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Quinnesec, Michigan, No. 1: [specimens] 11000-11138. No. 40 1885-07-02/1885-07-13

Williams, George Huntington, 1856-1894

[s.l.]: [s.n.], 1885-07-02/1885-07-13

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QUINNESEC, Mich.

July 2-13, 1885.

No. 1.

U. S. GEOLOGICAL SURVEY
FIELD SECTION BOOK

No. 40.

July 2-13, 1885.

Quinnesec, Michigan.

G. H. Williams.

11000 - 11138

Survey of the Pre-Cambrian Rocks of the N. W. States.

INSTRUCTIONS.

1. Ordinarily at least two pages of this book will be devoted to one section. On the left hand page place a map of as much of the section as has *actually been seen*. Denote rivers, lakes, marshes, etc., by the usual topographical signs. Denote the ledges of rock, when no structure is made out, by cross-hatching, making the cross-hatching cover as nearly as possible the areas occupied by the exposures. If the rock is a massive one, but still more or less plainly bedded, use the same sign with a dip arrow and figure attached, showing the amount and inclination of the dip. Denote slaty or other very plainly bedded rocks by lines running in the direction of the strike, with figures and a dip arrow attached as before. In all cases where there is the least doubt about the true bedding directions, indicate it by a query. To each exposure on the face of the map attach the number of the specimen representing it. In mapping the section count each of the spaces between the blue line as 100 paces, and twenty of these spaces as one mile, or 2,000 paces. Usually the southeast corner will be placed at the bottom of the page, or at the first black line above the bottom of the page, and at the right hand side. If, however, for any reason, it is desirable to show portions of an adjoining section, the southeast corner may be shifted up, or the map may be turned around and the north placed at the left hand side of the page.

2. On the right hand page place the notes descriptive of the exposures. Begin in each case with the number of the specimen, placing the number on the left hand side of the red line, after which give in order on the right of the same red line the position of the ledges as reckoned in paces from the southeast corner of the section, and the dip and strike when observable, for instance: 4025 | 250 N., 300 W., *Strike, N. 6° E., Dip, 50° E.* Then follow with as full a description of the ledge as possible.

3. The ruling of the left hand page is also arranged so that a smaller scale can be used. Each one of the black lines may represent a section line and the red lines quarter sections and "forties." The scale of the maps may thus be reduced, if desirable, to two inches to the mile (the ordinary town plat scale.)

4. Collect a specimen from each separate ledge of rock, or wherever there is a change of rock on any one ledge. In case of trips made on foot or in canoes, for long distances, neighboring ledges, unquestionably of one kind of rock, need not be sampled, the position and extent of the ledge being marked on the map, with a note that it is of a rock identical with specimen so-and-so. Under the same conditions small sized samples, trimmed to a uniform size of $2 \times 2\frac{1}{2} \times \frac{3}{4}$ inches will be allowed, but in all other cases *large sized specimens*, trimmed to a size of $3 \times 4 \times 1$ inches, must be selected, in accordance with § 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. In all cases collect chips for slicing. All specimens are to have numbers painted on them, in white on a black background, in the field.

5. On the last twenty-five pages of the book give, as may seem desirable, a general account of the examination of the region mapped in the previous pages, correlation of observations, sketches, cross sections, etc., etc.

6. Forward this note book, as soon as filled, as registered mail matter, to R. D. IRVING, U. S. Geologist, Madison, Wis.

#40

SUMMER OF 1885.

GEO. H. WILLIAMS.

Field Notes taken on the

Menomonee River

July 2^d - 20th 1885.

No. 1.

T.

R.



Lower Linnenses Falls

Scale 1 in. = 8 inches

July 2^d 1885.

Arrived at Quinnesec
on the Menominee River, northern
Mich. at 11 A.M.

Went in two boats with
Bayley (Aix), Mr. Buell and a
German trapper Charlie Mörbitz
on a reconnaissance trip to the
Lower or Little Quinnesec Falls.
Looked over the ground on
both sides of the river but
collected no specimens.

July 3^d Went with Bayley
in a boat to the Lower Falls.
[Compare Brooks' Map Geology
of Wisconsin Vol. III p. 469.
Scale: 1 mile = 4 inches.] see opposite
page scale doubled 1 m. = 8 inches

11000 Point on the Wisconsin
side opposite Brooks' w + v. Green-
ish-gray chertic rock without
decided evidence of ^(bedding) Schistose struc-
ture plainly visible. Contains
reddish spots (iron) breaks
easily into flat prisms. Strike

July 3.

2

nearly E-W. Dip nearly vertical

11001 The rocky ridge skirts the river basin below the falls to the point where the river bends sharply to the S.E. The ridge here leaves the river and continues its course S. of West. The rock on the shore at the point of this bend is massive and jointed. It is dark green in color with apparently very little feldspar. This is sometimes in large irregular porphyritic crystals which however are not common.

Just below this point, which is the last accessible at the water's edge, the rocks appear to become slaty as is the case above.

11002 Even in this massive rock occasional narrow bands occur having a wavy schistose structure. Upon the sides of these bands (Slickenside) a mineral appears resembling picosmine. These bands are undoubtedly the same

July 3.

3.

as the massive rock representing slipping or sliding planes in it.

11003

Going from here up the stream the number of these bands gradually increases until the massive rock is replaced by a wavy schistose slate having a greasy feel and apparently talcose. These slates strike somewhat north of west and dip east of north. This is conformable with the narrow bands above mentioned. There is no break in the continuity of the rock. The slaty character commences & increases very gradually. These slates are "flaserig" and contain quartz where they are bulged out. Where such lens-shaped openings — caused by pressure — are not filled with quartz they are empty and coated on their sides with druses of quartz crystals.

Beyond the slaty band the rock becomes as gradually massive

July 3

4

11004 again, but is here lighter in color than the first massive belt encountered (No. 11001)

11005 The transitional slaty beds are slightly different from 11003. They are porous and drusy and are filled with quartz and calcite. The shore here runs E. W. This slaty band (11005) continues some distance just outside

11006 of the massive rock (11004) with a strike nearly parallel to the shore. It appears as tho' the water had worn its way along the line of the softer rock.

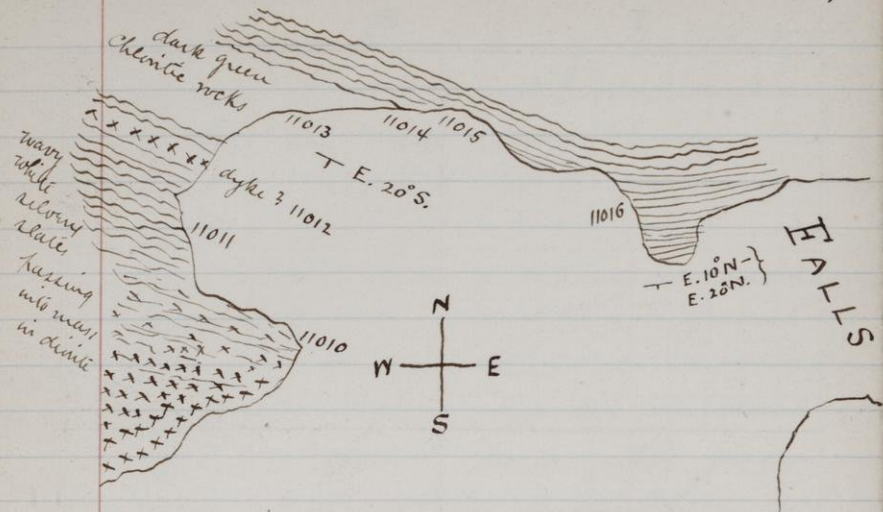
11007 On this belt of transitional rock (11006) is a band of a truly slaty rock like (11003)

11008 This narrow band along the waters edge finally disappears and is replaced by the truly massive diorite (passivite and fibrous hornblende) In some specimens these minerals are very distinct but in others they are blended to one grayish-green mass.

11009

July 3.

5.



In the little cove just below the face this exposure of diorite is seen to pass suddenly, but without any break in its continuity, into silvery white wavy slates.

At the western end of this cove
 11010 No 11010 is the diorite in immediate contact with 11011 the
 11011 wavy slate.

The latter seems to have been developed out of the former by pressure.

Next comes a narrow band of a hard, dark, compact rock in polygonal jointed blocks looking like a dyke. A spring trickles

July 3.

16

over these. The strike of the slates here is $E. 10^{\circ} S$ (comp) At and beyond the dyke they become less slaty. They are dark green and chloritic.

Other bands of massive rocks like 11012 occur in these green chloritic bands. These do not appear like dykes but are undoubtedly an integral part of the green rocks and appear like layers which remained unaltered by the pressure. They are conformable in direction to the wavy schists.

11013

No 11013 is from the widest of the massive bands occurring in these green rocks. It extends down into the water and on both sides grades by insensible stages into coarsely

11014

wavy-schistose green bands which are filled with infiltrated quartz and calcite.

11015.

These pass into wavy similar lighter colored schists

At the eastern end of this cove (p. 5), the rocks, where the trail leads up into the woods, are very

July 3.

7

11.016

finely schistose and closely resembles wood both in color and grain. They strike 20° South of West and dip from 65° N. 20° W to vertical.

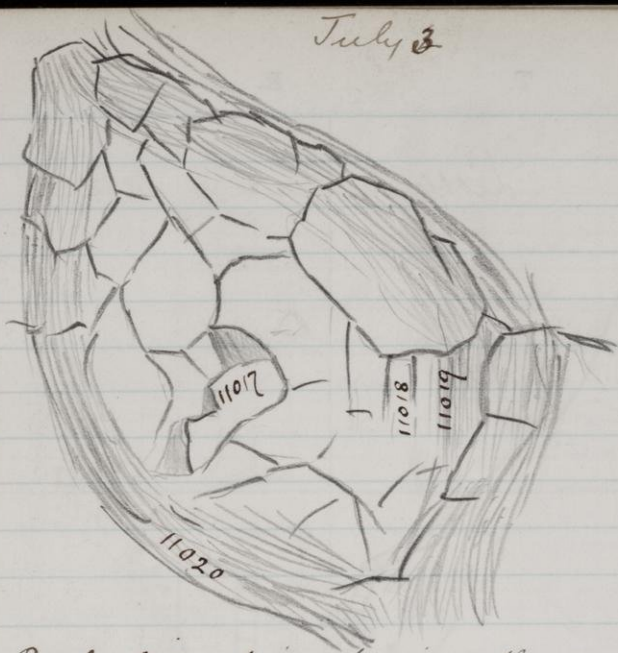
These rocks immediately underlie those green ones just described and seem to correspond to the silvery schists at the western end of the cove. The strike here trends around 30° - 40° . Both strike and dip vary greatly.

Beyond these schists, nearer the water's edge, are other green ones containing occasional masses of the massive diorite.

All the rocks exposed on the Wis side below the falls form one continuous and conformable series with steep dips from 10° to 20° W. of S and strike, except at the eastern end of the cove, of 10° - 20° S of E.

July 3

8.

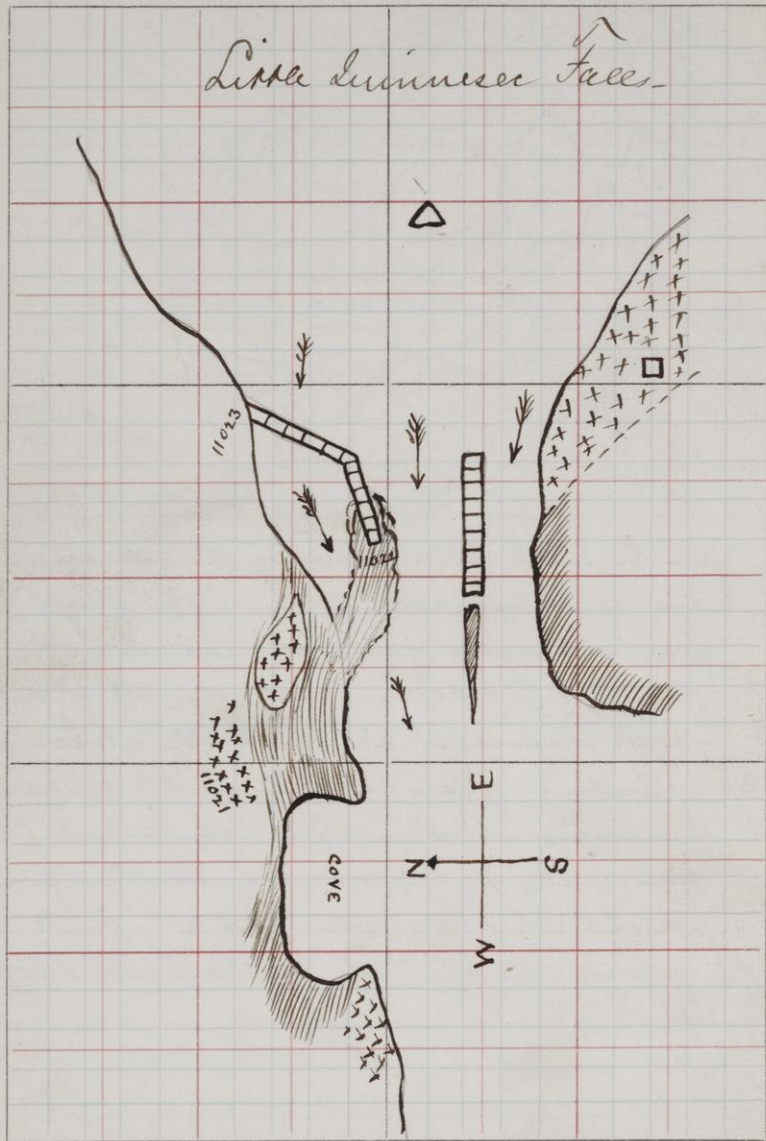


On the little point forming the eastern end of the small cove is a very fine example of a massive diorite core (11017 + 11018) which on every side grades imperceptibly into the surrounding green schists (11019 + 11020). This core is about 10 ft high and 6 ft broad. It is surrounded by the green schists which undoubtedly bred around to give it its lenticular shape. (!!)

T.

R.

Lissa Linneseec Falls



July 3.

9

11021

Above and directly north of the schists (11016) up the trail there is a considerable area of very massive rock. This extends to near the head of the brook-water and is filled with most curious "cross-gashes" looking as though the stone had been squeezed open by lateral pressure. !!

No. 11021.



11023

The rocks at the head of the brook-water are undoubtedly perfectly continuous with these massive ones. This rock or schist possesses no true bedding but only a well marked cleavage parallel to the normal strike & dip of all the neighboring schists. It cleaves into flat angular prisms wh. are covered with "slickensides". It is filled with the same "cross-gashes" as No 11021 which are free of infiltrated quartz and calcite. A careful examination of the wall in the quarry

July 3.

10

at the head of the breakwater is enough to convince one of the perfect continuity of the two rocks.

11022

At the foot of this breakwater is a massive schist

Mr (Bayley) climbed over the top of the high ridge extending along the north side of the basin below the falls and found the rocks the same as at the waters edge. We collected

11024

Dark green schist. High up on this ridge at the furthest point west. Strike $N 20^{\circ} E$ (comp)

11025

Now massive rock with veins of quartz and calcite. Specimen taken from the border of a large mass of quartzite.

11026

Massive rock from the summit of the second high spur below the falls. Perhaps like 11021. From the NE edge of the above quartzite mass. Strike $25^{\circ} S$ of East (?)

July 3. 4.

11.

11027

Massive rock from the top of the spur by the side of the faces just over where 11021 was collected.

Saturday, July 4th '85. Walked over the wood road from just above the Lower Falls toward the Sand Portage with Ch. Mörbitz - (see Brooks Map Geol Wis III p 469) We came out on the river at the eastern end of the great gabbro wall and followed along its foot to the Falls. River here runs 10° S of East. Wall nearly parallel to it, often ca. 125 ft high. The rock at the west end of this wall appears massive, compact and so fine grained as to appear homogeneous. No 11028 typical specimen.

11028

This rock everywhere shows many evidences of having been subjected to great pressure. It is seamed, jointed and cut by "cross-gashes" and parting-

July 4.

12

These joints often run in many directions producing something resembling a coarse breccia without cement. The rock is also frequently slickensided; so much so as to produce a regular schistose mass like that on the Wis. side below the Falls, but much coarser. These parallel slickensided planes often curve around massive lenticular cores.

11029

No. 11,029.

Much quartz with some calcite and other minerals is found incrusting the sides of these joints and gashes or filling them completely.

11030

Specimen of the gabbro somewhat schistose from pressure with fine cross-gashes.

11031

A very coarse gabbro with long hornblende crystals. This from a block found at the trail near the Falls; west end of the ridge.

11032

July 4.

13.

- 11033 Fine grained compact gabbro from near the west end of the ridge
- 11034 Porphyritic Variety - Same loc -
- 11035 " " " " "
- 11036 Finer more homogeneous variety with calcite - same loc.
- 11037 Dark green compact rock broken from a large block found on the shore -
- 11038 Slate, in situ near the shore -
- 11039 Gray schistose rock very hard and brittle, further east than 11038 very near the massive gabbro. Remembers a hornstone but appears to pass into the gabbro.
- 11040 Greenish gray brittle rock slightly schistose - from a wall immediately west 11038.

July 4.

WIS.

14

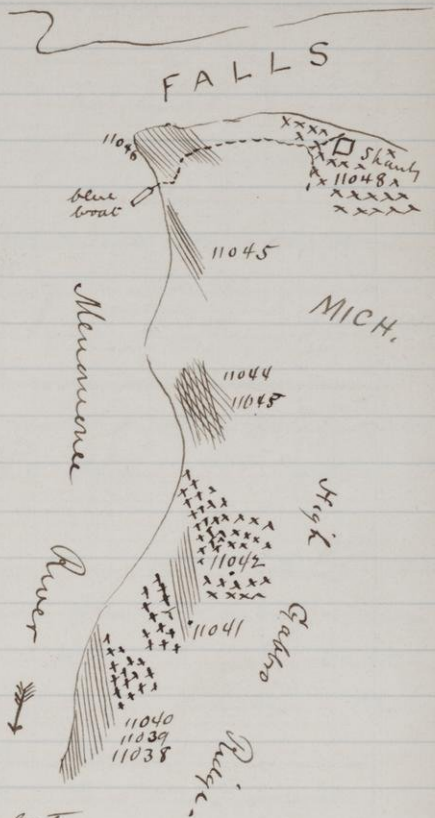
11041

As shown on
this sketch -
map the slate
or schist 11041
appears as one
point in a very
narrow band
striking $E 30^{\circ} S$
which may be
followed way
up the hill with
perfectly massive
gabbro on both
sides 11042.

11042

It seemed at
first sight sight
that the schist
graded into the
gabbro above but later
the schist in a band not over two ft.
wide was traced up the hill.

Farther toward the west
massive gabbro continues along
the shore for a short distance and
then gives place to a slaty rock
cleaving into rhomboidal pieces
It therefore has no strike but trace



with nearly equal rate in nearly every direction perpendicular to its surface. Over this expanse

11043

greenish variety and

11044

the gray silvery kind -

11045

These states are succeeded by similar ones of a dark green color which extend to the blue boat (map)

11046

Beyond here at the extreme corner of the falls they are lighter in color again.

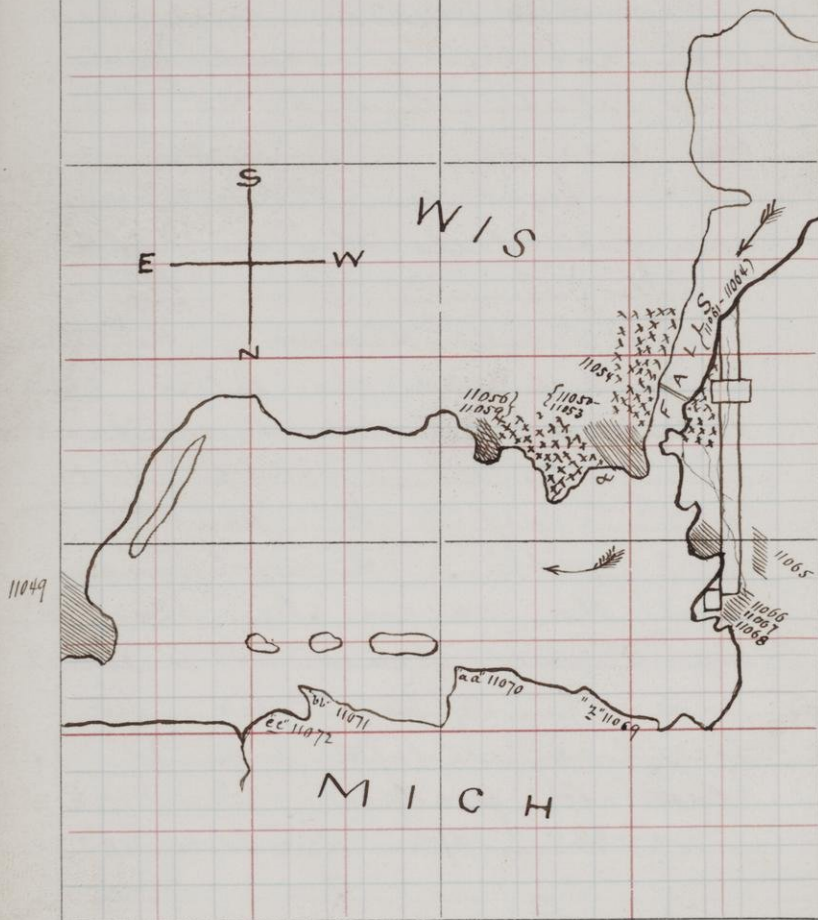
11047.

At the summit of the Falls on the N.W. side the silvery green slate change abruptly to compact green gabbro which compose the eastern half of this point.

11048

Just behind the woodman's shanty the rock has been blasted and is well exposed. It is composed of green of two shades; perhaps hornblende (after augite) + epidote (after feldspar). This rock closely resembles the block 11037

Upper or Big Linnesecc Falls.



Monday, July 6th 1885.

Big or Upper Quinnesec Falls
 [see Brooks map: Geol. Wis. III. p. 473.]

11049. Massive green rock from the
 furthest point on the Wis. side of
 the basin below the falls. Rock
 decidedly schistose E 20° S (comp)
 strike; Dip nearly vertical.

At the west end of the basin
 on the Wis. side just below the
 Falls the rock changes from a
 beautiful massive diorite to
 schistose varieties.

11050. At the foot of the high rock wall
 which bounds on the west the little
 bay α is a red band containing
 dihexahedral quartz crystals. It
 looks like a quartz porphyry but
 is decidedly schistose. Str. E 20° S
 Dip vertical. Toward the south this
 red band which is not over 5 ft
 wide graduates into the normal
 gray schist.

11.051. Variety intermediate between the red
 band and the gray schist.

July 6th

17

- 11052 Typical gray schist from a few ft further north.
- 11053 Schistose rock somewhat different from No 11052 taken from the side of the high wall which ascends here.
- 11054 Beautiful typical diorite from further north. Actinolite compact and massive. This rock is stated by Maj Brooks to compose this entire region which however is not the case.
- 11055 Rock from the ledge 20 ft beyond (south of) 11053. Less schistose. This graduates into perfectly massive diorite which is in position beyond and at the head of the falls.
- East of this point near the next small cove the rocks appear in interesting relations.
- 11056 Massive diorite (11056) is the prevailing rock, but in this considerable slaty rock occurs. The diorite is here greatly crushed and slickensided and so penetrated by cross-gashes as to

July 6.

18

- 11057 resemble a schist or breccia. It is exactly like the gabbro ridge at the lower faces. It appears to pass gradually into a slate or schist. (11057) Sometimes this slate is much brecciated and again cemented with calcite. Considerable masses of the latter mineral appear as though wedged between larger pieces of the slate and the calcite in turn is filled with still smaller fragments of slate. Well crystallized Iceland spar is not uncommon in cavities in this calcite (11058)

There seems no doubt after a careful study of a large number of blocks at this locality (in situ) that the typical massive diorite, like 11056, becomes gashed and brecciated and then changes to rocks like 11057 + '58.

- 11059 taken from a much brecciated and broken diorite block shows both massive and schistose rocks

July 6.

19

equally filled with calcite. In the large block the true connection existing between these two rocks was much more apparent than it is in the specimens. Its whole upper surface was composed of the slate which had evidently been formed by sliding action in the diorite.

11060 is from another similar block near the other. The slaty portion is here much flatter but there is little or no calcite.

On the west (Michigan) side of the falls the hydraulic works have recently made great excavations. The upper portion (head of the Falls) is here - as opposite - composed of massive diorite - not of schist as Maj. Brooks has it. The rock is beautifully fresh and green. Large masses, thrown out of the excavations lie at the

upper end of the Breakwater - The rock contains immense quantities of calcite. It shows in places relations to intercalated slaty bands exactly like those just mentioned as occurring on the other side of the river.

11061

Typical diorite. This contains calcite and is often gashed and brecciated. It is also tra-

11062

versed by frequent quartz-seams another variety, probably altered from the same locality but less distinctly cupreous.

11063

Rock often slickensided occurring with and apparently coated with a chlorite slate.

11064

is a rock only occasionally met with among the numerous blocks of the others and not discovered in position.

The massive diorite here appears to be perfectly continuous with the diorite opposite, on the Wisconsin side of the Falls. It is not

July 6.

21.

noticeably schistose. The recent deep excavations exposes this rock very finely. On larger exposed surfaces there are enormous amounts of fibrous and laminated talcose or chloritic minerals secondarily developed which along with the calcite indicate the profound alterations to which this rock has been subjected.

11.065
Near the north end of the great sluice leading to the hydraulic engine-house in a rock wall behind this house is a most instructive exposure showing the gradual transition of massive diorite to sericite (?) schist. The schistose structure is only gradually developed as the mineralogical composition changes.

11.066
On the north side of the engine house light sericite schists are well exposed.

Directly underneath this

11067
11068 house is a fine exposure of sericite schist grading into chlorite schist as given by Brooks - (his x + y)

- The schists along the north shore of the large basin below the falls are Brooks' "z" (p. 474)
- 11069
11070 "a a". This specimen does not contain much of his pinkish feldspar.
- 11070^a One specimen from this point apparently contains much red rutile(?) surrounded by rims of leucocoxene(?)
- 11071 "bb" Specimens only of the huge red veins running parallel to the shore. They externally resemble felsite, but are red Jasper or gray or banded flint.
- 11072 "cc" Last out-crop - end of the cove. Appears very massive and is perhaps Brooks' No. 2073 - dyke(?)
- All of these schists are undoubtedly altered eruptive rocks.

Tuesday, July 7th - 1885.

Worked along the sides of the river above the Falls in a boat with Jas. Durant.

11073

Brooks' "p" Mich. side which he calls "light greenstone of medium grain resembling Kersantite." (11073) This appears to be the usual coarse grained diorite exactly like that occurring on both sides of the falls. Just as there, so here it has occasional schistose beds running through it. On the shore the rock is weathered gray. Where fresh it is light green with much feldspar. No 11073 is a typical, fresh, rather coarse grained piece from a large block found here in the woods.

11074

Above this point is another marked by Brook as composed of "biotitic gneiss". This is a fucile chlorite schist with red crystals of feldspar like several found yesterday below the falls. It does not look at all like a gneiss but rather like

an altered diorite or diorite -

Just in front of this is a small island outcrop with the same rocks exposed on it. Here the strike is E 12° S. These rocks are just like 11074 without the red feldspar. no specimen was taken.

11075 Opposite this point on the Wisconsin side (at Brooks "o") is the same rock, "Chertic schist" No 11075.

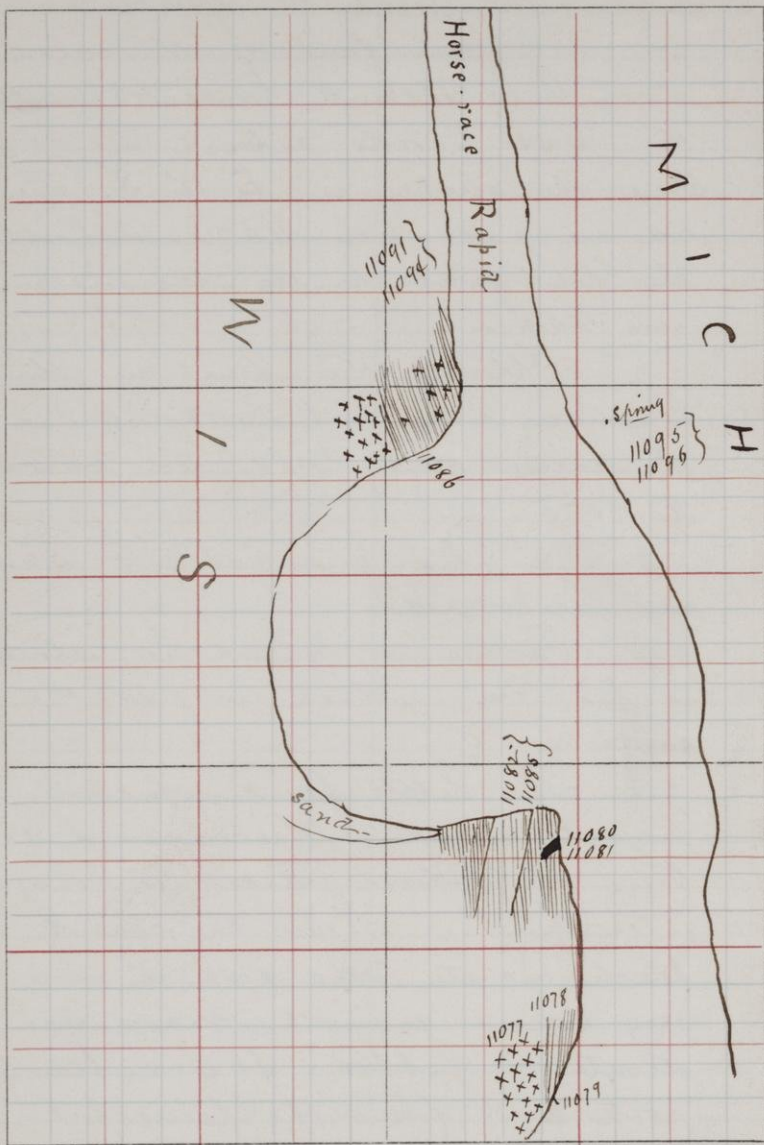
"n", his quartzschist was not discovered.

11076 Farther on, behind the island, is his "m" which is just the same as "o"

11077 The little point which projects on the Wisconsin side below the Horse Race is very interesting. Near the sand beach on its lower side is a very coarse grained massive diorite or gabbro. It is a beautiful rock and forms the principal mass of this point. 11077.

T.

R.



July 7

25

11078 Near the shore this changes to the schistose and slaty rocks which were seen below. Strike from due E W to E 10° S. (11078)

11079 Near the shore is a narrow straight siliceous band in this rock following the strike and looking like a dyke (11079)

On the upper side of this little point the relations of the rocks are even more curious and instructive. There is considerable massive diorite as below in which is a very fine grained rock looking like trap, which cuts across the strike and may be a dyke although it grades into the coarser rock on the sides. 11080 is this

11080

11081

rock. 11081 from the sides of the band showing the transition

Considerable rock just like this, some in large blocks crossed by white veins; some in situ in veins like 11080 was also seen at the lower end of this point.

July 7

26

On the upper side of the point is considerable "biotite gneiss". Some of it looks porphyritic with feldspar crystals standing out prominently on weathered surfaces. This gneiss band appears to cut across the strike of the more basic green rocks, which are here for the most part schistose, and yet its bedding is parallel to that of the green schists !!

This looks as though the more acid rock had once been intruded as a dyke into the more basic one and finally both were simultaneously rendered schistose by the action of the same pressure. This explanation of the occurrence of these "gneiss" bands seems the most probable one after a study of all the field relations.

11087

is a beautiful, dark, somewhat porphyritic, biotite rock, perhaps a granite. It occurs as a massive core in the

July 7.

27

gneiss and passes gradually into this without other change than the development of a schistose structure.

11083

is gneiss occurring immediately beside the last and undoubtedly a part of the same mass.

11084

is gneiss compact like granite from the contact with the schistose green rock. Perhaps this was originally the fine-grained side of the dyke! due to more rapid cooling.

It strongly resembles No. 11079 which is from a narrow band and may hence owe its grain to the same cause.

11085

Gneiss - coarser grained from nearer the center of the mass. This is somewhat weathered.

There is a beautiful coarse grained massive diorite exposed on the lower shore of the small cove between this point + the foot of the Horse race Rapid.

July 7.

28

On the upper shore of this cove just at the corner near the foot of the Horse Race is a diorite splendidly changed to chlorite + talcose schists.

11086

is almost wholly composed of lamellae of fine light green talc(?)

Further on toward the corner the beds of biotite gneiss appear better developed than below. They are wider. Str. 8° - 12° S of E. Dip 70° N. These gneissic bands are often most intimately connected with the altered diorite schists and are filled with immense quantities of secondary infiltrated quartz along the seams. These are sometimes oval or lenticular masses like the eyes of Angou Gneiss.

We left the boat at the cove and climbed along the crest of the high bluff on the Wisconsin side of the Horse Race. The rock is almost entirely massive diorite

July 7.

29

after my course graded. It shows in a striking way the alternation of coarse and fine grained varieties occurring side by side; also the occurrence such varieties as are composed almost wholly of plagioclase such as calcite and hornblende.

Irregular patches looking like a few structures are also seen.

Examples of the passage of this diorite into schist are not uncommon but are more exceptional here than at the localities farther down the stream.

Several places were observed where dykes of acid felsitic reddish rocks intersected the diorite. One of these from the top of the bluff is 11087.

11087

11088

Not far from this 11088 shows the contact of this rock with the coarse diorite.

Considerably farther up

July 7.

30

11089

The stream was seen at the water edge a wide dyke of this same acid rock, ~~has~~ coarse-grained but not in the least schistose. It is a very fresh porphyritic granite. The weathered surface is red and shows huge square feldspar crystals an inch in diameter, with a perfect outline and often a decided zonal structure. No typical specimen of this could be secured from the huge blocks as only weathered surfaces show this structure plainly.

[Maj. Brooks says (Wis. Rept. p. 474) that on the Michigan side of the upper or Horse Race basin of Big Suisunese Falls typical gray gneiss with plagioclase occurs (His. Ind. XVII) It is often quite massive and affords granitic varieties.]

This is the same thing as what was here found on the Wis side. It appears to oc-

July 7.

31

cut in much larger amount
on the opposite (Main) side
but does not then differ in
character. Brooks did not
find this exposure on the
Wis side.

11090. On its edge this mass of
granite becomes much finer
grained. Immediately at the
contact the diorite, tho' once very
coarse grained is now schistose
and talcose (11090). These acid
rocks are not rare in the
diorite and run in different
directions through it. They
seem to be the rocks which
in most disturbed and pressed
regions have given rise to what
Waj. Brooks calls "gneiss".

Diorite from the Wisconsin side above
the Horse Race Rapid.

11091 Very coarse grained

11092 Somewhat fine - commencing
to change to talcose minerals.

11093 Finer grained.

July. 7-

32

11094 Very coarse grained. composed
nearly wholly of hornblende.

[Some of these rocks strongly resemble the Baltimore and Gabbro-diorites. They show the peculiar pitted appearance due to the weathering out of the feldspar. The hornblende is always fibrous.]

On the Michigan side opposite the foot of the Keweenaw the rocks are much the same as on the Wisconsin side.

At the spring we found massive diorite; (~~11095~~) more schistose diorite and talcose slate (11095.)

11095

11096

Also much quartz (11096)

Wednesday, July 8th 1885.

Staid at Simmesee during the morning for the purpose of arranging and labeling the specimens collected.

In the afternoon hard rain; but we nevertheless went in the scow to the Liver Faces.

The "gabbro" at this end of the ridge is seen on the high point back of the second log-cabin where it is very porphyritic. Large white feldspar crystals stand out prominently on weathered surfaces. These are not regular in shape and vary much in size. Some are no more than rounded grains, others show more or less crystal form while still others appear broken into the pieces but slightly separated. Green inclusions in this feldspar are common. They sometimes have a zonal arrangement. Perhaps may be due to ~~alteration~~ ~~alteration~~.

July 8-

34

The porphyritic structure is not uniform being much more developed in some portions than in others. Many blocks show no traces of it, although it here surely appears to be the rule. On a fresh fracture the rock is a light gray and the porphyritic structure not nearly as pronounced as on a weathered surface.

Fresh pieces of this rock strongly resemble the porphyritic zone of Hawes' "Albany Granite" at Mt. Willard, N.H.

At the end of the "gabbro ridge" high up, the rock certainly looks altogether massive with no indication of porphyritic structure. It weathers into huge blocks which easily break into polygonal fragments on account of jointing which runs in every direction. Hand specimens are very difficult to obtain.

11097

Typical porphyritic rock from this loc.

July 8.

35

The massive rock on the corner of the Michigan side at the head of the Lower Falls is represented by Maj. Brooks as a triangle enclosed on three sides by schist. It is well exposed behind the shanty (cf. No. 11048). The whole of the elevated point behind is of the same character - It is composed of very compact dark green hornblende and Epidote.

11099

This was once feldspar - (11099) Whether this rock is most closely connected with that composing the long "gabbro"-ridge, or with that on the opposite side of the Falls is not certain -

This rock exhibits very well jointing by "cross-gashed". These are often so numerous, small and crowded as to give the rock almost the appearance of some of the wavy green schists, which undoubtedly originate from the alteration of circular mts to these.

July 8-

36

These "cross-gashes" are always parallel in direction and generally make a considerable angle with the incipient cleavage or schist planes.



11100

No 11,100 -

The rocks on the Michigan side above the lower Fall are exposed for some distance. They are the same, more or less schistose greenstones undoubtedly the result of alteration of the diorite. Some are apparently massive but nevertheless cleave quite readily in the direction of the average strike $E 20^{\circ} S$ (comp)

11101

from the second outcrop above the falls.

11102

is much like it from a point where the joint trends nearly at a right angle just opposite No. 11,000.

11103

A quite schistose variety from further up the river, at the

July 8-9.

37.

lower end of the last and largest exposure. This is considerably above the last exposure on the Wisconsin side at No. 11000.

Thursday, July 9th 1885.

Bayley + I roved in Charlie's scow to the Upper Falls. Started into the woods at 9:30 and spent the entire morning in a fruitless search for the granite lying to the south. Returned for dinner to the foot of the falls where we had left the boat and left immediately afterward with better success.

We followed the trail to the foot of the Horse Race and thence took a southwest course from the summit of the ridge. Crossed the low swampy brook + crossed thro' $\frac{3}{4}$ of a mile of thick

JULY 9.

38.

back on the opposite high ground without meeting a rock. Finally encountered several exposures of hornblende schist, evidently the same ones hammered by Maj. Brooks & at length reached the granite called by him "Hudsonian". We did not attempt to go further south.

11104

This granite where we struck it forms a high and abrupt wall running, as far as we could see through the woods, ca. 10° N of E. (comp.) It is coarse grained with apparently fresh feldspar often in Callisbad twins. Another feldspar is red.

Not more than 100 yards ^{north} south of this is a large exposure of hornblende schist. apparently not differing from that which occurs in connection with

JULY 9.

39.

11105.

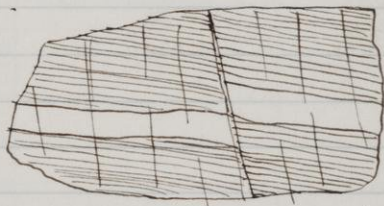
The massive rocks at the face. It strikes nearly E W (comp) and dips 45° - 80° S. (11105)

Still further north exposures of this same hornblende schist are common. In some places it seems to be filled with dykes of granitic material which is very fine grained. These dykes vary in size from the finest shreds to such as are of large dimensions. They apparently run generally parallel to the bedding of the rocks. This schist is jointed at an angle with the bedding and sometimes faulted.

11106

No 11106 is a good specimen of such a fault as shown by a small dyke.

These dykes are a light flesh color, pink, or red. They



are frequently so fine grained as to resemble felsite.

JULY 9.

40.

11107

is a specimen from a larger dyke. These larger ones often show signs of a schistose structure so as to resemble the so called "biotite gneiss" at the Horse Race, which is doubtless of the same nature as these: i.e. eruptive dykes of granitic material (offshoots from the main granitic mass) which have been rendered schistose by pressure like the massive gneisses.

The granite is evidently younger than the gneiss, although the conformability in the bedding of both shows that the pressure which affected both came after both were formed.

Still further north a high ridge of hornblende schist was met with striking 12° S of E & dipping 60° S.

Others of a similar nature were also met with beyond.

Friday, July 10th. Professor Irving reached Linnæus at noon. In the afternoon we rowed to the lower Falls to look over the ground there. No specimens taken.

Saturday, July 11th '85. Started early with Prof. Irving, Mr. Russell and Bayley to drive to the Sturgeon Falls (New York Farm) which we examined and left again before 10 A.M. for the Falls of the Sturgeon River Road Road! Reached the old mill dam at dinner time. Afterward I walked with Prof. Irving southward to the Falls.

The rapids above are bounded by a reddish gneissoid granite.

11108 (11108) very intimately associated with great quantities of massive gneiss looking like diabase

11109 (11109)

Immediately at the Falls at the junction of these rocks

July 11.

#2.

which are probably Laurentian, with the Huronian beds underlying them, are fine bands of coarse conglomerate composed principally of rounded pebbles of the reddish granite occurring above. Some of these are very angular with only their sharpest edges worn off. These vary from 8 inches in diameter to very small. Pebbles of white quartzite and of the greenstone also occur. (11110)

11110

The matrix is greenish slaty in appearance and doubtless wholly fragmental.

Several bands of slaty compact rocks (argillaceous quartzite) composed almost wholly of the fine material with only occasional pebbles are interstratified.

11111

Light brown (11111)

This is in places covered with beautiful ripple-marks.

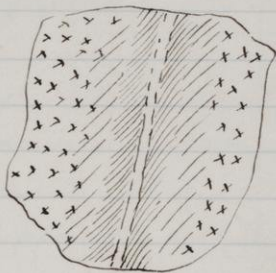
11112

Another similar slate is somewhat darker (11112)

Sunday, July 12th 1885

Drove with Prof. Irving, Messrs
 Brewster Gould and account of
 Iron Mt., and Prof. Pettie of
 Ann Harbor to the Twin Faces
 Rocks at both the Upper
 & Lower Face precisely like those
 at the Simineec Faces - Massive
 compact fine grained gneiss
 with more or less schistose
 bands.

An interesting
 block seen at the
 lower Face - a
 break + fault
 in the massive
 rock which is
 filled with quartz. The rock
 has become schistose near this
 fault + grades insensibly out
 into the massive part.

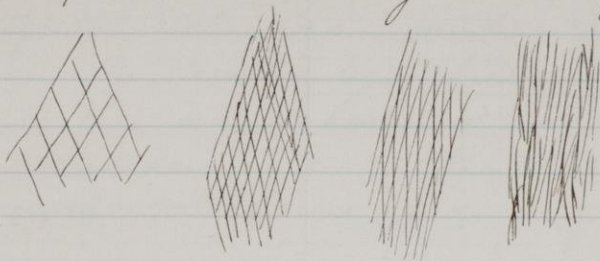


The massive rock is
 cut by two series of joints
 which cut at an angle. This
 angle gradually grows more

JULY 12.

44.

acute until the jointing de-
velops into a wavy cleavage



This is sort of a lenticular or
"leaser" structure which is
often typical of gneiss

On the railroad $\frac{1}{2}$ m. west
of where the road between Iron Mt.
and Iron Falls crosses it is a
cut exposing thin black slates
or shales containing many
intercalated quartzbands.

11,113

Quartzite from a light band

11114

Slate with thin bands and
lenses of quartzite.

11115

Black soft slates.

This band from its strike
seems not to belong to Brook's
clay slate band south of the
Iron Foot Fall, but belongs to the
Huronian Series.

July, 12.

#5,

The dip and strike of these slates exactly corresponds with that of the schistose bands produced in the diorite by pressure - Is this an accident or a coincidence? The slates are without doubt sedimentary.

On Sunday evening drove with Mr. Buee & Prof Irving down the old road along the river to see an outcrop of the iron formation not noted on any geological map. They are very near the SE corner of the NW quarter of the NW quarter (or lot 1) of Sec. 11, T. 39. N. Range 30 W. Mich.

The ledge is exposed for a considerable distance as a low ridge - The slate is black & thinly fissile. (11116)

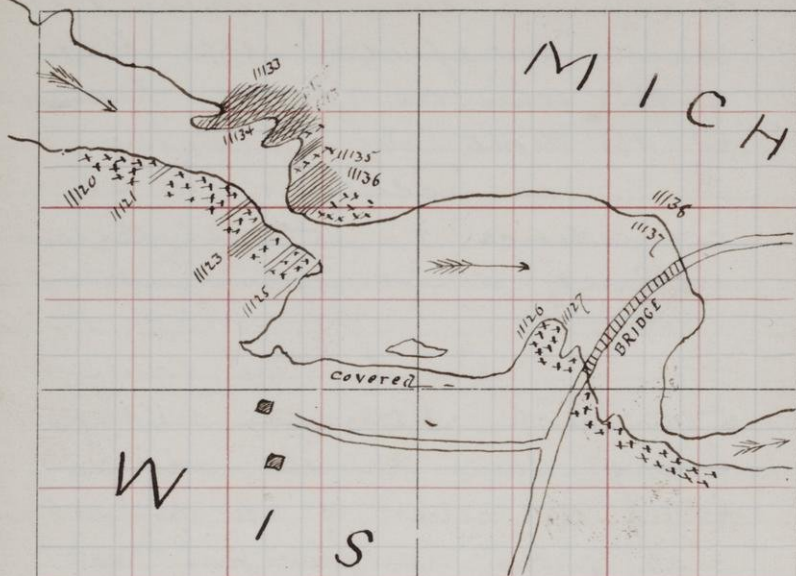
11116

Beyond this several shafts have been sunk exposing the ore. Good specular iron with much white quartz & banded.

11117

T.

R.



Upper Twin Fall.

July 12 + 13.

46.

11118 Associated with these are
the usual so-called "talcoze
slates"

11119 At one shaft is a very com-
pact massive green rock
with reddish spots

Only single specimens of these
taken - all sent to Madison.

Monday, July 13th

Upper Twin Fall

11120 Commenced at the upper ex-
posure on the Wisconsin
Side. Brooks' "cc". Home very
fine grained diorite with pyrite.

It rarely contains quartz seams
and and shows frequent indi-
cations of commencing schistose
structure in its tendency to
cleave in one direction and
in the traces of slickensides
inside of its mass.

Brooks' "bb" which extends down
to the falls seems not to be different
from this "cc".

July 13.

47.

11.121 Just at the head of the Face
is a very narrow (10 inch) band
of the massive rocks made
up of long interlacing lenses.
It strikes 20 S of East and
stands nearly vertical.
(11.121.)



11.122 Just here such bands
some of them very narrow
become very numerous. At the
foot of the Face the rock is
quite massive and rudely
jointed - Brooks bb. (No 11.122)

11.123 Possibly This Brooks has lettered aa - This
fragment is quite finely schistose and
slaty in its center but grades
on both sides into the massive
rock by the broadening of the
lenses into thick diamond
shaped pieces produced by
two systems of joints crossing
at an acute angle.

On the narrow schistose band
at the cove just below the Face

July 13.

48.

11124

is a vein (?) of a curiose rock containing much blue quartz and a light colored cement. It resembles a breccia and appears when the crushing has been most intense.

The remainder of this exposure is included under Brook's V which he says extends without change far below the iron bridge. It is filled with numerous schistose bands, many very narrow & some rough on their surface. All are parallel (Str. 20° S. of E.)

11125

The massive rock from here is 11125. It is here smoothed & polished by glacial action with strae running N. S.

The rocks are covered for a distance down to the first projecting point below the Falls and above the bridge. Would they appear as above with hardly any traces of schistose bands. (11126). In this

11126

July 13.

49.

11127. occurs a curious rock like
a breccia, sryany in structure,
(11127) and cemented by fine mar-
ble or quartz. It is but
Resembles 11124 some-
what.

On the Michigan side of the Upper
Twin Fall at the point farthest up,
(Brook's ff) the rock is massive
as it is opposite.

11133 At the fall the rock is mostly
massive (11,133) but is traversed
by many beds of schist. These
are produced by the joints becoming
more and more nearly parallel
& thus lengthening out the diamond
shaped pieces.

11134 One quite finely schistose band str.
 10° N of E but another below
it strikes 17° S of E as is the
case on the opposite side of the
river. The rock is here much
waterworn and the differences
in ~~at~~ hardness & structure

July 13.

50.

11135

are well brought out by this action. The band to which 11135 belongs is for the most part less distinctly schistose than the others. A portion of it however on the north side is finely slaty. 11136.

11136

At the iron bridge the rocks cannot be divided into just three bands $w, x + y$ as Wright has done. They are massive for the most part with very fine diamond shaped parting and are everywhere traversed by schistose bands - (Wright's x) There are plainly only lines of especial weakness under pressure, since they are only produced by the jointing being carried down to a finer scale.

The most instructive feature of the Upper Twin Face exposure is the innumerable instances of a diamond parting with angles, sometimes nearly 90° , grading

T.

R.

M
I
C
H

W

S



Lower Twin Fall.

July 13.

51

into fine jointing and this into a lenticular schist. This is admirably displayed in the little quarry on the upper Mich. side of the bridge.

11137.

Massive rock from River bank

11138

Schistose " " Quarry.

Lower Twin Face. The lowest exposure on the Wisconsin side is at the west end of the north side of the large basin. Here the rock appears quite massive but is much weathered and brown. It always joints into long diamond shaped ridges where longest diagonal is parallel to the usual direction of the strike. In spite of its massive appearance this rock possesses a latent tendency to cleave parallel to this longest diagonal, which tendency is especially brought out by weathering. This is well shown in No 11128, where long ridges weathered so

11128

(North "p.")

July 13.

52.

as to show this cleavage.

11129
(Part of)

These rocks pass gradually into fine slates, Str. 10° N of E and dipping N. These are bluish black, greenish, and brownish gray according to their weathering. 11129. A smoothly worn surface perpendicular to these finely fissile slates can appear quite massive.

These slates are now again replaced by the same shaly bedded cleaving rocks above mentioned. The freshest of these are green; the more weathered brown.

These are succeeded by other slaty rocks much green or blue (hence fresher) than those below. These are filled with white quartz seams and veins and pass through the lenticularly jointed variety into massive diorite.

11130
(Block)

Slaty rock 11130

The massive diorite all the way up the face shows the

July 13.

53.

same tendency to break into diamond shaped pieces (not unlike *Sphene cupressus* in shape) thus becoming more or less schistose according as the lenses are longer or thicker. It contains much fine quartz and calcite. It becomes more and more fresh and hence more and more massive as it approaches the Fall. Just at the base of the Fall on the Wisconsin side the schistose structure is seen quite plainly (No. 11131)

11131

The massive diorite is the barrier rock at the fall. (Brook's "5") At the top where these specimens were taken the rock is quite massive; immediately below however it is quite slaty.

11132

Brook's band "7" chloritic slate. could not be found, perhaps because the water was too high.

The long band which

