[illegible] the white rocks [illegible] are drift to [illegible]. At the lower end of the Island, [illegible] on [illegible] high, [illegible] feet, [illegible] rocks. Right at the end of the island in this bluff red ferruginous slaty strata are exposed and some [illegible] highlights are seen. The strata strike from northeast to the southwest with a southerly dip at a high angle. The red ferruginous schists are exposed for the length of about 30 or 40 steps. Next to it follow a schisty-chloritic rock and then a hard massive diorite with little feldspar crystals with chlorite and quartz veins which contain iron ore in small streaks. Also in the diorite some streaks of ore are seen. This diorite is of considerable thickness (a few hundred feet).

Then further down the river again ferruginous and argillaceous slate strata with hard and jagged beds which I described in coming up the river follow again and continue for a quarter of a mile when again the diorite protrudes and forms numerous islands and rapids in the river. This remains so in endless repetition until down to the beginning of White Rapids, the river is very wide and so shallow there that our canoe was considerably damaged and filled with water, all things getting perfectly soaked in the water. So we carried the effects and boat ashore and had to empty. Rain all night.

Tuesday Oct. 17. We are drying our things at the fire and patching up the holes in the birch bark canoe with pitch which will probably take the whole forenoon. Then we have to make a portage of our very heavy baggage for about a mile or more, the river being so low that we cannot float down without breaking the canoe to pieces. At about 10 o' clock we get ready to leave. The canoe was loaded and one man brought it down to the regular White Rapids which are about a mile below. We walked and went over drift on a terrace some distance back from the river.

On descending to the commencement of the rapids we found the river bed formed of horizontal ledges of a soft white sandstone which also crops out under the drift at the waters edge. Below the falls the country is tolerably level and formed by drift. At the surface in the drift among older rocks are principally the lower strata of the Trenton limestone or Chaz(Chazy) limestone represented. No fossils seen in them.

About a mile below White Rapids some diorite protrusions are seen in the banks of the river. A number of islands here begin to be emerging from the river bed. They are called 30 Islands. Most of them are rich alluvial soil. Some show diorite rock protrusions. The timber is hardwood, for a good distance. 2 or 3 miles below the falls is another diorite island in the river which belongs to the 30 Islands. Further on to the mouth of the Dicke River which comes in from the Wisconsin side and is half a mile below the land is all covered by drift. This continues so for about 2 miles below where we are encamped in a fine norway timber grove.

Our boat leaked considerable and I was obliged to pay the specimens by buying another one for 1. dollars. The man Davis I dismissed in the evening and paid him 20 dollars for seven days labor, 5 dollars included for restoring a canoe which he took to his camp up the river. My specimens I had in the evening occasion to send down to Menominee on a wagon.

Wednesday Oct. 16. Started in a little after seven and made about 8 or 10 miles down the river through an almost level country with banks elevated from 4 to 10 feet. The soil is mostly a rich alluvial ground, only in places sandy, with hard timber. Only a few short strips are pine land. There are a few farms on the river. One of them whose name is Vitchen lived there for 40 years, The river has a gentle current, is deep and about 100 yards wide. No rocks exposed on the whole distance. In some of the gravel banks I found some Devonian pebbles in the Trenton pebbles. Very few fossils are noticed.

At a place inhabited by an old hermitical fellow named Lovejoy we stopped for dinner. The whole distance of 8 miles down to the rapids we saw no rock exposed. The banks are mostly low or only in places somewhat bluff-like and consist either of alluvial sand and loam soil or of gravel.

At the upper terminus of Grand Rapids which are about 3 miles long for the first time ledges of limestone projecting about 4 feet above water's edge are seen. It is a hard dolomitic rock in banks about 4 or 6 inches thick going down the river for about ¼ of a mile. From under this dolomite sandstone layers with ripple marks and with limestone fragments enclosed come to the surface. There are some intermediate beds of argillaceous nature interculated. Proceeding downwards after the sandstone has been exposed for a distance the dolomite beds again begin to cover it and subsequently higher strata come in which shall be closer investigated tomorrow. We stopped at night as guests in a farming establishment close to the river. It belongs to Samuel Stephenson.

Thursday Oct. 19. In investigating the strata at the rapids I found as noticed yesterday lowest sandstone strata with some argillaceous seams and occasionally inclosing limestone pebbles (strata No.1) . Above the sandstone changes into an arenaceous limestone. Then come some bituminous smelling calcareous and somewhat shaly strata with red or brownish red dots and stripes and some traces of a peculiar fossil. Its upper strata change into a hard earthy feeling dolomitic rock. Above it are very peculiar silicious limestone strata all composed of concentrically structured irregular nodules, which often resemble stromatopora. specimens.On top of them are some dolomitic slabs with argillaceous partings and even surfaces. In none of the whole series of rocks any fossils could be collected although there are undoubted evidences of organic remains noticeable.

The outcrops of rock soon disappear under the drift and for the whole extent of the river downwards no more rock is to be seen until reaching some rapids situated about 7 miles above the mouth of the river where some higher strata of the limestone with a few fossils are exposed in the bed of the river.

beetle are [illegible] old store, a [illegible], an [illegible] and [illegible]. It is [illegible] that all [illegible] to the south [illegible] of the [illegible] but for the [illegible] of the river which flows [illegible] until below the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. The land along the river is low, [illegible] cause little of cultivation but a great [illegible] is made about worthless by the late conflagration. The timber is also considerable divested of its useful [illegible] (trees) by lumbering.

Arrived at Hancock at 4 in the morning. Paid to Mr. [illegible] 50 dollars for [illegible]. 50 dollars for rent of 1 beam for [illegible]. During [illegible] observed [illegible] a bag of Marquette County [illegible] I left at the [illegible] house was stolen.

Friday Oct. 20. Sent [illegible] by the [illegible] which I had to leave on the banks of the river 2 miles [illegible]. Loaded 3 boxes, one bale and one chest and delivered for ship [illegible].

Saturday Oct. 21. The railroad connection with the steamboat line is interrupted by the Sunday intervening, while leaving on Sunday I can travel without interruption so I determined to leave [illegible] early tomorrow.

Sunday Oct. 22. At 10 o'clock left [illegible] with [illegible] Dunlap. Total bill 7 dollars. [illegible] (age) to Chicago 7 dollars. Mr. [illegible] Barry [illegible] for brot 2 dollars. On board of steamer .TI.

Monday 23. At 2 started with steamer Dunlap to Green Bay, arrived about 4. Along the road there are numerous fine ports of rock from the Hudson River group with a large number of shells. There must not far from place be an exposure and quarry of this rock. The immediate neighborhood is flat and [illegible].

Departed in the evening for Chicago where I arrived 8 o'clock in the morning. The train for Ann Arbor leaves at 9. Arrived at Ann Arbor 5 in the evening on Monday Nov?(Oct.) 25. Expense 7.30 from Chicago. Freight for boxes and [illegible] equipment

Received from [illegible] Bank Detroit in 5 different notes for the old [illegible] bought of my own money I had with me and expended.	100.00
	30.00
	130.00
Bought to [illegible] out of the way for the first boat from [illegible] and funds	100.00
Freight for boxes, [illegible]	50.00
Expedition (credit for)	77.00
	1017.00
Of this sum I brought back 20 dollars, balance of expenses	1017.00
since return expended travelling, expenses to Detroit	
Muriatic acid 60th a 15 -	4.50

outlays in the service of the geological survey.

1 doz. field books	.[illegible]
Wells map of field on or linen	[illegible]
Sent material and mailing	15.
1 compass	[illegible].50
Dry goods and items, boots	[illegible].50
Gloves, glove-arms, shields	[illegible]
Blankets	5.
Leather Stone bag and packing straps	7.
Printed cards for labeling specimen boxes	[illegible]
Writing materials, lead pencils, paper, etc.	1.50
Traveling expenses to and from Detroit	4.40
Camp utensils, kettles, plates, knives, spoons, etc.	10.
Traveling clerk	5.

Memoranda from leaves in back of book.

[illegible]

[illegible] 1

7 [illegible] 10111[illegible]

1017181[illegible]1415 The diagrams

1020[illegible] [illegible]

Diagram showing Sturgeon Falls and surrounding locality.

Crosses(largest) marker at Northwestern Hotel.

If possible it is recommended by Mr. Bugalls to examine with some care Town 59, R.26, particularly the northwest quarter of Sec.9, also sections 11, 14 and 1 in the same town. Some of them have cropouts which alleviate the examination, (Potsdam, granite, quartzite, talcose slate and iron deposits.)

Pine River Pt. Sandstone bluffs. Sand Point, sandstone, high bluffs. Salmon-Trout Pt. Sandstone bluffs. Big Bay Point, sandstone.

A belt of horizontal sandstone strata from ½ to 1 or more than a mile wide surrounds the high granitic hills. The sandstone is red, soft argillaceous, but some harder useful beds intercalated. In particular near the contact with the granite. I am informed by the lighthouse keeper of Grand Island harder sandstone is to be found .

Granite Point is a low spur where some granite protrudes, lined on both flanks by sandstone. The sandstone and occasional granite protrusions alternate until down to Scott's head from where for a good distance granite occupies all the shore. Sand with interjected drift until Presque Isle.

Louis Dennis.

Average sample of the soft Hematite ore from Green Mine. Say one pound made up of various fragments.

Also some specimens of the rock associated with ore, with their relative positions.

Also a rude geological section across the Green Mine.
Green Mine T. 56, R. 28.

Upper Iron Range. Green Mine ore beds . Dip south about 55 degrees. Strike about east and west. General character of rock slaty ferruginous layers with some quartzite beds, conglomeratic iron ore with quartz and jasper bands. Exploring out about 300 feet. General character of rock remaining the same, pyrobedded as far as seen, not over a few feet thick, but some slaty ore layers repeat themselves often with interlaminat (or ation) of poorer rocks.

Possibly intended for township diagram in this paragraph.

Two small diagrams.

Expenses for Geological Survey May 1871.

Tent repair	3.70
Packing straps	.75
Mosquito bar	1.50
Writing material, pen and inkstand	3.25
Tinware for camp equipment	5.00
India rubber cloth	2.50
5# tea	8.75
Account book	.37
Hammer	3.00
Traveling chest (or chart)	5.50
Betunos 5#	2.00
Ink etuis(cases)	.20
Cartage	.25
R.R. fare to Chicago	7.60
" " " Marinette	10.70
Ropes for trunks	1.00
Overfreight	1.50
Meals	1.50
Hotel at Green Bay	1.50
Repairing of chests at Menominee	1.50
Hotel bill "	6.00
Other expenses	7.00
Steamboat to Escanaba	4.25
Travel to Centreville and back	2.50
Victuals for trip up the Escanaba	3.00
A woodsman for 3 days	7.50
Hotel bill Escanaba	12.00
Night quarters at a farmhouse of Olivers	1.00
From Escanaba to Marquette	3.60
Cartage of baggage	.50
Arrival at Marquette Monday evening May 13.	
May 26. Paid to Joe for safe keeping the boat of survey	10.00
Mon.27. R.R. fare to Negaunee	.65
Meals "	1.00
Fish barrel	.80
Hotel bill up to May 29	22.50
Victuals	4.50
Cartage	.50
Night quarters at farmhouse	1.50
A packer for 5 days at $2.50 per day Chas. Nomenegawo	12.50
$2.00 paid in advance to " " July 3.	
A wagon to Marquette	4.00
June 5 to Negaunee	1.50
Aneroid barometer recd July 6.	.35
Provisions	4.50
Weber employed Friday June 7 at $2.00 per day.	
Hotel bill 6 days	12.25
Passage to Munising for 2 persons	6.00
June 10 Indian guide	1.00
for bread	.25
June 12 " "	.25
meat	.25
Weber advanced .25	

Camphor spirits against mosquitoes	.25
Provisions at Munising	1.00
Indian guide Thomas for 3 days	9.00
Steamboat from Grand Island for 2 persons	6.50
Weber partial pay for services	10.00
" " " in full June 18,1872. vide receipt.	12.00
3 days hotel bill	6.00
Drayage	.50
To Ford River, wagon	1.00
To Escanaba	3.65
Drayage	.50
4 meals at Ford River	2.00
Return to Driver	1.00
3# cheese	.60
Sugar and tea	1.00
Ham 17½#	2.80
Bread	.50
Hotel bill 3½ days	10.00
Crackers 6#	.75
Salt pork 7#	.87
June 23. Expense for dinner on lake shore fishing station	.50
" fish	.25
Bread from Matelan	.50
Indian guide	2.00
Canoe and Indian	1.50
Matelan, board and provisions	2.00
At Scotts point bread	.25
fish	.25
Paid to boatman for 12 days use of the boat and his labor	48.00
To another man used as packer $2.50 per day, 12 days July 5.	30.00
Hotel 1 day	3.00
From Escanaba to Marquette	3.65
Cartage	.25
From Marquette to Champion mines and back	3.50
Hoops for barrel	.75
Hotel bill	9.75
Drayage	.50
Steamboat passage to St. Marys	6.00
John Boucher	2.00
Stuart for baggage	.50
Provisions	2.50
For 3 days boat and man	12.00
Hotel bill	6.25
Boatmen	2.00
Additional hotel bill, July 17, supper and bed	1.50
Passage to Pt. DeTour	2.50
Porter for baggage	.50
Boat and man to Scammons Harbor	5.00
3 days at DeTour	6.00
Scammons Harbor for boxes and sundries	1.50
For freight of boat	16.00
Provisions for trip to Little Traverse Bay	6.50
A man at $2.00 per day 14 days from July 24 to Aug.6	28.00

Aug.	Sugar 10#	1.50
	Hotel at Mackinac July 24	3.00
	Berries	.25
	Guide and packer at Pine Lake	2.00
	Hotel at Mackinac	1.50
	Hotel at Pt. DeTour	4.00
	Steamboat to Detroit	10.00
	From Port Huron to Ann Arbor	3.50
	Freight for specimens	10.50

Total expenses about $535.00. Received thereon $300. balance due $235.

Freight for boxes	5.00
Sept. 2 to Detroit	3.00

Sept. 16. Draft on Gov. Baldwin of $85.00 for analytical balances.

Sept. Draft on Gov Baldwin for $250. for above balance due to me.

Also draft for $500.00 for quarterly salary. Deposited in Ann Arbor Savings Bank.

Sept. 16. On Mast, order to Bank for $200.00

Diary

May 2, 1872

C. R.

Aneroid barometer 80 feet elevation corresponds to 1/10 inch 800 to one inch on the scale. The outer ring gives directly the elevation above the level of the ocean.

Langley Sawmill, Escanaba.

Diagram ?

V. Munising to Aux Train the Marquette road runs at a distance of 12 miles.

Johnson Gault, St. Mary.

Diagram Sandstone near Mod Ma Bay (Harvey junis Chaetetes)

Charles Monvenegawo. 2 dollars loaned. Will go for 14 schillings. Fair wind.

Second day of May in the evening left Ann Arbor, arrived at Chicago the next morning and proceeded from there at 10 A.M. towards Greenbay where I arrived 11 at night. The next morning, Saturday(4th), I took the cars for Menominee at seven o'clock and arrived there at 10 o'clock On the way between Chiacgo and Green Bay near Atkinson and further North a yellowish , porous dolomite rock is near the surface , but makes very few inconsiderable outcrops. Near Minnesota Junction I noticed a conularia in it besides some crinoid stems and an Orthis similar to Testudinaria. Along Winnebago Lake apparently the same rock is seen in fragments but no outcrops. The rocks used as a building stone in Green Bay are quarried at Duck Creek 5 or 6 miles northwest of Green Bay.

Between Green Bay and Menominee no rocks are seen, it is a low marshy land over which the road goes.

At Menominee I heard that Monvenegawo ? is an entirely unprincipled man and consequently I gave up all thoughts of employing him.

Sunday May 5. Went up the river on the Wisconsin side. Could not see and instructive outcrops nor any fossils in the loose bowlders.

The boat Saginaw going north just departed when I returned to Menominee. Too late to go along with it, about ½ past 10 in the forenoon.

Monday May 6. No chance to get off. Visited the new government's dock, the cribs of which are filled with stones from Sturgeon Bay, part of which is the Pentamerus dolomite of the Niagara formation, part the well stratified dolomitic banks at the base of the formation like those at Marble Quarry of Quarry Pt. of Drummond Island, or of Burnt Bluff or Bay de Noquets. No Hudson river group beds amongst them.

Line of Railroad from Menominee to Escanaba.
T. 32 R. 27, Sec. 34, 27, 22, 13, 10, 2
T. 33 R. 27, Sec. 36, 26, 23, 14, 11, 2.
T. 34.R. 27, Sec. 35, 26, 23, 14, 11, 2.
T. 35 R. 27, Sec. 35, 26, 23, 14, 11, 2.
T. 36 R. 27, Sec. 35, 26, 23, ~~14/13~~ ~~13/22~~, 1

T. 37 R. 26 Sec. 31, 30, 19, 20, ~~17/11~~. 9, 3.
T. 38 R. 26 Sec. 35, 36, 26
T. 38 R. 25, Sec. 30, 20, 16, ~~15/10~~, 11, 12
T. 38 R. 24, Sec. 9, 5, 4, 3, 2, 1
T. 39 R. 24. Sec. 35, 36.
T. 39 R. 23 Sec. 31, 32, 29, 28, 27, 26, 25, 24.

Thursday May 7. Left Menominee with steamer Dunlap at 12 noon. Arrived at Escanaba 8 in the evening.

Wednesday 8th. Visited Superintendent Baldwin, got a pass over the road for the duration of the month and was promised a season's pass clear to Chicago. At noon 1½ o'clock a train leaves for Negaunee with which I intend to leave for Maple Ridge, 24 miles from Escanaba, and return with the 9 o'clock train to Escanaba.

Enquire for Hulberts Chart of the Lake Superior Region at Marquette T. 42 R. 23 Sec. 5 is at Mapleridge.
Centreville is in town 43 R. 23, Sec. 6 From there the railroad goes to 44 R. 23, Secs. 31 and 30 and in Town 44 R. 24 it goes through Secs. 24, 14, 11, and through the centre of the line ? separating Secs. 2 and 3. 45 . 24 diagonal of Secs. 34 through 27 & 28, 20, 21 18. 45. 25, Sec. 13, 11, 2 and 3. 46. 25, Sec. 34 crossing the town in a straight diagonal line running its course ? in the centre of Sec. 5.

Went to Mapleridge 24 miles from Escanaba several miles before realizing there the limestone beds of the Trenton group are occasionally observed under the drift at Mapleridge. Good exposures of about 10 feet of the rock are opened in a quarry. The rock is argillaceous and little apt for a building stone. It contained several large casts of gasteropodes, some large Orthocerata, Leptserieca, one Dictronema Echinoencrinitro. It is evidently of the same age with the dolomite at the mouth of Menominee River, containing the same fossils. It is to my opinion the upper termination of the Trenton group. This limestone extends on the surface as far as Centreville. Six miles further there, it is still more argillaceous and forms entirely worthless easy decaying rock but traces of fossils Leptserieca Chaetetes stems crinoid stems are seen but nothing well preserved and only few. The distance from there to the Escanaba river is 8 or 9 miles. An Indian trail laeds from there but nobody has ever went that way and I could not get any guide. The interval is described to me as very swampy.

At 9 in the evening the train from Negaunee passes through Centreville and I returned with it, arriving in Escanaba a little after 10.

Thursday, the 9th. A rainy day, cant go out. Went at 10 o'clock up to the river and followed it about a mile above the old upper mill dam. At the lower mill dam dolomitic, subargillaeeous limestone banks of from 5 to 10 inches thickness containing crinoid stems, some specimens of Leptaena serieca and a few other brachiopodes, Echinoencrinites, Murchisonia. About 6 or 8 feet of it are exposed below the first mill dam. Above the dam in the bed of the river the same strata are exposed one-half mile higher up. They continue to the second mill dam where 12 or 15 feet of the next lower strata (wedge-shaped limestones) are forming an island in the river and stick out in the banks. These lower strata contain apparently the same fossils with the strata at the lower mill dam, and not many of them. (Chaetetes Leptaena deltoidea, Orthis testudinar, crinoid stems. Some beds contain a good many small calc or dolomite spar geodes. The strata at Mapleridge are still higher as those here described, but the rock character of all these strata is very similar and most of the fossils are common to all the beds of this upper horizon.

Diagram of above description.

N.B. The rock quarried at the mill dam after repeated inspection does not seem to have any superior qualification as building stone to that one quarried at Maple Ridge, both are of inferior quality.

Friday. May 10. Engaged a boy to accompany me on a tour up the Escanaba for 2½ dollars per day.

Saturday. 11th. Rode up to the sawmill with Mr. Olivers team taking along the camping utensils. Started from the mill about ½ past 9 and followed an old supply road. 3 miles higher up several farms are under cultivation. The ground is good. The limestone lies close under the soil. We followed the road up to the place where the river makes a big bend and flows eastward after having had before for a long distance a southerly course, We encamped at a Indian hut. In the river, sometimes on one side, sometimes on the other, the strata are exposed.

Above are about 15 feet of ledges of from 6 to 8 inches thickness containing some crinoid stems and a few other fossils, below them 10 or 15 feet of the wedge-shaped limestones crop out containing few fossils only. Under them the argillaceous fossiliferous limestones come to appearance but have on this side no good exposures. Below them again some thicker ledges are seen. I followed the river upwards for about 2 miles but did not come far enough to see the fine outcrops I visited last year. We will go up there tomorrow following the old supply road. A few specimens were collected in particular a slab with chaetetes of peculiar polygonal concavities on the surface resembling the specimens seen at Montreal and considered to be Protaraea.

Sunday May 12. Started up the river on the supply road. Rainy day. Roads knee-deep filled with water. Struck for the river some distance before approaching the falls, about 6 miles above our camping place

About a mile above the fine ex osures with fossils on the other side, the river is too high for crossing.

T. 41. 28, Sec. 17. The fossiliferous shaly limestones are on this side of the location swept away from the west bank which is low and marshy. The series of successive Vereda ? I ascertained again today. Lowest are the fossiliferous shaly limestones but not all beds contain fossils, a portion of the bluish argillaceous beds is replenished with fucoid-like ramifications which contrast from the remaining rock mass by a lighter color. The upper strata of the fossiliferous limestone are more pure limestones, above are some thicker banks and then follow the wedge-shaped or nodular limestones which contain very few fossils and are about 15 feet thick. Above them again thicker-bedded limestones amounting to 20 or 30 feet are deposited. They are full of porous silicious matter in irregular patches,contain few fossils except crinoid stems.

The Maple Ridge strata are still higher and may add to the thickness of the formation perhaps 20 or 30 feet more. It seems above doubt that under the fossiliferous argillaceous limestones strata similar to the wedge-shaped limestones are occurring which contain in lesser abundance about the same fossils.

Returned on the bank of the river to our camp, and left there for Escanaba about ½ past one. Arrived at Mr. Oliver's farm at 4 and remained there, a snowstorm prevailing and all my clothes thoroughly soaked with water. Sent my carrier with the pack to the sawmill. The lower falls are only 85 rods northwest of the Oliver farmhouse but a bad swamp is between.

Monday May. 13. From Oliver's farm it is 3 miles to the mill. Along the river near the upper abandoned mill I closely observed the wedge-shaped limestone exposed there. Some beds are of purer calcareous kind, other beds are entirely penetrated by silicious matter. They contain as a general thing few fossils except crinoid remains, stems and plates of Echino-encrinites, leptaena serieca, atrypa recurvirostra, a few orthis testudinaria and other orthides Murchisonia gracilis and other gasteropods chaetetes. Some beds are nodular layers of 1 or 2 inches thickness, some are in banks of about 6 inch thickness,at the upper and lower terminus these thicker banks are prevailing. The fossiliferous shaly limestones are decidedly underneath and separated from the upper wedge-shaped limestone by some thicker beds.At the base of the fossiliferous shaly limestones again some thicker silicious banks are found.Before the deeper thick-bedded nodular limestones which line the middle falls are reached in the descending order, the general rock character of all these strata is so similar that no exact orientation can be made. If the outcrops are isolated and limited, the silicious matter prevading the limestone is common throughout the whole series. In the upper wedge-shaped limestones small geodes containing calc-spar and dolomite spar are characteristic.

At 9 o'clock in the morning Monday 13th, I arrived at the lower mill yesterday it snowed all day. With the four o'clock train I left for Marquette.

The exposure of Potsdam sandstone in a hill projecting over the general plateau about 50 or 60 feet is near the 45 milestone from Escanaba.

At the 50 milestone the first granite protrusions are noticed. Arrived at Marquette between 9 and ten in the evening.

Tuesday. 14th. Found my boat in good condition in the water. Brooks has not arrived but will be here very soon as his trunk is already in the depot.

Wednesday 15th. Writing an article for Mr. Swineford's Mining Journal.

Thursday. 16th went to Carp River. ½ a mile below it the quartzite cliffs come to the shore, their ledges are nearly perpendicular with a strike from east to west, the projecting edges are rounded and water worn, the brown conglomeratic sandstone has deposited itself over these smoothened edges filling out all the depressions and fissures. Its beds are inclined, and dip away from the quartzite at sometimes an angle of 30 degrees, but this is only for a short distance and depends from an influence exerted by the inclined plane of the underlying rock on the material which was deposited on it. Thickness of the quartzite beds about 150 to 160 feet,

On the south side of the exposure the brown sandstone and conglomerate beds come against the quartzite in almost horizontal position but the regularity of the strata is considerably disturbed by false bedding.

After passing the quartzite protrusions a flat hiatus covered by drift and doubtless underlaid by the sandstone follows; proceeding a ½ a mile another quartzite ridge striking in the same direction and in almost vertical position dipping south is met with its thickness is about 78 feet. About 200 feet further the slaterock striking east and west and dipping south comes out about 100 feet. Thick quartzose veins and concretions are intermingled. Then quartzose limestones or sometimes regular quartzites with only a small procentage(percentage) of lime follow in the series, also amounting to 100 or more feet. Above them are about 50 feet of purer limestone strata much bent and contorted by lateral pressure; beyond again the calcareous quartzites and then the strata beds appear striking east and west but dipping north. A section of this locality is subjoined.

Diagram of above.

Friday 17th. On the hill striking from east to west on the north side of the Mary and Negonee road erect slates approaching Novaculite are forming the crest, their vertical edges are ground smooth and have beautiful drift scratches running with great regularity and parallelism from northeast to southwest.

On the north side greenstones are the next following stratum, on the south side quartzose or dioritic greenish slates exhibiting like the Novaculite strata which are of a whitish color; the effects of subsequent pressure and minor dislocation of the sedimentary parts producing curved and wedge-like cleavage through the whole mass.

In the evening Brooks arrived and after talking over the plans for this season's work, I found it entirely impractical to extend my work over a field which was entirely to be covered by both Brooks and Pumpelly.

So I decided to make a more accurate investigation of some portions of my own field which was not sufficiently investigated.

Saturday 18th. went with a sailing boat to Whitefish Point,but the wind left us and we arrived at Whitefish Point only on Sunday morning at 10 o'clock, the shore was yet covered with large masses of ice. Went over the ground for about 3 miles back from the shore up along the Whitefish river and its branches. The sandstone formation is covering the whole ground ascending to the high ground about 100 feet above the lake. The strata at the landing are coarse grained massive blocks of a reddish colored sandstone with very strongly developed false stratification. Going back to the sawmill some hard white slabs seem to overlie it,above a series of bluffs ascend having about a hight of 25 feet which are composed of very compact hard coarse grained sandstone of red color or partially with wi the stripes the sandstone breaks in large solid blocks and would answer admirably for heavy constructions as bridges, canal locks etc.? but it is not so good for fancy and carved work .

The sandstones similar to this rock occupy the whole elevated ground over which I went and gives inducement for opening quarries in it Its beds are close to the surface and form a line of perpendicular escarpments all round the higher portions of the point. On Whitefish River it is said that near the Whitefish Lake above and below, large falls precipitate themselves over ledges of a white sandstone which is the upper portion of the Lake Superior sandstone.

The red shaly portions lining the shore seem to be the lowestrata of the formations. In them the fine grained red sandstones quarried last year are imbedded. A large pile of them is stored on the dock.The effect of the winter opened some seams of them but they seemed in general to have withstood the frost very well.

On the lower ground the timber is most cedar, hemlock and some pine. On the higher ground good hardwood grows intermingled with pine and hemlock.

Monday May 20th. Wet, foggy weather. Investigated the strata forming the shore line of the point and the abandoned stone quarry.

I found the following order; The highest beds are the coarse grained red sandstones with occasional white seams which were described yesterday as forming the elevated bluffs in the rising country along Whitefish River and its branches. The next lower beds are the fine grained sandstones in which the quarry was opened below, are even bedded hard slabs whitish or red or variegated and alternating with shaly seams lowest. Those beds continue but with the shaly strata of red, variegated, dotted or striped much prevailing over the sand layers. The strata according (to) their appearance along the shore and in points backwards from it, exhibit many undulations so that the lower strata often are occupying a higher level that the upper strata.

Diagram of above strata.

Explanation 1.	Coarse grained sandstone	20 ft.
2.	Fine grained sandstone	12 ft.
3.	Alternations of sandstone slabs visible about with much shale	25 ft.

Concerning strata No. 1, which forms the imposing cliffs at the dock I observed yesterday that in some of the bluffs large sound blocks apparently having resisted the action of the weather for centuries can be obtained but the same strata at the shore are so much disturbed by false stratification exhibited there in a very large scale that few sound blocks could be quarried there. In many places the rock is also segregated in many thin layers perfectly useless for any purpose. Along the tram road a portion of the beds has been begun to be quarried but also there the rock is too seamy and does not furnish sound blocks of larger size. It is therefore great circumspection to(should) be used before any expensive preparations for a quarry could be risked.

Concerning No. 2, I got the impression that in the end the stone will not prove durable. It is too argillaceous and the exposures are all full of uneven irregular fissures which make eventually the rock decay in irregular fragments,

Tuesday 21st. At seven in the morning started up the river. 4 miles from the mill the State road going to Marquette is crossed near the river. From there we entered the woods on the east side of the river without a trail, it is a swampy bad place to travel. About 2 miles up we crossed the river and got into hard land where the traveling goes well.

Four miles above the State road the Whitefish Lake is situated. It is much bigger than represented on the maps over a mile long and ½ of a mile wide. From there we followed the narrow valley up to the falls which are 4 miles further up.

Speaking of the rocks, the surface to the upper end of the lake is almost exclusively formed by the hard coarse grained sandstone beds forming the cliffs of Whitefish Point landing.

At its bottom gradually it assumes the argillaceous nature of No. 3. No. 3 has beds of dark red arenaceous shales, thin even-surfaced slabs of a hard sandstone sometimes ripple marked, sometimes segregating in paper thin laminae. The color is white and red variegated or dotted with the peculiar round white dots so often observed also in other locations where the formation is exposed.

The following conclusions I derive from my observations:
1. The lowest portions of the Lake Superior sandstone are highly ferruginous with prevalence of argillaceous beds. The sandstones contained in it are generally of sufficient degree of hardness but for one or another reason little adapted for economical use. These strata are exposed at Sault Ste. Mary, At Sable Point, at Whitefish Point west of Grand Island.

The Marquette sandstone seems to be still lower. The same lower strata prevails west of Marquette all along the shore line to Keweenaw Point. At the Grand Island Bay near Munising furnace, the next higher rocks composing the pictured rocks are seen. The same higher strata form the falls of Taquamenon river, the exposures at Salt Point ? Similar higher sandstones are reported to form the falls of Au Train River a few miles above Au Train lake and the falls of Whitefish River which I intend to visit tomorrow.

Diagram. Local section of the formation.

(Insert the above paragraphs on the preceding page ahead of paragraph headed Tuesday 21st. Turned two pages at once in copying.)

The lake is on both sides lined with 50 or 60 feet high escarpments which are on top formed by this rock in solid ledges many of them well adapted for heavy masonry. Below the fine grained red sandstone, the even-bedded white or variegated slabs and the red arenaceous shales are cropping out.

Above the upper end of the lake the hills rise to the hight of 150 feet above the bed of the river. The hard coarse grained sandstone is near to the water. Above it are rose-colored soft sandstones with pebbles and above them about 100 feet of quite thin and irregularly bedded, soft whitish sandstones with blue shaly seams separating almost each individual thin layer and above them 50 feet of soft massive sandrock ledges are forming a perpendicular precipice some beds are white with nodules of ferruginous matter, other beds are equally yellow colored by iron but all so soft as to disintegrate into sand by pressure of the fingers. The lowest bed of them easiest decomposes and for this reason large caves are at the base of the perpendicular rock walls , in one of which we camped. The falls precipitate themselves perpendicularly over those upper beds and on arriving on top of the thin bedded ledges which are exposed with a superficial slant of 50 degrees, the water psreads itself fanlike and rolls beautifully over, this highly ravined ? place. The whole valley above the lake to the falls is formed by those precipitous rocky hillsides of 150 to 160 feet hight.

Ascending the hight a wide plateau is spread out on which about 10 feet of arenaceous limestones are resting exactly similar to those described on the land of Munising furnace. Fossils are very few, but I found one distinct specimen of the Pleurotomaria like gasteropode. This limestone is uniformly spread over this upper plateau. The plateau bears splendid hardwood forests plenty of game in the lakes, many beavers, two of them I saw playing in the water. A number of springs come from the hillsides near the falls. In the bed of the river several feet of a coarse red conglomerate are outcropping in the bed of the river immediately underlying, the thin bedded white sandstones mentioned as forming the lower portion of the falls.

Thursday 21. Went up Whitefish River. Whitefish lake is much larger and longer than on the maps. Its both sides are lined with rock escarpments 50 or 60 feet high. The lowest strata seen are the variegated shaly strata.

Above come the fine grained quarry stones of Whitefish Pt. Then follow the coarse grained massive banks about 20 or 25 feet thick. Higher thick beds of rose-colored soft sandstones with pebbles included are seen following Whitefish river above the lake 4 miles. All the way along high hills are lining the narrow valley. The river has a rapid current. The hills are 150 feet high and consists from bottom to top of sandstones like the Pictured rock sandstone.

Lowest for about 100 feet thin bedded soft sandstone layers with irregular stratification and full of fine seams of a blue argillaceous matter and mica form the base of the escarpment. Above are more solid vertical sandrocks of soft consistency and white color which form the top of the hill. Their thickness is 50 feet or more, one subordinate bed, yellow, rusty, 5 feet. At the foot of the hill in the side of the river bed below the thin bedded soft sandstone layers a red coarse conglomerate bed 5 or 6 feet of which is visible.

A ½ mile higher up the falls are where the water rushes from the hight of 75 to 80 feet over an inclined plane of about 50 degrees in inclination with a perpendicular portion of about 15 feet. The strata exposed are the same as above described.

Diagram. Falls of Whitefish. Sec. 16, Town 46, Range 22.

Wednesday May 22. Fine clear weather. We started 8 in the morning from our camp downward and took this time the opposite side of the river from the one we went up. Arrived at 3 o'clock in the afternoon at the sawmill. The river from the mouth up to the falls has a very strong current and mostly runs in rapids. It must certainly rise in its course to the foot of the falls 300 or 400 feet. The falls can be little less than 100 feet. The ridges lining Whitefish River are very probably the high hills visible from Marquette as the highest landmark backwards of Whitefish Point.

Thursday 23. Heavy frost in the morning but bright sunny weather.

Sections at the point Diagram.

Explanation. 10 ft. coarse, compact sandstone.
5 ft. red fine grained sandstone in thin beds with false
1 ft. thin bedded white sandstone slabs. (bedding.
3 ft. Red sandstones in beds about 6 or 8 in. Visible.
Lake.

Sailed from Whitefish point 10 o'clock. Arrived in Marquette 4 o'clock. Took supper and night quarters at the Hotel and started at night, 12 O'clock, with a small tug up to Granite Point with Mr. Adams of Negaunee. It rained all night and during the following day Friday 24.

The outer point of Granite Point is a knob of granite against which abut from the landside the lower dark, iron-colored argillaceous sandstones and conglomerates projecting there about 15 feet. Above the water the rock is worthless, easy decaying in small fragments containing in places large quantities of pebbles and harder sandstone nodules, much argillaceous matter entering into its composition. The layers are thinly laminated exhibiting everywhere fine bedding, many white colorless roundspots porvade the mass, the centre being whitest, and excentrical rings gradually more and more intensely tinted, surround it. It is evident that all was once equally iron-colored and the discoloration begun from the centres of these spots, a very remarkable proof of this subsequent discoloration is seen close to the shore. A long straight fissure about an inch wide runs through the rock for the length of several hundred feet. The edge of the fissure is for the distance of 1/3 to ½ an inch entirely colorless. Behind, the rock is dark brown red. The mass filling out the crack is also white and of argillaceous nature.

The horizon is about the same with the fine grained sandstone of Whitefish Point. Ascending towards the sawmill I find at the mill the somewhat harder coarsegrained sandrock corresponding with the upper Whitefish Point rock, but it is also of not much account for practical use. The ascent to the mill may be about 20 or 30 feet from the mill to the granite hills backwards from the shore. The distance is about ¼ of a mile.

This level is underlaid by the upper coarse grained sandstone but much of it is covered by several feet of drift or alluvial sand. In the bay southwest of Granite Point close to the shore a denudation of the sandstone formation about 40 or 50 feet high is seen. It appears all to be composed of argillaceous non-compact dark red colored layers.

On the surface of contact between the sandstone and granite, portions of the granite are seen in a soft and decayed condition friable with the fingers, and particles of decomposed granite largely are intermingled with the sandy material at the base of the aqueous deposit.

Under the mill in the excavation for the wheel the coarse grained red sandstone is well exposed. It is fracturing in smaller blocks of irregular form by exposure, is not near as hard as the Whitefish River stone, nearer in hardness to the Marquette stone but evidently not as durable.

In coming down I looked at the granite point and found on its southeast side the sandstone reaching the top of the knob. The contact of the two is finely to be observed, the sandstone strata abut horizontally against it and have there (here) a hight of at least 50 feet. All are (an) argillaceous sandstone of equal quality throughout the whole thickness. That will say the beds are tolerably uniform in hardness and color. It breaks in irregular fragments by weaknesses. Similar strata are exposed at the basal end of the point towards the mainland, but little distance of the granite hills come close to the shore and continue so to Presque Isle Point. On the northwest side of the point the sandstone seems to run out up to the next land spur. Still the shore is sandy.

N.B. In a conversation with Mr. Wagner I learn that Mr. Wettemore of Marquette, which is reputedly gone over the country back of Whitefish river, that only on or two miles back of the falls we would have struck the regular limestone district if we continued to proceed.

Sunday 26. In the forenoon, much rain;at noon clear weather; evening rain again.

Monday 27. Cold foggy weather. Went down to Chasalls and followed the railroad which is graded but not finished joining the Escanaba and Negaunee railroad about 1 mile south of Goose Lake near the 54 milestone from Escanaba. The Huronian rocks extend to the spur of mountains ending close to the village of Chaselch(?). From there the road leads over drift hills composed of red clay with sand on top. The Huron rocks are at least ½ mile north of the road. 1 mile before the junction with the Escanaba road it has reached the highest elevated pine plateau on which the drift is considerably mixed with pebbles and fragments of the brown sandstone and conglomerate. No where near the road, older rocks than drift are to be seen. The drift forms sometimes high hills alongside of the road.

The pine plateau extends north along the Escanaba railroad to near the 56 milestone. A small distance this side of it the first diorite protrusion comes to the surface. ½ (one-half) a mile further Goose Lake begins on both sides of which large exposures of slates of different character, jaspery strata and quartzes make outcrops. Further on again diorite comes out. Coarse drift material and large boulders from time to time cover the soil of the valley, until again the slates elevate themselves in bubble-like hillocks with much bent and fissured beds. Nearby some iron mines have lately been opened.

Diagram illustrating above

(The top of the hill is diorite and in front of the ore(one) another diorite comes out.)

Near Negaunee along the declivity of the series of hills stretching along southwest side of the railroad bank(track) everywhere openings for ore have been made. Arrived at the Escanaba road Junction 12 o 'clock. Left Marquette 8. Arrived in Negaunee 3 o'clock.(Weather very cold).

Tuesday 28. The man whom I intended to take along as guide and packer has not returned yet. On the surface of the Diorites close to the sidewalk leading down to the iron furnace very plain drift scratches are observable running from northeast to southwest.

The specimens in the bag are from the environs of Goose Lake and part of them from Mecumber mine. Sulph. of Baryta occurs there in large crystals. The bright green diorite is cropping out in front of Maccumber mines.

Afternoon visited Lighthouse Point. At the foot of the drift hills on which part of the town is built, dioritic shists stricking(striking) from east to west dip under a high angle northwards. Above them follow diorites partly almost a granitic, partly of coarser grain, some layers are a crystalline dark hornblende rock, stratification very distinct, thickness of diorites at least 500 or 600 feet.

The surface of the rock bears everywhere the polishing effects of the drift period. ¼ of a mile north of the point a rock island striking east and west is composed of the largely crystalline hornblende-rock of which specimens were collected the former season. The next outcrop to the north about a mile distant are the granites at the mouth of Dead River.

Diagram Lighthouse Point.

Looking more carefully I find that on Lighthouse Point the well stratified shistose rock forms the south and the north side of the spur. In the centre the massive blocks of dark hornblende rock protrude. They are not distinctly stratified and seem to be intrusive on the limits of contact. The shists do not join always with even faces. It is frequently noticed that the massive hornblende rock unites with it in the following manner. In places blocks of the stratified rock are entirely surrounded by the massive hornblende rock, or thin seams of the hornblende rock have forced themselves between the stratified layers.

Two diagrams of above.

Diagram . Shrinkage cracks of a block of shists near the contact with the black hornblende rock.

In the quarry west of the point a continuation of the strata is seen north and south, stratified shistose rocks with silky splendor, in the centre the black non-stratified crystalline hornblende rock.

Near the Mosie (?) the outcrops are of similar nature but I did at first not understand them. The section is as follows.

Diagram of above.

Wednesday May 29. Succeeded in the afternoon to hire a man to go with me. Started at 3 o'clock and went along the old State road to a place 4 miles behind Chocolate river village. It began to rain hard and we had to stop at a farmhouse for the night.

The land we transgressed is all covered by drift, partly red clay, partly the upper sandy strata are at the surface. The clay seems to have all the qualifications for a good brick clay. Timber mostly hardwood. Soil productive as far as the few farming establishments along the road indicate. Surface is a rolling land, gradually rising. It is an immediate continuation of the land seen two days before when following the railroad track to Negaunee.

Left the house ½ passed 8. The road is generally in very good order all round fine hardwood timber. Several farms in good condition are seen. 2 or 3 miles further on the land is undulating with drift hills. The drift material is a loamy red sand with intermixture of pebbly layers. The pebbles are partly older crystalline rocks. To the greatest extent they are coarse grained red sandstone whose layers can not be very far from the surface. I am told that in some places the rock comes to the surface in the bed of Chocolate River.

We arrived at Chocolate River (the second arm) at 9 o'clock. No rocks exposed there. It is a pleasant valley with a meadow at the spot where the road crosses it. N.B We had crossed the main river and this is the second branch of it. From there we walked, gently ascending over undulating hills until ½ past eleven and took rest for dinner. Over all this space drift is the only surface material. It contains very many blocks of the coarse grained red sandstone but no ledges of it are seen. The timber is mostly mixed hardwood, hemlock and some pine. Some small clearings around former camps have a thrifty growth of good grass. At our dinner place the timber is exclusively hardwood with only few hemlocks. Birch trees are there of from 2 to 3 feet in diameter.

We arrived at the last creek crossing the road and flowing into Carp River at half past two. Nothing but drift with sandstone boulders seen. The ground is an undulating hilly, high plateau with splendid hardwood timber occasionally mixed with hemlock. In the depressed, swampy locations, cedar mixed in.

At 3 o'clock we arrived at the bend of the road which runs due north and south, from there to the place where the road crosses the Whitefish River there is an almost imperceptible gradual descent to the river. All hardwood timber except the borders of a creek which we had to cross. Drift material principally containing blocks and smaller pebbles of the hard red coarse grained sandstone. In the bed of the river at the crossing the water flows in rapid course over dolomite ledges in all probability belonging to the calciferous formation. No fossils seen int it. A few pieces of such dolomite I found also mixed with the drift about one or two miles before I reached the river. The hills in general are not over 50 feet elevated over the river bed and also the hills rising above the plateau are not much higher.

Our camp is in Town 45, Range 22, Sec. 29. Tomorrow I intend to go as far as Laughing Whitefish River falls in T. 46, R. 22, Sec. 16, a distance of 8 miles.

Friday May 31. At 7 in the morning started with the intention to strike Laughing Whitefish River falls by following the section line straight north for 8 miles. I found the corner and followed the line for two miles but lost in then in a long almost impenetrable cedar swamp. While on the north and south line, Town 45, R. 22, Sec. 19 and 20, the birdseye limestone with some of its fossils covered a wide space of swampy flats, above which a low bluff of drift material with red sandstone blocks is deposited. I followed in north direction about 2 more miles but most of it is swamp, and on the elevated grounds drift coveres the limestone. Not hoping to reach under such impediments the falls of Whitefish River, I returned and followed downwards close to the river bed in which several times dolomitic limestones with silicious nodules are forming the bottom.

Returned to camp 2 o'clock afternoon. I felt very tired and somewhat sick in the stomach. During the night I could not sleep, had chills and a bloody diarrhoea began. Each time I had to go I had almost a fainting spell, could not stand or walk.

Sat. June 1. Do not feel any better. It rains all morning otherwise I would have tried to return to Marquette. At ten o'clock it stops raining and I commence to return, dragging myself with much fatigue back to the main branch of the Chocolate river where I encamped.

Sunday June 2. Went from camping ground to the settlement 5 miles distant and hired a wagon to bring me to Marquette where I arrived a little before 12 o'clock. Diarrhoea continues and some prostration but I feel better.

Monday. Had a sound sleep and feel improved, still unable to go to work. Visited the quarries again. (Very rainy in the noon). The Wolf quarry seems to be situated in a protected corner where the agitated waves did not so much disturbe the regularity of sedimentary deposits.

In the other quarry the same strata but much more in inconformable wedge-shaped stratification,are to be seen.Below the useful ledges a soft argillaceous sandstone comes out. Brecciated strata are more frequent but do not along a great space --? their brecciated nature.

On the top of Wolf's quarry likewise a very coarse band of Breccia is seen . In the centre of the valley the drift action has removed a large portion of the rock and the beds of one quarry and the other are not to be followed out in continuity. On the surface beds of Wolf quarry drift scratches are observable.

Mr. Wettemore bought on the northwest side of Wolfs quarry a piece of land with the hope of finding a quarry but I think the whole deposit has been removed there by drift action and nothing of it is left.

Diagram.

Tuesday June 4. Made an arrangement with Mr. Stafford to visit Lighthouse Point at Portage entry. Left at 8 o'clock in the evening and arrived there at 4 o'clock. Went with a small boat to the point.

Wednesday 5. A small distance this side of the lighthouse point a few feet of thin bedded sandstone ledges come out of the lake. Their visible thickness increases to about 10 or 15 feet. Under it a massive bed of a red fine grained but quite argillaceous sandstone comes up. It is from 5 to 7 feet and ½ thick. It ascends in the distance of ¼ of a mile about 10 or 20 feet. At the lighthouse ½ of it is under water. ¼ of a mile further on it is with its bank 15 or 20 feet above it. The same time in(it) thins out out there to nothing, and the lower strata which are likewise with the upper ones thin bedded,striped and variegated sandstones, merge into one succession of such beds 30 feet high at the mentioned point, and not interr pted by the massive bed at all. It is however seen that the massive bed after shrinking to the thickness of 2 feet begins to divide and split into thin beds, a quality which it has not in the thicker portions. In the upper strata very beautiful ripple marks are to be seen.

Argillaceous shales are in the series almost entirely excluded,the argillaceous matter is combined with the sandstone mass.

Similar exposures are seen on the south side of the entry where Capt. Bender has opened a quarry. Returned to Marquette at 4 in the evening.

Diagram. Section at the Lighthouse Point.

Thursday June 6. With railroad to the Junction with S.C. Smiths ? mine to investigate the extension of the upper members of the Potsdam Group.

At 53 milestone from Escanaba as has been mentioned in former pages the last connected Huronian protrusions are seen. From there following the railroad southwards unto the 44 milestone which is at Smiths Mine Station on both sides, an extended level spreads out. The pine timber on it is burnt all clean away and at least for 1 or 2 miles on both sides nothing hinders the view. Near the 50 milestone a few low rounded domes of granite project(it looks like greenstone), but after those the dead level continues to the 43 milestone where a hill of about 60 feet elevation rises over the drift plain, its south side limited by a creek which flows into the Escanaba. (In the drift I found Devon. fossils).

The lower strata are a soft white friable sandstone with a great many holes above it is a calcareous sandrock with nodules and pebbles of more silicious nature inclosed. I also see some traces of fossils, but nothing of distinctly recognizable form I could find. The station to S. S. Smith's mine is a mile south near the 44 milestone. Returned in the evening to Marquette.

Friday June 7. Rainy. Prepared for excursion next morning.

Saturday June 8. Sailed with a small boat holding 16 fellow passengers, a cow and a calf, an annoyingly mixed companie as usual. We had no wind, or a contrarious one and finally arrived 3 in the evening at Whitefish Point where we encamped. Very cold rainy weather. Dense fog all over.

Sunday June 9. Started a little before 4 o'clock with fair little breeze but in a dense fog. Passed the Steamer Union which had run on the ground close to the shore of Whitefish Point. Wind soon left us and by strenuous rowing, in the fog scarcely knowing where we were, we finally landed in Munising about noon. Encamped there on old camping ground of last year.

The rocks at Pauls Point on the opposite side of Munising Bay are the red, thin bedded and variegated strata of which the fine grained Whitefish River sandstone makes a part. Above them the massive ledges of the coarse grained sandstone perfectly corresponding with the coarse grained sandstone at the landing of Whitefish Point are seen. The quarries are opened in these layers.

In looking at the perpendicular outcrops in the creek behind the furnace, I see again as on Whitefish River falls the top of the cliffs about 80 feet high formed by somewhat harder more massive sand ledges of whitish color (from 25 to 30 feet thick). Under them more thin-bedded, very soft whitish, sometimes a little argillaceous, sandstone beds form the base of the escarpment. The lower coarse grained hard beds which are seen as the next following beds at Pauls Point, are not disclosed here. These hard coarse grained sandstones have a more light almost whitish color in this neighborhood, while farther west they are more reddish tinged. Most all the higher hills up towards Whitefish are composed of the upper soft whitish sandstones.

For tomorrow Monday June 10, I have a trip arranged to the Falls of Aux Train river. They are 2 miles south of where the old Marquette road intersects the river. Three miles from there is the halfway house.

From the Falls it is not a great distance to the Mud Lake which forms the headwaters of Whitefish River. We started at 9 but missed to find the road and had to return. An Indian set us on the right track.

Weber is not able to carry a light pack. Got exhausted and I had trouble to reach with him a place where we could find water. We had three pigeons for our supper but he lost two of them on the road. His pack hangs on him on a really pitiful manner and on my return I will have to look for another man. In ascending the precipice near the furnace I found on top of the massive soft sandstones a few layers of the calciferous immediately resting. The bluish pyritiferous sandstone beds in the small quarry further back are above and consequently seem to make part of the calciferous.

From the margin the land rises considerably in high hills much intersected by ravines but they seem to be wholly composed of drift, a rich loamy soil covered all over with splendid hardwood. The road leads over such high land unto Aux Train river but so far as we have advanced (Sec. 36, R. 20, T. 46) I did not see a rock. Mosquitoes are very severe on us.

Tuesday June 11. A fine nice day. We started about 6 o'clock or perhaps later (my watched stopped to run) and arrived at about 12 on Aux Train River. The road leads constantly through splendid beech and maple woodlands over the rolling high plateau. Coming near Aux Train river a descent of about 150 feet is made. Such hills limit the river on both sides. The narrow valley is lined with small belts of swamp. These high hills are entirely composed of drift material sometimes with gravel and boulders of various Huron et Laurent rocks with red sandstones but generally the material is a rich sandy ferruginous loam. The river bed exhibits there also no trace of rock. It runs very rapidly. Thinking to find the falls above (Some persons telling me they are south of the road, others north, which latter are correct) I followed it up for about 3 miles without finding neither rocks nor falls. The falls must be from 2 to 3 miles north from the bridge on the brink of the lower hill row composed of the Potsdam sandstone, about on the same comparative level as the small fall of a creek behind the iron furnace, which is not much over 150 feet above the lake level, while the drift hills backwards attain double this elevation and more.

At noon we got caught in a thunder storm and severe rain. Mosquitoes insupportable, fatigue great, so I determined to return to our last night's camp and arrived there about 4. Had a good pigeon supper which was necessary for our exhausted bodies.

Wednesday June 12. Returned to Munising and arrived there about 11 o'clock in the morning. No additional observations have been made except the repeated view of a rich comparatively level strip of ground all along this distance, which if the climate were milder would be of very high value for agriculture.

The length of this old Livermore road which intersects the Bay de Noquets and Grand Island road is from Munising to Marquette about 53 miles. The road is almost overgrown and obliterated only to be found by closely observing the marks on the trees. The 35 milestone from Marquette is near Aux Train river. Our night camp was near the 43 milestone. At the 48 milestone the road descends from the very highest hills down to a lower elevation to my estimate near 200 feet and from this level to the brink of the hills near the lake at least 100 feet more of descent is made before the upper Potsdam beds can be seen. Today the weather is very fine but mosquitoes in the morning awful.

Thursday June 13. In consequence of contradicting opinions about the situation of the falls and intending to see also Mud Lake and Trout Lake I hired the Indian Thomas to bring me there. We started from camp 7½ o'clock and arrived at a place said to be 4 miles from Trout Lake and about one mile from the lake at the head of Sturgeon River. At 1½ o'clock afternoon where we took dinner the road we followed is the Grand Island and Bay de Noquets road all the way through hardwood timber land of fine quality. No water along the whole distance from the creek a few miles west of Munising. From the Sturgeons Lake to Munising they(course, coast, consist?) 16 miles.

After leaving the noons camping place we followed the road 5 miles further. The hardwood after 2 miles disappears and a level pine plain with much open land expands from the road. After 5 miles we branched off in a southwesterly direction and traveled at least 2½ miles. Then our guide did not know any more about his exact whereabouts. We went in a northwesterly direction further on. Finally after much walking entered hard wood timber again and reached the brink of the hills at the foot of which Trout Lake is situated,(hills about 130 to 150 feet elevation). Trout lake where we struck it is a series of small shallow springs, ditches in which at several places strong springs bubble up through a white sand. In other places much vegetable mud has accumulated and in a few spots boulder accumulations form bars in it. The boulders are mixed with a great proportion of flat little worn dolomitic and arenaceous limestone, containing no fossils but evidently similar to the beds elsewhere seen in the calciferous sandrock formation. Several miles down at the end of the lake the water at its exit is said to form rapids which run over limestone ledges.

The hills surrounding the lake are drift with many red sandstone boulders.

The flat pine plateau above has a coarse sand covering with pebbles intermingled. Pinus banksiana as the principal tree. Hills round Trout Lake hardwood with a narrow strip of cedar swamp near the lake. Went in the evening 2½ miles south along the lakes but did not reach the biggest of the lakes, had to return night overcoming us.

Friday June 14. Sent the men out to hunt for a corner to ascertain our whereabouts. Found an east and west line but lost it on both ends about ¼ of a mile north of our camp in the swamp ledges of the calciferous sandrock make actual outcrops. At 10 o'clock we left camp following the east side of the big Mud lake. Crossed the creek coming in from the east and finally struck the river at 12 o'clock where we took dinner. The river has there a rapids course. We crossed it and after about three miles travel partly along the river with rapid current and very tortuous in its course. Strong rapids succeed for the distance of about a mile. The bed of the river is formed by arenaceous limestone beds.

Small Diagram

The aggregate thickness of the exposed strata of the rapids is not less than 50 feet. Then follow falls of also 50 additional feet but not perpendicularly which are entirely composed of similar arenaceous limestones and below the falls in a number of rapids still more additional calcareous strata are exposed in the thickness of which can not be less than 100 feet altogether below the 50 feet falls over the inclined plain some perpendicular ones of about 8 feet high are found which produce a much greater noise than the big falls. From there to the bridge, a distance of about 2 or 3 miles in straight line, the water has continuallya rapid run but no more rock beds are exposed. But no more rock are exposed.

After an extremely rugged travel we arrived at 6 o'clock at the Aux Train river bridge where we found a nearly starved man which says he lost himself in a spell of drunkenness and is erring ? in the woods since, the 28th May. How much of it is true I do not know. We fed him, warmed him and will do so next morning, when we return to Munising and send him help. We and the man are suffering severely from mosquitoes in this locality.

Saturday June 15. Returned from Aux Train river 16 miles distant from Munising. Started after 6 and arrived at Munising after 3 o'clock When endeavoring to make arrangements to visit the limestone visited out by the agent of the furnace Mr. McCallum, he found himself mistaken in his former statement and ascertained that the mentioned limestone beds are seen on Rock River in Town 47 R 17, Sec. 26

The clerk of the store also informed me that at the southern outlet of Mud Lake the water runs in rapids over white pure limestone ledges which to his remembrance, contain fossils. This would in all probability be the birdseye limestone which is found on Whitefish River in the same township range further west.

The lines previously drawn on the map as limiting the extent of the calciferous sandstone have consequently to be moved further north to which effect I made alterations on the map. The southerly lines have to be erased.

Sunday 16. At 5 o'clock in the morning the Steamer Norman landed at Munising and at 8 started for Marquette, Having no more inducement to remain at Munising, I broke up camp and returned to Marquette where we arrived after 10 o'clock. The weather was very clear and I could observe the islands and the Peninsular coast very plainly.

First. The exposure at Pauls Point with the variegated thinbedded sandstones below and the more massive coarse grained light reddish or almost whitish grey above projects from the shore in an elevation variable from 15 to 40 feet upwards,towards the furnace the exposures recede from the immediate proximity of the lake.Between Grand Island and Aux Train Point extended shoals are seen with large flat sandstone beds forming the bottom. The two islands at the entry of Grand Island Bay are also formed of sandstone beds. The smaller more southerly one exhibits little of the rock beds. The larger more northerly one has at the northeastern end bluffs of 40 or 45 feet hight in which part of the lower portion of the formation reaching as high as the coarse grained sandstone is exposed. Also Aux Train Island does not seem to bear much higher beds on its top.

The bluffs of Grand Island facing west are exposing at the base strata equivalent to those at Pauls Point. They contain not near as much coloring matter and argillaceous parts as the equivalent beds at Laughing Whitefish Point.

Above the various alternations of soft sandstone beds of different thickness corresponding to the pictured rock series or to the series forming the falls of Whitefish River are forming partly perpendicular partly highly inclined declivities are seen. On top another distinct capping of these beds by some sort of a deposit can be noticed which is in all probability the fossiliferous calciferous sandrock whose existence there is reported in different geological reports on Grand Island.

The scenic beauty of these rock exposures of Grand Island which appeared to me on my first visit fully equal to the scenery at Pictured rocks is perhaps not so fully equalling the latter as my first impression told me. Still it is sufficiently attractive and interesting not only for the geologist but for the general admirers of natural beauties.

In the afternoon I visited with Mr. Brooks, Lighthouse Point, where I again became strongly impressed with the idea of the intrusive nature of the crystalline diorites between the well stratified shistose dioritic and partly chloritic rocks. In one instance we plainly observed an interruption of the stratified beds by the crystalline diorite under a rectangle.

Diagram of above

A mile north of the lighthouse point some rocks called Pick-nik Islands project from the shore and into the lake. Their structure is massive with scarcely any well-marked stratification. The principal mass is a coarsely crystalline hornblende rock intermingled with red feldspar crystals; some portions are exclusively formed by this red feldspar with only here and there a small cluster of hornblende. Also quartz is abundantly distributed through some portion of the mass so that in hand(hard) specimens it would be doubtless pronounced a regular syenite. Besides these crystalline admixtures there are a number of fragments of chloritic and dioritic shists with very plain stratification imbedded in the mass giving it in places the appearance of a regular breccia.

The rock and (at) Dead River is pronounced an unqualified granite but these rocks are in so intimate local and lithological connection that I do not hesitate to bring them in immediate connection, as I do the granites of the Granite Islands opposite Presque Isle and further north. The granites of those localities are decidedly younger than the stratified schistose rocks forming the shoreline of Marquette and Lighthouse Point, because they inclose fragments of them also.

The granites on Escanaba river near S. C. Smith's mine are so intimately connected with diorite rocks that I view them in the same way. The granite domes along the Negaunee and Escanaba railroad track are also as far as transient observation of the rock was allowed to me in passing them more like diorite rock than like a regular granite. Their color is also green. Comparing further in my memory the rocks at Sturgeon falls and on Menominee the same crystalline hornblende rock with red feldspar interspersed or segregated in purer bands of red color, the partly brecciated character of the rocks, I feel myself inclined to consider all these complexes of strata as identical and have very strong doubts whether any of the Huronian mountains contains a truly Laurentian rock. It is much more probable to me that the Huronian mountains were the nucleus by which the elevation of the Huronian formation was effected and that this nucleus was not merely a subjacent already finished older rock by which the Huronian beds were pressed aside but it was some way in a plastic unfinished condition which allowed fragments of the superincumbent rocks to be inclosed by it.

Monday June 17. Rainy day. Packing and arranging specimens.

Thuesday 18. Fine warm day. Intended to leave for Escanaba but was detained unto next morning.

Wednesday June 19. To Escanaba. Arrived 5 o'clock in the evening.

Thursday. 20th. Rode down to Ford River 8 miles distant. I was told that at the sawmill men could be procured for the trip up the river and at all events Indians living at the mouth of the river were to be had. But I was greatly disappointed. The agent of the mill is a very unaccomodating man, perhaps he does not know any better, and the Indians are lazy dogs which wont work.

Going up the river for about a mile I came to rapids formed by loose limestone fragments. The high drift banks limiting the river in places are above sand, below red, well stratified clay and large accumulations of limestone fragments, partly angular, partly waterworn. Some fragments contain large pesteropodes and Echino cryptites(crysites) plates, other are cont(aining) Pleurotom. conoid. Orthoceras et other fossils of the birdseye limestone. What I learn from descriptions, in the bed of the river frequently the rock beds of the limestone are exposed, but seldom in the banks.

Friday June 21. Started at 4 o'clock in the morning from the mill up the river. 2½ miles above are a few farms belonging to the mill company on which good sandy loam soil produces a fine crop of grass, oats and potatoes. At the river the wedge-shaped limestones form the bed and project in the banks about 4 or 5 feet. Generally they contain very few fossils but some layers are full with small Leptaenas, Orthis, a Trilobite orthoceras fragments. 4½ miles up are some other similar exposures over which the river runs in rapids. 6 miles from the mouth the railroad crosses the river but the work proceeds very slow.

From a man which is well acquainted with the surroundings of Whitefish River I learn that the slate exposures are on the so-called Mills Creek. They do, according to his statement, not show themselves anywhere near except in this limited locality about 1 mile long.

About Ford River I learn that for 75 miles up similar limestones as below are the principal rock species seen along the river. At noon - 4 o'clock - the team of the sawmill went to town which occasion I took for my return to town.

Saturday June 22. Made arrangements with a boat owner to bring me to Point Patterson and back at 4 dollars per day. Hired another man to go with me at 2½ dollars per day. They promised to be ready Sunday morning but until now, 9 o'clock, I can see neither men nor boat.

Sunday 23. Fine clear weather. Slight southeast wind. (Before I left Marquette I signed a draft on Governor Baldwin amounting to 200 dollars and deposited it in the Citizens Bank of Marquette. No money received on it yet.)

Monday 24. After long waiting for the boat and men we finally got under sail at 9 o'clock. Landed 2 miles below lighthouse and reached Elliot's Harbor after 6 in the evening. We had much contrary wind. The old boat leaks badly and my two men are about as green in woodscraft as any man possibly can be. Camp. Feature(picture)? cooking everything I have to show them because they have not the least idea of it. The point at Elliots Harbor is Niagara group, unstratified lower beds

Tuesday 25. Prepared for continuation of journey and started at 6 o'clock.

A thunderstorm overcame us but subsequently the wind turned in our favor and we turned Point Defour, sailing with fair wind towards Point of Barques. At noon the wind at once faded away and we had by rowing to make a distance of at least 6 miles to the Point where we arrived at 4 o'clock in the evening. Nothing new occurred to me in respect to the geological features. The rich fossiliferous strata of the Niagara group are largely intermingled in the drift covering which forms the elevated part of Point of Barques.

Wednesday. June 26. Left Pt. of Barques at 5 o'clock with very little wind. About 9 we got a fair breeze but it soon died away and we was in the same situation. About 8 miles from Seul Choix we had to use the oars and finally arrived there about 6 in the evening, while if the wind has lasted an hour longer we would have been there before noon. The view of the peninsula from this side is very uniform, a belt of woodlands remaining almost of the same low elevation scarcely ever more than from 50 to 100 feet above the lake. The low flat shore portions are generally underlaid by the Niag. beds. The bluffs are formed by extensive sand accumulations which in many instances decidedly are dunes. So the sand bluffs immediately west of Seul Choix, behind the dunes the lands are low and swampy. Distance from Pt. of Barques to Seul Choix 30 miles, from there to Mille Coquins about the same distance. Sand dunes for a distance of many miles.

Diagram. Point Seul Choix seen from the West.

Thursday June 27. Left harbor of Seul Choix before 5 o'clock with good wind but after one hours sailing all wind was gone and a dead sea threw us hither and thither. We took the oars and rowed to Scotts Point when at 12 or 1 o'clock favorable wind rose which brought us all the way down to Mille Coquins river. Matelon lives 1½ miles further down behind the point which on the map is falsely named Milles Point. There is a good harbor for small boats.

Asked Matelon for a guide to the trail of Manistique Lakes which he promised for the next morning. The whole days journey did not offer any new geological facts which was not observed before. At Seul Choix the Niag. group contains Huronia, at Mille Coquins the fossiliferous Niag. limestones are mixed with the drift as at Pt. of Barques. Ledges of the rock are only seen at a level of the lake shore. No higher hills visible from the lake, but eastwards towards point Epoufette, higher hills come up to near the lake.

Friday June 28. Rowed down to Matelons place and anchored the boat and stored away our things. About 7 took the road to Mille Coquins lake accompanied by an Indian. We followed principally the same road as last year. At the lake the trail leads west on the southside of the lake, crosses the river (on logs), follows it upwards for some distance and then strikes in northwesterly direction crossing soon another creek.

From there a well broken path goes through hardwood lands to the Manistique lakes where there is an Indian settlement between the larger and the more southerly smaller lake, about half way the distance between the Michigan lake shore and Manistique lakes.

At 2 o'clock I had to encamp, my men being entirely worn out and perfectly demoralized, a worse set I could not have got, entirely unfit for such business. But being so far I have to subdue myself to the necessity, hoping to reach the point of my destination tomorrow. Up to our present camping place all rock near the surface is Niagara rock with many silicious nodules and containing Pentamerus casts, besides Stromatopora expansions. It is a crystalline dolomitic rock weathering with nodular silicious projections in relief.

Timber over this district extremely nice hardwood. Our camp is about 6 miles northwest of the lower end of MilleCoquins lake. Mosquitoes abominable. Weather fine.

Saturday 29. June. Left camp before 6 o'clock. Traveled through most admirably fine hardwood lands over a comparatively level country along the well broken Indian trail and arrived before 12 at the Manistique lakes. The men again exhausted, resting every 15 minutes and almost giving out. No rock seen along the whole route. The southern smaller Manistique lake runs by a short river into the big one, which river the trail crosses. The small lake is separated from the big one by a strip of drift hill about ½ mile wide. Along the river the land is low, swampy. Both lakes are surrounded by hardwood lands rising to a hight of approximately 50 or 100 feet (view from lake). The background in the northeast corner of the lake has a high hill which on its northern slope sends his waters to the Taquamenon river. The Indian says that he traveled with a canoe in 3 days from the sources of Taquamenon to its mouth. In the big Manistique lake are 5 or 6 small drift islands composed of numerous metamorphic boulders and of limestones, partly Trenton, partly Clinton or Niag. group.

In the northwest corner of the lake about a mile east of the outlet of the lake into Manistique river, there are limestone ledges cropping out along the shore. The(y) contain numerous flint nodules and some indistinct fossil remains but few. One conularia, one orthis-like shell crinoid and cyathophylloid remains. I am inclined to consider the strata as not older than the Clinton group. On the south side of the lake the only rocks seen are drift boulders and intermingled limestone fragments.

The linerock marked on the maps as exposed on the west side of Little Manistique lake is doubtless Niagara. The strata along the trail to the lake have been yesterday mentioned as containing Pentamerus casts and their situation is further north than the locality on the little lake.

Diagram Manistique Lake.

During the night a severe thunderstorm . The tent was not put up right and leaked badly and the men again showed themselves entirely helpless. I had to take care of them instead they of me.

Sunday. June 30. Morning. Dried our things at the fire and set out for return at seven in the morning . After five miles walk the men desired to rest and promised to follow me so as to be at Mille Coquins Monday noon, to which I agreed and went on my way arriving at Mille Coquins at 5 in the evening. On the road as often as rock came near the surface it was always Niagara rock, some of it with entirely similar silicious nodules as the ledges on the north side of big Manistique lake. Some contain traces of fossils. In the creek about 3 or 4 miles to the northwest of Mille Coquin lake, Niagara ledges with abundance of pentamerus and some specimens of Catenipora and Favosites are seen.

The land immediately on the west side of Mille Coquins lake is for some distance swampy with intermixture of cedar and spruce, but further on the road after having crossed the second river and ascended the high lands, the hardwoods continue right on the the Manistique lakes. As a district for future agricultural development this strip of land is highly recommendable.

Monday June 31. Staid over the night with Matelon. Very foggy morning, could not have sailed in any event. Men have not arrived yet. Bought me five bear skins for $18. At two o'clock the men arrived.

Thursday July 1. Last night a severe thunderstorm and rain. In the morning a dense fog had spread itself over the lake and no wind. When the tugboat Dorner, of Mackinak came in, on my request, the captain gave us a tow to Scotts Point. We departed at 8 o'clock but owing to the dense fog and not knowing exactly the whereabouts it was noon before we arrived there.

Scott Point is a very poor harbor and a strikingn (dis)deagreeable place therefore we went off with very little breeze and this blowing against us. We did not come further than about 3 miles to the next point when we had to seek the shore, another severe thunderstorm coming up and raging till after 10 o'clock with considerable rain.

Gravelly points with numerous large rock blocks of Niag. limestone but no outcrop of actual ledges. I found some good Niagara fossils along the shore.

Wednesday. July 2. Air clear but cloudy and a little breeze from the south. We prepare for a start. Soon after departure entire absence of wind and heavy rain. Then a breeze comes from southwest which just allows us to enter Seul Choix Harbor. We first passed it , intending to continue the journey but with the old leaking boat it was a dangerous task and we soon returned to Seul Choix. Wind blows very hard from southwest and a dense fog covered the lake. We had arrived at Seul Choix ½ past 10 in the forenoon.

Collected along shore several specimens of Huronia. All the other fossils of the Niagara group are also found but in poor preservation. The thickness of all the exposed strata there is not much over 22 feet. The beds have a uniform southerly dip of a few degrees. 3 o'clock at noon. Wind still hard blowing from the same unfavorable direction so that for today the prospect of getting away is gone. In the evening another severe thunderstorm, the wind changes to northwest, All night severe blowing. At 4 in the morning the wind moderates and we set out at 5 o'clock in the morning.

Thursday July 4. Arrived at Pt. of Barques at noon. It is severely cold all day. Sky cloudy. We passed the point and had good wind until opposite Orthoceras Point when at once the wind came from the southwest again and for the little distance around Point DeTour we had to contend for 4 hours. Finally we succeeded and sailed 3 miles up the bay and encamped opposite Little Summer Island, arriving there at dark.

The place is here formed by a drift terrace of exclusively calcareous debris from the Niagara group. Part of the limerock is in angular slabs with numerous siliciferous fossils but in very imperfect condition. In a second low terrace the fossiliferous Niag. ledges make an outcrop of 10 feet.

Friday July 5. Clear weather with southwest wind. Very fresh. The Niagara limestone of the second terraces are very rich in all the usual fossils but their preservation is not good. Still it shows a general similarity of all the particulars of lithological characters with the equivalent strata in remote places. It occurs to me now also that the fossiliferous limestones of Pt. of Barques are not drifted but emerge on top of the terrace from an inclosing mantle of drift material.

Diagram. Opposite Little Summer Island, 4 miles north of DeTour.

At 8 o'clock we left for Escanaba, first with contrary wind but successively it got fair. We arrived about 12 o'clock across the Bay in a little bay between the lighthouse point and the first larger promontory on the east side of it. This promontory is composed of ledges of the Hudson river group projecting about 8 feet above the water and full of the ordinary fossils but nothing in well preserved condition. The rest of the bay is covered by sand. A small river enters the lake which comes from a little lake in the interior of the land tongue. Took dinner here. At 6 in the evening we arrived at Escanaba.

Saturday July 6. Went with the 4 o'clock train to Marquette arriving there at 8. Observed the more argillaceous nature of the drift covering where the limestone formation comes close to the surface. The transition to the sandstone is to be located somewhere across Little Lake Station.

Further on the granitic rock seems to form a great part of the elevated plateau projecting only in gentle low bubble like knobs of a few feet elevation immediately covered by the sandy and in part gravelly drift material without any intervening clay beds.

The limits previously allowed to the Potsdam sandstone have probably to be restricted because a large portion of the high pine bluff seems to be underlain by the quartz. Still this granite seems to me of Huronian or post-Huronian age rather than of Laurentian. Singular it is also that the outscirts(outskirts) of the Huronian area are generally formed by the granite-like rocks while the centre of the district is occupied by the more regularly stratified members of the formation.

Sunday July 7. Received 2 letters from home. Took possession of the anaeroid barometer sent for by Mr. Brooks. It costs $55. of which are paid $6. Wrote a letter home announcing my probable return at the beginning of August.

Monday July 8. Spent with packing and other work.

Thuesday July 9. Visited the mines near Michigamni Lake. Champion Mine, Edwards Mine et Washington Mine. These mines strike from east to west. Their composing strata dip to the north under a high angle but the order of the whole complex is much less disturbed by contortions and other irregularities than in any of the mines further east. Highest apparently are quartzite beds,under these light flesh-colored talcose slates of silky a pearance are seen in a thickness of perhaps 30 or 40 feet. Then follow dark green colored talcose and chloritic rocks with large garnetory stones (?) inclosed and imbedded in these and under them the ore deposits are found.

Under the ore a fine grained glittering shistose talcose rock of grey color forms thick strata and farthest south a ridge of a granite-like rock with prevailing quartzose material runs parallel with the strike of the mines.

The lithological characters of Edwards and Washington mines are about the same. In Champion part of the ore is slate ore, part magnetic ore, so also in Edwards and Washington Mines. The ore, particularly the magnetic is in places considerably contaminated by iron pyrites which is found in large masses. I saw cubes of it measuring 2 inches. Edwards mine is 4 miles east of Champion. Washington ½ mile east of Edwards.

according to a statement of a railroad engineer the platform of Negaunee Station is 770 feet above the lake. My aneroid only indicates 550 feet but there was a severe thunderstorm rising and the barometrical conditions must have considerably changed since our departure from Marquette. According the same engineers statements, the railroad near Champion Station is 990 feet above the lake. The Champion mines are at least 150 feet higher situated.

(Pencil notes, maybe included in foregoing paragraphs. Champion mine strike east and west. Dip north. On the north side talcose schists with garnets and talcose light colored shists. Chloritic above quartzite. The ore partly slate ore with little sulph. Partly magnetic with considerable drift intermixture of sulph. of iron in places. South is in close proximity a granite-like rock forming a hill crest.
Edwards mine 4 miles east along the road. has about the same characteristics as the Champion. Some specimens of it 2 magnetic, 1 slate ore and 2 talcose spec. are from it.
Washington mine is still more east. It has only the magnetic ore with little slaty ore. On the north side of the ore beds are massive quartzose beds. Little of the light colored talcose slate rock. The dark partly amorphous talcose rock prevails.)

Wednesday July 10. Went to see Dead River Furnace and the so-called Laurentian rocks over which the river falls. Passing along the railroad to Bankrofts furnace occasionally the shistose strata of the Huron group break through the heavy drift covering which is spread out over the whole ground. At Dead River in close proximity of those rocks the granitic rock masses come to the surface and form a considerable protrusion. The rock character is that of a granite but its connection with the Huronian rocks is so intimate as has been also observed in other neighboring places that I am not fully convinced of its Laurentian age.

Thursday July 11. Packed my things and delivered them to the steamer Arctic on which I took passage down to the Sault St. Mary. It is expected to depart at 2 o'clock in the afternoon. 2 barrels of specimens shipped to Detroit and Ann Arbor. Boat departed ½ past 6 in the evening and arrived at St. Mary, July 12.

Friday morning at 11 o'clock on my arrival I found John Boucher whom I paid the 2 dollars due to him from last year. Left my baggage in the canal office with Mr. Carlson.

Saturday July 13. Left St. Mary with a small boat at 10 o'clock rowing down Hay Lake. nothing of importance seen until arriving at the west Neebish rapids. Shoreline formed by marsh land and low timbered lands. The small island at the north end of Neebish Island is formed by large boulders of metamorphous rocks. But immediately below it in the channel of the river the flat ledges of the calciferous sandrock formation make their appearance. Their dip is southwards. The ledges are divided in large tabular slabs with almost rectangular fissure cracks. Thickness of ledges from 6 inches to 1 foot. Rock hard crystalline with only few traces of fossils. Crinoid stems, Rhynchonella, Pleurotomaria. Arrived at 4 o'clock at the rapids. Several small islands in the river are formed by this calciferous limestone. The exposures are not more than ½ or one mile long as the uppermost strata. I noticed some more argillaceous limestone beds which contain fossils in somewhat greater abundance.

Chaetetes petropolitan, Streptorhynch politent , ectr.? on the mainland side. The rock is only seen in a few places on Anebish Island it is for some distance close to the surface and may be quarried. The rock being in good sized large ledges and of durable quality. Long time before leaving the narrow channel the rock has disappeared under the drift which here is composed of large boulders of crystalline rocks with limestone blocks intermingled.

Entering Mannusco Bay I found it lined all round with extensive low marshy lands, only at the south side of it some more elevated spurs project into the bay and a few islands come near the shore all of which are composed of this coarse boulder drift containing besides the crystalline rocks many calciferous sandrock blocks of angular form also some pieces with Lentamerus oblongus (Hiag.) I found mingled with the boulders but not a trace of any ~~of~~ Hudson River group rock which I expected should be found here in place.

Looking from the bay west, in the remotest distance some hills are rising but all along the nearer proximity of the bay low land and in part marshes prevail. The south end of Anebish Island is likewise verylow and marshy.

Sunday July 14. We had encamped on a marshy landspur limiting the north side of Mannusco Bay, crossed the bay, found the shore formed by drift as already reported and from there crossed over to the village of St. Joseph, where I spent a few hours in looking over the large masses of Trenton limestone blocks which are mixed with the boulder formation composing the hills and all the surrounding surface on Anebish Island and St. Joseph's island .

We left St. Joseph at noon and arrived at Churches Landing at 6 in the evening on Sugar Island. No outcrops of rock can be seen. Drift forms all its surface. On the Canada side the shore is formed by quartzites dipping toward the channel under a degree of from 30 to 45. Entering Georgian Lake the quartzites recede some distance from the shore and a belt of lower land formed by boulders and debris spread out before them.

A few islands in Georgian Lake are formed by coarse boulders with many sandstone blocks intermingled. 3 miles this side of Churches Landing where Mr. Church showed me some supposed outcrops of the sandstone I found extensive accumulations of very large crystalline boulders with prevalence of sandstone blocks of the coarse grained massive kind which is significant for the upper horizon of the lower portion of the Lake Superior sandstone formation. The number of blocks is so great and their surface so little worn that I have little doubt the strata will be found in place right there by doing very little digging. In another similar place right above the sawmill near the landing, the ledges make a well visible outcrop on the top of the drift bluff, which near the lake is composed of more sandy material and of the well stratified red clays, of good quality for use. Some of it has been shipped to Marquette.

Monday 13. After having visited with the son of Mr. Church several localities on the Island I returned to St. Mary leaving the landing at 1 o'clock. Bought from Mr. Church 4 gals. of raspberry jam. 10.50

The Sugar Island side as well as the Canada side is all along the lake inhabited by a good number of settlers which have cleared some of the land. The soil composed of drift clay in proper mixture with sandy and gravelly material. Seems to be fertile.

No rock beds noticed on the island but everywhere the coarse boulders are strewn over the shore or the slopes of the hillsides. On the Canada side the older uplifted rocks form large briskly ascending hill chains in front of which there is sometimes a belt of lower alluvial or drift land occupied by the settlers and farmers. Arrived in St.Mary at 6 in the evening.

In the new canal at St. Mary under a drift covering of a few feet with many large metamorphic boulders and some large sandstone blocks first appear 4 or 5 feet of hard vitreous coarse grained sandstones in thin even beds which are used in building up the inclined sidewalls of the canal and seem to stand the weather very well. Below them are softer, argillaceous dark red and variegated sandstone beds in thin layers which at present have not been penetrated. They correspond exactly with the red soft beds of Laughing Whitefish Point underneath the coarse massive sandstone layers forming the cliffs at the dock there.

The higher hills some miles behind Tipples place according to the statement of a surveyor exhibit at their base outcrops of the sandstone. The hill tops are composed of the clay beds of the drift and of boulders.

Diagram of above.

(Pencil notes. We rowed that day as far as Churches landing.Mr. Church thinks to have found the lower coarse grained Lake Superior sandstone in place and will show me the concerned (?) places tomorrow but I have doubts whether it is anything more but worn blocks imbedded in the drift.
Monday July 15. Took breakfast with Mr. Church. The lower landspur on which the landing and sawmill is situated has near the shore the red well stratified drift clays exposed on the entire of the spur. Large boulders cover the surface mixed with coarse grained sandstone blocks, the beds of which make in some places regular outcrops. It is hard red or white or variegated but does not seem to be in very large massive blocks or ledges.)

Thuesday July 16. Intend to row up to Naiska bay. Lake too rough to go out in a small boat so I desisted from the excursion and determined to go with the next arriving boat downwards the lake to Pt. DeTour.

Wednesday 17. At 7 in the morning the steamer Japan entered the locks and I took passage 2.50 to Detour.

Passing by Anebish Island and Sailors Encampment I notice that although no rock ledges are making an outcrop, that the abundance of angular limestone pieces in the drift accumulations of the surface indicate the close proximity of the rock,(calciferous sandrock).

Arrived at noontime in Detour. Made some collections of fossils that and the following days, Thursday and Friday July 19, only a few new kinds of fossils found.

The number of terraces formed by the lake at different periods is worthy of notice. The highest terrace is about 30 feet above the lake, at which hight the rock ledges of the Niagara group form an escarpment (1 mile north of the landing).

No steamer for Mackinaw has passed by yet, and for sailing the wind is not favorable. 2 barrels of fossils delivered for transportation.

Saturday July 20. Sailed with a small boat to Scammons Harbor where I arrived after 9 in the evening having no wind during the day to promote our journey.

Sunday 21. Visited the stone quarry proposed to be opened by some Cleveland men. The rock there is forming vertical walls of about 15 feet high in massive blocks but the rock is un-homogeneous and would not answer for any other but coarse masonry.

Monday 22. Rowed up to Father Perry's Farm on the land spur opposite the northeast end of Big Marquette Island. Much of the land joining the lake channels is low and swampy. Some of the elevated lands are covered with large loose Niagara limestone blocks and with metamorphic boulders. Much of the land is of poor quality bearing pine, cedar and populus primula,ectr.

Tuesday July 23. Preparing for a start tomorrow with a sailing boat to Mackinaw and the north coast of the lower peninsula. Freight for my boat 16 dollars.

Wednesday July 24. Started for Mackinaw a little after 7 o'clock but did not arrive until past 5 in the evening.

Thursday 25. Left Mackinaw at ½ past 8 and arrived with fair wind at the lighthouse point of McGresin Point (?). The beds of the Upper Helderburg group with all its characteristic fossils crop out in the lake bed. The terrace on which the lighthouse stands is mostly composed of loose limestone fragments of the same formation with few large metamorphic boulders interspersed.

The limestone strata in the lake are of the same argillaceous nature as the beds of the opposite side with nodular concretions of a white flint. The lighthouse stands about 40 or 50 feet above t e level of the lake, and behind it the ground rises some 30 feet more but seems to be all drift or detritus of the limestone formation.

Took dinner at the shore and proceeded. The limestone soon disappears from the s oreline and all the beach is sandy. The landspur forming the next promontory is low and ends in several low islands with shallow water between.

Near Cross village the sandhills are elevated about 100 feet above the lake forming several terraces, one very prominent one on which the village is situated, is about 50 feet above the lake and extends on to Little Traverse. The bluffs of the hills are very numerous and exhibit sandy or gravelly material sometimes mixed with larger metamorphic boulders and apparently containing argillaceous admixture in large proportion; particularly away from the immediate vicinity of the shore where the cleaner sand is always washed out from the mixed drift material.

Near the shore is much cedar but on the higher lands backwards is hardwood and the prosperity of the settlement indicates a good congenial soil. No rock visible all along the shoreline until to the head of little Traverse Bay where on the south side of the bay about 1 mile east of the mouth of Bear Creek the rock crops out, first in the bottom of the lake with a gravelly shore line, then in perpendicular bluffs 30 feet high and extending close to the mouth of Bear Creek. The beds exposed first in the lake bed are the lowest. They are of bluish dark color with argillaceous sandy looking surface but tough containing there few fossils except some of the so-called acervularia and some cyathoph. cali-- es. Above follow ash-colored brittle dolomitic limestone strata weathering readily in irregular sharp angular fragments containing scarcely any fossils except a layer in which Favosites cervicornis is densely spreading out its nodular branches and ramifications. Also black impressions of plant stems are spread over the surface of some slabs in considerable quantity and indistinct compressed casts of bivalve shells lay sometimes crowded over portions of them - the thickness of these beds is about 10 or 12 feet. Then I notice a s ngle bank of a similar rock turvus (characterized ?) by many small cellular cavities some of which are lined with spar, above which again dolomitic layers similar to those below continue and are finally capped with 30 feet of rockbeds which are not much differing from those below in lithological character.

It is a light drab-colored absorbing rock very brittle under the hammer and in the humid state soft enough to be scratched with the finger nails . In places it is destitute of fossils only with differently colored dots of the size of an hen's egg all through its mass.

In other places brachiopod shells, strophodonta denuissa, atrypa reticularis, spirigere concentrica and some cephalopod shells (Phragmoceras ?) are found in it with here and there a favosites or Eridophyllum or Stromatopora in other portions which are the immediate continuation of the mentioned beds. The whole rock mass is one solid agglomeration of stromatoporas in globular and otherwise variously shaped masses of many feet diameter. It is in one place principally the Strom. pustulifera, Linch. In a more westerly situation the cespitose ? form with the nodular associated (root portions ?) is prevailing. At all events this cespitose form and the connected massive lumps have always distinct structure of the same character.

While the specimens of pustulifera , except the distinctly marked laminae do not exhibit any finer textured spongious tissue; intermingled with these sponges eridophyllum, cyathophyllum, cystiphyllum and favosites are more or less abundant. On the west side of Bear Creek mouth for some distance, the rock beds have disappeared and loose detritus and drift material principally composed of the different Hamilton rocks form the shore and adjoining terraces.

Friday 26. Went from Cross Village to Bear Creek with fair wind and arrived there at 10 o'clock. Visited the rock bluffs east of Bear Creek.

Saturday 27. Our camp is at the dock built by the owner of the small sawmill on Bear Creek. I intend to remain here as long as necessary to investigate the next surrounding country.

Followed the shoreline westward for 2 miles. About ½ mile from camp in the bed of the lake blue limestone beds containing acervularia are seen. Some carbonaceous shales arec connected with them. Stromatop. Mortheni, Favosites etcr. Further on above lighter colored beds with the same fossils besides Str. monsiculifera. Then a seam with cyathoph. acervularia , Strophodonta subdemissa ?, Cyrt. Hamilton, atrypa reticularis. Above, light colored brittle limestones with Spirif. Mucronat. et other Spirif.

An interruption of a half a mile by drift deposits 60 feet thick and composed of gravel, clay and sand in not plainly stratified condition. Again then crop out from below the drift the last mentioned upper beds, containing a few brachiopods and occasionally an acervularia or Stromatopora.

The next large connected section is little distance from the large drift bluffs and gives the following series in descending order.

Dolomitic grayish, light brown limestones, brittle with rough sandy fracture containing Sp. mucronat., acervularia, stromatopora from 15 to 20 feet.

Under them is a seam of a few feet thickness of a soft blue clay and replenished with acervularia, favosites. Stromatopora, Atrypa reticularis, Strophodonta, Cyrtia, ectr.

Below about 10 or 12 feet, light brownish yellow colored brittle limestones with many stromatopora monticulifera, acervularia, Favosites and some carbonaceous seams.
Then a few feet of blue colored limestones crowded with fossils acervularia, Stromat. Northeni, ectr.
Below again light brownish yellow brittle limestone with few fossils getting of a smoother finer grain downwards. 5 or 6 feet visible.

The whole series appears also represented near and above the saw-mill on Bear Creek, but the outcrops there are not very extensive, drift being rarely eroded down to the rock.

Comparing the section west of Bear Creek with the section East of it, I come to the following conclusion:
The series east is highest, the blue colored beds at the base are probably above the top strata of the western section. The acervularia and Stromat. Northeni are confined to the lower strata. Acervularia pustulifera et cespitose are restricted to the upper strata.

Diagram. Sect. west of Bear Creek.

(In pencil. description of diagram. 1. Limestone, fine grained with sp. mucronat. Stroph. natrea ?2. Dolomitic beds with acervul. ectr. 3. Acervular clay beds. 4. Limestone with Stromat. Monticulif. carbonaceous seams. 5. Acervular limestone with carbonaceuous seams, blue colored. 6. Limestone brittle, light gray brown, fine grained, few fossils. Atrypa retic. In all 40 feet.)

The outcrops west of Bear Creek are by fire-fallen timber and the falling rock from above much more covered up than I found them 4 years ago when a far greater abundance of fossils could be collected.

Sunday July 28. At 4 o'clock in the morning clear sky, sun rising. After 6 a thunderstorm and rain.

In the fine grained brittle limestones which occupy a position not much above the coralliferous blue clay beds I found the following fossils: Spirifer mucronatus, Spirifer (Iowensis ?)(crusineus), Pentamereous?arata, Spirigera concentrica, Atrypa reticularis, Strophodonta demissa, ------ sub demissa (Strophod), Chonetes, Cyathoph. Stromatop., alveolites, acervularia, gomphoceras, Troetus crassimarginata, Favosites cervicornis et other forms, Strophodonta nacrea.

Loose blocks are strewn all over the terrace at the dock where we encamped but along the shore further up I saw the same strata in position a few feet above the coralliferous beds with acervularia, cyathophyllum, Stromatopora, ectr.

Diagram with following description.

(½ mile west above camping place in water. Acervular beds blue with Str. North. Monticulif. Favos. above Str. nacrea beds with the before mentioned fossils. In places --- in other places few fossils. Above 1 ft. similar, brittle fine grained limestone containing very few fossils.

Sunday morning I ascertained on the exposure nearest to our camping place the true condition of things. The blue acervularia beds are lowest. Close above come in the Strophodonta nacrea beds, and above are brittle limestones with scarcely any fossils. The thickness of the mentioned beds is Blue limestone as far as seen 4 or 5 feet. Strophod. nacrea beds 3 or 5 feet, fine grained brittle limestone with only few fossils 8 feet. To these follow upwards the blue fossiliferous clay beds. In the lower horizon are carbonaceous black shales intercalated in irregular wedging out beds of limited thickness. The beds with Strophod. nacrea are not everywhere rich in fossils, in one spot are scarcely any while a few steps further their numbers great.

Afternoon went up to the locality with the blue fossiliferous clays. I seen them having a position immediately above the brittle limestones with few fossils which formed the top of the escarpment which I visited this morning. The rock however is there somewhat different between the blue acervularia beds and the brittle limestone. Not much of the stroph. nacrea beds is to be observed here but the Stromatopora and Acervularia is in greater abundance in these. The rock above the clay strata is coarse grained of rough fracture and contains also acervul. stromatop. et cyathophyl.

Below the blue acervular limestones a series of at least 10 or 12 feet of strata is seen. Some of the beds contain scarcely a trace of fossils. Others are carbonaceous with many fossils, corals and brachiopods, and in one of the beds a Favosites in clusters of finger thick branches almost entirely covers the surface. It is surrounded by black carbonaceous shaly matter. The strata dip under an angle of about 8 or 10 degrees in northeasterly direction (towards the bay).

Diagram

Monday July 29. Passed night. a thunderstorm with rain. Sailed out about 3 o'clock towards Pine river with contrary wind. Landed about 4 or 5 miles west of Bear Creek by wading to the shore.

A very instructive section is seen there. At one place in the lake the blue acervularia limestones with a great abundance of the usual fossils are seen; seams of black carbonaceous layers with many fossils are also alternating with these limestones.

Above some beds of a brittle grey limestone with few fossils follow then 3 or 8 feet of Stromatopora monticulifera limestone which is there in immense accumalation, also Str. Northeni et acervular and cyathoph are in the same beds. Then comes above 1 or 2 feet of blue fossiliferous clay and above this 5 or 10 feet of a brownish yellow dolomitic limestone, containing only fewer fossils.

½ mile west of this escarpment another still more extensive one is seen lowest black carbonaceous acervularia beds abounding in fossils.

Above them compact beds of a dark grey limestone containing only few fossils follow. One bed above is of fine grained fracture like lithograph limestone but very brittle. Then again an acervularia bed. Above again 4 or 5 feet of brittle limestone with few fossils. On top the Stromatopora monticulifera beds which form the terrace near the lake shore.

Little distance back of it the ground rises again at the bottom. Everything is covered by debris and drift gravel but there must be the blue fossiliferous clays because higher up the crystalline dolomitic limestones are cropping out in considerable thickness. At the lake shore among the waterworn rock, pieces (of) a brownish highly crystalline dolomitic rock is found generally without fossils. But some specimens contain casts of brachiopods, ectr. This dolomite seems to be the next higher member in the series but I did not see it in place. However I recollect from my visit 4 years ago that several miles further west this rock forms a large escarpment along the lake shore. It is also related lithologically with the Stromatopora beds east of Bear creek and according to my present knowledge these strata form the highest beds of series in this place.

The high sea did not allow me to land any more and I postpone the visit of the remainder of the shoreline to the future. We arrived at Pine River 4 o'clock and entered Pine Lake at the lower end of which we encamped.

Tuesday July 30. A severe wind blew down the Pine Lake so as to prevent us from sailing up. I then went to the rock exposures at the headland west of Pine River. The rocks exposed there amount to from 15 to 20 feet. The lower beds are the top strata of the acervularia limestones with only few fossils. Above them the brittle fine grained beds with Strophod. nacrea, chonetes, Spirif. crusineus(crutineus) Mucronatus, Stroph. demissa and subdemissa form an escarpment. Some beds contain also a large number of exictopora stems but the place is not near as rich in fossils than I presumed from my former visit when I made good collections there.

My man refused to go with me pretending that he hired out to me only to manage the boat, and in fact he did during the whole trip no other work to assist me. After this experience I got perfectly disgusted with the continuation of the journey and as soon as possible I will make myself ready for return to Mackinaw, not however before I have sailed around Pine Lake which is reported to me to have nowhere along its shore any rock ledges exposed. A number of settlers have already made their homes along the borders of the lake. Part of the land is sandy but a good deal of fine productive soil is also in places. At present they derive a living from the sale of fuel wood which is carried to the dock by a small tugboat where it sells from 3½ to 4 dollars per cord. The settlers sell it at their landing places at 10 schilling per cord.

Severe east wind blows all day with a fine spray of rain. In the evening the wind rises to a perfect gale from the east and rain falls all night so that we got all wet and had to fasten the tent not to have it blown off.

Wednesday July 31. All forenoon wind and fine rain. Towards noon it is clearing up some and I intend to sail up Pine Lake. The drift material forming the bar between Pine lake and Michigan Lake is to all appearances re-assorted by the subsequent action of the lakes. Recent alluvial clays are covered up with heavy sand and gravel beds containing besides Hamilton rocks, metamorphic rocks and Niagara limestone with fossils. There are two distinct terraces, one about 25 feet above the lake, the other 50 or 60. The whole afternoon and following night rain.

Thursday Aug. 1. Sailed up the lake and arrived at its end about 1 o'clock. Ascended the highest hill coming close to the shore and found it 270 feet high. The difference of the barometer within ½ hour being 1/20th inch rising at the same standpoint on the lake surface. The hills are superficially all drift and along the whole shore of Pine Lake no ledges outcropping. Among the pebbles many pieces of black shale are found which indicates its close proximity.

The shore at the head of the lake as well as its valley and other places intermediate have alluvial white calcareous clay beds with fresh water shells and vegetable remains deposited and extend far out in the bottom of the lake. The formation of terraces is conspicuous all around the lake and on them numerous farms with good prospects have been located the latter few years.

In returning we had contrary wind and had to lay over night about 1½ mile below the sawmill. The lake shore is all over formed by whitish grey clays containing sweetwater shells and wood. Many strong springs emanate from there.

The next low terrace above the lake shore is formed by drift with many calcareous pebbles principally of the Hamilton group but also some Niagara group, also black slate pieces are very abundant.

The timber is most all hardwood except a seam of cedar around the shore. The hills surrounding the lake are from one to 200 feet in hight and are superficially all composed of drift material, some sandy, some gravelly and argillaceous.

Friday Aug. 2. Got up at 4 and saw the drift in which a number of Stromatopora and large favosites Hamiltonensis are to be found. At 8 we sailed downwards with contrary wind. Arrived at 11 o'clock at Pine River where we encamped outside west of the lock. Wind from the northwest and hard blowing so we are forced to remain.

Saturday Aug. 3. Sailed into Little Traverse Bay. Observed the rock bluffs extending for several miles along the shore in vertical escarpments about 15 feet high.

Lowest strata seen along there are the Acervularia limestones very rich in fossils. Above in several places the blue fossiliferous clay beds come to the surface in the bed of the lake, and under the before mentioned rock bluffs which are immediately succeeding above and are merely a modified form of the usual dolomitic rock capping the clays.

This rock is a brown crystalline dolomite sometimes in homogenous thick beds without any fossils. Sometimes the beds are porous and nodular with occasional nests of corals or also with casts of shells. Interstratified with them are brittle fine grained limestones in thin beds and some of the upper layers are again thick bedded, full of encrinite stems or entirely made up of them. I found this brown dolomite rock very widely divulgated (?) in the pebbles at the shore but the regular outcrops are restricted to these bluffs.

We sailed from there for Cross Village and arrived there at 7 in the evening. The wind had left us all before we came near Middle village and only be helping with the oars, we proceeded so far. At Cross Village we slept in the boat and sailed out Sunday morning Aug.4 at 3 o'clock with fair wind. Arrived at Mackinack 8 o'clock and went in the evening to Scammons Harbor.

Monday Aug. 5. packed specimens and effects in the forenoon, after noon went out to Spectacle Reefs. The lighthouse in construction there is a really admirable piece of work. The foundation rests on solid rock ledges about 12 feet under water. Some cores from the boring machine which I collected there are of the Marblehead stone, 2 shorter pieces are from the bedrock on which the lighthouse rests. Returned to the Harbor in the evening 18 miles distance. Time for the steamer 1 hour and 25 to 30 minutes.

Thuesday Aug. 6. In the evening with Steamer Warrington to Pt. DeTour.

2 pages diagrams.

Bluff 50 ft. at the end. equally ? a (the) Strophe bed 2/3 inch thick with discoid bed and discoid spiriger(spirifer) interposed bed 7 ft to 8 ft. thick, thinning out to nothing at both ends. extend for 1 mile. Above it are from 10 to 12 feet of thin-bedded sandstone slabs with ripple marks exactly like the strata below the thick bed. All strata ascend to the north so that the thick bed where it disappears to a thin seam is 20 feet above water while at the lighthouse it is partly under water. Beyond lighthouse all rocks disappear from the shore. No actual clay strata. Pencil notes in back of book).

Diagram.

Note on a diagram (questionable) Mr. Houghton tells me to have seen gypsum deposits on Cedar River, south of Escanaba.
J. H. Orthey, Negaunee, Michigan

Diagram

(Pencil notes on above diagram. Gr(een) Feld is more south one single Island vll (?) lengths. Huron west(with) 5 smaller ones. Island (Grand) 3 rods distance (?). 1 or 1/3 mile from shore the high mountains come close to the shore apparently leaving only a narrow strip of land for the Potsdam if there is any at all. We pass them at 11 o'clock. From there the projecting land tongues are all low and composed of the Potsdam.

Page diagram

3 full page diagrams.

Escanaba et Megaunee R.R.d. Megaunee at the centre of the west side of Sec.6 in T. 47, R. 26, goes diagonally through Secs. 8 along the base of Secs. 9, through 14 and 15, along the side of the lake through the northeast corner of Secs. 23 and almost diagonally through 29, diagonally through 30 in the next eastern town making its end in the middle of the south line of Sec. 32, then through town 46 R. 25 in a straight line drawn from the centre of the north line of Sec. 5, to the southeast corner of Sec. 34 from there to the centre of Sec. 11 in Town 45, bending there and taking direction to near the centre of Sec. 21 in the same town range 24.

Diagram Mills Creek, Whitefish River

Diagram Smith's Mine.

J. Koninger Dec. 1, 1912. Memorandum.

Artesian well in Lansing Reform School. ~~Lines of correction.~~

Drift.			101 feet
Clay mixed with gravel	33		
Sand and gravel	4		
Sandy hardpan	4		
Lake sand and gravel	59		
Claysand and gravel	18		
Lake sand and gravel	1	101	
Soft sandrock	5		
Fireclay, hard	4		
Soft white sandrock	13		
Soft sandy fireclay	15		
Close hard sandrock	119		
Hard fireclay mixed with beds of soft sandrock of variable bluish or white color	84		
Chert line	1		210 feet
Grey lime	1		
Sandy fireclay mixed with streaks of harder rock			51 feet
Soft sandrock			37
Hard grey limestone			3
Soft whitish sandrock			13
Blue limestone			1
White fireclay			1
Sandrock			4
Mixture of fireclay and iron pyrites			50
Soft sandrock			5
Blue limestone			18½
Total depth			505 feet

Copied from the record book of the institution.

Artesian boring at Depot of Detroit & Milwaukee Railroad Owosso.

1. Clay and gravel	20 feet
2. Hardpan	7
3. Blue clay	10
4. Clay, gravel and boulders	5
5. Fire clay with some traces of coal	3
6. Blue shale	20
7. White and sandy shale	2
8. Blue sandy shale	25
9. Shale, hard below getting arenaceous	17

D(ate or dug) Juni(June) 82.

Boring at Spring Lake, Ottawa County about 1½ miles from Lake Michigan.

Sand on top	14 feet
Blue clay	36
Clay and gravel	6
Blue clay	30
Fireclay, drift	15
Sand clay and gravel	45
Coarse gravel	12
Sandrock, blue and soft	20
Shale, blue	51 ?
Sandrock (Marshall)	20
Water.	

Boring at Grand Haven 1560 feet deep.

Commenced in Marshall sandstone	240
Then shales	320
Then Hamilton group, that will say limestones and alternating shale beds.	
Then probably through Helderberg.	
Onondaga group at	1550
containing gypsum to nearly	1500
Saline water.	

Statement of the different strata of East Saginaw Salt Mining Co went in boring their first well.

Sand	from 1 to	15
Clay	15 "	37
Sand	37	45
Blue clay	45	75
Sand and pebbles	75	90
water rose 5 ft. above surface, slightly saline		
Pebbles, boulders and quicksand	90	92½
Sandstone	92½	171
Dark clay shales	171	197
Light clay shales	to	211
Sandstone with some coal seams	to	239
water 10° by salometer		
Coal & sand (about 3 or 4 ft. of coal less sand to		254
Clay shales	254 to	265
Bituminous shale	to	268½
Sandstone with thin seams of coal	to	278½
Blue clay shales	to	295
14° by salometer. 10 gall. discharge per minute		
White sandstone	to	320
Fetid (Fetid) limestone	to	405½
Sandstone	to	409
Limestone	to	410
Sandstone	to	415½
Limestone	to	416½
Sandstone	to	431

Sand, muck.		
Limestone	to	420 feet
Sandstone	to	42[illegible]
Limestone	to	[illegible]
Sandstone	to	[illegible]
Lime and hard rock about [illegible] feet	to	440
Sandstone	to	450.
Lime and sand with argillaceous matter	to	[illegible]
Clay shales	to	467
Sandstone (salometer 38°)	to	475
The clear sandstone all light colored on exposure getting rusty		
Clay shales (salometer 46°)	to	510
Fine blue sandstone	to	515
Clay shales(salometer 44° dip. 51°)	to	551
Sandrock hard	to	55[illegible]
Clay shales	to	55[illegible]
Hard sandstone	to	587
Clay shales	to	741
Clay shales with some sand	to	747
Light colored clay shales	to	749
Dark clay shales	to	550
Light clay shales	to	554
Dark clay shales	to	55[illegible]
Fine hard blue sandstone(salometer 50°)	to	567
Same	to	567
Blue softer sandstone(salometer 74°)	to	569
Dark clay shales	to	574
Hard blue sandstone	to	59[illegible]-10[illegible] inch
Same, softer	to	5[illegible]
Same but lighter colored	to	590
Dark clay shales	to	594
Fine hard blue sandstone	to	595
Grayish, angular coarse sand	to	599
Same but very hard	to	599
Dark colored clay shales	to	605
Very hard sandstone		1 inch
Fine blue sand with much mica scales.(Sal.[illegible])		60[illegible]
Same very hard	to	60[illegible]
Same softer. Dip. [illegible]	to	610
Sand and light colored slate(Sal.90°)	to	115
Alternate soft sandrock	to	15[illegible]
Very hard rock	to	1[illegible]-[illegible] inch
Dark shales	to	15[illegible]-[illegible]
Very hard seam of dark blue changing to blue sand		15[illegible]-10 "
Dark clay shales	to	15[illegible]
White sandrock changing darker and harder with a little slate at near		645

Sandrock. Water increased as soon as this was struck so as to raise all the casings and no continued drill at 655 a hard seam was struck and boring for a time suspended. Water from the bottom rises 61' by salometer.

In a new locality the water will not travel to penetrate to the depth of 648 feet through sandrock and from there to 10. feet it has flowed [illegible] gravelly red color.

In all localities of Scioto Valley water flows from sandstones generally. Limestone formation was found before reaching the neighboring sandrock.

Ohio localities for fossils of the carboniferous and subcarboniferous period.

Marville. Limestone. Coal measures.

Locality Coutonville. Muskingum County. Parallelized with Chester group.

Mitchell, Summit County. Fossil crinoidea, described by Hall.

Scioto ville, near Portsmouth.

Rockville on the Ohio southwest of Portsmouth. Fossils of Waverly sandstone formation.

Lowsville limestone, best localities. Clintridge and Baldridge 8 miles southeast of Newark, and a location 1 mile west of Somerset Perry county, south of Newark.

Memorandum for next Saucons investigation.
Delta township, Eaton Co. On Sec. 31. Must be close to Grand River and near the Bellevue and Lansing Road. Vide Mincholl Report.

Drift	5 ft.
Fireclay	2 - 8 inches
Coal	2 - 5
Clay	4 - 3
Coal	1 - 11
Fireclay	3 - 8
Shale	18 -
Coal	Pitch
Shale with pyrites	12 -
Sandstone	4 - 2
Coal	4 - 1
Sandstone, grey, soft forming bottom	
Total	58 ft. deep.

Same well following strata penetrated.

Sand	50 ft.
Yellow clay	30
White sandstone	30
Red sandstone	15
Grey sandstone	5
Red sandstone	40
White shale	10
Red sandy slate	30
White shale	3
Red sandy slate	30
Blue shale	55
Red sandstone	40
White slate	40

Continued	
Red sandstone	5 ft
White slate	40
Red sandstone	[illegible]
White slate	[illegible]
White sandy slate, first indication of salt	25
White slate	134
Grey saltrock (sandrock)	195
Blue slate	10
Total	805 ft.

White rock. Old boring. general notice.

Blue clay	40
Slate	10
Sandrock	3
Slate	568
Sandrock - salt brine	190
Shale and slate	195

At Port Hope other boring experiment furnishing salt brine.

At Port Austin. next place with borings 1100 feet deep

Moesville. Pigeon River, Huron Co.
Boring 650 feet (Fuss)
Brine 75° salometer

46 Navesitoid ectr.
30 Stromatop.
5 Petrad. 1 Mozmo's
12
 Includs. astr. spec. Hamilton et Multipora.
4 Paeloz. Trenton.
1 probably Moraain Dura
1 Unknown Diag.
6 Huron et Discos.
2 Orthoc.

Diagrams

C. Lesinger May 1873

Memorandum. Morrison. Vassar on Sec. 7, in Town 11 N. 9 East and in Sec. 12, T. 11, R. 7 E.

Cass City, Mr. E. Brown lives south of Cass City. Traverse ledge Browns land on Sec. 1, T. 14, R. 11.

Mich. Lubert - Coal Mine.

Drift	11 ft.
Sandrock	30
Slate	17
Coal	4

Under slate and gravel (?) Porter 8 miles(?) Lubert - ?

Mar. 24. Left Ann Arbor for Jackson. Afternoon visited the coal mines north of Jackson, one the property of Mr. Walker & Co. The other the property of Lubert et Co. Could not enter either of the mines. Walker is considerably prejudiced against the geol. survey.

As far as I could learn from him the coal bed is found approximately 40 or 50 feet below the surface. Maximum thickness of the sandstone in the locality 50 feet, often less.

Below he says is a 4 inch seam of coal with a thin slaty roof. Under it from 4 to 15 feet fireclay.

Below shales up to 50 feet but frequently much less. Then coal from 3 to 4 feet. Below shales and poor coal and sandstone which however is not penetrated by the miners which quit working as soon as they get to the shales below the coal.

The laborers of Porter and Luberts Mine gave me the following section of their mine.

Drift	11 ft.
Sandrock	40 ft.
Slate	17 ft.
Coal	4 ft.

Sometimes fireclay and slate at the base . The whole shaft 30 ft. deep.

The sandstone is a middling coarse grained glistening rock quite irregularly stratified and of unhomogeneous nature. Even the harder beds of it have little coherence and are making a very poor building stone. Some layers are easy friable between the fingers and fall into soft sand by exposure. They are partly white, colorless, partly highly ferruginous and even the white rock on exposure turns yellow or brownish by oxidation. Calcites are not uncommon in the sandstone. Some portions are conglomeratic by admixture of quartz pebbles and nodules and streaks of kidney iron ore. The sandstone covers an extended area on the right hand side of Grand River. The State Prison stands on this flatend like ground which has an elevation of 30 or 40 feet above the river.

The undulating hill land rising on this plateau is built up by drift and the sandstone only occasionally raises its head above the banks of these or in ravines.

The fireclay or what the coal no at the roller line is an argillaceous line primed sandrock which easy decays into a semi-plastic mass. Other beds are described to be in being softer and ori inally in plastic condition. The color of it is bluish gray. It contains also some few vegetable remains.

The coal is a shining bituminous coal not fit for cooking but said to be very good for heating steam boilers. It contains some seams of iron pyrites in quite considerable quantity which are practically used for the oil of vitriol works connected with the mine.

In the shales and in the coal compressed trunks of **Lepidodendron** or Sigillaria are quite common. Also fragments of a soft charcoal, like coal penetrate the coal in thin seams. The average market price of the coal at the mines is from 1 to 4 dollars per ton according to the quality.

There are several artesian wells in Dachsen, I believe 4. The oldest is in the State Prison. One is close to the river behind Lurds Hotel which is only 105 feet deep and furnishes a very sweet drinkwater. Another is behind the Ribbed House, said to be a magnetic mineral well but it tastes very little different from ordinary well water. I could so far not collect any reliable information about the depth of these wells and much less about the strata penetrated.

By 8½. Saturday. Mr. Eastman in the morning appeared considerably disheartened by the prospects of the excursion and I advised him to return home, which he gladly did paid his expenses.

Went by railroad to Lamm with 7 o'clock train. Met there accidentally with Prof. D. J. Luthus, principal of the school there. He accompanied me on an excursion north of Lamm. Went about 1 mile on the road which forms the boundary between Lamm and Sandstone township over a level ground through which a creek flows. A mile from town a ridge about 40 feet high extends from east to west. At the foot of it a layer of irregularly stratified sandstone is seen which in appearance not different from the sandstones of Dachsen. It contains nodules of iron pyrites and is quite friable. The top of the hill is formed by drift containing an abundance of carboniferous sandstones, some very compact silicious with trunks of Sigillaria and other vegetables. Followed the ridge eastward for about a mile and went south across the swampy bed of the creek to the next hill and went south on it. Followed this to the place of Mr. Kirch which has his place situated in the southwest quarter of sec. 30 and in the north half of northwest quarter of sec. 29, in town 1 south, range 2, in Sandstone township.

[illegible] the fullity [illegible] by the Dwelling House the [illegible] is close under the surface and fully [illegible] and [illegible] of it [illegible] - bandoned [illegible] [illegible] of a [illegible] quality but fre- quently [illegible] [illegible] dislocated and dipping northwestward by which [illegible] [illegible] is [illegible]. [illegible] [illegible] observed and its character appeared [illegible] [illegible] the better por- tions of the adjacent sandstone.

Close to it at a little lower level on both sides of a small creek the carboniferous limestones are tolerably well exposed and some a- bandoned lime quarries are found there. This limestone seems to under- lay the whole of the flat country between this spot and the railroad to Lama which has a width of [illegible] of a mile.

The limestone is blue colored crystalline with spar veins and silli- cious portions. It does not make a good lime. Contains very scarce fossils but I found several alveoline shells in it. The upper beds of it are dark brown, iron colored argillaceosilicious limerock to which above the sandstone seems invariably to follow.

In a well dug by Mr. Finch the following section is described to me. Entire depth [illegible] feet. Under a few feet of drift is found a solid sand- stone 12 feet. Then follow 40 feet of a hard limerock which has not been penetrated. Water was in good supply first but was partially lost by going deeper.

In the village of Lama a well has been bored 350 feet deep. Below a drift covering of several feet they struck sandstone whose thickness is not ascertained. Under this a hard rock supposed to be a limestone of great thickness, but also not measured. Next below to the bottom of the boring a softer rock which they called soapstone and in which leaves (fern) are said to occur. Water was not obtained. It first rose to within 17 feet of the surface but was lost by going deeper.

In several other locations of the neighborhood, outcrops of sand- stone are described to me and invariably as succeeding below limestone is mentioned.

At Mr. Craig's place one mile west and two miles south of Lama, outcrops of sandstone and limestone are reported. One mile west and one mile north of Lama, north of the railroad the limestone forms a hill elevation.

At Sandstone 5 miles east of Lamar in sight of the railroad in a level swampy place coal has been found close to the surface and has been mined on a small scale but is not abandoned. The mines of Wood- ville are 100 feet deep not far to the east of it on rising ground, but are at present full of water and not worked.

South of the railroad and north of Spring Arbor are some coal mines worked which are also close under the surface and are also little bet- ter than the sandstone coal mines.