to him is 55 feet. In the east branch of Pine Log River are rapids 5 miles long and these flow over evenly laminated sandstone beds entirely similar to the sandstones found in the wells. The man said he knows perfectly well to distinguish a sandstone from a limestone. He has been hunting anxiously for limestone in the surrounding country but never found any. Also the gypsum is according to his knowledge never been found near by.

The well on Thomas Greens place which is about 5 miles from there he helped to dig and says exactly the same sandstone as in his own is found to form the bottom of that.

The soil of the farms in this section are all free of the numerous boulders seen in other localities. It is a rich sandy clay of great fertility. Man owning the farm Ranal McDonel.

New River well strength brine 85°. Commences in grindstone 15 ft.
Then soft shale 30
Then slate with some subordinate sandstone ledges about 800
Salt water was met with already 80 feet below the surface.
Brown rotten bad smelling rock about 140
Salt rock over 100 feet a sandstone.
Lowest shale or slate only penetrated a few feet.

Sunday Aug. 25. Walked to Grindstone City. The high bluff over which the shore road leads is composed of the coarse grained Port Austin sandstone and frequently comes to the surface at the quarries. I observed on top of the grindstones about 6 feet of strata which are in part a highly calcareous conglomerate with quartz and feld spar pebbles besides pieces of sandy shales and calcareous spherical nodules inclosing frequently a goniatite or some fish remains. Also carbonaceous vegetable stems are in certain seams very abundant. Connected with these conglomerates are thin hard sandstones slabs which sometimes are of a brown or reddish color.

In the grindstones the same fossils as in the conglomerate are found but more rarely. Among the more interesting fossils I found in the horizon of the conglomerate is a very large fish tooth with transverse ridges. Also fine specimens of Ichthic (?) Varolites and other fish bones are found. Bivalves are rare and very indistinct. Of goniatites I found 3 species, one little involute, one very involute and one indistinctly preserved and compressed with long spines on the dorsum.

In returning I followed the shore up to Pt. of Barques and convinced myself that the ledges with Centronella Julia must be above the grindstones and below the Point of Barques rock intermediate between the two places numerous slabs of this ledge are thrown out by the lake.

Monday Aug. 24 to Caseville by stage. Plumps land Town 18, R.11 E. Sec. 19 and 18, southwest quarter. The swampy plain below Plumps house towards the lake east of Oak Point and of about 30 or 40 feet elevation above the lake is underlaid by hard arenaceous sandrock ledges containing in certain layers numerous fossils, Productus, Spirifer, Rhynchospira, ectr. The same rock beds must be forming the lake bed at Oak Point where the shore is completely crowded with fragments of the same rock. Some layers are more arenaceous, others are almost a pure dolomitic limestone and still others are a regular shell breccia.

The position is decidedly above the point of Barques sandstones forming Nat Point and also an identity of those beds with the fossiliferous limestones in the bed of Cass River is beyond doubt, as well by similarity of the rock as by the fossils inclosed.

The saltwell of Caseville bored most recently has a brine degree strength and furnishes dayly a supply of brine for about 100 barrels of salt. The work in operation has one block with boiler iron pans and another with steam pipes feed fed by the waste steam of the boilers. At present another block is in course of erection in which the evaporation is intended by the heat escaping from the hot air blast furnace. The arrangement is the same as in the steam evaporation with the only difference that the tubes are heated by hot air instead of steam. It has not been tested how this contrivance will work but the prospects are very promising.

Two diagrams of above.

Tuesday Aug. 25. Hired man and boat for Charity Island and Point aux Gries. At the dock of Caseville by dredging the river much clay and gravel with boulders has been taken out and spread over the dock. The boulders are all very plainly drift marked and a large proportion of them belong to the calcareo-dolomitic arenaceous beds with shells supposed to be the next overlying rock to the Pt. of Barques sandstone.

In some of the limestone boulders with shells I noticed seams of gypsum, and the connection of these beds according to the rock character with the gypsiferous strata appears to be a very close one.

Charity Island, on side outcrop of carb. limestone alongshore.

Diagram

Sandstones imitating an uplift and discordant position to the limestone and in its own stratified arrangement discordant.

Lowest in the outcrops is a coarse grained fragile sandstone partly calcareous and amounting to at least 40 feet thickness. Its stratification is very discordant and on some of the beds ripple marks are observed. It is overlaid by perfectly horizontal limestone beds with flint nodules and at first sight this limestone and the sandstone appears decidedly of discordant stratification with each other. But the inclined strata frequently connect so insensibly with the horizontal ones changing from the sandy character into the limestone that I cannot believe in a great intervening interval between the deposition ofthe two. The limestone beds are seen in all about 10 feet thick, quite solid but inclined to splinter up into wedge shaped pieces. In one layer the surface is perfectly covered with ramified lithostrotion stems. Also Allorisma, Syringopora and some Fenestella and Rhaenopora fronds are found, but fossils are otherwise not very common. The limestone of many of the beds is free from flint and answers well for line burning.
Howard, lighthouse keeper of Charity Island.

Thursday Aug. 27. On the day before passed gravelly point then sailed to the mouth of Au Gres where we took dinner at the Bay Shore House. Point aux Gres has flat rock exposures which are identical with the Charity Island rock. The limestone is in part very arenaceous but contains the usual flint nodules, Syringopora, Lithostrotion, Saphrentis, Productus of the upper beds of Charity Island.

On return we had contrary wind and had to lay over at the sawmill on gravelly point. I was informed there of a white limestone cropping out on Whitestone Point and 3 miles further on Mr. Whitmore has opened the gypsum beds along the shore.

The shore portion at Gravelly point and a strip of land backwards 6 or 8 miles wide are of a sandy sterile nature and not inhabited. The land back of Pt. au Gres is said to be better and some settlers there. Timber oak and pine mixed. Low land between Gravelly Point and Whitestone Point however not swampy.

At White rock Point the lake shore does not offer any rock exposures. It is a gravel beach at the point and sand beach on the indentures. A few ledges of limestone however are opened close to the shore.

In a hole dug by some explorers and a mile back of the shore this same limestone has been found close under the surface. Fragments of it are seriously mixed with the loose sandy material forming the surface of the lower lake terrace. The limestone is thin bedded, easy weathering and layers full of flinty concretions help to compose it. There are also beds of arenaceous nature connected withe these layers and some cavernose cellulose marls . But no gypsum was noticed in this locality.

2 miles distant from it are Mr. Whitemores plaster quarries and 7 miles from it is the plaster bed of Mr. Smith. The limestone of Whitestone point appears to have an intermediate position between the limestones of Aux Gres and the plaster beds of alabaster. Under the plaster beds seem to be next the strata of Oak point and Bass River.

Friday Aug.28. Examined the boulders taken out by the dredging machine from the mouth of Pigeon river. All of them are very distinctly drift marked. Besides the metamorphic rocks and some few of the Helderberg and Hamilton group. A very large proportion of sandstones and limestones from the underlying strata are found.

The variety of rock character is considerable. Of the sandstones there are Grindstones of the usual quality. Some others are brownish red containing occasionally a goniatite and other shells. Some are of the courser upper Port Austin beds. Others are more calcareous or conglomerates. Also sandstones evidently from the lower strata of the carboniferous limestone are there.

The prevailing kind of rock is an arenaceo-dolomitic limestone wit with Productus, Spirifer and other shells, with limestones which are almost entirely composed of shell fragments and which have much resemblance with the limestones of the shales below the Berea sandstone of Ohio. Also black calcareous shales containing numerous indistinct vegetable stems are connected with these.

Brecciated beds with green colored masses seem to belong to the same series of strata. A well preserved Spiriferina with large hollow spinulose projections was found in one of these limestone blocks.

Also pieces of Gypsum are occasionally found in the loose material of the river bed. The limestones with fossils below the gypsum of Alabaster Point and some of the fossiliferous rocks found here are very similar and the vertical distance of the strata near Caseville and those cannot be great, judging from fossils and rock character.

Saturday 29. With steamer Quimby to Bay City. and from there with 5:20 train to Saginaw City.
Analysis by Dr. Garrigue Port Hope salt well.

Sulph. lime	0.0800
Chl.Calc.	1.8905
Magn.	0.7587
Chl.Sod.	18.1079
Water	79.7139

White Rock salt well

Gypsum	0.[illegible]
Chl.Calc	0.[illegible]
Magn.	0.4105
Salt	12.9154
Oxide iron trace	
Water	79.[illegible]

Port Austin 2 analyses

	1	2
Chlor	15.[illegible]	
Sulph. ac.	0.0071	0.0032
Calcium	1.1245	1.1570
Magnesium	0.[illegible]	0.3535

Wells of Holly waterworks now about 80 feet deep all uniformly going through hard blue clay with gravel. In the adjoining salt block they went through a drift thickness of 100 feet before striking the rock. In another well of the waterworks they got a good supply of water at 90 feet but the water rushed in so forcibly that all caved in and the well had to be abandoned.

Some of the self evaporating saltworks are in constant operation. They have from 5 to 8 inches of water in it and constantly supply the evaporating quantity by new supply of brine. It requires in good seasons from 6 weeks to two months before the salt is taken out and the reservoirs refilled. The production from those works in the Saginaw valley this years until now, about 25,000 barrels.

Along Kittabawassee many brickyards and tile factories.

Monday Aug. 31. Copies from Dr. Garrigues memorandum books.

Bay City, Gillmores works
65 saloneter degrees
Depth of well 505 ft.

Sulph. lime	0.396
Chl.Calc.	0.5502
Magn.	0.4115
Sod.	15.2674
Water	83.3945

No.2. Portsmouth (?)
54 Saloneter
Depth of well 664 feet

Sulph.Lime	0.4084
Chl.Calc	0.3472
Magn.	0.4853
Soda	12.5315
Water	86.1996

Fitzhugh & Co. Salzburg
68 Saloneter
Depth of well 1080 feet

Sulph.lime	0.0068
Chl.Calc	2.4691
Magn.	0.9452
Salt	13.3582
Water	82.1303

Notice there must be some mistake about this specimen of brine. on a later examination of Dr. Garrigue the brine stood 98 on the saloneter.

East Saginaw Salt Mfg.Co. E.Sag.
Saloneter 80
Depth of well [illegible] ft.

Sulph.lime	0.1513
Chl.Calc.	2.2885
Magn.	0.8829
Salt	16.4856
Water	79.7954

Chicago Mill & Salt Co.
Saloneter 82
Depth of well 980 feet

Sulph.lime	0.0830
Chl.Calc.	3.2119
Magn.	1.2109
Salt	17.3032
Water	77.5288

Lea & Lewis well now
Swift and Rockwood, Leg. City.
Saloneter 66
Depth of well 800 feet.

Sulph.lime	0.0005
Chl. Calc.	3.3430
Chl.magn.	1.0335
Cl. Sod	17.5105
Water	75.8730

Barbawlin Salt well

Chl. Sod.	18.20
Ch. Calc.	3.43
Magn.	1.43
Sulph. lime	0.52
Carb.iron	0.003
Sulphide lime	0.005
Silica	0.005

Bangor Salt Mfg. Co.
Block now destroyed
Saloneter 75
Depth of well 774 feet

Sulph.lime	0.0722
Chl Calc.	2.3811
Chl.Magn.	1.2312
Salt	19.1395
Water	75.3430

The brines mentioned contain traces of iron and compounds of bromine and Potassa.

General report of strata penetrated in the saltwell of Mr. A. T. Blackman
Surface material 60 feet. Boring results for the first 450 feet similar to those of Saginaw river. It was principally shale. Then 90 feet of very coarse sandrock. (At 140 feet from surface a strong overflow of slightly mineral water). In the sandrock a large supply of brine. 66 degrees saloneter. Below sandrock 45 ft blue shale. Then red shale mingled with different shades of color about 300 feet. Then gray shale arenaceous and sometimes mixed with red colored shales, about 850 feet. Below this the lower saltrock is struck, its thickness about 110 feet. 18 or 20 feet of grey shale below this. Lowest 2 feet of limestone. At the depth of 550 feet the rising brine from below had yet the strength of 95 degrees. Above this horizon the brine was found weaker by dilution with the overflow of sweet water, which discharges near 30 gallons per minute. Entire depth of well 1704 ft.

At Goodrich wells within 300 feet above the salt layers there is no water found. The streams of sweet water found above are let down to the salt to dissolve it. Well borers name Isaac L. Bigelow.

Bored part of the well at Alpena. He says that he struck a plaster bed between 700 and 800 feet. Its thickness was about 80 feet clear white virgin pieces. The upper and lower layers of it mixed with limestone. At about 800 feet a rock smelling very strongly bituminous.

On Monday Dr. Barrigue and Mr. Blackman owner of the new bored saltwells the details of which are sketched on the preceding pages, accompanied me to the locality and made every effort to give me all information they could.

Tuesday. Sept. 1. Dr. Barrigue went with me over a number of the principal saltblocks in the valley.

The evaporating system in kettles is practiced in several of the old blocks. The pan system is also frequently used but the usual way of evaporation is the steam evaporation. The surplus and waste steam is led in iron tubes protected by a wooden coating from the mills to the salt blocks. Another employed system is the solar and spontaneous evaporation which furnishes coarse salt for pork packing.

The one establishment which I inspected furnishes this season 25,000 barrels of salt at a cash value of 1.25 per barrel at their dock. The evaporating vats are shallow wooden boxes with a rim about 2 or 3 inches high. They are filled with the brine which in the measure of its evaporation is from time to time replenished with additional quantities of brine until a sufficient quantity of salt has crystallized, which in favorable seasons takes about 3 weeks to two months. From two to three crops of salt can be made during a season from these vats. Over all of them moveable roofs are attached on slides and rollers. Their process requires a considerable number of laborers which are however not constantly necessary. Also the wide expansion necessary for such works and the pumping of brine over the whole area is a quite expensive process.

Wednesday Sept. 2. With Dr. Barrigue to the place of Mr. Shattuck where a mining experiment for coal has been made. 3 borings made in that neighborhood. One close to mill 139 feet, all in drift. Found abundant overflowing water. One, ½ mile distant, 135 feet before they struck rock. A 3rd boring near Madisons mill gave the following boring results. 75 feet clay drift. From 75 to 150 hardpan. Then arenaceous shale of dark blue and blackish color. Total depth 225 ft. No water yet. Well caving in considerably.

Well at Shattucks. 30 to 70 feet clay at surface. 4 inches iron rock. Then hardpan to 92. Then 74 feet of sticky shale or clayrock. The laborers term it camrock. Then a stratum of very hard rock about 9 inches, nature not described. Then 5 feet of coal. The coal however has not been exactly ascertained in its nature. It was merely a black substance in small fragments.

Influence of very dry seasons on the saltwells diminishing the quantity of brine.

Wednesday Sept.9. Left Ann Arbor at noon. Arrived in Springfield Illinois at 4 A.M. on Thursday 10. Failed to meet Mr. Worthen. He left with the train a half an hour before I came to his hotel the St.Nicholas.

The collections of the survey are stored in the new Capitol basement but all boxed up and not accessible for inspection. In digging the foundation of the building sandy shales with Cyatharonia and some bivalve shells are thrown out but merely few specimens are mixed up in the debris.

1½ miles west from town is a coal mine in the shales and limestone geodes of which are numerous discina shells, some bivalves compressed and Productus and Spirifer camerenes. In the mines 3 miles north of the city the same strata are noticed. In connection with the latter mine is a iron rolling mill. No plant remains in good preservation but numerous wood fragments partly transformed into iron pyrites. South of the city is another mine which I am going to see after dinner. Springfield is a town of 18,000 inhabitants.

Friday 11. Arrived at Edwardsville in the morning.
Saturday went back to Alton. Inspected the stone quarries.
Sunday Sept.13. Left Edwardsville at 8 in the evening. Arrived at Crawfordsville Monday morning at 4 o'clock Sept.14. Went to fossiliferous outcrops near town and bought a collection of crinoids from Dorey, an old collector of fossils for the sum of 150 dollars. 5 paid in hand and 135.00 to be paid to Expressor before delivery of the box

Thursday 15. This box sent off by American Express. Started at 10 in the morning for Michigan City. Sent letter home ordering the money to be paid. Quit smoking to make up for the extravagance of buying the collection.

Some 3 or 4 miles before reaching Lafayette hard blue shaly rock is noticed several times in the bed of the creek. Near town the drift is of considerable thickness, of stratified condition.

The drift bluffs near Crawfordsville are at least 50 feet high. The lower part is stiff blue clay with drift marked pebbles and boulders. Little distinctness of stratification in the lower beds. The upper are stratified after crossing the railroad bridge for a mile, yet the arenaceous shales are seen outcropping in the railroad cuts. They are of a greenish brown color, contain few signs of fossils. The fossils are lower in more purely shaly layers with some calcareous beds.

Michigan City. State prison well continued to about 300 ft. depth and furnishing a big stream of overflowing strongly sulphurous water with saline ingredients. Has been analyzed in Chicago.

Wednesday 16 from Michigan City to Browns Station. Land along the road in part very fertile and not of the sterile sandy nature as I expected.

One mile east of Brown Station sandrock is found very close under the surface which is sufficiently hard to be used for home structures but it id not a marketable stone. The surface layers are a rotten ferruginous sandstone containing numerous casts of bivalve shells similar to those of the Marshal sandstone. Underneath are harder sand rock beds of brownish violet color. The ledges are however not very sound and are of oblique stratification. In the ravines near by the stone is not seen but the drift is full of sandstone fragments, particularly of such hard laminated slabs as are thrown out from the lake near Michigan City.

Up to St. Joseph fine fruit plantations are seen. Strawberries peaches, blackberries, apples, pears. The land is a light sandy loam. Also grapes are planted but I did not see rich bearing ones.

Near St. Joseph, lake bluffs about 40 feet high. Behind the dunes but further on the land is low level or slightly rolling, and all the way up to South Haven junction most of it joining the road is good fertile land with light sandy loam. Much fruit. Good corn crops. The timber land is oak, beech and maple and some smaller sawmills are working it up into staves ectr. Near the junction there is a low swamp district with burnt pine and little hardwood.

From there up to Richmond mixed timber, partly pine, hemlock. Not much land improved. Large river passing Richmond, low elm lands surrounding it. Soon after crossing it, high broken hills, considerable hardwood. Clay and gravel soil containing the Waverly group iron geodes.

Last Saugatuck is the station close to those interesting cuts. No hotel there.

Near Holland well improved farms. Soil very sandy but apparently productive. North of Holland across Black River fine hardwood land with level surface. Clay and gravel with iron geodes. Fruit trees do well but much wild land yet.

Thursday 17. Muskegon. Arrived there the night before. It is a place of more city like appearance than I expected to see, and in the lumber business it seems to be one of the first in Michigan. The port is spacious and secure but I do not know about the depth of the water in it and on the entrance.

The salt well is near the store in front of the Occidental Hotel. It has a depth of 2200 feet. No accurate record of the boring has ever been kept. The following statements I receive from the memory of the man that superintended the boring.

Drift material 255 ft. Cretaceous shales of blue color varying in hardness or alternating with soft purely argillaceous beds or seams of regular sandstone.
1. 60 ft. sand. Blue clay to within 35 ft. of the bottom, the rest gravel.
Most of the brine supply at 2055 feet in the sandrock bed.
30 degrees saloneter.
First, small streak sandrock 4 feet.
Then shale alternating with some sandrock beds to the depth of 700 ft About that depth an overflow of slightly mineral water which by going deeper disappeared. It kept flowing till down to about 200 ft.
From 700 to 1500 ft. all shales with slight interruptions of harder bed.
Near 1500 feet much gas and oil, also brine was in this horizon.
To 1600 feet lime and shale (slate) beds alternating. Lime soft.

At 1500 red shales in the thickness of about 75 feet below lime and shale very soft .
At 2000 ft. lime 50 ft. then sand 4 feet, while last 75 ft. lime. The other beds shale and sand.

At the office of the proprietors of the well I saw specimens brought up by the sand pump from the depth of 2010 and 2050 to 60, which are indicating a coarse grained sandrock at this horizon. There are some pieces of shale mixed in, which fell in from above. The first brine was struck at 1250 ft. The principal supply at 2300. The lowest rock in the well is hard black lime.

Another flowing well is seen further west from the salt well. It is bored to the depth of 1500 feet. The water has a slight very pleasant mineral taste. The flow is a stream of fingers thickness. The water issues from the depth of 300.At the lower depths they found also strong brine.

Thursday Sept. 17. Went from Muskegon City down to the outlet of of the river or rather the small inland lake into which the river expands. Sawmills form an uninterrupted chain all along the borders of this lake, and the immenseness of this industry of Michigan fairly represented in this spot.

The shore of the big lake is formed by briskly ascending sand hills, apparently dunes, which have an average elevation of 50 ft. but some hills near the outlet are over one hundred feet high, totally composed of fine loose incoherent sand and overgrown with some pine and also beech and oak.

The bluffs lining the inner lake or the river are about 30 feet high. Their top is also covered by this fine loose sand to the thickness of from 10 to 15 or 20 feet. Below is a reddish tenacious clay with many interspersed pebbles and well stratified when properly exposed. The thickness of this exposed clay is about 30 or 40 feet and intermediate between it are layers of gravel and sand, which in some places have been cemented into a hard sandrock or respectively breccia which exhibits considerably discordant stratification. The cement is calcareous and the thickness of the indurated layers is not over 6 feet, sometimes less. I never saw a harder cemented rock mass belonging to the drift deposits.

Diagram of inland lake.

Mr. Whitney's well

First 50 ft. sand	8 inches iron pyrites
5 ft. clay	15 ft. sandrock
10 ft. clay and sand	5 ft. slate
100 ft. clay	33 ft. sandrock
10 ft. gravel boulders	17 ft. slate
52 ft. sandrock	306 ft. slate, plaster and sandrock
total 225 ft.	The rest of the boring not recorded.

First water course at 350 ft.
Second at 445. Sweet water.
Full depth of well 1350 feet. Found salt water there

Friday 16. 4th 6:40 train. Returned to Richmond. Embankments of railroad cuts. Fine sand with small pebbles evidently stratified. Cuts 25 feet deep. Soil close to railroad quite sterile. North of Holland clay with gravel forms frequently the surface material. South of Holland to the Kalamazoo river at Richmond this clay and gravel with many iron geodes is everywhere at the surface and ravines 50 ft. deep are cutting into it and have to be crossed by the railroad track. Timber mixed, much hardwood.

International well 1175 feet deep. Manager Amethyst. Pump in from 740 feet deep. Sweet water stream strong at 100 feet.
Drift 182 ft.
Soft grey limestone about 240 ft.
About 60 feet of sandrock.
Blue limestone up to 900 feet, mixed with and (a) little red.
Blue shale to the salt.
9 ft. white limestone above salt.
25 ft. salt.
5 ft. limestone below.
30 ft. salt.
Continued alternating of rock and salt.
The deepest place for water about 500 to 600 feet. Below dry.
No gypsum nor red shale.
Water rises to 60 feet from surface.
Pans 134 long, 24 wide.
3 arches straight, not returning. 600 barrels intended per day from the 4 pans.

3 small diagrams.

Left Ann Arbor Monday morning Sept. 28 for Detroit. Left Detroit with Grand Trunk road at 7:35 and arrived in Godrich at 3 in the evening. We found in the environs of Seaforth a number of salt blocks in operations.

One of them is 1140 feet deep. The pump is down to depth of 700 feet. The tubing is down to the bottom of the well and outside of the tubing water enough runs down to the salt rock to keep up a constant supply of brine.

In the surroundings of Godrich are about 15 or 16 wells in operation. One of them, the International Salt Works has 4 pans, 134 ft. long and 24 feet wide. Each pan is heated by 3 straight flues which behind unite in a high chimney made of iron plate. Each pan gives about 100 to 120 barrels of salt per diem(day). Two of the pans are heated with wood. The two others are heated by coal but are not quite finished.

On both sides of the front part of the fireplace are heaters of boiler iron from which the pans can be supplied ad libitum. The brine is pressed into them by tubes entering at the bottom. The feeders of the pans have their exit from the top.

Diagrum of above.

The well of International Salt works is 1175 feet deep and the following particulars of the stratification I could learn.
Drift 108 feet.
Soft grey limestone 240 feet.
Blue limestone alternating with blue shales and streaks of red shale 410 feet.
White limestone 9 feet.
Rock salt 25 feet.
Limestone 3 feet.
Salt 50 feet.
Lower again a bed of salt in alternation with shale and limestone beds.

The water in the well is abundant but does not originate from deeper beds than 500 to 600 feet below surface. It rises in the tubes to 80 feet from the surface. The pump is down to 700 feet. Tubing all the way down to the bottom.

Dr. Garrigue visited several other salt blocks . In one, the Dominion Salt Works the well is 1150 feet deep. Mechanical arrangements about the same as the former.

In the river valley below the railroad depot which is about 150 feet deep, the bottom of the river bed and in places 50 feet of the sides of the valley are formed by massive rock ledges of the Helderberg group.

The lowest is a dolomitic lime rock laminated with black bituminous streaks similar to the beds of Monroe or the lower Mackinak beds Few traces of fossils in it. The rock serves a good purpose for building and is easy to work but much waste. The higher beds are a greyish blue limestone with more a conchoidal smooth fracture. They contain few fossils but Atrypa reticularis, Spirifer acuminatus, Strophodonta concave ? Dalmannia, Cyathophyllum sctr. are not rare but poorly preserved.

Above all is drift in various thickness consisting principally of limestone pebbles and a stiff clay, which in places is quite free from coarser particles and is useful for brick manufacture.
Wednesday Sept.30.

Thursday Oct. 1. went to Guelph. The country from Godrich to Guelph is a very rich agricultural district under good cultivation. All the surface is covered by heavy drift.

In the river valley near Guelph considerable exposures of a white dolomitic limestone are seen. The rock is in solid thick beds and is a very good building material. Most all houses of Guelph are built of this stone and have a very pretty appearance. Fossils although quite abundant in certain layers are rarely found in good preservation.

Most common are Stromatopora partly of eve spherical shape, partly in mamillatet form. The structure is very obscure. Numerous Gasteropods, Murchisonia and others are also found in casts, then Orthoceratites regalonus, canadensis and Trimerella but the latter two are very rare also. Halysites, Favosites and Stromboides pentagonus are found. At 6 o'clock in the evening returned to St. Marys. Flora perpendicular rocks 100 feet high.

Friday Oct. 3. Rainy and cold. Arrived at 8 in the morning in Tidder. Cut near village, 20 feet. Blueclay with abundance of Spirifer mucronatus, Cyrtina Hamiltonensus, Betr., above marly beds with the same fossils and some additional. Bryazoa, Syringopora, Spirigera concentrica, Rhynchonella laura above limestone with Strophodonta demissa and Syringopora. 4 feet seen.

Saturday Oct. 5. Went to Arcona. In the creek near Rock Glen Mill the following section is seen. Top of hill formed by about 6 feet of hard irregularly splitting limestones of brownish color, containing few Spirifers, Spirigera concentrica and a Syringopora. This is the same layer as the top strata of the railroad cut near Tidder.

Below are blue shales with a few calcareous banks and with nodular calcareous concretions. Spirifer mucronatus is here in great profusion found. Besides I found a Pleurotomaria, Orthoceras, Rhynchonella laura, Chonetes. These shales amount to about 30 feet. Some layers are richer in fossils than others. Next below is a calcareous ledge 2 feet thick.

Below is a yellow shale from 3 to 4 feet thickness which is perfectly crowded with Heldophyllum, Favositoid and Bryazoa, besides a number of other fossils.

Under it is again a blue hard limestone bank also from 18 inches to 2 feet thickness.

Then follow fine soft blue shales which contain Chonetes, a very elongated spirifer and in particular slabs and calcareous concretions full of Tentaculites. These shales are seen in the thickness of about 20 feet and below them seem to be again limestones which are seen in the bed of the river.

The whole Hamilton outcrop amounts to about 60 or 70 feet in thickness.

Among the fossils of Tidder to be noticed, large Orthoceratites 2 inches to 5 inches in diameter, 1 large nautilus, 1 Gomphoceras.

Sunday Oct. 6. Went to the Kettle Point. From Tidder to the lake shore nothing but drift covers the surface.

Near the shore of the black shales come out forming there the first struck it loose accumulation in comminuted fragments. In the lime very numerous limestones in angular blocks are noticed. The ledges of them are not leinly visible but all indications are for their close proximity. The limestone is hard, blue in various shades, containing many seams of flint and a great number of Chonetes. Besides Stropa reticularis, a Spirifer close to mucronatus, Strophodonta nacrea and fragilis ?, a Spirifer similar to acuminatus . Also large Orthoceratites and Cyathophyllum and Cystiphyllum are seen in it, also Favosites, Stictopora, Stromatopora. Very remarkable are also large arms-thick, branching cylindrical masses laying on the surface of the ledges. Like fucoids their surface is sometimes covered with shell fragments.

Also layers of oolithic structures are seen containing the same fossils.

Other limestone beds are greenish variegated with smooth conchoidal fracture and with nests of dolomite spar crystalls of yellow color among the loose limestone fragments also. Stromatopora monticulifera , Str. Northeni is found, and a great quantity of crinoid columns almost composes the whole mass of some blocks.

The overlying black shale is not seen in immediate contact but it is no doubt the next following stratum. The black shale is exposed in the thickness of about 10 feet. Some layers are full of light greenish fucoid-like ramifications and expansions. Also numerous iron pyrites nodules are in it. But the most remarkable thing are large spherical masses of Stink-kalk (Stink stone) of fibrous structure radiating in all directions from the centre to the periphery. Those balls are mathematically true globes of from 1 to 4 feet in diameter. They lay in the shales entirely isolated and the laminae of the shale are bending over and beneath them.

Diagram of Stink-kalk.

The surface portions of the shale beds appears to have been burning(burned) and is of bright red color. Large old trees grow on this burnt red shale.

The lower black portions are divided by vertical fissures into large almost rectangular plates of from ½ to several cubic yards in extent.

Two diagrams in back pages without explanation.

Other notes from back of book. Salt well Muskegon loose material 335 ft. then
Seaforth Salt works 1140 ft. deep well. Pump 600 ft. large pans. 75 cts. per barrel.

Expenses for Geological Survey from Aug. 13, 1874.

To Detroit, railroad	1.10
At Detroit, detained to noon Aug.14	2.
Fare to Port Hope by Steamer Clinton	4.
Expenses at Port Huron	3.
Sunday to Lighthouse	3.50
Horse and buggy 3 days to Bass River	9.
Tuesday expenses	5.
Wednesday expenses for guide	2.
for board	2.
At White Rock	3.
To Port Austin with Steamer Benton Friday	2.
At " " horse and buggy 2 days	6.
Hotel bill	3.50
Monday stage to Caseville	2.
Tuesday to Charity Island, Pt.au Gres and Whitestone Pt. with boat. Meals and nights quarters Charity	3.
at Sand Pt.	2.
" Aux Gres	1.
" Charity	1.
Boat and man for 4 days	16.
Hotel bill at Caseville	6.
Boat to Bay City	3.
Dinner	.50
To Saginaw	.50
To Bridgeport, Bay City and surrounding salt establishments railroad fare and other expenses	4.
To Shattucks with Carrigue, horse and buggy	3.
Hotel bill 4 days	12.
Railroad to Ann Arbor	4.50
Supper	.50
Sept. 7 to Detroit	4.
Wed. Sept.9 to Mich.City and Chicago	7.55
Chicago to Alt. & St.Louis depot	.50
Fare to Springfield	3.60
Omnibus	.50
To Alton & Edwardsville R.R.	4.50
At Alton, hotel	3.
To Danville	3.35
To Crawfordsville	1.75
Omnibus	.25
At Crawfordsville Hotel Dienstag(Tuesday) Sept.15	3.
Hotel bill at Springfield and connect. expense	3.50
To Mich. City	4.70
Meals on the way	1.25
Hotel	1.50
Mich. City to (New) Buffalo	.40
To Muskegon	3.35
Dinner	.50
At Muskegon omnibus	.50
Hotel 2 days	4.
R.R. to Richmond	1.50
Omnibus	.25

Dinner		.50
Supper		.50
R.R. to Junction at Kalamazoo		1.50
At Junction hotel bill		1.50
From Junction to Ann Arbor		.50
Left Ann Arbor with Mr. Harrigue Sept.30,to Detroit		3.20
At Detroit, Hotel for 2		3.00
Took out of Bank from Hunter	100.00	
" from Savings bank 40	11.50	
Dinner at Stratford		1.50
Hotel bill at Godrich		.50
To Guelph		3.10
At Guelph		2.
From Guelph to Midder		3.50
Expenses at Midder, Canadian money		15.
R.R. to Detroit and one to Saginaw		6.
To Ann Arbor		1.10
To Detroit and back Nov.?		4.
Exp. for survey		
3 trips to Detroit office		
Photographs		50.
Chemicals		5.
To Detroit Mar.(?) 15		
Photographs		75.

Austasand capitalion Apr.10 1873, 10,464.

Diagram without explanation

Notes. Chicago Mail Express from Alton 9:25 A.M.and 8:55 P.M.
Alton abd St. Louis Depot
G.G.Skym - Skene.
Larned
Cooper and Grevy, New River.
Jastings Emerson, left hand side South Ave.(?)
Arrive Richomnd 12:40
Train from Richmond south 5:55 and 6:55.
Dare train at East Saugatuck 8:55.

aus

Fossilien aus den Rock schichten westlich von LeAnce.

Fossils of the rock layers westerly from LeAnce

Leptaena sericea.
" alternata.
Orthis occidentalis
" lynx
" testudinaria
" insculpta ?
Lingula
Rhynchonella increbescens ?
" hemiplicata ?
Strichlandinia ?
Cyrtodonta
Avicula
Several other bivalves et gasteropodes.
Crinoid stems
Streptelasma
Orthoceras
Cyrthoceras.

Fossilien (fossils) from Ebcanoba River.
Lingula antiqua
Some indistinct remains of a gasteropode and one lamellibranche.
In the lowest calcareo-arenaceous ,besides, some fucoid impressions.

From the Trenton limestones
1. Rhaenopora multipora
2. Rhaenopora sp. ?
3. Coscinium flabellatum
4. Stictopora ramosa
5. Stictopora
6. Stictopora
7. Ceramopora
8. Rhaetetes metropolitanus
9. Rhaetetes ramosus
10. Arthroclema pulchella
11. Streptelasma corniculum
12. Stromatocerium rugosum
13 Falco lycus
14 Micrelypeus Ottawaensis
15 Schizocrinus nodosus stems
16 Conarocystites punctatus
17 Casts of Murchisonia major Hall ?
18 Casts of Pleurotoma gigantea ?
19 Buccania anguina
20 Trochonema umbilicata
21 Cyrtolites compressus
22 Tucula levata Hall
23 Lept. sericea
24 Lept. alternata

48. Streptorhynchus filitextus
49. Orthis testudinella
47. Orthis testudinaria
46 Orthis tricenaria
50 Orthis lynx
50 Zygospira recurvirostra
51 Rhynchonella increbescens
52 " specimen not determined.
53 Orania laelia Hall
54 Cholidops Trentonensis Hall
55 Proteles gigas
56 Illaenus Americanus
57 Cheirurus pleurexanthemus
58 Calymene senaria
59 Ameluurus ? Lyyidian (?)
and several Orthoceratite forms in imperfect fragments.
Invesites of this list are all in one stratum

Strata of Lesmaba river.

No. 41 is the lowest limestone stratum exposed. It contains lingula antiqua, traces of a bivalve and an Ehomphalus like gasteropode fucoid impressions.

The next visible stratum is

No.42 which is identical with stratum 44 et 45.

Then follows stratum

No.43 which is identical with stratum 46 et 47.

No. 48 to 53 are similar dolomitic limestone strata with No. 49.

In stratum 51 I notice a Streptorhynchus filitextus and another traces of a fossil.

The next following ledges upward are 54(1), 54(2) and 54(3). the first two contain a number of bivalve shells. the third one resembles the dolomites below.

54(4) Contains numerous Orthoceruta, brachiopodes, Tetradium fibrat. It remembers me most of the upper strata from St. Joseph and Lacompent D'ours.

55 et 56, 57 et 58 are strata of nearly the same horizons as those below 54(4). They contain Columnaria, Tetradium, Stromatocerius Labtona sstr., Lecheles.

56 is the lowest stratum at the next falls of 5 feet descent.

58 the uppermost stratum. Identical with stratum 57 et 55 above. Stratum 51 resembles in all particulars the stratum 54 (3) with the bivalve shells.

Diagram section on Lesmaba.

Locality 57. Whitefish River. Town 45 R. 20, Sec.3, at the dam built across the outlet of a lake. Loose large blocks of limestone imbedded in the drift but appear still close to its original bearing place. Arenaceous dolomitic limestone with numerous remains of Echino encrinites.

Orthis pectinella
" testudinaria
Leptaena alternata
A gasteropode - perhaps Maclurea
Streptelasma of the usual lower Trenton form.
[illegible]
A small modiola-like bivalve and indistinct rib fragments of trilobites.
And the head of a calymene.

Locality 34, 37 et 38. Rocks of 3 different places in the bed of Whitefish river.
38 is 2 miles above the mill.
34 is in T. 43 R. 20, Sec. 36 and
37 is in T. 42 R. 20 Sec. 3.
All are entirely similar dolomitic with only crinoid stems. One specimen of a very convex variety of Leptaena and cast of a large gasteropode I found enclosed.
On the surfaces exposed in the river bed a hard crust of ironoxyd is deposited, which gives them a very dark exterior appearance.

Locality 40 Day's River. Several strata exposed in thin bedded slabs, and in thicker banks with silicious nodes which peculiarly weather out in relief.
Fossil crinoid stems Schizocrinus nodosus
Echino encrinites
Leptaena sericea
Leptaena alternata var.or(rare?)

Limestone strata on top of the Grand Island sandstone east of Munising furance contain a number of imperfect casts and cavities left from some gasteropode shell similar to those called Maclurea. The section of the tube is rhomboidal. No other fossil observed but those in abundance.

Diagram of fossil

Compare Pleurotomaria canadensis Billings page 342. From the calciferous formation

From the loose blocks on the hill near the village St. Joseph. Supposed to be identical with the limestone beds in the middle of the Sulphur Island series.
Loose specimens of Chaetetes petropolitanus
Fr. amulets of Chaetetes
Streptelasma corniculum
Receptaculites occidentalis
Orthis pectinella also Orth. subquadrata
" plicatella
" testudinaria et subequata
Leptaena alternata
" sericea

Streptorhynchus filitextus
Rhynchonella increbescens ?
Pygidium of a calymene ?
Illaenus crassicauda
(3 whole specimens)
Orthoceras protoiforme

Fossils from Sulphur Island

Orthis tricenaria
" " modinella
" " testudinaria x
" " subaequata ? x
" " subquadrata
" " lynx x
Leptaena alternata x
" serieea x
Streptorhynchus filitextus
Rhynchonella hemiplicata x
" increbescens x
Argyopira recurvirostra., only one specimen.
Discina or Orbicula
Orthoceras proteiforme x

The small diagram of fossils

Arbonychia orbicularis
Cyrtodonta subtruncata
Schizocrinus nodosus stems
Cyptocrinus stems
Thamnotes retrojolitanus
" runcosus
Stictopora recta
" multipora
" ramosa
Columnaria alveolaris
Streptelasma corniculum x
Those with x are found in the upper and lower strata the same time, the others only below.

Catalogue of Star corals

Prepared March 1874

Streptelasma, Hall. Single conical polyp cells, surrounded by a perfect epitheca. Radial lamellae extending without interruption from the apex to the calycinal margin, forming 4 principal fasicules separated by intermediate longer septal interstices, one of which is generally more conspicuous than the 3 others. The principal lamellae extend to the centre and become there irregularly interlaced with the transverse diaphragms into a cellulose network. Transverse diaphragms not discernible in the bottom of the calyx, but distinct in a vertical section. Calycinal portion of the lamellae free without interstitial cell vesicules. Differs from Zaphrentis Rafinesque only by a less pronounced development of a septal fossette.

Streptelasma corniculum, Hall, not milne Edw. Small somewhat curved conical polypcells rarely 2 inches long by 1 or 1½ inch calyx diameter.

1. Trenton limestone(Birdseye) St. Josephs Island.
2. " " higher strata " "
3. Middle Trenton strata, Escanaba River.
4. Upper Trenton strata Sulphur Island.

Streptelasma canadense, Billings. Zaphrentis canadensis,Billings
Streptelasma corniculum,Milne.Edw.
Hudson River group
Madison and Richmond Indiana
Hudson River group, Drummonds Island.

Streptelasma calycula Hall.
Niagara group, Lockport.

Streptelasma calycula ? With distinctly crenulated lamellae.
Clinton group, Dundas and Lockport

Streptelasma calycula ? Granulated lamellae in some specimens.
Pentamerus limestone of lower Helderberg group,Clarksville, N.Y.

Streptelasma gracilis. No(new) Sp. Small very elongated polyp cells with longitudinal ribs and delicate concentric lines of growth.
Niagara group, Waldron, Indiana.

Streptelasma vera. Nov. sp.
Niagara group,Pauls Station, Indiana.
" Point DeTour, St. Marys River.

Streptelasma radicans
Niagara group. Pauls Station, Indiana

Streptelasma patula. Nov.sp.
Niagara group. Point DeTour, St. Marys River.
Masonville, Iowa.

Streptelasma conulus, Nov.sp.
Niagara group, Point DeTour, St. Marys River.

Streptelasma recta, Hall
Hamilton group, 18 mile Creek and
New Buffalo, Iowa

Streptelasma ? distortum Hall
Hamilton group, 18 mile Creek.

Paleocyclus M. Edw. Cyclolites, Hall. Is placed among the Turbinolites by Edwards but its affinities are much more with the other Paleozoic corals of the Zoantheria rugosa, and I place them in close proximity with Streptelasma.

Paleocyclus rotuloides Hall.
From a pebble on Manitou Island. Probably Niagara group.

Paleocyclus, Sp.indic. Iowensis.
Niagara group (Clinton group ?) Iowa.

Paleocyclus pileolus, Nov.sp.
Niagara Group, Masonville, Iowa.

Zaphrentis Rafinesque. Simple polyp cells surrounded by a perfect epitheca. Radial lamellae well developed in 4 fascicules with intermediate wider septal interstices one of which is preeminently large. Diaphragms distinct. Lamellae either extending to the centre over the surface of the diaphragm, or diaphragm smooth in the centre. Sometimes concave, sometimes even and sometimes forming an elevated cone. Lamellae free within the calyx, with no interstitial vesicules. Sometimes crenulated.

Zaphrentis Stockesii. M. Edw.
Niagara group. Point DeTour, St. Marys River.
Masonville, Iowa.
Several other forms are found in the Niagara group which may be different species. One of them I propose to name Zaphrentis dilatata.

Zaphrentis Dalmanni.(Cyathaxonia Dalmanni M.Edw.)? Casts.
Niagara group. Milwaukee.

Zaphrentis bilateralis Hall.
Clinton group. Raynules basin.

Zaphrentis Roemeri, Milne Edw.
Lower Helderberg group. Clarksville.

Zaphrentis exigua. Billings(Heliophyllum exiguum,Billings)
Corniferous limestone, Port Colborne
Falls of Ohio ectr.

Zaphrentis Rafinesque, M. Edw.
Corniferous limestone. Perhaps only young specimens of Z.gigant.

Zaphrentis prolifica, Billings
Corniferous limestone. Port Colborne ectr.
Columbus, Ohio
Charlestone Landing, Ind.
Zaphrentis Arconensis, Widder
Hamilton group Widder
" Little Traverse Bay.

Zaphrentis, sp. indicand. Regularly curved cones somewhat laterally compressed, large septal fossette on the convex side. Centre irregularly depressed. Lamellae crenulated like Heliophyllum. In one specimen 3 septal fossettes like anisophyllum.
Devonian. Charlestone Landing, Ind.
Similar but smaller cells from Port Colborne.

Zaphrentis aculeata. Basal portion of polyparium ornamented with spines as in Zaphr. spinulosa. Otherwise form like prolifica. Lamellae with granulated surface.

Zaphrentis. Specimens not sufficiently well preserved for detailed characteristics.
Hamilton group, 18 mile Creek.

Zaphrentis. Eifel. Curved turbinate. Septal fossette on the concave side.

Amplexus Yardellii.
Corniferous limestone. Falls of Ohio, Charlestone Landing
Port Colborne Drift.

Amplexus decorticatus (Plotrophyllum decortic Billngs).
Corniferous limestone, Port Colborne Drift.

Zaphrentis Dalii. Septal fossette on the concave side.
Keokuk limestone, LaGrange, Missouri.
" " Keokuk
" Warsaw. Warsaw limestone
" Burlington. Burlington limestone.

Zaphrentis. Curved. Elongate turbinate. Septal fossette on the convex side on lateral specimens about 3 inches long and one wide at the calycrinal margin.
Keokuk strata near Louisville.

Zaphrentis spinulosa, Milne Edw. Spinulifera, Hall.
Chester limestone, Chester.
et Spergen hill.
Warsaw, Illinois.

Zaphrentis spinulosa ? dentiformis ?
Small specimens.
Warsaw limestone, Warsaw.

Zaphrentis dorsalis. Septal fossette on convex side. Like the former but without spines.
Keokuk limestone. Keokuk.

Zaphrentis dentiformis, nov.sp.(Menophyllum, Edwards)
Warsaw limestone. Spergen hill.

Zaphrentis (Menophyllum. Like the former in all particulars but spinulose surface.

Zaphrentis elliptica,White (Menophyllum). Septal fossette on smaller concave side.
Burlington.

Zaphrentis ? glans, White. Is near related to Hadrophyllum.
Burlington.

Zaphrentis hassata, nov.sp.(Menophyllum) Lanceolata, Worthen
Spergen hill.
Straight compressed, conical with sharp edged sides. Septal fossette corresponding to one of the edges, frequently with a smooth diaphragm in the centre. Small and larger lamellae of very regular stout form alternating.

Zaphrentis (Menophyllum) compressa. Curved specimens of the form of dentiformis but laterally compressed.
Spergen Hill.

Zaphrentis. Small curved cones with very stout coarse lamellae. Septal fossette on the convex side. Centre depressed with a smooth diaphragm somewhat secluded from the septal interstice which in other species is an immediate continuation of this central diaphragmatic space.
6 miles south of Louisville.

Zaphrentis(Menophyllum) calceola, White.(Lophophyllum,White).
Septal fossette on larger side.
Burlington limestone.

Lophophyllum M. Edw. It may be that some of the specimens connected with this genus have by others been placed with Cyathaxonia but Edwards distinctly states that Cyathaxonia has neither traverses nor synapticles between the lamellae, and all these have transverse plates going from one lamella to the other. But the figures of carboniferous cyathaxonia species given by Edwards resemble very much those which I place in his genus Lophophyllum and I do not doubt that Cyathaxonia and Lophophyllum are almost identical corals.

Lophophyllum proliferum
Coal measures. Springfield, Illinois
LaSalle, Illinois. and
" " near Pittsburg.

According to McCoy's definition all these forms would be Cyathaxonia and I am finally disposed to discard Lophophyllum and give Cyathaxonia the preference.

Cyathaxonia. 2 varieties ,one with very marked ribs, the other more smooth. Both of minute size.
Keokuk strata near Louisville.

Cyathaxonia. Very elongate curved conules.
Burlington limestone.

Cyathaxonia.
Keokuk strata. Crawfordsville.

Cyathaxonia
Goniatite beds, Rockford, Indiana.

Cyathaxonia. Sub-cylindrical curved cones several inches long.
6 miles south of Louisville.

Appendix to Carboniferous corals

Amplexus
Subcarboniferous(Waverly group) Rockford, Indiana

Amplexus
Warsaw limestone. Spergen Hill.

Lithostrotion proliferum Hall. Branching isolated stems.
Subcarboniferous limestone. Bellevue
Grand Rapids
Wild Fowl Bay.

Lithostrotion mamillare. Same form as above with caespitose coalesced starcells.
Subcarboniferous limestone. Bellevue
Grand Rapids
Wild Fowl Bay

Lithostrotion. Probably same species with small cells.caespitose.
Subcarboniferous. Arkansas

Axophyllum rude, White.Is in structure not differing from Lithostro-
Coal measures, St.Clair Co. Illinois (tion.

Siphonodendron. McCoy
St.Louis limestone, Edmondson City, Ky.

Cyathophyllum. Very elongate, tortuose.
Ratingen carboniferous limestone.

Sphenopoterium cuneatum. M et Worthen
Warsaw limestone. Spergen Hill.

Sphenopoterium obtusum
Keokuk limestone. LaGrange, Missouri.

Cyathophyllum. Genus characteristics. Conical, simple or aggregate polyp cells with a concave terminal cup. Composed of vertical lamellae radiating from an epithecal peripheral wall towards the center, which they reach or not, and of transverse vesicular plates, filling the interstices between the vertical lamellae.

The vesicular plates are arranged in conformity with the shape of the end cell, the central bottom of which is formed by larger transverse plates or also by continuous diaphragmatic laminae, while the ascending sidewalls are built up by more minute vesiculeus plates, disposed in arched rows directed upwards and outwards. In compound species each polyp cell is strictly defined by its own epithecal wall.

Sub-genera included within this definition are Heliophyllum, Cliziophyllum, Omphyma, Acervularia.

Cyathophyllum multiplicatum, Owen.
Niagara group, Masonville, Iowa.

Cyathophyllum. Closely related to multiplicatum, but specimens too imperfect for minute discriminations.
Niagara group. Pt. DeTour, Huron
Masonville, Iowa.

Cyathophyllum Shumardi, M. Edw.
Niagara group Louisville, Ky. and
Charlestone Landing.

Cyathophyllum. Not determined
Niagara group. Pauls Station, Ind.

Omphyma grandis, Barrande
Silurian. Bohemia.

Amplexus constrictus. n. sp.
Niagara group. Point DeTour
Masonville, Iowa

Amplexus socialis.
Niagara group. Pt. DeTour. Lake Huron

Cyathophylloid coral. Generic relations not accurately determined. Affinities Strombodes and Psychophyllum.
Niagara group. Pt. DeTour.

Strombodes pentagonus. Goldf.
Niagara Group. Drift. Point DeTour.

Strombodes striatus D'Orbgn. Only a large celled variety of the (former.
Niagara group. Pt. DeTour
Louisville
Charlestone Landing
Drift.

Strombodes mamillatus, Owen.
Niagara group. Pt. DeTour
Masonville, Iowa
Charlestone Landing, Ind.

Strombodes minor
Niagara group. Pt. DeTour.

Strombodes Johanni, Hall(Smithia Joh.Hall is no Smithia).
Hamilton group. Rockford, Iowa
Thunder Bay River, Mich.

Diphyphyllum -(Eridophyllum) multicaule Hall.
Niagara group. Point DeTour, Lake Huron.
Masonville, Iowa.
Drift at(et) Milwaukee

Diphyphyllum cespitosum, Hall
Niagara group. Lockport
Pauls Station, Ind.

Diphyphyllum Archiaci, Billings.
Helderberg Group. Sandusky
Caledonia, N.Y.
Falls of Ohio
Drift.
Hamilton group. Widder C.W.
Thunder Bay and Thunder Bay River
Drift.

Diphyphyllum panicum, Winchell
Hamilton group. Little Traverse Bay.

Diphyphyllum, strictum Milne Edw. (Eridoph.)
Devonian.Fallsof Ohio.

Diphyphyllum Verneuillianum Edw et H.(Eridoph.)
Corniferous limestone
Drift.

Diphyphyllum Simcoense, Billings
Corniferous limestone. Caledonia N.Y.
Port Colborne
Drift.

Diphyphyllum arundinacium Billings
Corniferous limestone. Caledonia, N.Y.
Drift.

Diphyphyllum colligatum Billings (eridoph.)
Corniferous limestone. Drift and Port Colborne.

Heliophyllum. Cyathophyllum with crenulated lamellae. This character is not constant and not peculiar to the corals assembled under this name. It is found in species placed with cyathophyllum, acervularia, Eridophyllum, Zaphrentis ectr.

Heliophyllum Hallii.
Hamilton group. Widder C.W.
18 mile Creek, N.Y.
Little Traverse Bay
Alpena, Thunder Bay.
New Buffalo, Iowa
Darien, N.Y.
Independence, Iowa
Corniferous limestone Port Colborne and
Caledonia, N.Y.
The latter forms possibly could be separated as distinct from Hallii

Heliophyllum juvenile
Hamilton group. Widder
Little Traverse Bay.

Heliophyllum solidum. (Zaphrentis solidade, Hall)
Hamilton group. Rockford, Iowa.

Heliophyllum. caespitose form.
Corniferous limestone. Drift.

Heliophyllum. Conico-cylindrical stems with anular constrictions and attached to each other by lateral processes as in Eridophyllum. proliferatic calycinal diameter about one inch.
Corniferous limestone
Drift.

Heliophyllum cornicula. (Zaphr. corn. Edw. and H.)
Helderberg group. Sandusky
Falls of Ohio
Columbus, Ohio
Drift.

Heliophyllum. Similar to H. juvenile.
Corniferous limestone. Caledonia, N.Y.

Cyathophyllum simplex, Hall.
Hamilton group. Little Traverse Bay
Thunder Bay.

Cyathophyllum geniculatum
Hamilton group. Partridge Point, Thunder Bay.

Cyathophyllum. Various forms not accurately studied.
Hamilton group. Widder.

Cyathophyllum Lesueri, M. Edw.(Vide N.Y. Rep. 4th Dist.)
Corniferous limestone. Columbus
Helderberg group. Drift.

Cyathophyllum Zenkeri, Billings,
Corniferous limestone. Port Colborne.

Cyathophyllum. Large expanded calyces similar to C. Zenkeri.
Port Colborne.

Cyathophyllum
Hamilton group. Independence, Iowa.

Cyathophyllum
Hamilton group. Independence, Iowa.

Cyathophyllum sessile.
Corniferous limestone. Columbus
Falls of Ohio.

Cyathophyllum sulcatum.(Aulucophyllum sulcat Milne.Edw.) Is perhaps not different from C. sessile. The latter being more irregular in shape.
Corniferous limestone. Columbus

Cyathophyllum (Amplexus ?) Several not determined fragmentary species from Falls of Ohio.

Cyathophyllum. Very large fragment.
Corniferous limestone Drift.

Cliziophyllum Oneidaense Billings.
Corniferous limestone Port Colborne
Mackinak
Drift
Charlestone Landing

Chonophyllum ? ellipticum Hall
Hamilton group. Rockford, Iowa

Chonophyllu,m magnificum Billings.
Helderberg group. Mackinak
Charlestone Landing
Drift Ann Arbor

Chonophyllum ? Similar to Ch. elliptica Hall.
Hamilton group. Widder.
Is not a true Chonophyllum. As little as Ch. ellipticum its structure is very coarse, vesiculose in the internal area. Same structure is observed in Cyath. simplex.
From Little Traverse Bay.

Cystiphyllum Niagarense (Chonoph. Hall).
Niagara group. Point DeTour
Lockport, N.Y.
Masonville, Iowa
Pauls Station et Charlestone Landing, Ind.

Cystiphyllum compositum
Niagara group. Point DeTour
Masonville, Iowa.

Cystiphyllum sulcatum, Billings
Corniferous limestone. Port Colborne
Mackinak

Cystiphyllum Americanum. M. Edw.
Corniferous limestone. Caledonia, N.Y.
Columbus, O.
Louisville
Drift.
Hamilton group. Widder
Thunder Bay
18 mile Creek
Independence, Iowa.

Cystiphyllum. Young individuals. very abundant in the quarries of Columbus, Ohio.

Cystiphyllum. Compare Lamellosum, Goldf.
Helderberg group. Columbus, O.

Cyathophyllum rugosum ? Hall.
Helderberg group. Sandusky and Drift.

Cyathophyllum rugosum Hall.
Corniferous limestone. Mackinac. A large variety of it with indistinctly developed boundary lines of the cells. Is generally considered to be a specimen of Phillips astrata (astraea)

Cyathophyllum Davidsoni. (Acervularia).
Hamilton group. Little Traverse Bay
Thunder Bay Island and Alpena
Independence, Iowa
New Buffalo. The specimens from New Buffalo are perhaps nearer to Ac. inequalis than to this form.

(Cyathophyllum - Acervularia) inequalis, Hall.
Hamilton group. Rockford, Iowa
Independence, Iowa.

Cyathophyllum amplicellulosum. Similar to Acervularia Davidsoni but in all proportions coarser built.
Hamilton group. Little Traverse Bay.
18 principal lamellae with as many smaller intermediate ones.

Phillips astraea Verneuillii.
Corniferous limestone. Drift.

Pachyphyllum Woodmanni, Hall
Hamilton group. Rockford, Iowa
Mason City, Iowa.

Hadrophyllum D'Orobignii.
Corniferous limestone. Delaware
Charlestone Landing, Ind.

Hadrophyllum panciradiatum M. Edw.
Devonian. Eifel.
Is quite a differently structured coral from the former species.

Calceola Sandalina.
Devon. Eifel.

Calceola. Sent to Prof. Hall and not returned.
Charlestone Landing.
Devonian.

Adiagram of a fossil with this description on it. A thick solid mass with a depressed centre radiated in the manner of a star coral and sending out a proliferation from near the centre.
Helderberg group. Drift.

Heliolites megastoma, McCoy.
Niagara group. Point DeTour
Masonville, Iowa
Charlestone Landing, Ind.
Drift
Silur. Str. Beraum Bohemia

Heliolites interstinitus, Linnea
Niagara group. Point deTour
Louisville
Charlestone Landing,
Masonville, Iowa
Pauls Station, Ind.
Beraun, Bohemia.

Heliolites minutus. Parasitic on favosites favosus.
Niagara group. Masonville, Iowa.

Heliolites subtubulatus ? McCoy.
Niagara group. Drummonds Island
Masonville Iowa

Heliolites pyriformis(Halls species)
Clinton group. Raynales basin, N.Y.

Heliolites. Casts not accurately determinable.
Milwaukee.

Heliolites porosus, Goldf.
Devonian. Eifel
Hamilton group. Partridge Point, Thunder Bay.

Plasmopora follis Edw. et Haines.
Niagara group. Charlestone Landing
Pauls Station, Ind.
Drift Ann Arbor.

Plasmopora spinipora Hall
Niagara group. Lockport
P Pauls Station, Ind.

Plasmopora
Silurian. Gothland

Lyellia americana Milne Edw.
Niagara group. Point DeTour Lake Huron
Masonville, Iowa
Drift Ann Arbor.

Lyellia glabra. M. Edw.
Niagara group. Masonville, Iowa.

Lyellia Charlestonensis
Niagara group. Charlestone Landing, Ind.
Louisville Ky.
(Compare Thecostegites Bouchardii mentioned as occurring at the Falls of Ohio).

Lyellia paprillosa Nov.sp.
Niagara group. Point DeTour, Lake Huron
Point of Barques Lake Mich.

Lyellia (Compare Propora tubulata.)
Beraun. Bohemia.

Calapoeria Huronensis
Cincinnati group. Madison Ind.
Drummond Island
Drift.

Calapoeria anticostiensis, Billings
Anticosti.

Aulopora serpens Goldf.
Devonian Eifel.
Hamilton Group. ThunderBay

Aulopora Iowensis Hall.
Hamilton group. Rockford, Iowa

Aulopora saxivadum Hall
Hamilton group. Rockford, Iowa.

Aulopora conferta, Winchell
Hamilton group. Little Traverse Bay

Aulopora alternata (Stromatopora Hall)
Helderberg group. Drift Ann Arbor
Hamilton group Rockford, Iowa
18 mile Creek N.Y.
Widder, C.W. (Canada West)
New Buffalo, Iowa.

Aulopora conglomerata et spicata Goldf.
Devonian, Eifel.

Aulopora faviformis
Hamilton group. Stony Point, Thunder Bay.

Aulopora tubaeformis, Goldf.
Devonian. Bensberg.
Hamilton group. Widder, C.W.

Aulopora spectabilis
Hamilton group. Independence Iowa.

Aulopora ?
Helderberg group. Columbus, O.

Aulopora
Warsaw limestone. Warsaw.

Aulopora ?
Warsaw limestone, Warsaw
and environs of Louisville.

Aulopora (Pyrgia)
Warsaw limestone. Spergen hill.

Aulopora (Cladochonus crassus McCoy)
Keokuk strata. Crawfordsville, Ind.
and environs of Louisville.

Syringopora verticillata, Goldf.
Niagara group. Point DeTour
Drift Ann Arbor.

Syringopora cancellata ? Eichwold
Niagara group. Point DeTour
Drift Ann Arbor.

Syringopora annulata, nov.sp.
Niagara group. Point DeTour
Drift.

Syringopora fenella, nov.sp.
Niagara group. Point DeTour
Louisville
Drift.
Resembles much an Aulopora. Funnel shaped diaphragms not observed.

Syringopora
Niagara group. Point DeTour
Masonville, Iowa
Drift.

Syringopora compacta. Billings
Anticosti group. L'Anse al'veille

Syringopora hybrida
Helderberg group. Environs of Louisville. Is an intermediate form between the genera Syringopora Michelioda(?) and Chonostegites.

Syringopora
Niagara group Waldron. May be a drift specimen and originate from the Helderberg group?

Syringopora. Penetrating specimens of Stromatopora.
Niagara group. Charlestone Landing. Similar specimens are found in our drift.

Cannapora junciformis, Hall.
Clinton group. Brockport, N.Y. and
Drift.

Syringopora tabulata. M. Edw.
Helderberg group. Sandusky

Syringopora Hisingeri, Billings
Corniferous limestone. Port Colborne
Louisville
Drift
Caledonia, N.Y.
Is closely allied to tabulata.

Syringopora nobilis, Billings
Corniferous limestone. Drift.

Syringopora perelegans, Billings.
Corniferous limestone. Port Colborne
Drift.

Syringopora Maclurei, Billings.
Corniferous limestone
Drift.
Port Colborne

Syringopora Hamiltonensis
Hamilton group. Thunder Bay
Widder, C.W.
Independence, Iowa
18 mile Creek
Devonian Eifel

Syringopora gordialis
Hamilton group. Independence
and Thunder Bay River.

Syringopora parasitica
Helderberg group. Sandusky. Growing always in association with
(stromatopora.

Syringopora multattenuata, McChesney
Coal measures. Sagamon Co. Illinois

Syringopora Harveyi, White
Burlington limestone, Burlington

Syringopora
Carboniferous limestone. Bellevue
Grand Rapids
Wild Fowl Bay
This and the following species are probably identical.

Syringopora.
Warsaw limestone. Warsaw.
Special locality not known. from Mohr.

Columnaria alveolaris Goldf.
Trenton group. St. Josephs Island
Escanaba River
Dixon, Illinois
Drift.

Columnaria(Favistella) stellata, Hall
Cincinnati group. Madison, Indiana
Drummond Island

Columnaria stellata
Niagara group. Point DeTour
Drift

Sponges

I. Tissue composed of a network of delicate threads with a globular swelling in the crossing points.

Obtusely turbinate, expanding in an excavated disc. Tissue arranged in vertical laminae radially converging towards the centre and inclosing tubular spaces of a similar radial arrangement, between these interstices which open on the surface of the discs. Tissue meshes triangular or quadrangular or polygon. The tubular spaces have no walls except the open meshes of the tissue, which are nearly as wide as the tubular cavity.

Some species have in addition to this structure equally distributed over the upper face of the disk shallow depressions towards which branches of the tubular system radially converge.

Astylospongia praemorsa, Roemer.
Niagara group. Perry Co. Tennessee
Waldron, Ind.

Astylospongia stellatim sulcata, Roem.
Perry Co. Tennessee
Louisville Ky.

Astylospongia incisolobata, Roemer
Perry Co. Tennessee.

Astylospongia Cratera, Roem.
Perry Co. Tennessee

Favospongia inornata(Calamopora fibrosa,Roemer)Astylospongia inornata (Hall.
Globular masses composed of diverging tubes which are formed by interlaced bands of the spongious network.(Hindia). Roemer took the meshes for side pores and considered the tubular spaces to be true (tubes.

Diagram of same
Perry Co. Tennessee and Masonville, Iowa.
Ceriopora nuciformis,Hagenow from the chalk of Rugen has the same structure.

Astraeospongia meniscus, Roemer
Perry Co. Tennessee

Zaphrentis glans Diagram of same
Burlington

lanceolata, Worth
hassata milne Warsaw

elliptica. Fossette on concave side.