

At the head of Big Bay de Noquet at Fischdam river a few miles back from river there are rocky hills with limekilns established there. Probably Niagara limestone as in the hills at Garden Bay, Furnace and the promontory above Eliots.

7 miles down the bay on this side the same man reports me that about a foot below the surface all is one solid rockbed in a tamarack swamp. He describes the rock as bluish, darker than the Clinton and Niagara strata.

Next river below Sturgeon is Ogons river 4 miles from Sturgeon. The river is said to form rapids about 1 or $1\frac{1}{2}$ miles up from its mouth.

Monday June 12. Paragraph in German

All prominent points along this side have a gravelly bottom with plenty of dioritic boulders mixed with the limestone slabs above the Hudson and below the Niagara. The specimens are marked 30.

Diagram

Upland above silicious limestones covered with several feet of good argillaceous-arenaceous sand and well adapted for agriculture. Hardwood timber and large cedars ectr. mixed.

Wednesday. Passed Squaw Point 7 A.M. Both sides flat sandy. On Wisconsin side back from shore there is a high drift bluff which is a continuation of the drift bluff. Following the shore up from Escanaba and there keeping close to it unto the narrows at Squaw Point. At the head of the bay to the right and a few miles backwards there is a hill higher than the rest noticeable.

Railroad commencement is falsely placed on the map. The point where it is represented is the low flat land, land before the drift bluff which there has receded and reappears on the inner shore of the little bay.

Whitefish river is on both sides joined by low lands, the surface of which here and there forms little elevations on which people have placed tolerably good grazing farms. The whole surface is formed by drift pebbles which are derived from the Trenton group and the red sandstone of lake Superior besides from granite and diorite boulders .

Sunday June 18. Paragraph in German

Diagram

Foster and Whitney

Escanaba more than seventy miles along its meanders Trenton limestone almost constantly exposed. River at its mouth flows over level strata which dip less than the fall of the river consequently the strata are cut through. First rock in ascending a tough limestone in thin layers separated by a band of slate containing Orthocerata and other fossils (Birdseye) and Black River.

Succeeding layers well exposed about 1 mile above. Thin irregular wedge-shaped limestone, ash colored. Contain many Trenton spec., crinoid remains ectr. At the lower mill dam, about 1 mile above the first exposure there is an escarpment of about 15 feet. Fossils collected *Isoteles gigas*, *Calymene blumenbachin*, *Orth. testudinaria*, *Laeptena serieca - alternata* (Trenton). In ascending the river these beds continue as far as the lower Falls distant 2 miles from the lower mill dam. Dip of strata nearly corresponding to the descent of the river.

At lower Falls the thin irregularly stratified strata are followed by regularly bedded strata of limestone 15 or 20 feet thick, arenaceous and argillaceous matter intermingled. Fossils are of Trenton and Hudson or Niagara group but few.

After passing the falls these beds soon disappear and in an interval of several miles few rocks are observed. The rocks are thin light gray, granular structure, contain numerous cavities lined with crystals. These compact grey beds lie above the limestone seen at the lower falls since they clearly pass beneath the channel before the others emerge between the lower falls and the meadow distant 9 miles from the lake. The surface is mainly covered by an accumulation of boulders.

Below this place the river turns to the eastward cutting deeply into an accumulation of this character but above it again bends to the westward and lays bare on the east side a ledge of some 12 feet thick of grey limestone thin bedded and containing small cavities. Those layers are a continuation of those described at the waters edge several miles below.

From this point onward for a considerable distance the dip of the strata is more rapid than the descent of the stream consequently there is a succession of the lower strata represented to view in its banks. I had therefore an opportunity of verifying my first observation that the grey granular limestone rested on the shaly arenaceous beds with thicker calcareous strata like those seen at the lower falls succeeded by the irregularly stratified beds observed at the upper mill dam.

We had the opportunity of tracing these two last divisions for several miles along the river where these escarpments were exposed from 25 to 30 feet, disclosing in the ascending order the birdseye limestone, succeeded by the Trenton with scarcely a trace of the Black river limestone, for while *Ormoceras* characteristic for the latter rock occurs at the junction of the other two, in the same connection I found *Orth. multicameratum*.

From this first exposure of rocks above the meadow they are almost constantly in view up to the Upper Falls and from thence onwards to the forks of the river about two miles from the upper end of the meadow the birdseye limestone is seen at the level of the river and continues as far as the first rapids. Below the upper Falls at Indian Creek a short distance below the foot of the rapids the birdseye limestone is very distinctly defined and rests upon some heavy beds which clearly represents the Chazy limestone. One of these beds is peculiar for weathering in a peculiar manner a kind of tough silicious concretions stand out in relief while the calcareous part wastes away .

though
At the upper falls the strata more rapidly rise to the north and through the ascent of the stream is considerable yet on arriving at the foot the calciferous sandstone is exposed forming the base of the escarpments over which the water is precipitated, while above it there are two layers which represent the Chazy and Birdseye limestone and the lower part of Trenton group.

Sect. in ascending order

1. Birdseye limestone
2. Calcareous layers 4 feet.
3. Heavy bedded variegated limestone with much silicious matter 2 feet.
4. Thick silico-calcareous bed with fossils in the upper part
5. Silico-calcareous layers at the foot of the falls, thin and even bedded 1 foot.

The whole exposure at the falls is about 15 feet and in the bank above about 10 feet more. The beds forming the top of the falls disappear below the river near the point where Indian Creek comes in from the east. The layers having the character of the Birdseye limestone disappear short distance below and are succeeded by thin beds containing an abundance of Orth. Testudinaria, Laeptena sericea and Alternata with other fossils of the Trenton limestone.

Monday 19. Paragraph in German

Centerville 3 $\frac{1}{2}$ Station. Little Lake 4th station. 3 miles beyond is Smith Mine Station where I have to get off. Drift very red all the way along. In one place the limestones seemed to crop out. Beyond Smith Mine a fine outcrop of marly rock. Red clay visible under the drift sand $\frac{1}{2}$ mile above Marquette depot. Short distance, 1/8 mile before reaching Franklin Station there is a fine view over the Lake Superior to be had. Jackson Mine. MacCumber mine.

Another German paragraph.

Expenses 1 dollar at Negonee. About 5 a mir (mile ?) Descent in Escanaba, the first mile very rapid over granitic rocks, sides rugged, then we enter a level country about 5 feet elevated over the water, sometimes less. Woods hardwood in part. Pine generally destroyed by fire. In the banks there are heavy gravel deposits. No limestone pebbles in it. Current always brisk. After passing along about 1 mile further the banks on the right side are for awhile about 15 feet high, gravel below, sand and boulders above. After we had about 3 miles run the eastern branch of the river enters level country. Small distance below there are considerable rapids again over granitic boulders. 6 $\frac{1}{4}$ passing on east side a high gravel bank. 6 $\frac{3}{4}$ landed. Gravel exposed for the first time with numerous angular slabs of an earthy arenaceous limestone of yellow color. Course of stream very rapid. Specimens of limerock collected there No. 1 temporarily. No fossils in them seen except a lingula.

Left the place again 12 minutes before 8. A small distance after we noticed on the bank a survey mark indicating Town 44, Range 25, Sec. 9. No rocks exposed and sandy gravel banks continuing. Run of water moderately slow. Then rapids again over a gravel deposit containing no limestones. The river makes several short bends. There is in places apparently rocky bottom in the river but no ledges exposed. River flows quietly through level land.

No. 2. is several miles down the river where some ledges of it are visible in the bed. The associated loose rock pieces are identical with those from locality 1. At 10 o'clock we are at T. 44, R. 25, Sec. 22.

At this place some gravel with limestone slabs as described is exposed. Just below the entrance of the creek on the west side there are rock exposures of about 2 or 3 feet continuing some distance down the river. The specimens are marked No 3.

It is a sandy crystalline limestone in slabs with unequal surface and of unequal harder and softer structure. No fossils observed. The river runs in two rapids over the flat ledges. The lower rapids are exactly at the line of Town 43 R. 25 W. Sec. 3, a small distance above the junction of the west branch with the main river. Rock beds are in both rapids exactly the same. Somewhat below, the river falls quicker than the strata and cuts through them exposing some lower beds. The specimens are marked No. 4 and prove to be identical with No. 2.

At the junction of the west branch with the main river again the upper strata like No. 3 or near it form the surface rock. The river runs at the junction over rapids. The number of the specimen from there is 5. No fossils.

German paragraph

About 100 passes down the river there are 3 feet of rock ledges in the bank which prove to be identical with No. 3. Their number is 7. The same strata continue a good ways down the river, rapids and ledges about equally falling. For some distance the rocks again disappear and gravel covers the banks, or sand. The descent of the river is still very rapid. Passed the creek which comes in from the east, still no rock exposed. Passing Town 43, R. 25, Sec. 13 and 14 there are no exposures, yet half a mile or more below it, rapids with exposure of No. 8.

A little below comes in the creek from the west also in very rapid course. Rapids continue a piece longer and then rocks disappear again and river flows quiet. Locality 9 is about 1 mile below. Rock not different from the other formerly seen. Surface strata. Soon after very considerable rapids set in. The surface rock remains the same. One specimen is numbered 10 from the rapids.

The rapids continue for quite a distance, in some places the rock ledges project in the bank 8 feet. 3 specimens taken from this bank are numbered 11. It remains essentially through the whole 8 feet the same rock without any fossils. Separating in slabs with uneven surfaces of 2 or 3 inch thickness. This projecting rock bank continues on both sides of the river for half a mile, keeping always the same level with the river. Traces of fossils in the slabs but nothing distinct.

The numbers 1 to 11 mentioned in the preceding memorandum are altered in the series Numbers 40 to 51 correspondingly.

Thursday 22. Specimen No. 52 is different from the other 52 marked with ink, different 4 feet, the latter one being below.

Passing after the first mile the creek on the east side, rapid run of the river continued exposure of rock ledges of the same character as before. Sometimes not above waters edge, sometimes forming banks 4 feet high. A specimen from there is No. 53. The lowest and thickest stratum of the bank. Above it are 5 feet more rock ledges in slabs of similar character. About $\frac{1}{2}$ mile downwards after the ledges of rock were hidden a small ways, the ledges emerge again 5 feet. The lowest stratum is peculiarly mingled with silicious veins which whether out in relief. It is 54. 1.

Right above it are about 3 feet of slabs which contain a great many indistinct bivalves and Chaetetes. They are 54.2. Above it are 2 feet slabs numbered 54.3. The whole of the complex of strata fall almost equally with the river. The strata in this place perhaps a little more so.

Among No. 54.3 are strata which perfectly seem to be identical with the rocks that formed the bed of the river and its banks for some long distance upwards. Strata 54. 2 and 1 are actually lower strata. By further progress the strata 54.1 and 2 and 3 are seen in the river bank and immediately above a thin bedded limestone with silicious nodules and veins follows which contains a number of recognizable fossils. Rhynchonella, Laeptena, bivalves, Tetradium, several Orthoceratites, Chaetetes, Stictopora ectr. These fossiliferous strata are numbered 54.4. Further on the next lower strata are on the surface, the upper (fossiliferous 54.4) missing.

54. 1,2,3 exposed for $\frac{1}{4}$ mile. Then only rock fragments mixed forming the bank for about 1 mile. In the next following rapids with exposures strata 54.2 and 3 are laid open just protruding over the waters edge. Then another $\frac{1}{4}$ mile without exposures flat banks. No. 54.2 and 3 continue to be exposed at a place Town 42, R.W.24, Sec. 21 and 22. Specimen 55 is from that place.

Diagram of fossil

For quite a while no more exposures. Then rapids over No. 54.1,2,3 exposed from 1 to 3 feet in both banks for the length of about 1 mile. 54.1 particularly exposed lower down 54.1 and 2. Below this stratum 1 for some length forms strong rapids. Landing there I found in what I called 54.1 *Columnaria alveolaris* and *Stromatocerium*. No.2 is more arenaceous than above. Contains various fossils. 3 is more argillaceous and the 3 members are thicker than seen before.

1. is exposed 2 feet, 2 and 3 together 8 or 9 feet but I have no doubt that these strata are equivalents to No. 54,1,2,3. The No.4 with *Tetradium* lies above. The specimens from this locality will all be marked 56.1 and 56.2 for the higher strata a few 100 yards below the strata which was here 8 feet above the water are only 2 ft. above the water, but immediately rise again. We approach now the big falls where the water rushes about 5 feet perpendicular over ledges considered equal to 54.1 & 2.

Right at the top of the falls there is in the lower portion of 2 a large tetradium. Below the falls about 4 feet of deeper strata which however are to my estimation not deeper than the upper part of 54.1 are exposed and contain in some limited spots *Leptaena*, *Isoteles*, *Orthoceras* and other fossils.

In strata of higher position which are equal to 54.3 there are some *Cyathophyllum*, *Leptaena* and other fossils. The strata exposed at the falls and below amount to not much more than all 12 feet. The dip of the strata and of the river are about equal. The strata from the falls are marked 57, the upper layers 58. About $1\frac{1}{2}$ miles below the big falls the strata continue to be about the same and so down to other still bigger falls.

Then a descent of about 8 feet is made in which 7 specimens of rock are collected. The lowest one is 59, the uppermost one which is identical with the bedrock at the upper falls is 65. All these lower strata are in thin banks. The 59 to 61 in 4-6 inch, the 62-65 in much thinner uneven beds.

The river runs now for more than 7 miles with great rapidity through a canon lined on both sides with rock walls about 15 to 20 feet high. The lower 6 or 8 feet are composed of the more or less silicious crystalline limestone beds devoid of fossils.

Which Foster considers equivalents of Chazy and calciferous limestone. The upper 10 or 12 feet are composed of the beds as described above the falls in the lower portions with *Stromatocerium*, *Columnaria*, *Cyathophyllum*, *Tetradium*, several *Brachiopods* ectr.

Above them the wedge-shaped limestone beds as Foster names them with some similar but few fossils. Also in still higher limestone beds there is *Columnaria* to be found. After having passed the canon the lower strata of the Chazy and calciferous age disappear under the bed of the river while the upper strata which above are characterized by *columnaria* and *Stromatocerium* continue still. Down the river the layers of wedge-shaped limestone above appear to have here a greater thickness than above, amounting to almost 10 feet.

Specimens of limestone at the end of the canon of the river where we encamped, from the region of *Columnaria* irregular bedded (wedge-shaped) limestone with intercalated argillaceous seams 2 and 4 feet above waters edge No. 66. The strata of similar nature remote about 10 feet high. No. 67 is from there.

Friday 23. 68. Specimens from the opposite side of river in sight of camping ground just before the creek enters from the east. The creek runs in rapids over ledges of the rock as in the river. No exposure below the creek. River runs slow for $\frac{1}{2}$ mile. Then some rapids again over large rock beds in the river bed. To this follow rapids about 3 feet perpendicular. The strata through which the river flows and the low exposures at the banks prove the rock to be the uneven wedge-like limestone slabs or as I termed before No. 54.2 There is *Stromatocerium* in these layers besides *brachiopods*. In one of the layers there is a great number of *Phaenopora* specimens with *Leptaena* some *Gasteropods* *Chaetetes* ectr and crinoid stems in particular. The specimens are No. 69.

Half a mile below, above the rocks seen until now there is a series of about 9 feet which have not been seen yet. Above the thin uneven slabs of various nature there are some layers 6 inches thick which in places are full of bivalves and crinoid stems. Their number is 70. Above them are about 7 feet of earthy looking limestone in beds 4 to 8 inches thick. They are numbered 71. Locality just below the entrance of a good sized creek from west side.

The strata fall quicker than the river, and some higher strata appear to line the banks. About $\frac{1}{4}$ mile below the locality 70 and 71 after some interruption, there are ledges exposed which having in general the same aspect as those formerly seen. There is however no particular stratum to be exactly identified. Much argillaceous matter is intercalated between the strata and the limestones themselves are more argillaceous. I found there a whole *Isoteles gigas* in the stratum at waters edge. In the same horizon are numerous good specimens of *Orthis*, of *Rhynchonella*, some higher are *Chaetetes* *Lycoperdon* flat cakes. The specimens from this locality have No. 72.

Continuing to run down the river still higher strata are seen. About $\frac{1}{4}$ mile from the latter place there is an escarpment of 12 feet. Thin nodular limestone ledges with much clay or slate matter intercalated. Toward the upper terminus some harder limestone banks set in. These strata abound in fossils of the Trenton group also *Stromatocerium* is found in it.

$\frac{1}{8}$ mile further down still higher marly strata overlies these beds. They contain nearly the same fossils with the addition of *Leptaena sericea*. All fossils loose.

The strata along the last exposures are considerably bent so as to emerge sometimes over the water level and shortly after to sink down under it. This fossiliferous complex of Trenton strata does in general aspect not differ much or any from the lower strata seen the day before above and below the big falls. The whole thickness of both the calcareous and upper marly portion may be 25 feet. The specimens from the two last localities are not marked. The exposures are probably in Town 41, R. 23, Sec. 23 or 26.

Sunday 24. German paragraph.

There are down the river some hard limestone banks with many large silicious veins and above them the strata of wedge-shaped limestone layers about 10 or 12 feet thick. They resemble much the lower limestone layer with wedge-shaped ledges but besides several *Orthoceratites* crinoid stems, *Leptaena alternata*, *Orthis*, they contain *Leptaena sericea*. Apparently above these layers there are 8 or 10 feet of grey hard crystalline banks 6, 8 and 10 inches thick which perfectly resemble the much lower strata. No fossils observed. 1 specimen of this rock is numbered 73. The locality is about 1 mile above the island. From the island downwards there are heavy drift accumulations in the banks about 30 feet high.

The lower falls run down in 3 rapids amounting to about 12 feet. The banks are formed by 15 feet high walls composed of thin uneven bedded argillaceous limestones below and somewhat thicker and less argillaceous strata above, similar to the exposures higher up the river. There is decidedly a similarity in the rocks of the equivalent strata but surely there is also a certain variability in the rock so that in one place we find tolerably thick purer limestone beds where the equivalent strata of another place are thinner, more argillaceous. Also in the distribution of fossils there is a great difference. At the falls very few fossils are found but the rock particularly the lower beds have perfect resemblance to the fossiliferous Trenton layers above.

2 pages of German

Saturday July 1. No. 1. (German)

- 2 with *Pentamerus* and all the common Niagara fossils about 10 feet.
- 3 Thinbedded irregular and uneven slabs with occasional flint seams 6 feet.
- 4 Similar slabs a little different in rock character. Flint seams. Also about 6 ft.
5. Well stratified layers about 15 feet thick. By weathering splitting in slabs.
6. About 5 feet rough uneven bedded and indistinctly stratified sub-crystalline limestone.
7. Well stratified banks as above 15 feet.

Diagram

Rations for 3 men for 50 days. 200 # Fleisch (meat) 100 pork, 50 ham, 50 shoulders. 50 # flour. 2 barrels hard bread, 6# tea, $\frac{1}{2}$ bushel beans, 30# dry apples, Vinegar 1 gallon Salt 25#, Red pepper, Black pepper, Mustard 1#, Matches 1 box, Zucker (sugar) 45#

Brooks. 2000 steps about 1 mile after his experience
Prismatic compass from the war dept.

Huronia vertebrates and Orthocerat. point, 8 miles east of DeFour on north shore of Lake Michigan. Huronia annulata

Diagram

Diagram of fossil

Lingula primei from Escanaba River.

Phaenopora multipora From Escanaba river in Trenton limestone

Clathropora flabellata Escanaba river.

2 pages notes in German

(From loose leaf insert). Limestone quarries $1\frac{1}{2}$ miles north of Trenton village Wayne Co. Mich. About 25 feet of rock beds exposed with S.W. dip on the space of about 12 feet in that direction.

Light colored fossiliferous limestones	5 feet
Massive grey limestones fossiliferous	6 to 8 feet
Blue hard limestone with chert nodules about	2 feet
Blue compact limestone about	10 feet
Limestone bored through to a depth of 60 feet below surface.	

Upper Helderberg lower beds are exposed near Gibraltar and from there down to Newport and Point aux Peaux.

Diary
Commenced Aug. 1, 1871
Last specimen No. 147.

Along the west side of Lnebisk Island, along the rapids and the shore northwards, everywhere limestone exposures.

Diagram on Cover.

Upper Falls, T. 48, R. 8, Sec. 12. About 30 rods south from the corner and 60 rods east from Sec. line.

Low falls. Sec. 32. R. 7, T. 49.

Sec. 27, T. 48, R. 8. About 60 rods South of Sec. line and about 12 rds. east of Sec. line. Encampment in the bayou of Taguamenon River.

Thursday Aug. 1, 1871. We sailed along the northern channel between the mainland and the north side of St. Joseph's Island until the middle of the northwest side of the Island Encampment Dours. The rocky islands consisting of quartzite and the quartzes cropping out along the shore of the mainland give to the channel a very picturesque appearance. The large promontory of Joseph's Island before the face of Encampment Dours is also consisting of quartzite rocks, all everywhere where exposed in more or less inclined elevated position I could not perceive any general direction of the dip. In contrary each island or group of islands which are almost endless in number, belongs to a certain bubble like elevation from which the strata fall away.

Encampment D'ours not far from the channel between it and Joseph's Island presents to the northside a large hill, perhaps the highest position of the island, The side of it has some exposures which are found to be in the lower 15 feet from water's edge, the usual quartzite rock of somewhat reddish color. Above it it an embankment reaching about 20 feet from the quartzes top. It consists of regular horizontal strata of a white soft sandstone, partly containing pebbles. A quarry has been opened on it but abandoned because the rock is not hard enough.

Above this embankment the hill rises very steep about 75 feet more. Occasionally are sandstone banks sticking their faces out of the sides unto the very top but a clear section is not to be seen on account of the covering heavy timber and some dirt material spreading itself out almost over every hillside we passed on the south side of the channel this day.

In the lake and on the shore are copious bits of a red and green shale or slate accumulated. It could not be ascertained where from they are transported. The specimens of sandstone from this locality are numbered 148. Red and green slate 150.

In proceeding around the island the rock scenery of the channel grows more and more interesting. The quartzite beds rise in all directions and with all sorts of inclination in numberless islands of small size.

Also the shore of the large island to encircle is of the same character. And no signs of any higher rock beds can be discerned from the lake. On the north side of it a large clearing with old abandoned habitations and a plain road up the hill towards the interior. Following that road we ascend first a drift terrace about 40 feet high. The drift consists of some pebbles with a large quantity of white sand which decidedly originates from the decay of the Potsdam sandstone seen exposed further west and doubtless also forming the nucleus of this terrace.

On thop(top) of this terrace another one rises which in part is low and consists also of drift with larger pebbles in its centre, a still higher elevation rises, imposing by its steep hillsides, too steep to be easily descended, and still against all expectation there are scarcely any indications of the strata composing it.

This highest terrace consists of horizontal limestone strata with some shaly layers belonging to the lower Trenton group and containing numerous fossils. The top is or has been used for agricultural purposes and is overgrown with grass, without any trees, and from it a splendid view over the island and the lake is to be had. We collected some fossils and remained the next day for further investigation, Wednesday the 2nd of August.

The Potsdam sandstone beds of soft friable character are seen in place while ascending from the first terrace to the second. About 15 feet above the plateau and about 25 feet below the first exposure of fossiliferous shales, the banks crop out in the road leading up the hill somewhat hidden by drift material. Further south along the declivity of the imposing second terrace there is a better exposure of the ledges of the Potsdam sandstone. It occupies there the height of about 35 feet of the base of the terrace. Immediately in contact with and above it are soft bluish green shales amounting to about - .

Above those are hard rough-looking limestone banks almost entirely composed of fragments of fossil remains and containing a number of well preserved *Rhynchonellas* and *Cyrtodontas*, shields of *Flaenus* *Chaetetes* *Stictopora* coiled shells, ectr. Its color is bluish in the interior. The exterior portions as far as influenced by the air is dirty brownish yellow colored.

Above those limestone beds whose thickness we have not ascertained yet, the very fossiliferous soft shales of a greyish color with intermingled thin limestone beds follow. Their thickness I estimate to about 10 feet. Towards the upper end limestone banks yet prevailing over the shaly layers but still retaining the same general color and character. The limestone banks are very nodular, unhomogeneous and contain in some beds only few fossils, other beds are almost only fossils. The most obvious fossils are *Rhynchonella*, a species of *Stictopora chaetetes*, some coiled and bivalve shells, occasionally some Trilobite remains, *Orthoceras*, and in the upper layers *Tetradium fibrosum*.

This upper limestone portion which I connected with the fossiliferous slates may also be about 15 or 20 feet thick. Above all these strata forming the summit of the hill are light colored thin banks very uneven bedded hard limestones of about 50 feet thickness which contain in some places very numerous fossils. Most characteristic is for them Cypricarditae, *Leurotomaria*, several species of *Orthoceras* and coiled cephalopods *subulites*, crinoid stems, *Iliaenus*. The very summit of the hill is strewn over with numerous erratic blocks.

The quartzites at the shoreline on which the whole system rests are of a dark grey color and are connected with slate rock of green and red color, which are of great thickness. 151 is the number of the slates. 152 of the dark grey quartzite.

Thursday Aug. 3. Sailed out for the bay at the northeast side of St. Joseph. The land is considerably settled there by farmers and the hills by being cleared and under cultivation are accessible to geological investigation. But I found the whole ground up to the top of the hills composed of drift accumulations. There are in the drift some larger blocks of limestone belonging to the upper layers seen on top of Encampment D'ours, with the characteristic fossils but expecting an outcrop on the hills, I was disappointed and sailed for an island marked on the Canada survey fossiliferous.

In passing the eastern promontory which is little elevated ground, I was surprised by a very fine exposure of the strata corresponding to those of encampment D'ours. Still we proceeded, intending to observe them on the return from the island.

On the said island we did not find any rock exposed. It is composed of large boulders of older rocks with here and there a fossiliferous limestone slab. After a toilsome travel through it, we remained on shore for the night and returned Friday morning to the promontory on St. Joseph's Island.

August 4. Wind against us we passed the promontory marked in the Canada map as upper Trenton and landed in the bay on a small land projection where rock ledges was exposed about 4 feet above the water's edge and about as much below. The strata are rough limestone ledges about 3 inches thick with a number of furoid-like marks and numerous chert nodules and concretions. They break under the hammer with a very uneven conchoidal fracture into wedge-formed cylinders. The lime, as far as not penetrated by the chert is middling pure. Fossils are not abundant but sufficiently plenty to get the character of the fauna. *Leptaena*, *Leirurus* (?) *Cyathophyllum*, *Iliaenus* *Receptaculites* *Orthoceras* are most common. These strata with their cherty streaks and concretions seem to hold a position above the strata. At the point of the same bay marked by the Canada map as Beak(Beak) River et *Siriseye* limestone, the strata also agree perfectly with some drift specimens found at Ann Arbor. All specimens found at this locality are marked 153.

After spending about 2 hours there we proceeded and landed at the point marked on the map as 154. Also all the specimens bear that number. 154 are the uppermost layer. 155 the middle. 156 the lower.

The strata are as follows. Lowest there are beds of brownish blue arenaceous-argillaceous limestone with a great number of bivalves. Then quite a number of various species of Orthoceratites, Fucoid impressions, Chaetetes branches. They are in banks of about 3 or 3 inches thickness which however split easily in thinner uneven layers, argillaceous seams running through it.

Above them is a series of nodular limestone banks with intermediate argillaceous shales which contain an immense number of Rhynchonella Bryozoa, also Tetradium and Orthoceratites with some coiled and bivalve shells. This layer may be about 6 feet thick.

Above are similar nodular limestone banks with argillaceous partings and a great quantity of cherty fucoid-like stems intermingled which generally are less fossiliferous but in some layers, Strophomena Chaetetes et Stictopora are quite abundant. This portion is in character of rock and color allied to the lower strata and is considered the upper terminus of them. 156 includes all the fossils in the above strata.

Then come about 10 feet of a light colored hard limestone breaking with a smooth conchoidal fracture in wedgelike pieces and separated in banks of about 6 inch thickness. In some layers are fucoid-like branches of a more delicate stem quite abundant. Trilobites et Leperditia with bivalve shells are most characteristic for them, likewise Cyrtodonta. Then comes a series of a few banks amounting to about 3 feet of a dirty brownish colored hard dolomitic limestone, in some layers with large fucoid-like stems, and in some more argillaceous beds full of Leperditia and Bryozoa forms. On top of this again is a series of about 10 feet of light colored limestones very similar in character to those below the brownish dolomitic limestone beds, but splitting and shattering into still thinner fragments and containing very large specimens of Orthoceras, coiled and bivalve shells, besides Trilobite remains. 155 includes all the specimens of this series.

Finally on top of these layers beds of a somewhat crystalline limestone of yellowish amber colored are placed and look to have only a thickness of about 2 feet as far as the layers are not entirely abraded from the surface by the drift agencies of which period single boulders in large numbers are strewn over the surface. This limestone contains principally Columnaria alveolaris, Tetradium fibrosum, Stromatocerium and a number of fragments of crinoid stems. Also some large Orthocerata are found in it and occasionally a Leptaena and Staenopora. We remained Saturday the 5th and spent it with collection of fossils.

Sunday 6th. We left about 10 o'clock and arrived at our former camping place at Campment D'ours at noon where we landed and dined. Then we proceeded to Sugar Island and encamped at the entrance of Georgian Bay. On the Canadian side the rock exposures of the quartzites continue as far as our present position. (On the Canadian map there is a belt of a few miles wide touching the shore which is represented as red jasper conglomerate. The rock of this description is quite abundant in the drift deposits of the whole region, but along the shore just as far as the formation should touch it, there is a swampy ground and no rock exposures of any conspicuity.

Sugar Island is lined by a sandy shore and exhibits no rock exposures. Its soil appears inferior to the soil noticed on St. Josephs Island which in some places would be very good for agriculture if it was not for its northern climate. At the bay where we collected the fossils of the lower Trenton formation are several farms which produce a fine crop of timothy grass, oats, potatoes. And some garden spots was really in fine growing condition with beans, corns and other vegetables.

Monday August 7. Expenses during the last few days for butter, berries, milk etc. 1.50. I determined to go up the western channel through Hay Lake and not through Georgian Bay. Near the narrow channel between Sugar Island and Anobish Island there is a small spot on shore of Sugar Island where the white quartzites protrude a few feet over the surface. The rest of the island shore is marshy without any rock exposures. Also the general elevation of the interior is inconsiderable.

Towards the northern end of the island the elevation of the land is considerably increased. On the bluffs of the shoreline are some farms and the still higher ridge behind is well timbered with hardwood. The land on the west side of the channel is low and for a considerable distance all the timber burnt down to the ground for several miles back from shore.

Tuesday Mark left for Marquette. Loaned him 20 dollars, paid his hotel bill. Paid Hibbins 57.70 cts. Received from Governor 300 dollars paid for boxes and hard bread 2 dollars.

On the hills near St. Mary at the base of the drift formation which composes them, the rose-colored clay often mentioned is dug and shipped to the mines of Lake Superior as fireclay. The uppermost strata of the sandstone which forms the bed of the ship canal are a white friable sandstone equal in appearance to the white sandstone of Campment D'ours and St. Josephs Island. The lower strata are red or variegated, partly very soft, partly appearing very solid rock, but it does not stand the weather.

Wednesday Aug. 9. Sent boy home with Steamer Arctic for 15 dollars. Gave him 2.50 in money besides. Paid hotel bill amounting to 14 dollars. Left about 3 o'clock for little lake 30 miles southwest on the Mackinac state road.

After about 1/2 miles walk over the St. Marys sandstone, some hill land rises which forms further on an extended plain which stretches from the upper coast of St. Marys river to the Skebich channel. It consists principally of very heavy deposits of a well stratified rose-colored or sometimes variegated fireclay (fine clay) often bespoken before. Under the clay some gravel and boulder deposits are spread out on top of the plateau whose timber is all burnt down. There are scarcely any boulders except on low ridges rising on the righthand side of the road which consist of gravel.

The land is a fertile clay soil and from the numerous farming establishments commenced on it and according the accounts of the occupants, the crops are right productive. Oats, Barley, wheat and potatoes. The last farm on the burnt district is about 8 miles from town. Then begins some woodland, which is however also burnt out to the greatest extent. Through it the state road is cut on a straight line running nearly south until the distance of 11 miles or so from town. Then one stands in a characteristic wilderness. There is said to be an Indian trail but in these burnt woods no one but the very experienced backwoodsman can distinguish as the whole traversed district is covered by the red stratified clay which has in some places a blue color, or in some places becomes more sandy and whitish.

The elevated plain over which the road runs is in part swamp land but the swamp is dried out now so that we were suffering considerable for water which we finally succeeded in finding by leaving the principal direction and going westward to a branch of Carp River, where after following the dry bed we finally found a ditch with some cool water. Also there the red stratified clay forms the surface. We arrived in camp about 4 o'clock. Bibbins was half sick but I hope we will be able to proceed tomorrow.

Thursday Aug. 10. Started in southwesterly direction about 8 o'clock in the morning through burnt woodlands without any trail. About one and 1/2 miles of in that direction we struck upon a ridge with hard timber which besides boulders of dioritic rocks and sandstone rocks contained numerous large angular fragmentary strata of limestone with the lower characteristic fossils of the lower Trenton strata as seen in St. Josephs Island. About one and a half mile further to the southwest there is another such ridge in which the limestone strata actually crop out but I could not see any fossils in them but a few joints of crinoid stems. Both ridges have an approximative strike from east to west. The number of the limestone specimens from the first ridge is 157, from the second 156.

Further on we descended unto a swampy plain with large extensive works of beavers. We toiled our way through for several miles but finally returned because there is almost an impossibility to go thro all this fallen timber without the least indication of a trail. Also all the survey marks are destroyed by the fire so that I could not positively make out where I was.

In the evening we returned to our yesterday's mining ground. Struck the creek bed low down but followed it up to the old place. There are some beaver works along this creek but the larger part of it is perfectly dry. Where we encamped is the first drop of water in a kind of pot-hole of bog iron ore. As far as we went there was nothing to be seen, but an Indian who is well acquainted with all these localities asserts that he has found bog iron ore in many places. However, if asked for the quantity we would only speak of having picked up lumps as big as a fish. But I did not know if there was any masses of considerable extent. In contrary from his whole account it becomes clear that he happened often to find such fish-sized pieces here and there but not in quantity.

On this mentioned beaver work I noticed the water dammed up to form an extended swamp ditch. From there numerous canals was dug in lateral extension which was used for floating the cut timber sticks to the large mill ferrin the Jomicile. It is about 40 feet in diameter and about 10 feet high composed of sticks and mud. Several fresh cut saplings of poplar was laying around, so fresh that the leaves had not dried up yet this hot day.

Friday 11. Returned to St. Mary. Found our road back to the State road with difficulty.

On the northwest side of the State road parallel with it are gravel hills which lay on top of the stratified clay. The gravel is composed of Gicrite granite and St. Marys sandstone but no limestone pebbles.

When we returned the clerks of the postmaster had taken the boat from its anchoring place and badly used it, so as to get everything wet and the ropes and sails entangled. Paid hotel bill 2 dollars for me and Gibbins.

Saturday 12. Packed and shipped 3 boxes and 1 fish barrel. For provisions expended 3 dollars. Hired an expert Indian voyageur for 30 dollars a month to begin tomorrow Aug. 13. Boots for wood traveling 3 dollars. Hotel 1.50 - 3 meals. Also 1 dollar for sugar. 3 for beer 1.50, handbread. 5 loafs of bread 30

Sunday 13. sailed out at 5 o'clock with fair wind. Shore line about from 5 to ten foot high drift bluffs behind which some higher hilly land rises. On the Canada side the land marked on the map as belonging to the St. Marys sandstone series are low uplands, generally not presenting the underlying rock beds but covered by drift material. Behind them the granite area rises in considerable rocky hills which reach the shore as Gros Cap. On the American side the point Iroquois opposite to Gros Cap forms a prominent mountain from distance. Otherwise this whole distance is occupied by little elevated land. The hill rises near it. Iroquois and the highest summit itself are apparently composed of drift formation and in particular of the stratified rose-colored clay. The shoreline of the Canada side point of lines presents a low sand and gravel beach.

At noon we landed at the lighthouse point of Mt. Iroquois. The beach is composed of drift sand above some ferruginous banks. Below from the springs coming out I calculate that the stratified clays are laying. The high portion of Iroquois Point is about a mile further on, ~~is~~ encircled (encircled) by this lower drift terrace not exceeding the height of 50 feet and in some portions much lower.

I ascended the highest portion of these hills, which rise at a very brisk angle to the height of about 500 feet. The top and sides are overgrown with thrifty hard timber and on the ground with *Parus bacata*. No rock ledges are to be seen. The whole height but a white drift sand mixed with waterworn dioritic and other pebbles forms the surface from bottom to summit. We proceeded at half past 3 o'clock towards Neonecong (?) bay but I determined afterwards to land and encamp at an old sawmill at the mouth of a small river this side of the Indian reservation. T

The river comes from a small lake before which low Norway pine lands are situated toward the shoreline. Southwestward from the sawmill the hills rise higher again in a distance of about 1 mile back from shore and are covered by hardwood timber. The beach from Point Iroquois unto the sawmill is all sandy and low from the place where the high hills recede behind the territory of the just mentioned lake.

Through the night a heavy thunderstorm with rain came on.

Monday Aug. 14. In the morning we proceeded along the coast and found about 1 mile beyond the mill near the point, ledges of a very soft white sandstone cropping out at the water's edge at the point. They project about 5 or 6 feet, are horizontal, some strata having an irregular thin-leaved bedding in opposite directions.

Diagram of above.

Above the sandrock the land rises a little more and consists of drift pebbles. This point is called Salt point and lays this side of the Indian reservation which latter however is abandoned.

On the other side of the point no more ledges are visible but the same configuration of the land lets me suppose the continuation of it under a crust of drift deposits.

At Neomecong Point where a gentleman with the name of Hipples resides and besides fishing cultivates some land, there is the shore belt (beach) composed of sand with large boulders. $\frac{1}{2}$ mile backwards a steep hill rises to the height of about 50 feet which at the base unto near the summit consists of ledges of the white friable sandstone, on top of which red drift clays and sand with pebbles are deposited which make up a fertile soil. About a mile and $\frac{1}{2}$ further back after the interposition of a swampy plain there rises another range of higher hills covered with hardwood timber, which are composed of red clay and gravel deposits.

As Mr. Hipple informs me, which lives here since 50 years and has frequently visited these hill ranges he has not seen any limestone ledges in any of these hills, but informs me that about 8 miles from the mouth of Whitney (?) river on its west branch there is a limestone ridge which is probably the same as the one we found in the excursion towards little lake.

Taquamenon river is 8 miles distant from Neonkong Bay. Mr. Hipple informs me that considerable bog iron ore is to be found in that district. Also at Whitefish Point about 6 miles back from the shore on 2 hearts river, etc.

12 miles due south from Wendels sawmills, the place we encamped the night before, there shall be a Flint-ridge (so-called), the highest point on the peninsula from where the Indians of old times got all their flint for arrows. If this report is true it cannot be anything else but the flint beds seen in the upper part of the Trenton group, for instance on the Secansba river.

Tuesday Aug. 15. Felt sick the night. Probably in consequence of diet fault, we had too many berries and milk. Proceeded to Taquamenon. Paid to Baucher one dollar. Ditto 3 dollars. Ditto 14 Septbr. Owe to Mr. Gibbins 1.50 for board.

The whole shoreline between Neonkong bay and Taquamenon river forms a belt of 3 to 4 miles in width of low or comparatively low lands behind which only the higher hills begin to rise. The highest visible land is right south from Neonkong Point and again some on the south of the mouth of Taquamenah. In the centre of the intermediate bay, the back hills are not so conspicuous.

The entrance to the river is lined with low swampy shores. On one side of the river always some higher embankment is found when the other is low. Principal character of the timber pine wood wherever there is no swampy ground, which is covered by cedar and tamarack. The river is large and navigable for a Mackinac boat up to the first falls or rapids.

We rowed up to the bend of the river where it turns from a westerly course into a northerly close above an island in the river and at the mouth of a clear springlike creek. All along this way except some high sand bluffs on the north side of the river are low lands without any rock exposed. About a mile back from our present camping place a ridge elevates itself which is a continuation of the drift hill chain beginning at Point Wisconsin and of whose course I sketched the outlines on the map with lead pencil. This ridge directs itself to the upper falls of the Taquamenah and runs from there out according to the report of some Indian surveying a road to Marquette whose encampment we share tonight.

From the Indians who are well acquainted with the whole District I learn that all the way back to the south limits of Town 47 there is no rock to be seen in the hills except drift sand and clay but that about the parallel of Town 48 some limestone is to be found.

I intend to take a southwesterly direction tomorrow until I strike the forks of Maumeneh River and from there to make for the falls to the northward. The persons expert all tell me that to reach the towns 48, 9 and 10 W. Range it is much better to start down from Grand Marais than to force its way there from here.

Wednesday Aug. 16. Through the past night heavy thunderstorm and rain storm. Morning bright we started about 7 in southwest direction. Went not far from the southwest corner of Town 48, Range 7 into the northwest corner of 47, R. 7 and came out on the river in Town 47, R. 8 corner of Sec. 14 and 21. From the starting point the land rises in various rows of gradually higher hills and our way led ravine up and down through hardwood timber land until we reached a sort of a high plateau with splendid hardwood timber.

Everywhere the soil is an argillaceous sand with here and there intermingled dioritic pebbles or larger boulders besides some sandstone pebbles of variegated character like the St. Marys sandstone or white and soft like the sandstone at the Indian Reservation. But nowhere are ledges of any rock to be seen. On entering from the limits of Town 47, R. 7, into 47, R. 8, the land partly gets lower and swampy. Still there is a ridge continuing with little interruption by swamp lands to the river unto our present camp where the river lays at least 50 feet deeper than the margin of the bluff about a mile broad along the river. There are among some good hardwood timber in this place a number of good thick white pine trees 3 and 4 feet in diameter, also very big hemlocks, and during the whole space we traveled over the large size of birch trees was remarkable. I saw some over 4 feet in diameter. Also beech wood was of fine growth.

Water is in spite of the swamps very rare. All the little branches of the creeks are at this season dry and the swampland is also destitute of water enough only for a drink.

The river is yet quite large in this place and has hardly any perceptible current. Some specimens of sandrock from the drift are preserved. Their number is 159 et 160.

Thursday 17. Built a raft in the morning and floated down the river in the afternoon making a progress of only 3 or 4 miles. The land on the west side of the river is all low, swampy. On the east side is also considerable low land. In the immediate neighborhood of the river where the maps indicate the entrance of 2 rivers on one side and another on the other side the river has so little current that we were badly embarrassed to find out which was the river and which the entering branches.

We first entered the proper river and seeing no perceptible strong continuation we turned and entered a wrong branch where we encamped time being too late to return.

Friday 18. At 3 we pushed off our raft but could not come any further than about 5 miles until 10 o'clock having headwind and no current whatever. The river is lined with cedar and sometimes with hard timber intermingled with some fine white pine and hemlock trees. Its depth is at all events greater than 14 feet because nowhere we could reach bottom with a stick that long. So we left the raft and soon ascended from lower ground to hills of about 80 or 100 feet high overgrown with fine mixed timber.

After traveling about 2 or 3 miles parallel with the rivers course we descended and came to rapids which fall over ledges which amount on the half mile which it is down to the large falls to about 15 or 20 feet of a coarse white sandstone. The water here at this season was only knee deep and I could travel the whole half mile in the bed of the river. The falls are perpendicular about 30 or 40 feet over sandstone ledges of a soft kind. Still the layers above are softer yet. At the falls one can see the top of the hillsides composed of red clay and sand layers of the drift period.

Diagram of the falls.

The falls are in Sec. 15, Town 48, Range 8 West. In the lower strata at the foot of the falls there are red micaceous soft strata interposed between the soft sandstone layers. Also a very coarse pebbly sandstone layer is below the falls. About half its height too are occasionally harder layers found interposed between the softer ones. Some splendid pine trees in the woods east (each?) side of the river besides strong hardwood. The bluffs on both sides of the river at the falls are about 100 feet high. Some species of *Unio* I collected below the falls. Found also the skeleton (?) of a beaver somewhat damaged, a few teeth missing in the skull (skull).

We encamped about a mile east of the falls on a high maple ridge and proceeded Saturday Aug. 19 towards camp.

The other falls further north I did not visit because I did not expect any more disclosures. Correspondent to the trouble to get there besides our provisions was at an end. We traveled over high hardwood timber land all the way to our boat following an angular line marked on the map in the diagonal of the sections of Town 48, Range 7. All over there are numerous boulders on top of the ridges but no sandstone ledges to be seen cropping out.

We arrived at the boat in the afternoon and having favorable wind for upstream I determined to go up to the lower falls, a distance of about 8 or 9 miles by the river. Both sides of the river are with few interruptions lined with high banks often ascending 100 feet where land slips disclose a very thick deposit of a red drift clay.

The sandstone in any of the banks crimping out. The river is navigable unto the rapids which run over the bottom boulders of sandrock. Higher up the rapids, there are some low falls which I have not investigated yet.

Sunday Aug. 20. Rained very hard all night. Feel sick from diarrhoea and determined to take exceptionally a resting day and the investigate the environs of the falls.

From the above mentioned rapids there is about 4 to 500 steps up to the base of the falls. The river has about 1/2 mile above the falls divided in 2 branches and runs in a succession of falls and rapids over ledges of a generally thin bedded sandstone amounting in all to about 60 or 65 feet. The falls of one branch are, counting in a few small step-like offsets in one place nearly 30 feet high. In the other branch the most considerable perpendicular descent is about 7 feet, anteceded and succeeded by several others of 3 and 4 feet high.

The sandrock ledges are as a general thing harder than those at the upper falls. Have in some beds very plain ripple marks and some banks appear also of sufficient hardness and thickness as to be used for architectural purposes. However the value of the rock in this line seems to be inferior. The banks of the river are high dry land which runs out backwards in elevated swampy plains with some lakes. The water coming from these deposits in the bed of their runs considerable of brown iron-oxyd in the form of loose fine mud, but no where it amounts to any value. The sandrock specimens from Lower Taquamenah Falls bear the number of 161.

Diagram. Approximative sketch of the situation of the Lower Taquamenah Falls. From memory.

Monday Aug. 21. Went down the river by paddling. About 6 miles below the falls I inspected one of the several landslides and found them consisting of the often mentioned well stratified clay beds of rose color, above which on top, sand strata are placed. The clay beds at the locality inspected are visible at least 40 or 50 feet thick and present all the characters of this widely spread alluvial deposit as seen in other places. The specimens are marked 162.

In fact the whole elevated land composing the water sheet (sheet) between the shore creeks along Taquamenah bay and the east branch if the Taquamenah river is composed principally of this clay beds alternating with pebble and boulder layers, and covered up with sand strata. The older rocks generally are not coming to surface in the highest elevations.

At noon we encamped for dinner at clear springs where we had left our boat before and met the road surveying party on their return. From surveyor Mason I got special information about the exact location of the falls and corrected the marks made by me on the map previously accordingly.

The upper falls are in T. 48, R. 3, Sec. 12. The lower falls are in T. 48, R. 7, Sec. 33. Our camp along Taguamenah river when we lost the principal channel was T. 48, R. 3, Sec. 37. About six in the evening we arrived again at the mouth of the river where we encamped beside of the surveying party consisting of 13 men. The surveyor which followed and laid out the line of the State road to Languette and interrupted his work now after he had arrived three miles above the large falls of Taguamenah River, informs me that the road following the highlands back of Whiskey Bay and behind Iroquois Point comes to the shore again at the sawmill where we encamped, followed the shoreline for a while and entered the high lands again some distance back of Mr. Tipples place. That on this whole line except at saltpoint they did not meet with any rock ledges, and that all the high ridges they passed was composed of sand and gravelly layers and sometimes of clay beds, until reaching the falls of the river. The surveyor also repeated to me the statement that about 5 or 6 miles back of Whiskey Bay river there was a limestone ridge, the only limestone he had seen in this district.

Thursday Aug. 22. Received 79 $\frac{1}{2}$ hard bread; 13 $\frac{1}{2}$ pork; 2 $\frac{1}{2}$ tea; 10 $\frac{1}{2}$ sugar at Taguamenah river from Mr. Mason's surveying party. Paid subsequently 15 dollars.

About 9 o'clock after a thunderstorm with rain we sailed with fair wind towards Whitefish Pt., but intending to stop at Mr. Mason's place 4 miles this side of the point and not having to expect a shelter for the boat anywhere else we sailed into the mouth of Betzie (Betsy) river 9 miles from Taguamenah and 9 miles from the point. It is there a secure harbor in the river but the entrance is difficult being all surrounded by sandbars. I walked along the sand beach up to Mason's and found as I expected nothing more than a little slimy iron sediment covering the organic sediments from the creek, the same as all the springs around the lower Taguamenah falls are full of such ochreous slime. The superficial sand strata are likewise in places strongly impregnated by brown ironoxyd as it is almost universally the case all over the peninsula where this drift sand forms the surface.

From there I walked up to the lighthouse where Mr. Ashman, the lighthouse keeper cordially received me. The whole landspur from Taguamenah river to the point is a low sandy plain overgrown with Norway pine and tamarack marshes. In the lowest places at the point for the first time I saw extensive cranberry marshes from which the light house keeper yearly collects several hundred bushels of cranberries. It is a beautiful sight. The berries are almost ripe on the delicate slender stems. Likewise there is an abundance of sand cherries growing.

Mr. Tipple, whose son lives at the point informed me of the occurrence of considerable bog iron ore south of the Two-hearted river and according to his son's description it occurs in Town 48, R. 10 W., about 5 or 7 miles south from the coast line.

My men I left at the Betsy river encamped. They will come up to the point tomorrow and we will proceed to the spot accompanied by Mr. Tipples son. The coast having only very few protected places at large intervals I have to be more than usually cautious in sailing out from one place to another.

The descriptions given to me by Mr. Ashman and had others which are thoroughly acquainted with the region confirm me in the belief of the hopelessness of prosecuting those bog iron ore districts. And likewise their report is that along the upper half of the peninsula from Whitefish Point to Au Sable no rock exposures are to be seen by traveling backwards as far as Towns 46, except the few sandstone exposures on the Piquanoneh. At Whitefish Point I found among the pebbles some coralline remains in silicified condition.

Wednesday Aug. 23. Sailed 9 o'clock from the lighthouse accompanied by Mr. Tipples son. After having traveled about 8 miles the wind changed against us and with beating and rowing finally we succeeded in arriving at the mouth of Two-hearted river at night about 10 o'clock, but could not enter the river on account of its shallow entrance. So we anchored outside. But soon such a northeast wind and tremendous high seas sprang up that to save the boat and ourselves we had to go under sail again backwards to the Whitefish Point where we arrived 5 o'clock in the morning. Both of the men got seasick and the half-breed at once proved himself a terrible coward in whom I so lost all confidence considering such dangerous situations.

The coast all along offers to my boat no shelter and to (so) nouns volens (?) I have patiently to wait for favorable wind and opportunities to land. The whole coast is a dreary sand beach without any prospect of giving any further information of the geological structure below the surface.

Thursday Aug. 24. Heavy west, southwest wind. Sunny day. Wind continues all day. Along the shore I find with the pebbles some silicified fossils particularly of Favosites which appear to be Devonian forms, Alveolites, Stromatopora, Lophrentis, ectr. They must necessarily come from beyond the north shore of Lake Superior. I found also a Favosites which seems to be from the Niagara period.

Bought of Mr. Ashman for 3 dollars one barrel of cranberries to be sent to Ann Arbor under my address, October 1 or about that time.

Friday Aug. 25. Northwest wind continues. No chance to get off. Among the pebbles are vari-colored hornstone pieces quite abundant. These contain a number of Devonian fossils; Stromatopora, Syringopora, Favosites, Otadopora, Lophrentis, Alveolites, Strophodonta, Spirifer, Atrypa reticularis, Tentaculites, Encrinurites stems, Stictopora (?), Dipsophyllum.

At 5 in the evening the steamer Arctic came along and we asked him for a tow to Two-heart river which was granted gratuitously.

After sun down we arrived about 2 or 3 miles opposite the place and let go but having at first no wind to go with we only arrived late in the night at the river's mouth. In the morning we forced an entrance in to the very shallow mouth of the river which becomes deeper a jof a mile upwards.

Saturday 26. At noon we were ready to start on a foot expedition to the bog iron districts in Towns 47 et 48, Range 9 et 10. We take the shore for about 5 or 6 miles and then intend to go southwest. We camped in Town 48, R. 10 between Sec. 4 and 5 on the lake shore. As previously mentioned, the whole shoreline is formed by sand bluffs overgrown with norway pine and some birch trees. The beach itself is pebbly presenting an astonishing variety of Huronian and Laurentian rocks besides some sandstone pebbles and fossiliferous hornstone and limestone fragments. In some places out of the sand has been washed such an amount of magnetic ore sand that this material covers the surface for several hundred yards in the thickness of from 5 to 8 inches.

Sunday Aug. 27. Sun rises bright at 5 o'clock. windy all night and yet to northeast, as it appears from the sheltered corner of our camp. We intend to go following the section line south into Town 48. The way leads through an elevated plain spreading out behind the bluffs the timber at first is young spruce. After entering between Section 8 and 9, some good Norway pine and white pine is growing which continues between 15 et 17, there we cross several higher ridges with some hardwood mixed into the pineland. Finally we descend into an open marshy place with some cranberry patches which swampy land continues unto the river, but the ground is covered with pine, cedar and some leafwood timber.

The river where we struck it has a rapid current and is about 30 feet wide. A clear little creek murmurs down from the bank across and we took our rest there for dinner, after having crossed the river on a log.

At noon we proceeded south along the section line over high land. About a mile from the river we found a beaver hunter's camp with a number of beaver heads and mink heads.

After reaching the town line of T. 48, R.10, we went west until we struck the south branch of the river. We crossed to the west side of it and traveled south about a mile also over high land. There is fine hardwood all along our route with some splendid pine intermingled. We encamped on the margin of a high bluff bordering the creek as I suppose near the section line between sections 5 and 9 in Town 48, R. 10. Also the opposite bank of the creek is high land. In some of the ditches and springs along the creeks there is a gelatinous ironoxyd deposit but no where any bog iron ore as far as this. In the creek are sandstone pebbles but no rock, and the hills are composed of sand.

Monday Aug. 28. Fine weather.

At 3 o'clock we traveled in a south and somewhat east direction alternately through swamps, cedar or tamarack, then again over some elevated knolls partly covered with fine pine timber.

In section 18 we saw a considerable lake surrounded by such a knoll, with beaver dam and house which is not registered on the map. Passing it on the west side through swampy timberland, we followed for a little over a mile the north and south line until we entered upon a wide open swampy plain without trees or where there was any, (it was tamarack) they are burned off.

Still we found ourselves at the corner of Secs. 31 and 29 in T. 43 R. 10, not a trace of bog iron ore. The plain is covered by sand soil but in a little creek some ferruginous mud is deposited in the water. From there we traveled about 6 miles in a southeasterly direction until we arrived at the head of a creek running eastwards and which is a branch of Maquamenah river. The whole distance is an open marshy sand plain, sometimes with scattered tamarack or balsam trees of small size. Distant about 5 miles to the eastward runs a high hardwood ridge parallel with our course. Arriving at the creek and following through marshes its run until its bed is a more distinct continuous stream but with scarcely any current, beaver dams obstructing its run in places. The swamp plain shows patches a little more elevated. Some are sand hills with a thin coloring from iron over the surface and those are the higher elevated spots. Others are scarcely projecting but are strikingly distinct from the surrounding peaty soft ground by being hard layers of bog iron which covered the surface in the thickness from $\frac{1}{2}$ to almost two feet. Generally the ledges are interrupted by interstratified sand. Below the bog iron there is a white soft sand, the same which covers the surface of the whole district.

Diagram of above description.

The spots with ore immediately show themselves by being covered with low brushes and no grass. In some places the ore crust is not more than a few inches thick. The thickness as seen is about 18 inches including a thin intermediate sand stratum and the abridge (average) thickness of the whole is certainly not over 1 foot. The place over which the ore is spread out may be about 40 acres large and of these, if three acres are covered actually by the ore it is not too low an estimate. Therefore considering the limited amount (quantity) of ore, the distance from any proper (proper) road for transportation make it very doubtful if at the present time it would pay to make use of the ore.

Monday Aug. 28. Took our way towards the mouth of the river where our boat lays. We traveled north about 3 miles over open swamp plains with occasional low sand hills until we struck the higher hills with hardwood. It began to rain when we entered the woods so that after about 2 or 3 miles further progress we stopped for the day a few hundred yards from the river running north into the two-hearted river.

The rain continued all day and all night so we continued our way next morning Wednesday Aug. 30 under steady rain. Crossed the creek followed it for about 3 miles, crossed it to its east side and pursued our north course about along the section line running north and south until we found ourselves in the evening at the corner of Secs. 7 and 8 in Town 48, Range 7. We did not find any surveyors marks during the past two days, partly on account of the open plains, partly because we were too wet to give much attention to them. Finally we arrived at 1 o'clock under a continuous stream of rain at our boat harbor. The whole route was through hardwood land with only a few swampy places between. There is much fine pine timber scattered through the hardwood lands. Near the shore the woods are clear pine woods, mostly Norway pine, or where smaller timber is, spruce pine.

All the surface is sandy. Along the Two-Hearted river are very high banks of sand down to the bottom of the creek, this is about 100 feet down, below the margin over which we travel. We found a (the) camping huts of Indian hunters where I collected a number of beaver skulls, but most of them are fractured or the lower jaws were scattered and lost. Also a number of beaver domiciles we saw. Likewise deer was often seen in close proximity.

When we arrived at the lake shore the lake was immensely agitated and during our absence the waves must have run over the river bank and almost filled our boat with water so that everything was soaked in water and we could not even get dry clothes.

Thursday Aug. 31. The whole day was spent with cleaning the boat and drying our effects and packing up some rock which we used as ballast stone since our Drummond Island trip.

Friday Sept. 1. West-southwest wind. Heavy blowing thunderstorm with hail in the forenoon. No chance to get away. Collected fossils along the shore, among which silicified stromatopora of great beauty. Also a *Phillipsastraea* (?) was found et *coccolina* (?) *concava*, *Distulipora* etc., some fine Devonian *Trilobites* (*Estancia* character).

Towards evening the wind appeared to change in our favor but at sundown it was again from the west. During our absence the river had changed its outlet, breaking through 3 or 400 steps further west than its former mouth. The old bed was entirely filled up with sand and gravel by the high sea striking against the shore.

In the sand bluffs near the shore below the mouth of the river are several gravel strata. Towards the top is also the ferruginous sand visible.

Saturday Sept. 2. Remained at Two-Hearted river.

Sunday Sept. 3. Sailed 1 past 8 out of the river with almost no wind after slowly lingering ahead we finally got good wind and arrived at Grand Mareis harbor a little before 6 in the evening. This is a very good well protected place with deep water, surrounded by low sandy beaches overgrown with pine woods.

The coastline along the whole distance from Two-hearted river presents no peculiar interest. It is all the way along a series of sand bluffs sometimes lower and rising backwards in several terraces, sometimes higher when one of the terraces approaches close to the shore, (all is pine woodland).

In the sandbanks there are some gravel banks, and near the surface the sand is frequently hardened into a soft sandstone by ferruginous cement as it is noticed over the whole peninsula. Some sand hills close to the beach may be dunes, but only exceptionally, this is the case. The rest is a regularly stratified water deposit of the drift period. From Grand Marais westwards to Point au Sable the shoreline is formed by hills, apparently several hundred feet high. The hills between Two-hearted river and Grand Marais are not exceeding 50 or 60 feet.

In the evening I investigated the banks along the shore. They are from 50 to 60 feet high on the lake face, and consist of alternate layers of sand and gravel. The gravel and sand beds are very irregularly stratified, wedge-shaped, intercalated between one another and exhibiting in the most striking manner the material deposited by currents coming from different directions. The pebbles are most (ly) diorite, granite, quartz, sandstone, but a number of calcareous and flinty fossils of the Devonian era intermingled. The gravel beds are seen from top to the bottom intercalated between the sand beds. The sand beds the sand of the lower strata has a reddish hue. The upper sand beds are yellowish and are about a foot below the surface strongly impregnated with brown ironoxyd which cements it to a soft sandstone, or if there are pebbles intermingled, to a breccia. Specimens of it are collected.

Monday Sept. 4. Having stormy contrarious wind I determined to walk along the shore to Point au Sable. Round the bay of Grand Marais the shore line is woodland with an embankment of about 12 or 15 feet which consists of sand with ferruginous layers. Crossing a low sand point and approaching the open lake the coast hills are still timbered land forming bluffs of about 200 or more feet. Towards the lake a short distance before reaching the creek which flows out of a lake not far from the shore is a fine escarpment of the drift strata. Above are about 60 or 100 feet of sand and gravel layers, sand predominating and the gravel layers wedge-shaped not forming regular continuous bands. Below these are seen about 6 or 8 feet of a black peaty deposit consisting in parts of clay strongly impregnated with carbonaceous vegetable matter, in parts containing only very little clay and being almost entirely of vegetable composition containing a number of well recognizable leafs and branches and trunks of various kinds of timber among which birch and cedar is distinctly recognizable. Below this vegetable black stratum a streak of sand follows, and then the rose-colored well stratified clays crop out and come to the water's edge. They are visible in this place only 4 or 5 feet.

Further along the shore they project in places 30 - 50 feet but are sometimes quite sandy. Also large pebbles are intermingled, namely at this place below the peat layer.

This peat layer continues for a good while and crops out in another remote place about 30 or 100 feet above the lake underlain by gravel and clay banks, but finally it thins out and disappears entirely on the other side of the creek.

The hills on the other side of the creek are entirely naked to the top and consist of irregular alternations of gravel and sand layers amounting to 200 or 300 feet in thickness about 50 feet or so above the lake. In other places almost on a level with the lake the red clays come to appearance and give rise to a number of splendid springs along the shore with abundance of clear cool water. The declivity of the hills is so steep that it is a matter of no little difficulty to climb up on all 4 legs.

In the sand strata near the clay beds I found also some streaks and bands of magnetic iron ore sand with garnets ectr. The stratification of the sand beds proves a very great variability of the currents transporting the material.

At the bend of the coast line about on the townline between Range 14 and 15, the variegated sandstone layers crop out under the clay strata being first visible in the lake bed, then soon forming a rock escarpment of 10 and 15 feet high. The sandstone is somewhat soft, very distinctly cross stratified white and red, banded and variegated.

Small diagram of above.

Among the drift pebbles there are a good proportion of devonian limestone and silicious pebbles with well preserved fossils. The most projecting portion of it. An cable is much lower than the hill which first exhibits the variegated sandstone of its base. In this(?) the sandstone is overlaid by red clays and sand beds amounting to 30 ft. On the exterior land tongue the sandstone has only a covering of about from 5 to 50 feet, a gravel layer and then sand with the upper ferruginous portion is all. Above is no(?) red clay.

The sandstone is very remarkably variable in color and structure otherwise, sometimes dark red, micaceous soft layers, sometimes entirely white layers, then spotted in all variations, harder or softer with round hard nodules in it, or with green clay pieces and pebbles intermingled. The stratification is throughout irregular and cross-wise. The escarpment of sandstone around the whole point is not anywhere higher than about 15 or 18 feet but sometimes only 3 or 8 feet.

Thursday Sept. 5. 7 o'clock morning. We are expecting our boat to come from Grand Marais and take us in, to proceed to Grand Island but the weather and wind is not very promising. Distant thunder and south-west wind. So we prepare for walking back to Grand Marais and take the light of the hills.

As stated before the promontory of Cable Point is not much elevated and has only a comparatively thin drift sand covering of the variegated sandstone. The high hills ascend only in the pond of the bay and continue from there eastwards to Grand Narvais.

On top of these barren hills are considerable gravel strata with Devonian pebbles besides the prevalent Huronian and Laurentian rocks. Also some intermediate red clay strata are noticed. The highest portions some distance back from the margin are mostly fine sand and may be there subsequently accumulated by the winds.

The bluffs present also numerous slides of lately accumulated sand masses which are not always easy to be distinguished from the original stratified drift deposits but that fact is plainly proved by the circumstance that fragments of shipwrecks stick out from the sand banks which at a superficial glance may be taken as a regular continuation of the undisturbed sand strata.

Below the creek running out from a little lake which was mentioned in yesterday's diary I examined again the peaty strata with well preserved trunks of birch and cedar trees. These peat layers do not form a continuous bed but are only filling out a basin shaped depression, the bed of a former pond or river. May be they thin out on both sides and are bending upwards against some original sand strata into which not a trace of the coaly matter contains but a little distance from one such peat deposit. There is another still more extended one at the water's edge and underlaid by red clays while the one a short distance from it and 3 or 3 feet higher situated is underlaid by a coarse gravelly sand. It is therefore most probable that an excavation in the drift made by a river or from some other source filled its bottom with vegetable matter and timber which subsequently was covered over with heavy sand deposits, in this place about 50 feet in thickness. The sand taken right from the surrounding bluffs of course did not differ in any way from the adjacent sand layers and so it appears as if the peat deposits were of the age of the drift period, which to my estimation is not the case. (N.B. The red clays are more sandy than in other places.)

Diagram of above.

A number of specimens of wood and peat of this locality were collected. We had this day 3 thunderstorms and rain continued all night with heavy blowing from the west.

Wednesday Sept. 6. West wind blowing hard. Sky clear. Cold. Went along shore eastward. Saw the sand and gravel strata alternating in the most irregular manner, every wave almost discernible in the deposits, the direction of the waves, the coarseness or fineness of the material.

The shortness or length of such a period all is so nicely observable in the denuded steep embankment that one could almost tell from which direction the wind blew or the currents came on each of these early days. There is an excavation dug in the surface which is readily filled up by the next current transporting material in this direction instead of removing and so every action of the water is stereotyped by the delicate marks of stratification. Among the fossils I found a *Catenipora* and of Devonian fossils a hinge portion of a *Renssalaeria*.

Diagram of above formation.

Ascending the bank I found to my surprise a sharp edged margin or crest which fell in the direction towards the land almost as briskly as towards the lake. The land behind the crest of the coast line is in general much lower, as far as the eye can discern.

Lake considerably aroused at noon yet and the wind blowing hard so that no possibility of getting away is for today. (On Grand Marais river about $\frac{1}{2}$ of a mile from its mouth the sandrock ledges crop out and form about 4 feet high escarpments. Gibbins observations. Sundry observations during the last few days).

In the sand layers are sometimes a number of isolated smaller and larger pebbles dispersed. Sometimes also a large boulders sticks out. Along the beach are a number of larger angular granitic blocks of several feet in diameter. The reddish color of the sand is due to an admixture of red clay, of which a number of thinner beds are deposited also on the higher horizons of the sand deposits.

The fossiliferous pebbles are distinctly noticed in the beds of various heights so I noticed some in the gravel banks at the level of the lake and some similar ones in the ferruginous sand and gravelly layers directly above at about 70 or 100 feet higher level. In general the material of the gravel strata of the lowest and the highest layers does not very much differ. Still in some places one or the other kind of rock prevails. I found *agus*(?) on top of the sandhills 300 feet above the lake shore.

Thursday Sept. 7. Fine weather, rough sea yet and northwind. Cant risk to go of because there is no harbor before reaching Grand Island. At 10 o'clock the wind got to the northeast and we sailed out but returned after an hour because there was not wind enough to transport us to Grand Island in day time. In the evening the wind sprang up. Excellent but we have to wait till morning. In the afternoon I visited the peat deposits on the shore and convinced myself of their younger date than the drift strata. Going retour (return) again I saw nearer to Grand Marais where the hill is interrupted by a creek the peaty strata almost forming the surface layer in which the present forest sent its roots.

Full see diagram

Friday Sept. 7. Having fair wind we sailed at 4 o'clock in the morning and reached Point Sable and 4 or 5 miles further, then a heavy gale set in coming from southeast we had to pursue our course until we had passed about 3 or 4 miles Chapelle River. Then we had to return, the storm was so severe, to save our boat and ourselves. So with difficulty we reached the mouth of Chapelle River where we landed on a sandbank. Chapelle River comes in a fall of about 7 feet into the lake. On its east side the rocks are excavated in to a chapel-like structure wherefrom its name.

At the water's edge the sandstone which is generally of a dirty reddish white color is full of quartz jasper and other pebbles. Besides there are numerous earthy whitish nodules in it which sometimes are hollow, the cavities lined with calc spar and iron pyrites. Spec.

The stratification of the whole sandstone mass from below to the top which at the highest exposures I estimate from 60 to 100 feet, is very irregular cross stratified. Some layers are soft friable with the fingers, some are harder and form clabs. In one place I saw two gravel beds running together in the following way.

Diagram of above.

I expected to see in the pictured rocks some red and white variegated sandstones as at Point Aux Sables but there are none. The shore is at this place full with peculiar trans-lucid quartz pebbles striped jasper and hornstone ectr., which are derived from the pebbles enclosed in the conglomeratic beds of the sandstone.

In places there are large lacunae in the sandstone escarpment which are filled out with fragments and rubbish and above all considerable sand deposits are spread out. The whole distance from Point Sable to the pictured rocks is lined by a sand beach no sandstone ledges being exposed. For at least 10 miles in the background high hills are visible which are composed of drift deposits. (Sand).

Diagram

Saturday Sept. 8. We had all the past night severe wind which now turned to come from the northwest, so that our boat was in danger. We had to unload it and pull it as far ashore as we could. It lays now on its side half on dry land half in the water, but I think it is safe. The storm continues all forenoon and we can do nothing but patiently wait for our chances to get away. Provisions are now out except hard bread, salt and sugar.

The space between the Chapelle on the east side of Chapelle River and the high rock walls 500 yards west of it is a depression which continues backwards to a small lake from which the Chapelle River comes. This depression is filled with debris of the sandrock and drift sand. The actual rockbeds having previously being removed by some denuding destructive action.

Diagram of above.

Two full page diagrams of pictured Rocks.

Sunday Sept. 10. We raise our boat buried in the sand and set it on rollers to be ready for a start as soon as the wind allows us. This forenoon we have west wind and little of it. The sea has quieted down.

To the west of our camping place is a promontory of rocks forming a narrow linguiform protrusion behind which a deep indentation about 100 feet wide at the entrance and 400 or 500 feet deep is washed out of the rock walls which continues further in under the form of a narrow cavern which almost intersects the whole promontory, so that it would not need much digging to make an entrance to it from our camping place side.

The walls are vertical about 50 or 60 feet high. Lowest is conglomeratic sandstone visible about 8 feet. Above it, separated by a few inches of blue slate is a reddish tinted soft fine grained sandrock cross stratified about 15 feet thick. Then follows some coarser sandrock partly in harder slabs and sometimes with intermixture of fine gravel. The top is a white soft thinly laminated and cross stratified sandstone above which some drift sand and gravel is deposited.

Among the pebbles on the shore are almost only quartzose rock, no granite and scarcely any diorite. Only one specimen of a Devonian Favosites I found. Of pebbles I made a large collection having nothing else to do. They are very interesting objects for study. Most all belong to distinctly stratified aqueous deposits and the relation of all the concerned rocks is clearly recognizable by comparing a large number of specimens of the different varieties.

At noon we launched the boat on the water, loaded it and sailed off with scarcely any wind. So we slowly moved around the rock walls and had not made over 4 miles at sun set. Then with head wind from out the bay we finally arrived after 10 o'clock in the night at Lunising Landing. The coast is all the way lined by the perpendicular sandrock walls excepting some lacunae where rivers come out. Also the shore line of Grand Island as far as observable is lined with rock walls but they stand a little back from the beach in most places so that some timber growing in front of them practically hides them.

The boarding house keeper at Lunising directed my attention to the sandrocks in Grand Harais river. Then (there) he said he saw some limestone beds 3 miles from Lunising in the direction of the coal mines are (?) 3 lime kilns.

Monday Sept. 11. Visited the locality near coal kiln Nno.5. 3 miles east of Lunising. The furnace not in operation now on account of pecuniary embarrassment of the company. It is situated about 600 paces (steps) back from the shore at the foot of an 80 feet high sandstone bluff. The sandstone is soft, contains much iron pyrites and decays,

Opposite the bay on the point is a quarry of some harder sandstone, red and white variegated which is used by the furnace for construction of the furnaces. But also this is an inferior quality of building material. On top of the bluff the marginal strata are covered by a red tenacious drift clay and above it by drift sand dark stained by infiltration of ferruginous matter. Further back some higher layers of the sandstone formation are seen exposed in the place where the 3 coal lime kilns stand. It is a bluish very pyritous sandstone with clay partings and some calcareous cement. There are traces of gastropods in it and some fucoid marks.

From there the land rises to the east is a higher. The hills are covered by drift sand pebbles and larger dioritic and granitic boulders. Following the road for 3 miles through nice hardwood lands and in the depressions through cedar swamps, I arrived at the coal kilns nno. 3 in Town 47, Range 13, Sec. 23.

The surface is thinly covered by drift and large boulders under which some higher layers of the sandstone formation come to appearance in some wells dug around the kilns and in some other denuded places. The same rocks are also said to crop out in a creek in the same town, Sec. 26.

and also on Sec. 13, a foot of marly rock is described to me. The strata under consideration are a calcareous sandrock with streams of argillaceous-calcareous matter and sometimes with bands of a regular colith below. It is a stratum of 6 or 8 inches of a regular dolomitic limestone. In the calcareous sandrock are numerous cavities left by the decay of some gastropods which however are not allowing any special determination. These strata may be some ten or 15 feet higher than the blue calcareous sandstone described above but there is no possibility of accurately ascertaining this fact.

The soil is a loamy sand which in many places is showing his (its) good qualification for agricultural purposes, but the same time the frosts exhibit to the great disappointment of the land cultivators their destructive effects on the potato fields.

Expended for victuals 13. Ditto for pork and for boarding the night of our arrival 5 dollars 50 cents. Wrote home and to Major T. B. Brooks and to Governor Baldwin. Specimens from Lansing are all marked M.

Tuesday Sept. 12. Sailed at 9 o'clock for Grand Island coasting along its coast (south) and west side. Opposite Mr. Williams residence on Grand Island there is on the mainland a quarry opened for a sandstone which they use at Lansing furnace for a building stone but it is of inferior quality. It is a striped red and white variegated sandstone. Its cross stratified condition makes it unfit for quarrying any large blocks.

From that point to Day Furnace and further on to the next point west the shoreline does not exhibit any rocks which are exposed in the hills 2 or one mile back from the lake. Also the shoreline of Grand Island opposite to it has no rock exposures close to the shore. The hills are all overgrown with fine hardwood timber and some pine intermingled. The lower land is cedar woods.

Sailing to the point limiting the bay of Au Train River there are two islands in front which have not much elevation but consist of sandrock ledges which form all round their shoreline a bluff of about 3 feet high. Also the shore of the mainland limiting Au Train River bay on the east side is composed of rock bluffs of about from 6 to 8 feet elevation, but in a few places the bluffs are higher. The whole promontorial ground between mouth of Au Train River and Day Furnace is a low ridge. The high hills run deeper inland and approach the shore only about west of Au Train Island.

Au Train river is opening on a sand beach about 1/2 of a mile west of the rock exposures. Its course is very tortuous through a low unfertile sandy pine land. The lumber mills established there are abandoned. The entrance of the river changes frequently being blocked up by sand after every hard blowing wind in the depression towards the land.

The whole west side of Grand Island is formed by high rock walls similar to the pictured rocks. About in the centre of the west side are the highest escarpments where above the general outcropping strata a series of other layers capping them is exposed on the hillside. It appears to be also sandrock.

In the Canadian reports at one place I noticed the remark that the Michigan geologists report about some limestone strata above the sandrock of Grand Island but no one of the residents on the Island or near by did know anything about this.

At Bay Furnace I received a letter from Maj. Brooks enclosing 20 dollars from Mr. Mark. Weather has finally cleared up but the wind is very unsteady and generally against us.

Wednesday Sept. 13. Sailed out of the river but coming near Au Train Island the sea began to run higher so that water splashed all over our boat so we determined to return. Wind northeast.

The side of Au Train Island facing to Au Train River presents high rock escarpments. The rock escarpments on the Au Train bay where they join the sand beach are about 10 feet vertical high but the dorsum of the promontory ascends much more. It is a grey tolerably hard sandstone in large blocks here and there intermingled with pebbles. Some strata are also of the red and variegated kind but the cross stratification is making them unfit for a good quarry stone. The sand beach in front of the great curvature of Au Train River continues eastward along the outlines of the bay to the next promontory south of Au Train Island.

Canada reports page 53, notice about fossiliferous limestone capping the sandstone of Grand Island.

Thursday Sept. 14. Left du Train river at 8 in the morning with fair wind. Shoreline all sandy unto the other side of the next bay in which two rivers enter about a mile or more back from the shore. Between the two rivers is a high hill on the west side of the creek which comes out of a small lake the rocks form again escarpments along the lake. The strata are red colored and continue to Whitefish Point forming a more or less elevated escarpment. At the point is lately a quarry established which furnishes a fine stone, but its quality otherwise excellent is considerably impaired by a very marked cross stratification which produce very annoying seams in the blocks which make its durability doubtful.

The landspur of Whitefish Point is not much elevated, covered by cedar swamp but it rises gradually towards the first beginning of the outcrops near the before mentioned creek. The shore line further on towards Marquette is low and presents few or no rock escarpments for some considerable distance.

After taking in dinner at the point we sailed for Marquette, The quarry company is mostly composed of Germans. They intend to erect a furnace there. We arrived at Marquette at about 3 o'clock, just before a heavy gale rose. (Pencil note. In du Train Island is a big cave in the rock. Told to by Mr. Lunt, hotelkeeper Marquette.)

Diagram.

Friday Sept. 15. Packed up the contents of the boat.

Saturday Sept. 16. Dismissed John Boucher from service. Paid him 33 dollars for one month and 4 days, besides 3 dollars for a passage on the steamboat, Northern light. He insisted on having the following day paid also but doing this by grossly insulting expressions I refused to do so, because the boat after the clerks statement leaves this evening at 8 and will in all probability arrive at St. Mary tomorrow morning. Paid also to Ed. Gibbins for 2 months service up to Sept. 20. one hundred dollars. Packed and addressed 2 fish barrels specimens, 5 boxes ditto. Wrapping paper 30 cts.

Sunday Sept. 17. Visited the sandstone quarries.

Monday 18. Disused of the boat by giving it in charge of Merchant Spear, and delivered the same time 3 barrels and 5 boxes with him for shipment (?) On afternoon visited with Major Brooks the outcrops of Huronian rocks near the Carp river. The strata of the Huronian series stand partly vertical partly are highly inclined. Their strike is from east to west with some slight deviation. They dip so as to form going down from Marquette towards Chaselles an anticlinal axis after passing which we intersect a synclinal one. The rock is an alternation of well stratified quartzites in places with distinct wavelines, and of clay plates of various colors and hardness intercalated.

Between this are several limestone beds with variegated colors and very numerous quartzose seams and nodules. One of the heaviest beds of limestone appears to form the top of the series in the midst of the synclinal axis.

Diagram.

This rock in small pieces appears to be a nice marble but the quartz veins in it make it entirely unfit for this use.

At the first outcrop of the quartzites on the shore is the most beautiful exposition of the contact between these elevated rocks and the beds of the brown sandstone, deposited unconformably on and against them the sandstone filling out all the cracks of the quartzite and being a little inclined in correspondence with the obliquity of the surface of the quartzites on which they were deposited. Some rounded pebbles of quartzite and some angular fragments of it are cemented into the sandstone mass filling the cracks.

The exposed uninterrupted series of Huronian rocks may amount to 400 or 500 feet, but between the first and second exposure is an interval of half a mile where the rocks have not been observed.

Tuesday Sept/19 Ishpeming, Lake Superior Mine. Went with the 6 o'clock train up to Ishpeming, the location of the Lake Superior mines, passing Morgan's Furnace we saw a series of upright layers of slates quartzites and intercalated marble beds which are not so silicious as the marble near Chaseles, but the series seems to be the same. At Lake Superior mine a very well exposed uplift of the strata with several repeated bends is to be seen.

Diagram of above.

There are various kinds of ores of red and brown (grape ore) which are more or less predominantly developed in one and another place of the mine. The subjacent rock is a diorite and dioritic schists. In the hanging (?) are some eminently chloritic layers.

Afternoon we went to the Cleveland mines where the ore bed is immediately under a heavy ferruginous quartzite bed which in some portions conglomeratic. Above this is about 50 feet of drift material which immediately on the rock is a shapeless accumulation of clay and gravel. Above it the strata are exhibiting distinct lines of stratification. Little distance from it is a high hill which consists entirely of erected layers of banded jasper and alternating bands of iron ore which exhibit in a beautiful manner numerous contortions and bends.

Wednesday Sept. 20. Sent Gibbins off and paid him 20.75 cts traveling expenses, board and 3 days wages. Bought box and drayage (drayage) 1 dollar. Borrowed from Major Brooks one hundred dollars. One traveling map, 1 dollar.

Thursday Sept. 21. Dinner handles .75 Boatmen 3 dollars. Visited Presque Isle with a boat.

The lighthouse point is a prominent diorite hill specimens of which are collected. From there extends a sand beach to the next point about $\frac{1}{2}$ mile distant where a small island rock and a promontorial elongation of the mainland behind it exposes a larger crystalline diorite. From there to the mouth of Dead River a sand beach extends. At the mouth of the river a round protrusion of granite is projecting on one side of the river on the Parquette side. Then again a short sand beach until at the Presque Isle point the brown sandstone appears under the drift at water's edge but soon rises in a thickness of about 50 feet. The strata are partly conglomeratic, the conglomerate particles wedge-shaped. Considerable clay strata or clay sandstone layers interposed.

Lowest is a very coarse conglomerate of about 5 feet thickness. In the strata above it are single large pebbles dispersed. Under this conglomerate a series of rocks is protruding which are in an elevated position and form an arch whose ascending and descending sides are about a mile apart. The uppermost strata are brown with innumerable white veins which cross each other in every imaginable direction.

There is a great variation in character of this rock. Some strata are soft, some hard quartzite-like, some are chloritic or banded and traversed by jasper. They contain numerous quartz veins also asbestos; some iron and copper pyrites. Under this series which shows many distortions but little of distinct stratification there comes a powerful mass of dark rock like basalt. Part of it is hard, part grumbles (crumbles) and softens in water and is slate-like but not of slaty stratification. It grumbles (crumbles) rather in square pieces than in laminae. The exposure of this rock occupies the larger part of the rock escarpment. Beyond it the upper strata repeat and fall away from it.

Opposite this exposure about $\frac{1}{2}$ mile distant are two small islands which are said to consist of granite. The Lotsdam sandstone has in the exposures only a few beds which may prove to be good enough for a building stone although they are hard enough but the action of the weather on the exposed block is noticeable by numerous cracks.

Diagram. Section of Presque Isle.

Evening at 8 o'clock. Intend to sail for Houghton.

Friday 22. Arrived there in the morning at 7 o'clock. 4 dollars expense. Went to the Douglas House and met there on entering Mr. Hill which introduced me to the several persons there, in particular to Mr. Mass (Map) (Moss), the manager of the stampworks of (at) Isle Royale Mines. Went also round with me to show me the arrangements of the rock beds.

There is in the first distance a general strike of all the strata in a southeast to southwest direction and a dip of various degrees but generally amounting to 50 or 60 toward the west.

I see a very powerful series of dioritic rocks of various character making transitions into the red or greenish colored amygdaloidal rock with whose beds it alternates. There are also interposed 5 or 4 beds of a red more or less coarse conglomerate until on the east side of the brow of the hills, in the bed of a creek and at the end of a long continued series of exploring ditches a section is seen which is of remarkable interest.

After passing a bed of amygdaloidal trap of very great thickness there sets in dipping conformably under it a thick deposit of a conglomerate partly composed of fragments, partly of rounded waterworn pebbles. In connection with this conglomerate are strata of a brown sandstone evidently bearing the marks of once having been an aqueous deposit with here and there a pebble interspersed, also some argillaceous beds and then again conglomerate. Under this is a mass of diorite with dots of obsidian-like mineral. Then an amygdaloid rock of green tint and partly of red color. Apparently under it in close contact but the exact position of the beds not visible, but seemingly having equal strike and dip is a sandstone which in no way distinguishes itself from the ordinary brown sandstone of Marquette and other places. Several steps further only the beds of this sandstone are cropping out in the bed of the creek and have an almost horizontal position. They seem to occupy the base of the hillside only covered up by drift deposits. There is no doubt of the intimate connection between these conglomerates and the sandstone but it is a serious question in which manner the uplifted condition of the portion contiguous with the trappean rocks shall be explained, and how it happens that so near a brisk uplift falling to the opposite side almost a horizontal construction of the strata can exist. The section as I can intellect (recollect) the case is the following.

Diagram.

Afternoon went with Mr. Hill as far as South LeSabick Stamp Mills. Mr. Fischer, a German is the overseer of the now abandoned works which was erected with immense outlay of capital.

Close to the mill, west of it comes down a creek through a ravine in which about 80 feet of various well stratified layers of sandstone and conglomeratic rock in an uplifted condition are outcropping. The dip of the strata seems in conformity with the general stratification of the trap layers of this whole hill side and they seem to overlay the trap. There are fine ripple marks and sun-cracks to be noticed on the surface of the sandstones.

Opposite this location a little more to the west on a landslip of the Hancock side there is a sandstone quarry with similar layers exposed. Walking up from Loughton to South LeSabick Mills one traverses an immense series of various colored trappean rocks with amygdaloid copper bearing beds here and there interposed and likewise in numerous repetitions and in very thick layers the conglomerate appears to alternate with the trappean beds.

In some instances the conformity of stratification with the trap layers is plainly to be seen. The material of the conglomerates is to a great extent composed of trapezoid rocks partly in angular, partly rounded waterworn pebbles.

Saturday Sept. 23. Went over to the Quincy (Quincy) mines. Saw in a bed of amygdaloid trap the copper imbedded. The beds have no peculiar different quality from ore beds seen on the Houghton side. The enclosing rock wall above and below is a dark colored trapezoid rock with many chloritic nodules in places. Several zeolitic (zeolitic) minerals and calcspar are accompanying the metallic copper in the amygdaloid. The rock is generally burnt(?) in heaps before it is sent to the stamping mills.

On traversing the side of the hill one frequently meets with repeated bands of a coarse conglomerate in which the pebbles are generally waterworn and consist of a sort of red porphyritic trap but in part also of unaltered red amygdaloid pebbles. Afternoon went up to south Levabik mine mills.

Leaving (leaving) town at the end of the houses the dark trap rocks are seen cropping out for about 200 steps or more striking about southwest to northeast and with a northward dip in an angle of 30°, then come with the same strike and dip a peculiar sort of conglomerates almost wholly composed of angular fragment of amygdaloid of red, dark grey and partly yellow color. and about 8 feet I think after those a brown conglomerate with amygdaloid fragments and pieces of well stratified slaty and sandstone particles about 15 or 20 feet. Then again dark trap rock considerably weathered and in great thickness 400 steps on unto a shanty for the sale of beer. There a chocolate colored amygdaloid rock with many cavities filled with Lemmonite (limonite) and also a white mineral sets in. It is considerably weathered into a small fragmentary powdery mass. Its belt is about 30 feet wide. Then follow again traprocks for quite a distance. Then heavy drift deposits hide the outcrops. and from there the sequinoi of the strata can no more be well observed for the same reason. But a number of exploring ditches all the way along shows the industrial spirit of the people expending large sums of money with more or less success, for mere exploring purposes.

At the mills the sandstone strikes apparently from northwest to southeast and falls to the southwest against the hills from which it outcrops. But subsequent considerations make it doubtful if this observation is correct. I observed the outcrop and confused it with the line of strike. The strike may therefore be in conformity with the trap range.

The sandstone and conglomeratic strata are of a dark brown or red color. The strata are hard forming slabs with beautiful ripple marks, or of softer quality intermingled with argillaceous layers.

Numerous repetitions of conglomerate beds of finer and of coarser quality are in alternation with the sandstones. The thickness of the whole deposit amounts to at least 300 feet. To the east of this exposure along the road unto the brewery there are exposures of conglomerate rock visible. In places it drops out under the thick drift. Probably this whole series of conglomerates forms the downward continuation of this sandstone outcrop.

The hill on which the south Lewabik mines are situated (is) about $2\frac{1}{2}$ miles south from the mills. A fine road leads to it which discloses the above sandstone section, above which a heavy drift accumulation amounting to several hundred feet forms the top and continues to the mines where the trap rock begin to come to the surface again from under it.

In the evening letter home sent off. Expense for sundrys. 1 dollar Boxes, ferry, ectr.

Sunday Sept. 24. Saw a finely and carefully made section through the Isle Royale property. In right angles through the strike of the beds by a series of closely set ditches always dug down to the undisturbed rock, the succession of strata has been accurately ascertained and measured. Mr. Mabs made the section and most cordially communicated it to me. As a general observation I remark only that a few beds of conglomerate are found in the western half of the section which is a little longer than $1\frac{1}{2}$ miles and that at the eastern terminus nearer to the sandstone, laid unconformably against it. The conglomerate beds are more frequent and more powerful. Am going up to Lewabik mills to make the excursion proposed for the day before.

I have mentioned before the conglomerate deposits between the Lewabik mills and the brewery and beyond it. The sandstone exposures seem to be inaccurately superimposed to them and form an integral part of the series.

One and $\frac{1}{2}$ miles west of Lewabic mills at a creek from which an aqueduct leads to the mines is a very fine exposure of the sandstone series in the beds of the creek, the hillsides and tops being all covered by drift. The strata have a strike from northeast to southwest and a dip of about 30 degrees to the northwest. They correspond in appearance entirely with the south Lewabic strata but it is all a hard sandstone and some argillaceous beds but no conglomerates, of which however blocks have fallen from the drift and are in the creek. The sandstone forms large slabs 6 or 8 inches thick with fine ripple marks. But also more massive beds are abundant. They seem to have considerable of calcareous cement and are for this reason very hard. The large proportion of iron in them seems to affect the needle considerably.

We ascended from the creek over very high hillsides to the top of the ridge and traveled in southeasterly direction to the Lewabic mines.

Levee lines are striking from northeast to southwest conform with the general direction of the trap range and have a dip of some 34 or 35 degrees. On the west side a heavy mass of conglomerate overlies the trap. It contains a considerable amount of calc spar veins, so also the trap.

Further southwest from the mine in the direction of the metalliferous bed about 1 mile distant is a high hill rising over the general level which is called Alden's Bluff. A vein of about 3 or 4 feet in width which contains large calc spar masses but no metal runs across the trap strata in an east and west direction.

The metalliferous beds of the mine are of amygdaloid character. Contain the copper mostly in small globular grains but also in larger masses and I collected a number of interesting amygdaloid specimens in which partly the sedimentary character, partly the igneous cooperation in the formation of the rock is conspicuous.

Dined with Mr. Fischer then went to the Isle Royale locality and reconsidered the facts seen there. It is a very thick conglomerate bed of partly coarse, partly sandstone like or argillaceous material overlaid by trap and interstratified with a bed of iron containing an obsidian like mineral. The lowest mass bed is somewhat altered crumbling (crumbling) into a coarse powder and approaching somewhat an amygdaloid character but it is essentially a conglomerate..

In front of it are blocks of the ordinary Letsdam sandstone the position of which can not be made out. But a few steps farther in the bed of the creek strata are at a low angle falling away from the escarpment which has with its conglomerates the same strike and dip with the whole trap range.

Took notice of a patch of sandstone of ordinary appearance (like the whole north coast) on the Sheldon and Columbia land in Sec. 36 as Lumelly told me but I run accidentally on this spot. It is doubtful whether this sandstone is in place or to be considered as a huge fragment of layers brought there by drift action.

(Saw in passing by the sandstone quarry on the Hancock side opposite the South Levitic mills the character of rock, its strike and dip. Is in perfect conformity with the strata of the opposite side.
Monday Sept. 25.

Diagram.

Fossils Report on Mississippi Valley. Chicago. Griggs et Co. Memo.

West of entry of the Portage lake ship canal about distant 1/2 mile, brown soft arenaceous argillaceous beds dipping at a low angle to the northwest first make their appearance. Next above follow brown hard well stratified sandstone beds in layers one of which is over 3 feet thick and may be quarried in blocks of large dimensions.

The sandrock has a compact fine grained somewhat banded structure. Some layers are splitting with very even surface in slabs of any thickness. Some beds are exhibiting very distinct ripple marks.

Proceeding in westerly direction along the shore the strata are forming cliffs for a long distance above the mentioned quarry stones. Softer arenaceo-argillaceous beds and ripple marked sandstones with many micaceous seams continue until another quarry is reached there a better quality of sandstone is at the surface again but not near as good as in the first quarry.

Above it further on again about 70 or 80 feet argillaceous-arenaceous layers to be seen forming bold bluffs along the shore projecting in a point which hides from view the further continuation, but it is said these rocky bluffs continue for many miles further on. The thickness between the two quarries and a small distance beyond amounts to about 200 feet or more.

The canal is dug through a level swampy country about 2½ miles wide. The material thrown out is sand gravel and a red tenacious clay which forms the lowest stratum of the heavy drift deposits. In the pebbles which are mostly of trappean nature are numerous Devonian pebbles to be found. At the mouth of the canal the drift must be about 100 feet thick or more covering up the sandstone beds to the north and some distance to the south.

Tuesday Sept. 26. Very rainy day. Went in the forenoon to see Mr. Schenerman, manager of the Ann Pass stamp works but could not find him. Received from Mr. Foster some specimens of Kopper ore from the Sheldon et Columbia mine and a specimen of arsenical copper from another locality which was explored by Mr. Hill. Afternoon paid for a buggy 5 dollars to convey me to Calumet et Lecla mines where I arrived at 5 in the evening.

On the road besides a number of abandoned works I noticed the Boston et Albany mines also suspended now which worked altogether in a coarse conglomerate. The work however did never pay although in places a considerable amount of copper was found.

At the Calumet mines I visited Mr. Wood the superintendent which received me in a very cordial friendly way and will do all he can to make my visit as instructive as possible.

Wednesday Sept. 27. Mr. Wood informed me that the product the last two months has been 100 ton of washed copper per month and that probably they can produce a similar amount for a long time. He ordered his mining capitaine to conduct me through the mines which I visited after breakfast. The mines are about 300 feet deep in 7 stages (?) braced by timber. The hanging and foot wall are about 12 feet apart very regular and consist of amygdaloid trap which in the hanging rock often contains large masses of copper.

The copper bearing rock is a conglomerate which has generally a porphyritic character but contains beds so little altered that well stratified sandstone beds with ripple marks are often seen penetrating it. In places nodules of almost pure copper of the size of a fist or man's head are found in it but generally the copper is distributed in fine masses. The inclination of the bed is about 45 degrees. The rock is hauled out and broken in the shaft houses by rock crushing machines. From there it is transported by a railroad down to Torch lake where large stamping mills are erected.

After having seen the mines Mr. White and Mr. Bolton very politely accompanied me to Torch lake creek falls. Part of the way we made on a car of the railroad placed to our disposal. Then we went about 1 mile to the left when we stood at a precipice of about 100 feet high composed of dark drab rocks striking and dipping in the general drift dip and strike of the trap belt. The trap is staly and soft in some layers and contains some amygdaloid beds with copper. Under it with the same dip and strike are large conglomerate deposits composed of coarse boulders and some sandstone-like finer strata. Their thickness is very considerable. Over the trap rocks a creek forms a cascade.

Following downstream the immediate contact of the conglomerate with the sandstone is not seen but soon one notices instead of the elevated strata of the conglomerate dipping at an angle of 45° to the northwest, sandstones which are almost horizontal or dipping away from the conglomerates. The same sandstone is seen in some places along the railroad but most of it is covered by heavy drift. The sandstone also appears to be several hundreds of feet thick, its character in part very closely allied to the conglomerates, and some beds of it are also conglomeratic. But the higher layers are more light colored and approach the ordinary sandstone of Grand Island str. We returned at 3 o'clock.

Thursday Sept. 22. Excursion with Mr. Wood in the direction of the Cliff mines to see the position of the so-called greenstone belt. Starting at 8, Mr. Wood took me out all the way to the Cliff mines. We passed a number of mines partly at work, partly deserted. At the Seneca mines, an experimental mine not fairly prosecuted which is the first vein running across the strata, we found in a quartzose gangue mass considerable of metallic copper of malachite with some red copper oxyd.

The traprock near the vein is of amygdaloid character. Beyond this mine the so-called greenstone ridge which forms the precipices of the Cliff mines begins to rise and gradually to protrude in picturesque cliffs several hundred feet high. The greenstone is not essentially different in aspect from the ordinary trap layers but is more crystalline in texture and harder with crystals of feldspar (white) intermingled. Also in places large hornblende crystals are segregated in nests. Ascending the cliffs we found ourselves about 1 mile from the lake shore, the greenstone forming a blandly slanting descent towards the lake, and was then surrounded by a belt of lower elevation which is said to be conglomerate and sandstone. The greenstone ridge is seen continuing in a marked ascent to the northward, everywhere penetrating abrupt declivities on its eastern fall.

The cliff mines are in a cross vein traversing the sandstone. The wall rocks are of an angular character which is also cupriferous. The vein rock is very hard. The mines are not in operation. A section of the range at the cliff mines is about as follows.

Diagram of above.

After inspection of the situation of the mines and the characters of its rocks we returned and arrived at 3 at Calumet from where I returned to Houghton the same evening. Expenses at Calumet 9 dollars.

Friday Sept. 29. Paid for hotel bill 15 dollars. Transportation of specimens 50 cents. Left 2 boxes in charge of hotel porter. Departure at 9 in a small steamer, Mystic, to Leance.

About 1 mile from the entry of Portage Lake south of it, there is an exposure of almost horizontal strata of red sandstone. A similar high bluff is to the north right above the lighthouse. Exposures of horizontal sandrock are seen all along the shore until about 2 miles from the Catholic Mission. About 1 mile above this place a large bluff of which I think from a distance to be gravel of the drift period. From the Mission down to Leance can still no exposures, a low gravelly shoreline.

About half a mile below new town where the Marquette Railroad starts from, the slates of the Huron group dipping about south at an angle of 60 or more degrees and striking from east to west are to be seen for quite a distance along the shore line. Further on about two miles distant the Potsdam sandstone strata cover them unconformably and form the remainder of the promontory of this little peninsula. The slates are also in a similar way exposed and overlaid by sandstone, on the other side of the new village between it and the old village.

At the village itself the Huronian slates are covered up by heavy drift deposits (gravel) which contain not only Devonian fossils but also a sort of hard dolomitic limestone which contains gastropods. This may be the rock overlying the sandstones at the so-called Silver Mountain as I afterwards will be able to ascertain. Met Mr. Brooks accidentally. In the evening went over to the old village to make preparations for my excursion.

Saturday Sept. 30. Went up to the Catholic Mission. Under the house of Schaefer's hotel and all along the way to the Mission the layers of the variegated sandstone crop out in horizontal position from under the drift. Some layers are a pretty fair solid building stone partly impaired by large pebbles or by irregular cross stratification. Other beds are a dark red and white variegated arenaceous shaly rock which readily decays. Some of the better sandstone beds form the top of the first lake terrace and from it the new stone church of the Mission is built. The hardness of the sandstone is just right to make him a good building material. Juncracks and ripplemarks are plainly exhibited on its surfaces.

Expended 6 dollars for provisions and started about 10 or half past ten. We followed the trail over an undulating hilly land unto Sturgeon River which is 8 miles from Leance. Crossed in Leance which we was fortunate enough to find and traveled through somewhat swampy places to the Otter Creek. We followed the trail passing along its south side and had to encamp before we reached the forks where the trail crosses it.

Sunday Oct. 1. After a comfortable night comparing it with the poor accommodations we had, took up our travel at about 7 o'clock. Day bright. After toilsome travel we reached Otter Creek, passed and crossed it several times holding a southwesterly direction until at 12 o'clock we finally came to a quick-rising ground which we ascended and found on its top limestone exposures in perpendicular cliffs 20 or 30 feet high. The lower end of the beds is not to be seen and in the ravines below also no outcrops of rock are seen. Still I found numerous fragments of red sandstone. The limestones are dolomitic and argillaceous and split with uneven surfaces in irregular fragments. Fossils are scarce and indistinct, but among others I recognized a cyathophylloid coral, several Leptaenoid shells, *Orthis lynx*, one *Orthis*, several *Pasteropodes* and bivalves.

The rock exposures present a bold face to the north. The ravine runs to the west. There is also a slight inclination of the strata to the northwest. Ascending the top of the ridge I find it extending from north to south on its western declivity and at the south, and there is a wide open view over the country for quite a distance. The rise of the hill from our camping place makes me estimate at least 40 or 50 feet of additional strata to those observed in the bluffs. The strata reach to the highest summit and are there considerably inclined to the eastward, but this is probably an irregularity due to the decay of the outcropping rocks underneath. We returned that same evening a few miles distance to Otter Creek where we encamped.

Monday Oct. 2. It rains most all day and by a very fatiguing travel we reached Schaefer's hotel in the evening a little after 8 o'clock.

Tuesday 3 Oct. Expense for Indian guide paid 6 dollar 50 cts. Some of the hard yellowish colored limestones containing *Pasteropodes* in the bag are from the drift at Leance. They seem to belong to the same limestone formation forming the hill in Town 51. Hotel bill 3 doll

Diagram.

Addresses. C. S. Ingalls, Menominee, Mich. Mr. L. F. Young, surveyor Marinette, Isai Peterson, sawmill a few miles up from the mouth of Menominee river. Mr. Brown at same place. David Lakatosch and John Haut, 2 Indians recommended.

Full page Diagram.

at Leance 1/2 to 1 of a mile on lake shore north of old Catholic Mission
Look for calciferous sandstone about 1/2 to 3 rods back from etc P.M. Hill

Near the limestone locality west of Leance there are several others
nearby pointed out to me by Mr. Emerson and Hill. One of them is on the
principal stream in Sec. 33, about 1/2 of a mile north of the point.
Correct (ion) line. Another in in Sec. 7 or 8.

Carl Messinger, Chicago, from Whitefish Mt. quarry
land for 1 quarry by Leance and Fortage entry, lighthouse.
Locality very

33:35. Major M. exposures of marble right along this river
1/2 miles from its mouth. Locally.

at the bend of the Menominee river, at Town 40, R. 30 the country is
composed of shale rocks. The summits of hills palaeozoic. In particular
take notice of a hill Sec. 31 at the northeast quarter of T. In the
same town Sec. 1, finely ripple marked white sandstone quartzite.

From mouth of Sturgeon river, up only about a mile in Sec. 11, T. 39,
R. 30. Iron deposits exposed. But marble in Sec. 12, T. 39, R. 30 in
the banks of Sturgeon river.

On Calumet or Lohka. All to be seen there shown by J. W. Wood.
Go to Leance Mt. doubtful. At Lake Isabelle and the junction
of formations to be seen.

Locally.
Details about Loughton.

Junction of rock on Sec. 4 of T. 34, R. 35 on the Lake Royal mine pro-
perty. Mr. Chapman knows every thing about it.

Patch of sandstone resting on the trap. On the Sheldon and Colum-
bian land on the hill a little south of the centre of southeast quar-
ter of Sec. 33, T. 34, R. 34. Emerson there knows.

Trap series seen all around Loughton, also at South Menominee mill.
Conglomerates on the trap. At the south Menominee mill, sandstone above
the trap seen.

Ship canal at the end of Fortage Lake at their quarry on lake. Sup-
erior some more exposures of the higher strata at the sandstone.

Series of trenches on the St. Marys location (Emerson) which show
a great many rock exposures.

Mr. John(?) Senter at Eagle River recommended by Prof. Hodge.

Leather T. Emerson inquires about him at Whitefish Mt. Particularly
so painted about Ontonagon.

Mr. Bolton can give the exact details about the junction of sand-
stone and copper rocks on the road from Calumet to Torch Lake.

Limestone with *Lentamerus oblongus* corner of sections 14, 15, 23, 24,
T. 30 R. 34. Limestone in way it is marked range 33.

From Marquette to Loughton per steamer.

Douglas House, Proprietor W. Allen. Tell him sent by Brooks.
Also recommended by G. G. Wagner,
Marquette.

Memorandum. On white side of the river mining mine one of the bed
of bits of copper 1 mile from the hotel.

Building details, Harcoot.

Every morning the steamer Cable leaves for L'Ance. Got out at the
sawmill called Baraga.

Stop at Schaefer's. Get there some accompanying Indian for Silver
Mountain. Get supplies. From there a trail to Ontonagon if I should
be dis. used to follow it. also a wagon road to Houghton.

Honorable C. A. MacCormac (legislator).

If I have time, go across from sawmill to the new town. Terminus
of new road.

Jas. ? Houghton there, brother of Dr. Houghton. If he is not there
all along the shore north of new town and south at old sawmill out-
crops of soft Huron slate. Then strike the sandstone. Go back to
Houghton by steamer.

From Houghton to Calumet Mines. Then to Eagle Harbor by stage. From
there to Noweenaw It. (Before leaving Eagle Harbor inquire for Mr. A. B.
Wood at the argilloid mine, also Bolton, engineer. rely on his ad-
vices anyhow.) Ask for advice if it pays to visit Ontonagon

Name's recommended. S. L. Smith, James R. Devereaux, John E. Foster
at Houghton. (Honorable W. G. White (Lansing) M. Wood, agent at Calu-
met.) at Eagle Harbor A. B. Wood as above.

3 full page diagrams.

About 1 mile west of Grand Marais shore banks about 100 or more ft.
high. Above all a reddish sand with some iron colored beds as usual
at the shore about 8 feet above water a bank of peat 3 feet thick in
part almost all leaves. bluff in part more clay is and directly below
it a thin seam of sand. Then the red clays with many pebbles is crop-
ping out at water's edge. In the upper layers of the peat is plenty
of tolerably well preserved wood of cedar ectr. above it is gravel bed
followed by sand layers.

All this is exhibited a little distance before reaching the creek
which comes from a lake nearby. On the other side of the creek there
is a large naked bluff about 500 feet high. On top much gravel, below
more reddish sand with peculiar wave marks in the exposed section

wave marks illustrated.

and here and there some gravel beds interposed. Near water mark the
sand gets merged in to the red clay. No peat layers there. In the peat
layers below are well preserved stems of birch wood ectr. Some layers
of magnetic iron ore sand interstratified just in the region of the
red clays.

Some peaty strata are seen further on a little distance about 100
feet above the water. Below is much gravel and also red clay but the
strata wedge out and are very irregular in their outcrop.

feet

154. Upper 10 ~~feet~~. edge-shaped, brittle, hard, light colored.

154. Middle 8-10 feet. Dark, Scleritic, hard limestone banks with some succoid marks. Coarse on the surface. Some banks with many Bryozoa and Leperditia.

About 10 feet lower, like upper strata but thicker banks with many bivalves, Leperditia, Trilobite, Detrisa layer mit (with) succoid chert nodules.

156. Sandige knaurige (scanty or scarce) Necklike (necklike) mit chert knollen (with chert nodules).
Blau (Blue) grün (green) oder (or) dirty yellow mit (with) Bryozoa, Bivalves, in gneiss layer.
Contains (?) jasper
Trilobites, Brachiopods, Orthocer.
About 6 fuss (feet) dip (or might be layer).

Diagram on cover

Novaculite, Marquette

Diary Oct. 4, 1871.

Cartons Mine Sec. 22, T. 39, R. 23. Brandt geoses paid.

Expenses from Lauce to Noughton 1.50.

Noughton, Wednesday Oct. 4. Arrived last evening with a small steamer from Lauce. On the way had an opportunity of observing the sandstone outcrops along the shore from closer proximity. The formation in general is composed of soft argillaceous and thin bedded strata but some banks may furnish a useful building stone, not however to furnish an article for exportation.

Made the acquaintance of Mr. Wagoner, brewer, which presented me with a heavy copper specimen from Minnesota mine which once had attached to it a large mass of silver, parts of which are yet visible.

Dr. Fenjus(?) also gave me a fine specimen of crystalline copper said to come from the central mine.

In the morning after packing a box of specimens and leaving them in care of Mr. Louis Lewis to whom I also consigned the other two boxes, I went on board of a small steamer, Mystic, and in the moment of departure I saw the porter of the hotel dropping one of my specimen boxes to the ground, breaking it all to pieces and scattering the specimens. I sent a letter to Mr. Lewis to take care of the specimens and to have them packed up again and forwarded to me.

In passing over the lake I observed the small peninsular tongue at the base of which Lauce is situated, to consist principally of horizontal sandstone layers which near Lauce are seen deposited unconformably on the slate of the Huronian series. In the continuation of the travel towards Marquette, all the way along until reaching Big Bay Point the whole shoreline is composed of red sandstone layers, forming a belt of about one mile wide around the base of the high granitic hills composing the chain of Huron Mountains.

The sandstone is of an argillaceous character and does not appear to contain many useful beds, but the lower strata of it in the proximity of the granite are said to be of better quality.

From Big Bay Point on to about 2 miles this side of Presque Isle the sandstone deposits are frequently interrupted by protrusions of low granitic domes. About two miles this side Presque Isle the granite occupies the whole area. The particulars of the line from that point to Marquette are stated in a former memoir. The different islands of the coast appear all to be granite which incloses the volcanic (volcanic) rocks of Presque Isle from all sides very closely.

Thursday Sept.?(Oct.) 5. Received letters from home and money from the Governor (300 dollars). Paid back to Mr. Brooks the loaned 100 dollars.

After delivery of my boxes to Mr. Spear which are in all 3 boxes and 2 barrels I left at 5 in the evening for Leominster. Expenses at Hotel 3 dollars. Railroad to Lancaster 1.00. Steamboat to Lenoxville 1.50. Breakfast .75. Luggage transportation 1 dollar. My baggage was by mistake sent left at Lenoxville but I am promised by the officials for speedy recovery of them. Left big hammer at the hotel. To notify Mr. Brooks of it. Arrived at Lancaster Friday morning at 9 o'clock.

Oct. 6. visited Mr. Ingalls and got by his acquainted with Mr. Barton and Mr. Green, the 3 owners of Dresh line. Barton drove me round in the afternoon. Showed me the rock exposures in the bed of the river, and some smaller ones about 3 miles out along the road to the mouth of Sturgeon river. It is a hard dolomitic rock containing several species of large gastropodes, some crinoid stems and cavities filled with calc spar and quartz. The weathered rock becomes soft, saccharoidal and of yellowish color, showing also softer and harder portions.

The beds are at the bed of the river covered up with a thick covering of drift which is below a clay bed with many pebbles and angular fragments, mostly limestone and dolomite. Above it is some purer reddish clay with a considerable proportion of sand which gives it the properties of a fine (fine) clay. Above all is a heavy layer of fine beach sand.

In some swampy spots also, insignificant deposits of an impure bog iron ore are noticed.

The rock beds scarcely escape from the water and begin to be visible some small distance below the first dam near the bridge leading to Lenoxville. The outcrops continue some distance up the water forming cliffs over them until the water ceases all above the third dam which is about 1/2 a mile from the first. From there up the river for about 20 miles not much of rock exposures are said to exist but there in some falls considerable outcrops can be seen. The country around the river is low, partly quite swampy.

Hired a experienced woodman for my trip up the river and agreed to pay him 5 dollars per day.

Saturday Oct. 7. Expenses for provisions 10 dollars. Hired one horse team at 1.50 per day. 75 cts freight for carrying utensils.

After tedious (tedious) preparations for a trip on a wagon up the state road along the Lenoxville we finally started at half past 5. Loaded with considerable baggage and 4 persons. 1, Mr. Barton, 2, Mr. Barry 3, Mr. Kennedy (and 2 gentlemen of the press - crused) which wanted to accompany us. The road is in excellent condition and we proceeded 10 miles to a farmhouse where we stopped for the night. The woods are all in flames and the smoke darkens the air.

Of rocks no outcrops present themselves all the distance but in some places it must come very near the surface because a great many angular blocks are strewn about. Another use the gently rolling and partly sandy land is covered of considerable gravel deposits which are used for the construction of the road. The soil is of argillaceous nature and proves to be very adapted for agriculture wherever such experiments are made. The farm on which we stop is seven miles this side of the great rapids of the river.

Sunday Oct. 3. Left in the morning. Bill paid 3.50. After a 5 miles ride we came to a creek where I dismounted and followed it to the river which is about 1/2 mile distant. At the river the rock ledges are forming a flat bottom of its bed but scarcely any exposures along the banks are seen. It is a silicious dolomitic rock in beds some inches thick with uneven surface. In weathering some prove to be penetrated by considerable silicious veins. Some beds are oolitic, and also a brecciated condition of the beds is noticed. Above all are remarkable numerous slabs and nodules of concentric conchoidal structure but I could not detect any organic structure in it. The rapids continue about 3 or 4 miles but nowhere were plain exposures present themselves.

Left some 5 specimens of rock at the farmhouse. Stopped a few miles further at eleven o'clock for dinner. Bill 3.50.

Since leaving the river no outcrops of rock are noticed. The surface is formed by drift deposits with numerous large limestone boulders and smaller pebbles which are predominantly limestone. The surface soil is generally a reddish argillaceous sand soil. Near the tavern where we stopped Mr. Barton told me is an exposure of limestone about 30 feet high but by going to the place I was directed to I could not find it. All the hills are composed of drift material and the lower ground is swamp. After passing the north boundaries of Town 35 the land gets more hilly, still no rocks are seen except drift boulders. But arriving at a creek close to its entrance into the river, along the bluffs considerable exposures of a talcose shist of red, grey or also brown color and of otherwise variable nature is projecting. Intermingled with it are nests of a green quartzite and some beds of a shistose soft diorite.

From there on whenever rock is exposed it is of Huronian age. Dioritic rocks are composing the environs of Seneca Falls but in the overlying drift still the limestone forms the predominating material. We arrived at half past 3 at a farm and camping ground which is situated 1 1/2 miles from the river in Town 35, R. 38. The section I do not know.

Monday Oct. 4. Bill 3.50. Started for Green mine at half past 7. Distance about 10 or 12 miles. Walked there on tolerably good road while Mr. Barton and the other companion (companion) were driving to a camp on Sturgeon river 3 or 4 miles off from the mine. In going to the mine we saw no exposed rock, all the surface being deeply covered by drift deposits which contain many large limestone blocks.

Arriving at the mine at the mine which is until now only an exploring ditch we found the strata of the iron bearing Huronian group in some places cropping out but generally also covered by drift. One ditch running about north and south while the strata are dipping south at an angle of about 20 to 40 degrees, is over 300 feet long. At the southern end which begins at the edge of a swamp, the strata running east and west are a hard jaspery or partly quite pure iron ore in regularly bedded evenly splitting slabs. Similar strata sometimes more a pure ore, sometimes a jasper continue for about a 100 feet. I numbered them 1 and 2.

Then follows to the north consequently below them a conglomeratic iron ore with quartz pebbles and jasper or in places quite pure but of not more than a few feet thickness followed by ferruginous or white quartzites. These strata I numbered 3.

Still further to the north similar slabs but less rich in iron and gradually merging into an argillaceous rock are continuing for more than a 100 feet, when the ditch ends. Some yards further another small hole is dug which contains a ferruginous or slaty quartzite. One very remarkable circumstance is to be plainly observed in the ditch. The slaty and iron ore strata of the Huronian group are sticking out with their edges presenting deep furrows and cracks at the surface. These are filled out with the very ferruginous first deposits of the Potsdam sandstone which is horizontally spread out over the discordant edges of the Huronian rocks. And in some specimens the intimate connection between the two is plainly to be seen.

The lowest strata are very ferruginous, sometimes hard, sometimes soft oolith like. But a small space above the Potsdam sandstone is little colored, almost white. By going towards the Sturgeon River the Potsdam sandstone beds are seen in horizontal position forming an escarpment of at least 15 or 20 feet high and continue to do so for a mile. On top of the sandstone beds are a number of large limestone blocks of dolomitic character. They are not in place but still not far from it, must be this limestone in place. One specimen of this limestone is in the collection marked Sturgeon River. About 4 o'clock we came into camp.

Green mine is situated in Town 30, Range 20, Sec. 23, northwest half of the northwest half, and northeast half of the northeast, the sandstone exposures begin at the same location. Our camp is on Section 2 of the same town and range.

Thursday Oct. 10. Rained all night. Mr. Barton returns with a box of specimens and some other superfluous baggage (incl. rubber coat), tried to send home Mr. Berry but he sticks to us like a louse (louse).

About 1/2 of a mile from our camp traveling northeast we come to the Sturgeon river on whose banks high ridges consisting of almost perpendicular ledges of a white regularly bedded quartzite crop out.

The beds are 2 or 3 feet in thickness or more with very even planes of stratification. They dip at one place about 10 degrees to the northeast, (dip), but in other places they dip and strike nearly considerably. One hole has very distinct ripple marks. The direction of this quartzite formation is igneous. It has continued one above the other with the same dip and strike for half a mile until at the foot of the falls a change of rocks takes place.

The quartzites form a ridge which continues on for some distance on but at the falls is separated by a deep ravine rises another crest in front of them which has a series of rocks striking from northeast to southwest and dipping to east north east, lowest, that will say forming the bed of the falls, and the left hand side of it looking uprivers, are dark diabasic layers with considerable intermixture of iron pyrites and red crystalline conglomeratic and gneissitic rocks with bands of iron ore alternating several times.

On them follow some silty shaly platy silicious rockbeds with ripple marks interstratified with heavy conglomeratic beds, which as it seems form the transitory members from the quartzite beds to those lower ? strata. I imagine a section from the quartzites to the beds forming the falls in the following diagram.

Diagram of above.

The study of the concerned rock specimens will give an idea of their precise character, but it is so multi-various that the specimens do not cover a part of all the varieties. The platy and conglomeratic beds are merging into each other. After dinner I went over the ground again. The quartzites strike from southeast to northwest and dip north east. Their position is almost perpendicular in places. The rock series at the falls strikes almost from east to west, a little deviating from it towards northeast and southwest. The dip is to the south with a corresponding deviation. Strata almost perpendicular.

The variety of rocks in this lower series is very great but after passing the conglomerates in the downward series principally a dark silty shaly hornblende rock with iron pyrites and a red quartzose rock with considerable magnetic iron ore streaks are predominant and alternate frequently with each other.

Above the rapids we found a canoe. Took possession of it and floated it down the rapids or carried it in port. Tomorrow we intend to continue our travel down the Sturgeon river being now able to transport our baggage in an easy manner.

Wednesday Oct. 11. Bright weather. Making preparations for our journey down the river. Left at 6 o'clock. About one mile down the river on the right hand side heavy beds of quartzites striking from northwest to southeast, dipping eastward are exposed as (at) near the falls of Sturgeon.

Further on are no exposures until having passed Line Creek. About half a mile below its mouth large rock masses project at once from the left bank of the river and form a rounded hill of about 25 to thirty feet high. It is a red colored limestone (marble) with silicious veins but not so predominantly as I have seen it in the marbles near Marquette. But its structure is full of irregular seams which make the rock break in very irregular fragments and almost worthless for architectural purposes. The exact situation of the outcrop is Town 39, R. 23 sec. 13. No other rocks are seen in contact with the limestone.

About a mile further down the river slaterock striking about east and west with a southerly dip and almost perpendicular position is seen crossing the river. Some quartzite seams are alternating with the slate and a number of slaty iron ore fragments in the river bed indicate the neighborhood of such strata.

Further down, a bar passing through drift embankments, the slate beds are seen again crossing the river with the same general direction and dip as the former exposures. The slate is quite similar to roofing slate with a silty surface.

Still further in sec. 23, just in the centre of the section is a round protrusion of diorite peeping out of the drift which covers in thick layers the whole land joining the river. And below some distance below again some slate strata are seen in the river banks.

But then unto the mouth of the river no more exposures of rock, except very heavy drift deposits are seen. We arrived between 3 and 4 o'clock in the evening. Among the drift specimens I collected some varieties of marble which must be not far from the river exposed.

Thursday Oct. 12. In the morning the fellow to which the canoe belonged which we used coming down the Sturgeon appeared to find it out and claimed 8 dollars, which sum as being extravagant I refused to pay.

About 200 yards below the mouth of Sturgeon river there is a rock protrusion crossing the river obliquely which consists of talcose rocks, partly in a stratified layers of talcose slate or shist, partly in serpentinelike masses with veins of calcopare (calcepar) and several other minerals interspersed. They are all marked S. M.

About 50 yards further down after an interval with no exposures again similar rocks protrude which have the appearance of a diorite but are clearly united with the former by the nature of the rock and by the immediate sequence of similar talcose rocks as above.

In passing down the first outcrop is only about 50 feet wide, the second about 100. Obliquely downwards similar rocks are seen on the other side of the river being exposed there for some 4 or 500 feet along the river bank. Then on both sides of the river no more outcrops are seen until arriving at the falls which are about 1/2 mile below. The rocks collected at the several outcrops will be marked S. M. 2.

At the falls the river runs through a narrow fissure in the rock for about 1 or 200 steps forming rapids. The rock is a white and green diorite-like mass, variously finer and coarser grained and occasionally with a slaty band. Its strike and dip is not clearly to be ascertained. The whole ridge however has a direction from northwest to southeast with southeast dip.

Below the falls the rock exposures are cut off at once and the river flows through a level country with hills some distance back from the banks. Also in the other previously mentioned exposures I am inclined to suppose the same strike and dip from northwest to southeast with southwest dip. But I am far from being convinced because I have not been able to discriminate between stratification and cleavage lines. Specimens from second outcrop are not marked and also the white and green spotted ones (rocks) from the falls I neglected to mark.

Friday Oct. 10. Mr. Lemond, went last evening 3 miles down the river to procure a canoe and man but has not returned yet at 7 o'clock. Returns at 11 with a man and canoe which we can use all the way down the river. At 9 o'clock we carried our things over the portage at the falls and floated down the river. Little ways below on the left side and a piece further on, on the right side, small protrusions of rock are seen, to all appearances it is the same rock which composes the falls.

About a mile below the falls upright strata cross the river from northwest to southeast. They are composed of a red crystalline rock with talcose greenish mineral interbedded and of some subordinate slate layers between. The rock has much resemblance to the red strata at the upper Sturgeon falls. From there on both sides of the river are hills with large rock exposures. In one place I observed their nature on the left bank and found those to be a slate rock striking from north west to southeast. The specimens of those exposures are numbered in the order they were found with 111 to 5, No. 3 to 8 is unstratified rock which comes out a mile below this last exposure and continues down to Sec. 3, T. 26, R. 26. It forms several islands of rock in the river and protrudes on the hillsides enclosing the river in large exposures.

The rocks have decided (decided) similarity with the rocks of the falls above but there is a great variation in the grain and relative predominance of the constituent minerals. Some quartzose veins are seen traversing it. At the above named section 3 in town 26, we camped the night close to the river.

Saturday Oct. 14. Got under way about 3 o'clock. The outcrops of apparently unstratified rock are a series of rounded boulders which partly along the banks, partly in the bed of the river protrude. Sometimes for quite a distance, no rock to be seen except drift deposits of which red clay with pebbles are seen in several places.

At Nelson Creek about two miles below our camping place, rapids of about 1/2 of a mile long begin and continue down to the so-called Grand Island. The rocks exposed are a series of red ferruginous slates with heavy quartzite and jasper beds containing considerable admixture of red ironoxide followed by very massive rock of a grey color. A part of the very different rock varieties are represented by the specimens marked a. b. c. d. e. f. etc. The grey rock masses are not clearly stratified but the quartzite beds and jaspery strata are regularly bedded and banded in the direction of stratification. But I am unable to find out the correct striking direction. The dip is at a very high angle and some flexures are noticeable in the strata.

The just mentioned grey rock masses are decidedly belonging to the diorite family. A number of exposures of such rock but in every place again with a different shade are seen along the river until down to the falls of Lemene-bongowa where an immense protrusion of such rock covers a wide area and forms the falls. The rock at the falls is dark green with quartzose veins. About 1/2 a mile above the falls the greenstone contains a red crystalline mineral. At 3 o'clock we arrived in a heavy rain at Lemene-bongowa and encamped.

The river contains a remarkable number of Unios of many different species. Among others *Unio rectus plicatus* ?

Sunday Oct. 13. It rained and snowed all last night. The water run through the tent and we got all over wet. Our fire was extinguished and the cold was very severe. In the morning fine sunny weather.

The greenstone at Lemene-bongowa as noticed yesterday forms the falls and a large rocky island in its midst. Also the base of the surrounding hills are large masses of greenstone with occasional quartz veins. The top portion is a heavy drift deposit with limestone pebbles. Some portions of the greenstone are filled with numerous globules of different size. The mineral composing the globules is of a reddish color. No stratification observable in the rocks. The grey rocks in contact with the stratified ferruginous slates and jaspery strata is in close connection with the greenstone and seems to be a mere variety of it.

The greenstone knobs continue about a mile below the falls. Then only isolated protrusions here and there make their appearance, either in the bed of the river or on the banks. The intermediate space is drift deposits partly gravelly with many Trenton limestone pebbles, or red clay with pebbles.

About 4 or 5 miles from the falls again considerable diorite rock comes to the surface and forms strong rapids in the river with a wild rocky scenery on its banks. The diorite is here of a new character. Instead of being aphanitic as on the localities above it is very coarse crystalline containing besides large hornblende crystals and albite ? various other minerals.

In one place there is a bed of great thickness with large inter-
-ixture of red ironoxyd. In some others the fine crystalline mass of
uniform dark color contains large shining crystals of the same mater-
-ial. One other specimen spotted with green hornblende, and pale flesh
-colored Feldspar specimens, I found in a loose block among the others.
I marked it drift because I am not sure of its being found in place.

About $\frac{1}{2}$ a mile or a little over the Lemine falls are situated, large
masses of diorite form islands in the centre of the falls, and on both
sides quite considerable areas are covered by the same rock. It is an
almost aphanitic diorite of grey color with faint red spots. (when)
weathering the outside gets all light red. It is very hard and breaks
in rhomboidal pieces. Also cleavage plains (planes) which make it split
in large slabs of from 2 to 3 inches thickness, are very frequent.
The falls or rather rapids are about $\frac{1}{2}$ mile long and the rock for the
whole extent has the same character. None of the distinctly crystal-
-line hornblende rock is seen there.

With regard to the rapids $\frac{1}{2}$ mile above the falls I have to mention
yet that in immediate contact with the largely crystalline hornblende
rock containing iron ore some quartz beds and silicious earthy looking
slaterock are cropping out. This are very near rich enough in iron oxyd
to be considered as an inferior kind of iron ore. The outcrop is only
about 25 steps long and disappears then under the drift. The next rock
seen below is a diorite of granular aphanitic character and continues
so unto Lemene Falls.

Sunday Oct. 16. Ready for departure a little after 8. Fine weather
and pleasant nights coming. The state road with a fine bridge over
a creek running into Menominee is close under the falls. All other
bridges towards Menominee village are said to be burnt down by the
late conflagration.

Down to Lemene farm after short distance below the falls little
rock crops out. At the farm and in a few places below aphanitic diorite
comes to the surface but most of the space passed by is covered by
drift which is of gravelly nature and contains prevalently limestone
pebbles of the Trenton period.

At the beginning of the big elbow of the river chloritic slates in
upright position cross the river striking from northeast to southwest.

Small distance ahead on the Wisconsin side a considerable knoll of
red dotted greenstone crops out. Small distance further on an Indian
cultivated a farm. I bought of him about for 3 dollars. Here the big
Island in the bend of the river begins. The island is low but on the
Wisconsin side many greenstone knolls line the shore. This is called
Musceonge Island. At its further end the Musceonge rapids begin running
over a series of partly stratified rocks interangled with greenstones.
At one place I observed a distinct strike of the almost erect strata
from east to west with a southern dip. Among the different varieties
of rock exposed is a rhomboid striped variety which runs into a con-
-glomerate and the conglomerate gradually merges into a slaty rock with
only a few pebbles included. There is also in layers aphanitic diorite
rock interstratified.