Menominee Iron Range, Mich: containing few notes on rocks of Pine River, Wis.: [specimens] 41000-41141. No. 391 July - Sept. 1899

Bayley, William Shirley, 1861-1943
[s.l.]: [s.n.], July - Sept. 1899

U. S. GEOLOGICAL SURVEY

FIELD SECTION BOOK

9-891

LAKE SUPERIOR DIVISION.

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 number attached, showing the direction and amount of the dip. Denote a shaly or other very plainly bedded ledge by right parallel lines, and a ledge having a secondary structure by wavy parallel lines running in the direction of the strike, with dip arrow and number attached as before. The greatest care must be taken to avoid confusing slaty or schistose structure with bedding, and in all cases where there is the least doubt about the true bedding direction, 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 lines as 100 paces, and twenty of these spaces to 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. The ruling of the left-hand pages is also arranged so that, if desirable, a larger or a smaller scale can be used, eight inches, two inches, one inch, or one-half inch to the mile. With the two-inch scale, the squares outlined in black represent sections, and those in red, quarter sections and "forties," while the space between the blue lines is 200 paces.

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, the latter always being expressed from the north; for instance 4025, 250 *N.*, 300 *W.*, *Strike*, *N.* 78° *E.*, *Dip* 50° *S.* Then follow with a full description of the ledge. When topographical maps are used for locations this paragraph applies only in part.

3. Collect a specimen from every ledge, or wherever there is a change of rock on any one ledge, taking care to get fresh material, unless for a special purpose the weathered surface is desired. In case of trips made on foot or in canoes, for long distances, neighboring ledges, unquestionably of one kind of rock, need not be specimened. The position and extent of the ledges not specimened should be marked on the map, with notes that each is of a rock identical with specimen so-and-so. Under the same conditions small-sized specimens, trimmed to a uniform size of 2 x 2½ x ⅝ inches will be allowed, but in all other cases *large-sized specimens*, trimmed to a size of 3 x 4 x 1 inches, must be selected, in accordance with section 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. Specimens should not be placed together without protection in the collecting bag, as the fresh surfaces, important in determining the character of rocks, are thus destroyed. They should be damaged by no temporary mark, but the numbers should be at once marked in at least two places upon the inclosing paper or cloth bags. Specimens may be permanently marked in camp by painting the numbers upon them in white upon a black background, using Silver White and Ivory Black oil tubes for color, with turpentine as a diluent.

4. 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.

5. Forward this note book as soon as filled as registered mail matter to C. R. Van Hise, U. S. Geologist, Madison, Wis.

41000 - 41141 Notebook No. 391.

.41000

41000-41141 Notebook No. 391

Menominee Iron Range Mich

July - Sept. 1899

W. S. Bayley

Containing few notes on rocks of Pine River, Wis.

S. T. R.

NB- Index on last page

6—747

July 11.

Drove from Iron Mt to the Little Popple river.

For about 1½ miles from the bridge over the Menominee the road is skirted on the South by bluffs of greenstone-schist, that are plainly continuations of the Menominee schists at the Horse race rapids, though they seem to have more the character of the Quinnesec rocks.

At the crossing of the Little Popple these are rough, dark green or purple foliated and greatly contorted rocks, with the strike & the banding E-W and dip. about 60°-75° to the S.W. On fresh fractures the rock appears like a

41000 dirty gray, dark gray, hornblende-schist or tuff.

The specimen was taken from the bank of the stream North of the bridge. Probably Van Hise's 25667.

There is a belt of rock running N.W. across the stream at the bridge. N. of the bands are low

and sandy.

Went west on the South side of the Pine river from the "Red bridge" in Sec 22. and visited the "magnesian-schist" ledges & Brooks on South side of Stream west of bridge.

Found the weathered rock of the two to be a green chloritic rock spangled with scales of some chlorite? The rock is schistose with a schistosity striking a little N of W and dipping nearly vertically. It looks like an altered graywacke.

H.1001

H.1002 The ledge nearest the bridge differs very little from that further west. It is more crinkled and less chloritic. Schistosity dips triple to the South.

H.1003 From side of Carpenter avenue Dry Mountain, a few hundred paces from bridge over the Menominee. It seems quite similar to the Little Popple rock.

[See Note-book for 1901]

24-40-31

Drove to W¼ post Sec 19 to Examine the quartzite found by Clements on South side of the little hill near this ¼ post.

On the plains just south of the hill are exposures of undoubted quartzite about 500 E of Center of Sec 24. The rock is fairly vitreous. It resembles closely the Sturgeon quartzite, but is somewhat less vitreous. It may be a marble quartzite or a quartzite in the Hanbury slates. In some places there are interbedded with it small seams of slate and quartzite which is crinkled

Hinted

Crossed Menominee river at Twin Falls, went along road to Florence for about 2 miles then S. to drill at about 500 S of NE Cor Sec 17. Drill reached greenstone

[N.B. Records of this drill given by Mr Brown in 1902.]

The road is skirted on the South by little hillocks and ledges of

greenstone of which took 2 Specs.

H1005 From just beyond road crossing and C. & N.W. R.R.

H1006 S. side road near E. line Sec 9.

At about two paces W of mouth of Pine river found the black slates indicated by Brooks. These are very much like the rocks below the C & N.W. R.R. bridge on the Menominee at 4 Ft. falls. The rocks are well banded, thickness about 20° N of W. and dipping about vertically. The rocks, however, are buckled and in places are closely jointed, so that find several anticlinals and synclinals pitching high to the W.

H1007 Specimen slate, purplish

H1008 " "

H1009 End of anticline

H1010 Band of quartzose materials, reminds me of the quartzite band in the Iron formation.

H1011 Ferruginous beds, East end of Exposu-

area, north of H1007-8-9&10.
Colored red. This seems like H1010
we altered.

H1012-13 H1012-13 are from railroad
cut through western portion of
Exposures H1004.
These rocks are beautifully band-
ed, striking and dipping as in-
dicated by elements. Slates and
narrow bands of quartzite alter-
nate. The whole aspect of the rocks
is as if they were portions of the
iron formation - non-ferruginized.
May these not represent carbon-
aceous beds in Hamburg slates?
The slates are ripple marked
and are closely folded into a few
folds pitching steeply northwest.
H1012 From bands of impure quartzite
H1013 slate.

Clifford Pit. Braden's Mine.

The rocks in this pit are jaspers and ores striking generally N.W. but dipping 55° S.W. on S.W. side of pit and 85° N.W. on N. side. On the west side of the pit is a small N shaped fold. The rocks are greatly jointed by cross joints the best dips about 50° N.W. and another 20° S.E.

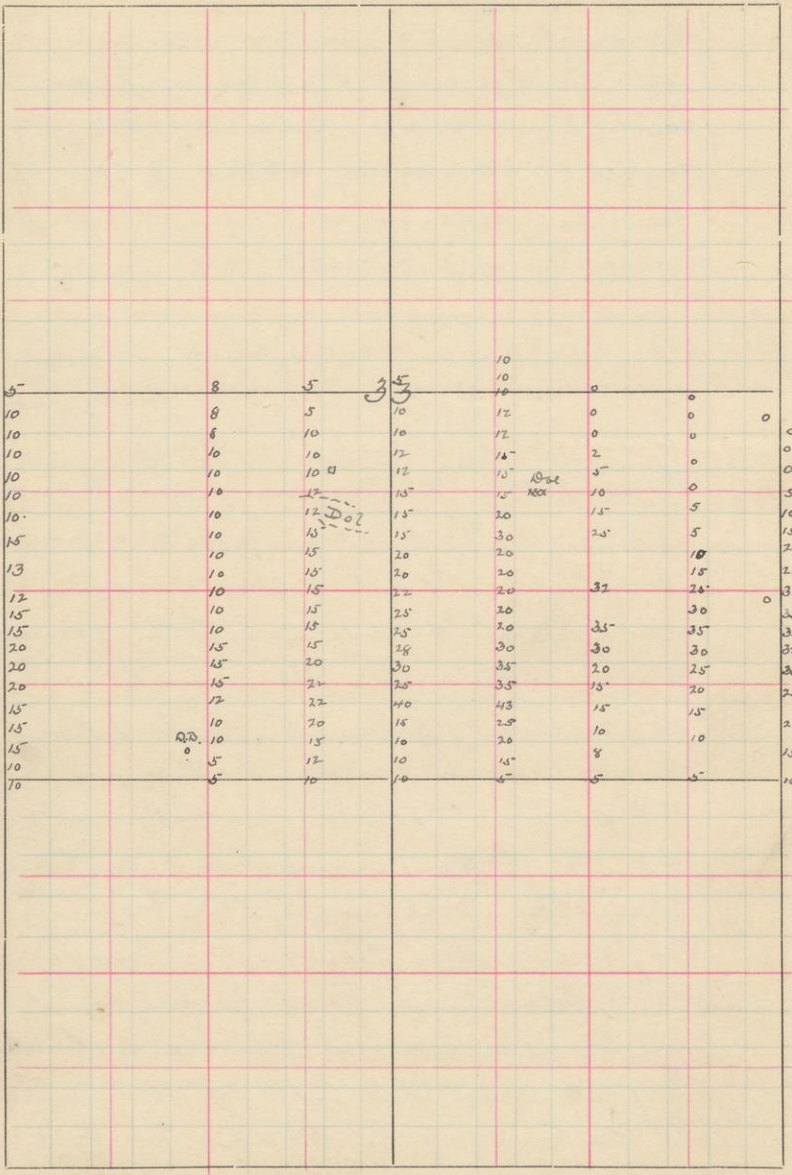
H.O.14 Gray scales near contact with ore at east end of pit. The scales form a steep westward pitching anticline (and syncline, covered) with ore on top.

H.O.15 Fine green schist - appearing a dyke that fringes out in the ore, producing no noticeable change in it.

Drive to Indiana mine.
On the road to Indiana from Lake Anton visited pits work of Dolomite (probably 26320 of Merriman) On the dump is ore, slate fragments and sandstone.

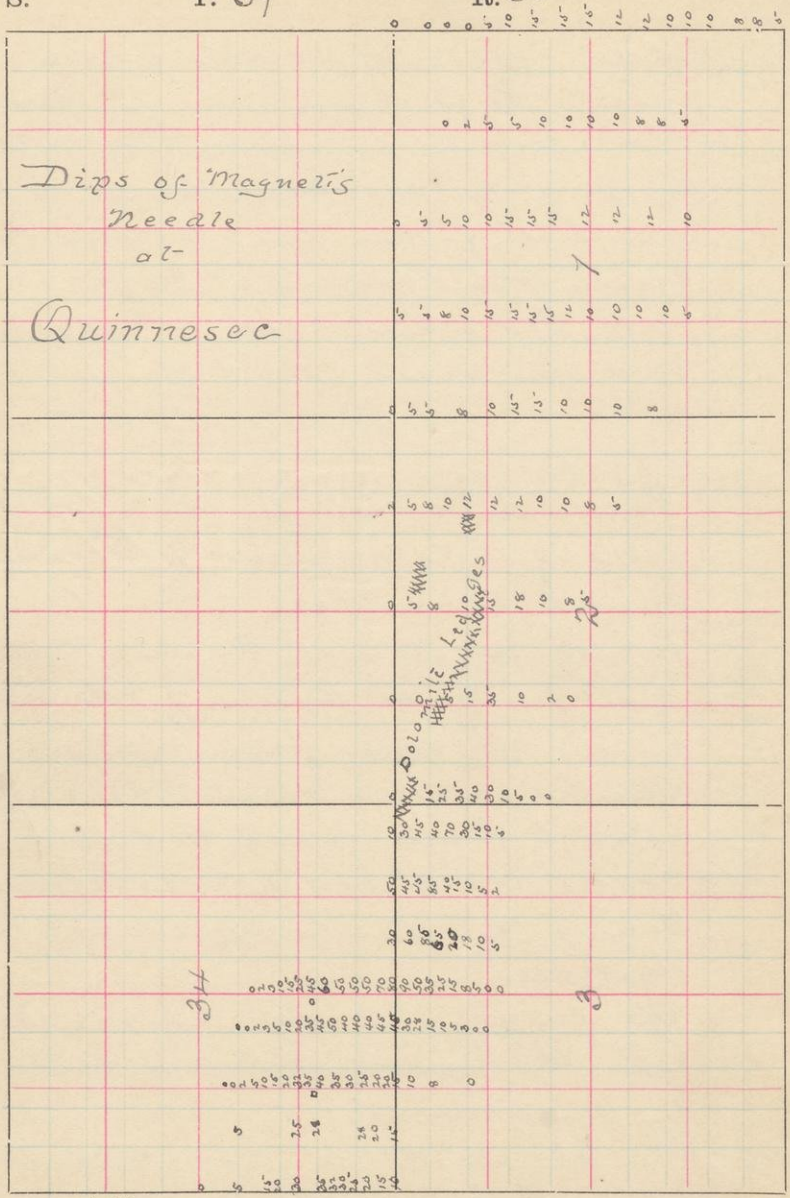
At Indiana satisfied myself that the Dolomite is between this mine and the cliff.
East of the Indiana and north of the R.R. track are several
H1016 pits in red calcareous shales that have supposed to be immediately above the Dolomite
H1017 Dolomite from D. Pike & railroad west of the Indiana. This ledge was located on former visit.
At the cliff mine had a talk with Mr. Shepard the Manager. He describes the ore as appearing and striking uniformly as on surface - viz: Strike a little E of N and dip 30° 35° N.
To the East of the shaft he describes
H1018 a "horse" of sandstone. It is a

S. 33 T. 40 R. 30



white, soft rock looking like Dal-
housie. Not found in 10th level
but is not in surface. The rock in
surface under Stirling is a
mixture of ores and slates that
seem the Cambrian beds
N.B. The white rock is Dolomite
On later visit (1901) found this
rock in surface in pit East
of shaft.
Examined country around the
cuts for exposures of Dolomite
said to exist there by Mr. Bell
but found none. Found, however,
pits in both sides of the Dolo-
mite in line of junction.
Then walked down the rail-
road & Runnings to look at
rocks described by Weidman.
Found the rocks squeezed and
Cambrian.
The conglomerates associated
with the Dolomites are certain-
ly contemporaneous.
41019 The black slate associated with
Dolomite bed appears as a layer

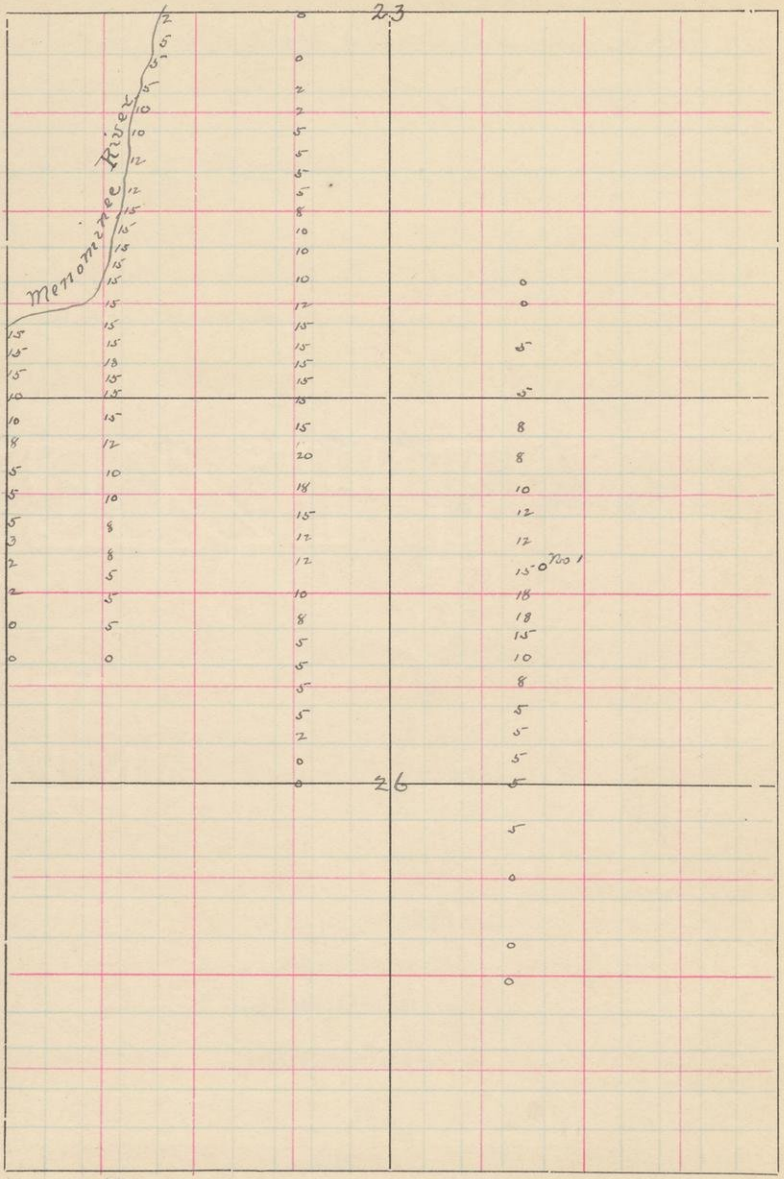
S. T. 40/39 R. 30



interlaminated with the Dolomites".

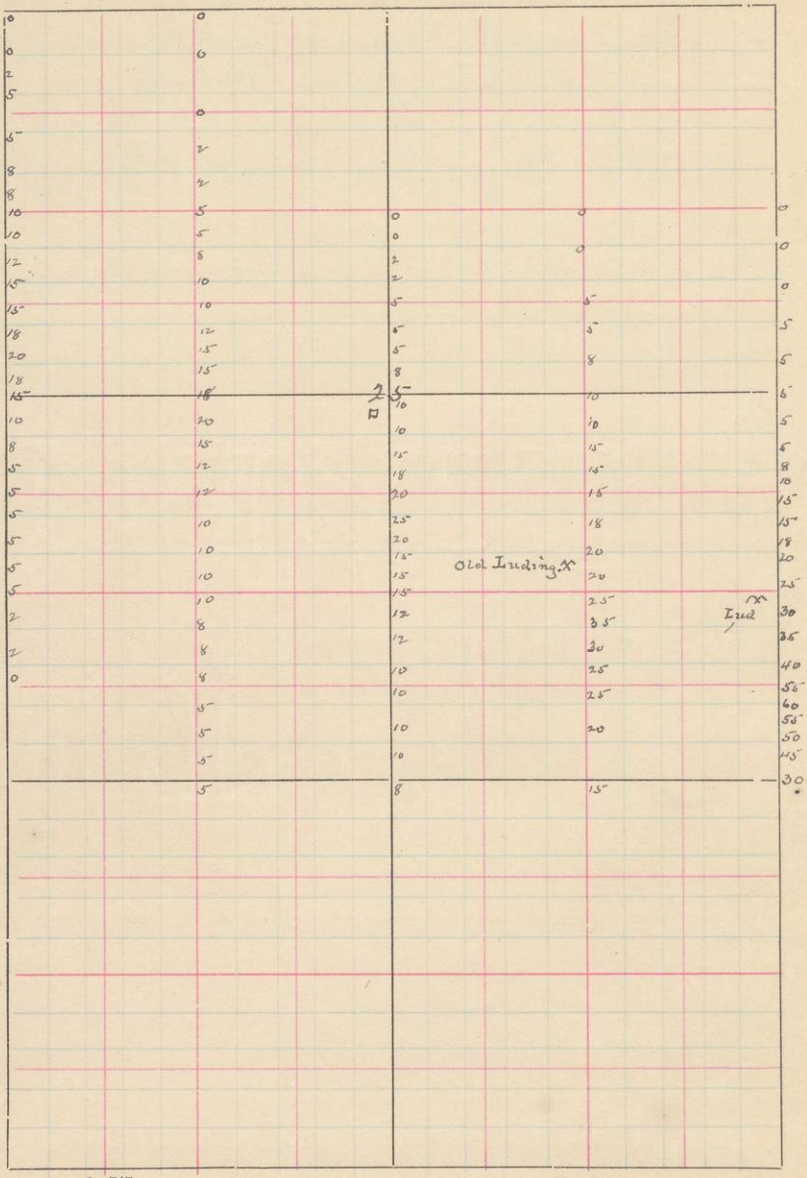
Dips on opposite page taken
from plats made
by the Manilla Iron Company

S. 23 26 T. 40 R. 31



Magnetic Dips on opposite page
taken from Polar
of
The Manila Iron Company

S. 25 T. 40 R. 31



Dips in opposite page taken
from plats of the
Manilla Iron Company

Commonwealth. Wis.

Examined pits at Commonwealth iron mine and looked at ledges of graphitic slate south west of there on road.

The two pits show the one formation slightly buckled on a large scale - i.e. folded gently, but closely folded on small scale.

The formation is shaky with quartzites, jaspers and slates interbedded. The formation being much more slaty than on East side of the Menominee. Though iron formation appears different from Menominee iron formation, the slates look like the Hamburg slates.

At the edge of the hill south of mines and on side of the road leading S. are graphitic slates which are fissile. These dip at 80° - 87°. They seem to grade into iron formation

H1020 Graphite slates

H1021

H1022 and associated rocks.

H1023

[N. B. More detailed accounts of the geology of the Commonwealth group is to be found in note books of 1901]

41022 a Sericitic slates from Pewabic
41023 a branch railroad. In cut near the wagon road between Iron Mountain and Quinnesec.

41024 From group of little pits at foot of sandstone bluff. The slates are purplish and resemble those associated with the dolomites, but their width is so great that I suspect them to be similar to those in northern part of the valley.
The sandstone bluff referred to is the great one overlooking the valley of Pine creek East of Norway

Supt. MacNaughton declares that marble boulders were found in the iron formation in the 4th & 8th levels of the Chapin mine, both of "C" shape.

At the Chapin mines there are often associated with the ores in veins
Calcite and dolomite, pyrite, talc & serpentine
In the lean ores the dolomite
In the slates associated with the ores manganese and talc

The talc and the serpentine are soft, while quartzite mineral streaked here and there with green streaks and occasionally spotted with dots of red hematite and ochre.

The following analyses were made and furnished by Mr E. E. Brewster of the Oliver's mine.

1. White "Soapy" minerals in chapin one.
2. White "greasy" min. in same one

	1.	2.
SiO_2	42.94	61.91
Al_2O_3	1.18	1.06
Fe_2O_3	1.40	.39
Mn_2O_3	.30	.14
P_2O	—	tr.
MgO	39.84	32.52
Loss	14.08	4.39
	99.74	100.41
Sp. Gr.		2.72

1. Seems like serpentine and 2 talc.

3. Pink dolomite from the dump of B Shaft Chapin Mine.

CaO = 30.94
MgO = 20.48
FE = .80
P_2O_5 = .05
Al_2O_3 = .20
Res. = .73

4 Hanging Scales - Cross-cut ¼ from 5th level Chapin Mine. #9

5. Foot Scales - Cut directly under #11.

		N	S
SiO_2	=	47.85	52.13
Al_2O_3	=	18.63	13.53
Fe_2O_3		6.14	21.23
FeO		.10	
CaO		—	
MgO		14.51	4.24
K_2O		2.91	3.29
Na_2O		.21	.03
Loss ign		9.96	2.96
		99.81	99.40

6. Specimen of the 60% ore of the Chapin Analyzed in 1885.

7. Nearly all ore when left on the stock pile 6 mos or more becomes coated with a white efflorescence which when washed off and analyzed gives as under 7.

6.

Fe_2O_3	85.44	= Fe = 60.58
FeO	.47	
Al_2O_3	1.33	
Mn_2O_3	.76	
$CaCO_3$	2.25	CaO = 1.26
MgO	3.02	
SiO_2	4.53	
P_2O_5	.15	
Ign	1.76	Loss 2.75
S	.002	
K_2O	.064	
Na_2O	.066	
	99.87	

In this analysis the loss is evidently supposed to be due partly to the escape of CO_2. .99% was calculated as the combination with the 1.26% CaO as $CaCO_3$ and the rest was assumed as water. As a matter of fact some of the MgO may be present as $MgCO_3$ and moreover some of the CaO may be present as a silicate.

7.

CaO	.74	Na_2O =	40.58
MgO	.79	SO_3 =	52.01
K_2O	.24	H_2O =	3.05
	Total	99.41.	

On the South side of the iron formation at the old Reed ridges running in Sec. 32-40-30 are "calico slates". The shaft is down 100 ft. in this and then cross cut 30 ft. N. to iron ore.

H1025

This pit is now known as the "Cunningham pit."

At the Cundy mine the ore body has not been explored. Drill holes show the slates to the South. and the ore to the North dipping about 60° S. with a clean contact. No jaspers anywhere.

H1026 Slates

H1024 Ore.

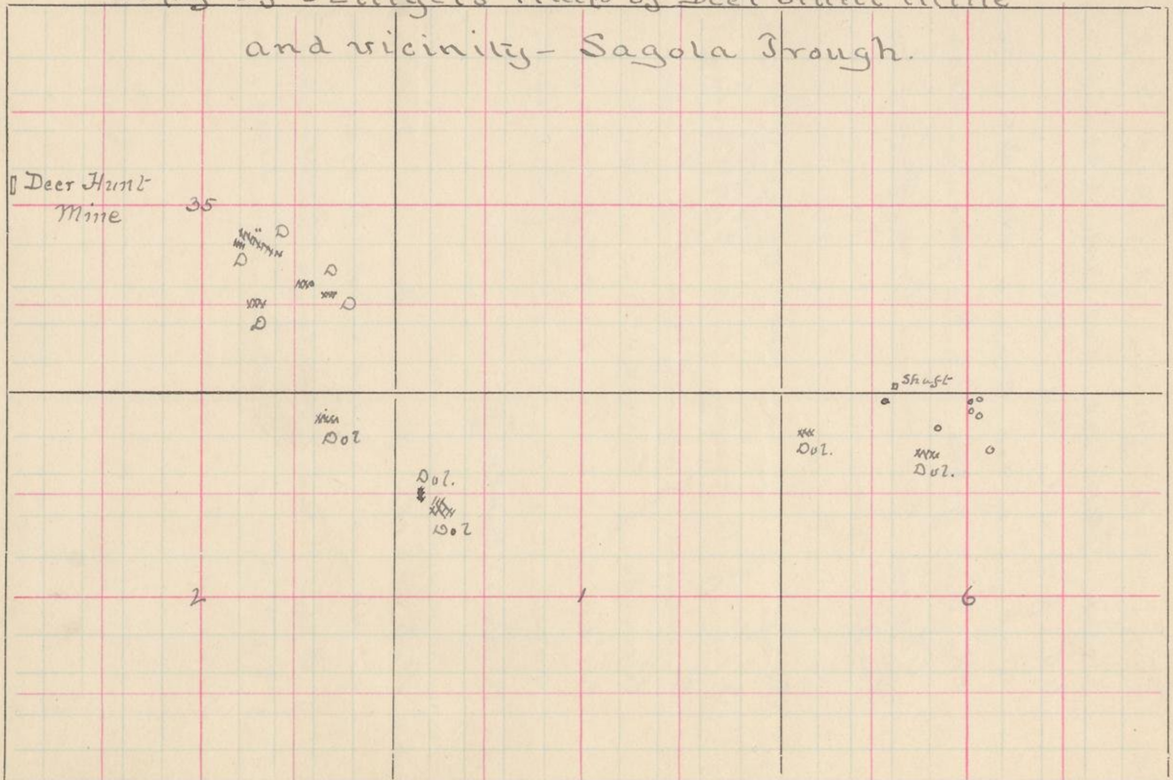
H1028 Gray slates from red pit S. of Lake Janice about center of NE of NW¼ Sec 35: Dalmeir's near the S.E. cor of the NW of the NE.¼ of same Section. These locations are given by Fredericks.

H1029 Slates from west side of hill S.W. of Norway where working the Swamp farm west of town. Bands of limestone 6 in to 2 ft. wide are interbedded with it. The rocks are contorted. [See Weidman's Notes]

H1030 Red slates from dump of shaft in Sec 15. T. 40 R 30. W side road.

H1031 } From Dunpeeley's Exploration
H1032 } in Same Section. E. side road.

Copy of Hillyer's Map of Deer Hunt Mine and vicinity - Sagola Trough.



S.

T.

R.

Made a rapid trip to Dees Hunt.
mine in Sagaca township
Found trench cut in sand on
slope of hill showing broken jas-
per and ore. This seems to be
mixed with quartzite which may
be in bands. Strike and Dip not
obtainable.

H1033 Specimen ore that seems to be
an impregnated quartzite?

The country to the west in Sher-
gen mine is underlain by
mottled reds and sandstones
that look extremely like Pots-
dam near the Quinnipiac. The
sandstones are red, gray, mottled
red and gray rocks with the tex-
tures of the Potsdam, but the
rocks are in gentle folds some-
times with high dips.
It looks as though we had
here a closely folded Potsdam

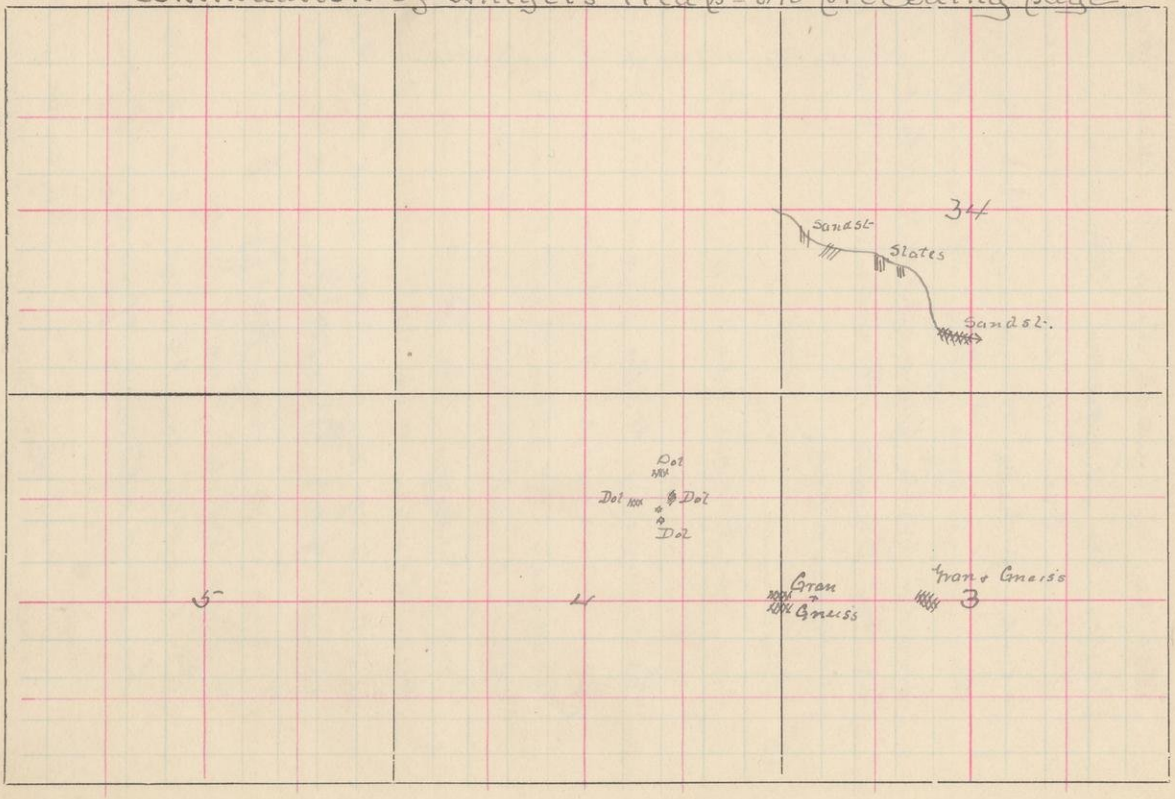
H1034 Reds and sandstones } W. side of stream
H1035 from this section } in Sec 31
H1036 in the mine.
H1037

Continuation of Hillyer's Map - on preceding page.

S.

T.

R.



Made rapid trip up the Pine river from Breakwater in Section 28 (39-18) to La Salle's at the fork of the Pine and the Poplar.

From the breakwater went East about ½ mile and on top of the west eastern hill on the north side of the stream found a shaft in the dumps of which was a great quantity of fresh diabase and a coarser grained actinolite-schist.

H1038
H1039

West of this are great bluffs of conglomerate greenstone or tuff-schistose, banded and jointed as described by Van Hise.

The joint seams are sometimes coated with thin seams of hematite and there are here and there wider bands of jasper and chert and occasionally an apparent pebble of jasper - though the "pebble" may be nothing but a concretion.

H1040 Schist or conglomerate
H1041 Pebble of one in Same

H1042 Pebbles of basic rock, practically same as groundmass.

Going west from river bed, i.e. immediately south of the conglomerate beds of black slate

H1043 that seems to be undoubtedly conformable with the upper conglomerate.

Further up stream at the foot of the lower falls the slates change a little in character and are weathered red in streaks. The rock is finely banded on weathered surfaces the strike being as indicated by Brooks. The dip is about 75° to the S. With this are interbanded coarse

H1046 fragmental beds containing considerable quartz.

Further up at about the head of the lower pitch of the falls the

H1047 slate looks hornblendic. Here they are slightly bent and in one band which is cut by quartz veins are contorted.

H1048 At the foot of the upper pitch the slates are beautifully banded

at the foot of the upper pitch and on
fresh fractures are clearly hornblendic. Some of the bands are fine
f garnets which appear in thread
like planes as little dark lines.
H1049 A few of these are over an inch
wide and at one place a band cut-
by quartz veins is a foot or 15 in
in width.
Above this a short distance is a
little fault like an anticline and
H1050 above this again the slates recur,
H1051 followed by a dense quartzite rock
H1052 which gradually passes into hornblende schist. These extend up to
where the bridge was. The rock here
looks very much like H1039.
About 300 W of the bridge the rough-
ly weathering tuff again ap-
pears. It is denser than the
tuffs of the great hills and the peb-
bles are not as distinct but other-
wise the two rocks seem to be the
same. Coarse, hard bands pro-
ject above the softer ones. These
sometimes look as though they

might be considered in the Ogden Schistose parts, but they might be pinched hard beds.

H1053 Slaty portions

H1054 Band or bands in same.

Continued West to 2nd falls. On north side of river found the quartz-schists of Brooks. These schists are simply the quartzose phases of the hornblende slates found further East - i.e. the bands that project in weathered surfaces. In some places they look like tuffs.

H1055 Eastern
H1056 Middle } of the edges marked by
H1057 Western
Brooks. They seem continuous
The rock at the 2nd falls is practically the same as at first falls, except that it is more quartzitic.

H1058 Specimen from 2nd falls

H1059 " " " "

[N.B. In 1902 Examined South Side of Stream at 2nd falls]

[Collected several specimens
and made rough map of same]

Notebook # 342, p. 47

Went to corner North of the river
working and Exam-
ined the conglomerate there. It
4.1060 looks like the Micaceous Quartz-
ite in the upper Huronian. It
contains pebbles of quartz and a
few banded ones like chert. But
could find nothing definitely like
jasper. There also appear in it,
especially in the more schistose
portions small flecks or coatings
of hematite? The rocks schistosity
dips South approximately conform-
ably with the dip of the rocks at
the river.

The conglomerate seems to be Up-
per Huronian as yet at the base
of the tuffs and Lumbermans Slates.

Attempted to make a run into Sec 28 to find conglomerate near the actinolite schist. After tumbling around for some time in a terrible wind-fare found a ledge of slate on top of a hill. This is certainly north of the conglomerate but somewhere near the 1/4 post

41061 found a ledge of black slate that is a little different from the slate at the breakwater. They may be young slates above the conglomerate, while the rocks by the creek may be older. Strike is about S.E. and dip. about 75° NE.

It is possible that the location of this slate is 200 S and 200-250 W of 1/4 post.

My woodsman was absolutely useless - but did discover his worthlessness until too late to run lines myself.

Examined again the conglomerate at the corner and found it getting

41062 less and less conglomeratic as

travelled north over it. At one place
41063 found it to contain a large sharp
fragment of jasper + ore.

41064 Saw conglomerate again at 420 S.
of N W cor of this sec. It possesses
same general character as that
at the corner.

41065 Southernmost ledge - red.

Went down the horse-race below
30? the dam in sec. — and travel-
[39-17] ed west along the north bank
nearly on the strike of the rocks, but
getting a little lower in the series
as proceeded. The rocks dip south.
There is here a splendid section
of bare rock 1/4 mile long. The
exposures show a succession of
of coarse and fine grained basic
rocks that are quite massive in
some places and are schistose
in others. The schistose forms
are often spheruitically parted

like the ellipsoidal greenstone of the Hemlock formation.

H1066 Hornblende rock, fairly massive
H1067 Schistose phase
H1068 Dense greenstone, rough weathering.
H1069 Dense fairly massive
H1070 Banded phase.

Nearer the Dam the rocks become better banded, denser, and in places amygdaloidal - though am not sure but that the apparent amygdaloidal structure may be due to the squeezing of siliceous bands.

The banding shows definite contortions. Large bands of lighter
H1071 colored rock are in the denser
H1072 Schistose hornblende rock. It
may be that the squeezing of the
H1073 two makes the amygdules
One of the dam is Brooks's
H1074 quartz-schist but I can see no
difference between this rock and
the others at the mine.

The same rock continues on the north side of the river at the Dam

H1075 Southerly ledge - South side of stream
H1076 Northerly " " " " "
at Dam.

From the Dam followed up the North side of the river to the Decium line, finding sporadic ledges of quartz schist (Brooks). Though there is no proof of the fact, think hornblende-schist grades into these. As pass west think the rock assumes the aspect of a gneiss and gets darker.

H1077 Lighter phase - Eastern ledge
H1078 Same common phase
H1079 Darker phase
Sporadic ledge in flood plain of
H1080 river, looks like a greenstone
Just a little north of the corner
H1081 is a ledge of very dense greenstone like Few Materials. This is probably the Eastern Extension of the quartzite schist.

H1082 At 640 N of corner is a small ledge of granulated basic rock exposed on the South side of a hill. It

looks as though it might belong
to Clements' Hemlock formation.
It is Brooks quartz-schist.
At 750 N of same corner on north side
of trail same line is a little differ-
H1083 ent phase of the same rock.
H1084 and at 900 N is a more hornblendic
phase. [Brooks hornblende-schist]
H1085 At 255 E 1/4 post the same rock
occurs, but there is nothing that
looks like gneiss.
H1086 Conglomerate near corner
H1087 } Ledges on same line, N side,
H1088 } little north of corner

H1089 Northern exposure north side of
dam, most quartzose phase
H1090 Gradation phase, most southern
ledge. Same as H1075-6.

Visited line on west side of
road south of La Salle. The line
has certainly the aspect of the
Archean. The main rock is a
H1091 hornblende schist or greenstone

cut by quartz veins and granite dykes.

At Washburn Falls the Poplar pitches over granite. It has an indefinite strike N 20 W and a dip 75°-80° N.E. It consists of coarse, fine and intermediate indefinite bands of red granite cut by coarse pegmatite in various directions and by sinuous quartz veins. Here and there are enclosures of basic material, probably of same composition as dark constituents of granite.

H1092 Phases
H1093 of Granite.
H1094

North, below the falls, is the coarse basic granite like H1091 cut by granite and pegmatite. The exposure is very like the typical Archean.

H1095

The hill at junction of Poplar and Pine, S. of La Salle consists

of a series of banded rocks. Hornblende schist similar to that below the Dam is interlaminated with a
H1096 grey rock which appears like a Gneiss. This at the East end of the hill strikes as is indicated by Brooks and dips S. at about 75°.
Going S.W. found coarse hornblende rock which appears like an altered amphibolite. This is jointed and schistose and is cut by granite veins.
Further South the amphibolite rock reappears. In places it is finely laminated and in others it is closely crinkled. In other places layers that look like tuff are interlaminated with schistose layers
H1097 } Two phases of the hornblende-
H1098 } schist
H1099 tuffaceous phase.
Further S. and W. are beds of dense greenstone that in some places may have been sphaeroidic. On the hill further South and sepa-

valed from the hill to the north by a little valley is a coarse, almost massive amphibole rock, which however on its borders and to the west grades into a schist which contains big feldspar crystals. They have lenticular forms and some are cut by two series of intersecting fractures.

411.00 Is it possible that the feldspar developed after the main portion of the region was substantially in static condition and were subsequently fractured?

This coarse schist appears to run NW as it is found at the west end of the hill with the mica together with the associated rocks.

Excluding the coarse schist last mentioned the entire series of rocks resembles the mica and hornblende schists at the base of the Lower Marquette at Champion and Republic, where the rocks are derived from mingled fragmental and igneous

materials and are regularly laminated.

The more regularly banded rocks are brittle, breaking into a clean cut cross fracture and splitting easily parallel with strike. In this respect they resemble metamorphosed sediments rather than igneous rocks. Certainly working is done to exclude sedimentary origin for a great portion of the rocks. The remainder may be tuffs.

Just this point went up Pine river and examined ledges worked by Brooks west of Skeam found a series of hornblende-biotite schists regularly laminated and schistose, very similar to those found South.

H1101 } H1102 } This schist is cut by a dense schistose porphyry weathering white at a distance it looks like quartzite. It may be Brooks quartz-schist granite

as occurring here.

H1103 The main mass and minor masses of this rock are cut by coarse pegmatite and granite. The largest granite dyke seen was about 18 in. across. One little dyke about 3 in across was faulted for a foot or two at a schistose band, evidencing movement & accommodation between dike & schistosity. Near the porphyry schist the hornblende-biotite schist seems to be more contorted.

The hornbe.-biotite schist near the coarse schist is intricately cut by knotlines. At one place the knotline cuts directly across the schist and near the contact

H1104 the latter rock appears to become chloritic. The cleavage extends through both. The coarse greenstone was not specimened.

There can be no doubt that this series is a continuation of that to the South, but on account

of the greater abundance of Eruptives it looks more like the Archean. However near Stinchcomb Junction depends upon age of oldest rock, viz: the hornblende-biotite schist.

H1105 At the bridge across the Pine is a small ledge of porphyry-probably Brooks quartz schist. It is probably a felsitic schist.

[For more detailed account of these Exposures see Note-books of 1901]

On way from La Dalles to Florence stopped at Keyes Creek to Examined hills to the North.
Went in an old road running N. from Keyes Creek. The first rocks seen were at the dump heap of an old mine. The ores are poor and are represented by four specimens

H1106 } Ores from dump heaps.
H1107 }
H1108 }
H1109 }

Next north of the iron formation are slates and
H1110 graphitic slates
H1111 Going to the East end of the hill rock we found not far from the mine Exposures of iron formation and a bed of quartzite 4 ft. thick. It strikes N. 40° W and dips vertically.
On the crest of the ridge the quartzite is between two small outcrops of green actinolite Schist (?)
H1112 which may be iron formation.

Immediately in contact with this
H1113 is an ore conglomerate containing fragments of the adjacent rock and quartz. This looks like a conglomerate but it may be a breccia. A few feet further
H1114 west is a little more conglomerate and then comes the great quartzite formation that is locally a conglomerate and contains chert fragments.
H1115 Specimen 10 ft. from ore formation
H1116 " 50 " " " "
H1117 " 150-200 " " "
Interstratified with the first conglomerate is a schistose
H1118 rock.
Further west the quartzite is coarser, but still is much mashed and granulated
H1119 From this locality alone could not be seen important break between the ore formation and quartzite; but the conglomerate band is as wide as at many places in the Marquette District.

S. T. R.

NB: The difficulty with this succession is

1. Absence of limestone formation of lower Huronian.

2. Great similarity between the Actinolite schists and Slates at 1st falls of the Pine and with hornblende schists of the 2nd falls.

This quartzite and conglomerate may be the continuation of Brook quartz-conglomerate to the S.E. in which case there may be intrusion material between this conglomerate and the Beaty actinolite schist at the falls of the Pine - there being plenty of room for such intrusion. If this is true the succession beginning at the bottom may be:

1. Amphibole schist, greenstone with granite gneiss etc of Popple river. [Archean]
2. Actinolite schist and slates at falls [Lower Huronian]
3. Quartz conglomerate
   Quartzite
   Slates bearing intrusion of Commonwealth to Florence. [Upper Huronian]

[For further notes in this area
See Note-book of 1901 #342 USGS.

211,120 Hornblende schist, about Centre Sec 25.

Went up road toward Camp 6 on Pine Creek. to Examine the two pits from which iron formation material is said to have been obtained.

From place where road crosses Stream in Sec 15. T 40 R 30. N. 70 W along road 325 paces, then N. 40 paces, E. 90 paces, N. 20, E 90, W 20 to test pit in ferruginous Slate.

From same crossing road in a direction S. 10 W 200 paces is the so called Plumbelly pit. in rock like Specimen H1171

While there is undoubted ore in this pit the main portion of the material on the dump is more nearly a ferruginous slate; which may be a feature found in the Wauberry Slate; or the same horizon as the main iron formation. It is on opposite side of the road from latter and this may account for lack of iron.

Made trip to Rock Dam on the Pine creek.
West of the upper bridge on the road, near the rock Dam is a ledge of calcareous quartzite forming a little cliff. The general strike is N. 55° E and the dip 45 NW. On the side of the cliff near the top the rock is seen to lie in a recumbent fold with a calcareous band-like underlying a mine dolomitic bed. About 50 paces further south the strike is N. 20 E and dip, 20 W. 100 paces still further strike is N. 40° W. dip. 45° S. E.
The rock is in a series of minor plications plunging to the west, and these explain fully the variations in dip and strike.
The rock is quite unlike the main mass of the rock on Pine Creek. It shows on weathered surfaces alternate elevations and depressions — ½ to 1 in in width — resembling cherty lime-

S. T. R.

Red slates were found in some places lying upon the calcareous quartzite.

stones. However it is not certain that these layers are due to bedding for there has been slippage movement between them. In fact where beds cannot be distinctly recognized they cut across the minor layers and various angles. Probably the weathering is due to differences in conditions of shearing - the depressions representing zones of weakness.

At one or two places layers were seen to be turned back upon themselves, the limbs of minor folds being recumbent parallel to the laminae already described.

The quartzites at the rock dam and east are brilliantly gray on weathered surfaces, very massive, and only here and there exhibiting any evidences of bedding. Where this was seen at the rock-dam the beds were

discovered when and - varying from high E to high W. An interesting features in this vicinity is the gorge 150 paces long. Here the creek cuts the rock into vertical cliffs running E-W. Parallel to the cliffs the rock is cut by one series of vertical joints that sometimes seem to reverse the bedding. Another set cuts the rock perpendicular to the first set. Besides these two structures there is a marked shearing or schistose structure dipping west at low angles 5°-10°. This gives thin layers 1-2 ft across, and at intervals joints have formed along them. Cause of this structure was probably the differential movement which must occur parallel to the plunging axis of an anticline. The thinness of the laminae and the closeness of the fissures between them make the structure approach near to gemmine

schistosity. The structure must have been produced by bending the quartzite under very heavy load. Faulting and jointing may be later phenomena.

The quartzite is cut by many white quartz veins of all sizes up to 20 ft. Some of them follow the joints in directions while others cut irregularly.

41122 Specimen of the schistose quartzite.

Trader's Mine

At the Clifford Pit. East end is a ferruginous and sericitic schist forming foot wall of ore deposit. The upper layers of the slates are in a series of wavy bands faded into at least one syncline and one anticline, superposed on which are several secondary folds. The general trend of the slate at the margin of the pit is N-S. The dip is steep - about 75° to the west. A cleavage or fissility cuts the slates in a general E-W direction. The two structures are not well marked so that it is difficult to differentiate the strike from the cleavage. However the bedding is certainly shown by the contact of the slates with the ore, which is a heavily ferruginized jaspilite. These jaspilites at the contact show cross cleavage, but the strike and dip are clearly shown by wavy bands

of chert in the more ferruginous layers.

Going along the S. side of the pit the jasper has a strike very nearly N.W. and S.E. dips S.W. about 70°. At the west end of the pit the ore and jasper are in a series of sharp pelicanian with steep westerly pitching axes. Cleavage is nearly E-W.

At the extreme N.W. and W. side of stripping worked banded red beds occur containing much less iron than the lower beds. The general impression gained from study of the pit is that the effect that we have a complex western pitching anticline, with cleavage certainly across the bedding at various angles, depending upon the position of the several layers in the pelicanian.

At the Trader's pit there again seems to be a bending of layers that enforces the idea of a plunging anticline. Here the

red slate is again seen on top of the ore, but underlying slates are not mineralized. Here again the cleavage cuts across the bedding at some places. The jaspilite thickens and thins along the crests and walls of minor plications. Do not remember any other place where distinct cleavage cuts ore and jasper indifferently. In other places the plications of the jaspers are equally sharp, but the ores are broken in planes of weakness rather than cleaved. Folding of the area must have been accomplished when the iron formation was covered with an immense thickness of rocks.

C. & N. W. R. R. cut from which H10 12 & H1013 were taken.
The slates are green and cherty, chloritic and biotitic and are interlaminated with layers that are incandescent 1-6 in in thickness. These layers a little further east, on top of ledge on the east side of the road among their strike, are in part ferruginous and cherty. The chert bands are in lenticules or layers which die out quickly as they do in jaspilites. This slate might be an upper (Hamburg) slate ferruginized but is more probably the slates associated with the iron formation (Biwabik). Slates are closely foliated with pitches of 45° W.

West of the railroad across the swamp is a ledge of chert and limestone. On the northern side of the limestone chert becomes important and on top of ledge seems to be as much as 50 ft thick, extending for some dis-

lance along its strike.

Keel Ridge Mine

The mottled slates of the ones in the pit of the Keel ridge mine look like Hanbury. At the shaft the slates extend
H1123 50 ft on cross cut north. Then fairly clean ones dipping 70°-75° N.

H1124 Ore

H1125 Chert

H1126 Jasper. Shaft Dec 34

H1127 Jasper " " "

H1128 Fragmental material, Shaft Dec 34.

At the little shaft near the Electric light works on Dec 6. The ore is in little pitching synclines, in a series of folds pitching 30° W. Red slate is to the south and again to the east.

Cundy mines

H1129 The Cundy is a hard ore mine. The ore contains some magnetite. It is specular and finely banded, in many respects similar to the magnetite ore at the base of

H1130 the upper Marquette. The slate of the roof of the ore is green and chloritic also similar to the chloritic slate of the Marquette magnetite. To judge from stock pile there is a gradation between the ore and the slate. The silica in the ore and the slate seems to be unevenly distributed, ~~in~~ narrow bands of chert being noticed only occasionally. In short in every respect the ore is like lower ore of upper Marquette and very different from the banded ore and jasper of the soft ore mines of the Menominee District.

H1131 Conglomerate on contact of Dolomite and Graphite Slate. (See p 54)

Chapin Mine

H1132 Black Slate, South side Chapin open pit.

H1133 Graphitic Phase Same.

H1134 Banded one, last Exposure west in Miller's hill - Hewett Bluff

H1135 Jasper associated with this one

H1136 " " " " "

H1137 Large Specimen of same rock from South wall of pit - from the same hill.

The slates in the South side of the Chapin pit are in places dark gray to black and in places a little stained by ferruginous materials. Both varieties carry a great quantity of hematite in some places the surfaces of bedding planes are covered with a lustrous coating suggesting graphite, but which may probably be massive hematite.

In the Miller's hill the Jaspers bands are wider than elsewhere - 6 to 8 in. They show a fragmental structure - i.e. many crumbs of Jaspers

that look like feathered pebbles but which may possibly be produced by brecciation and concretionary action, or both, favoured by weathering. The iron oxides between, on cleavage surfaces have the peculiar spotted appearance of the iron oxides of the Ohpenning formation just above the Veganna jasper. This locality has been taken as evidence of an unconformity in the Menominee jaspilites: certainly the material is very like the recomposed Ohpenning jaspilite when much weathered. But the author it is almost impossible in places to discriminate between the original and the recomposed formation.

In working over the line it was found impossible to detect a sharp line of demarkation between the peculiar jaspilite and the ordinary form of the region - which is prevalent over much part of the hill. If there is a true

unconformity at this place between this exceptional jasper and the ordinary jasper it is all but obliterated by mashing and attendant alterations.

Fault in Sec.
near Bryngelsons Shaft. 2 T 39-30

A cross cut at base of limestone cliffs west of the Bryngelson Shaft shows a contact between graphitic slates and dolomite for about 6 ft.
The limestone surface is irregular projecting forward in the middle and receding above and below, so that the slates are under overhanging limestone. The surface is also minutely irregular. The slates near the limestone are graphitic and contain fragments of the limestone where near to the ledge and also bands of chert—one 4 to 8 in thick. The slate is extreme-

by shattered into little chunks. There is no doubt that there has been important movement between the limestone and shale. The motion being distributed through the shale for at least the distance from the pit 8 to 10 ft. This movement may be merely differential movement between the limestone and shale with might must an inclination of joint by means of which the shales are thrust against the limestone across the iron formation. Absence of this formation. The shale is so much broken that it is impossible to say whether it is a conglomerate or breccia at the contact plane. If a conglomerate it probably means that the iron formation has been cut out by erosion and that the shale has been shattered by differential movements without disturbing the normal succession.

H1131 See p. 50.

as the Mammoth district is one of folding rather than faulting presumption is always against faults as explanation of phenomena and in favor of some other explanation.

Curry Mine

From E. end Quarry road runs east along Jasper ridge. The Jasperite is typical banded material apparently entirely free from slate and fragmental quartzite. Going south from this bed crossed broad band of slate probably 400 ft across and through drift into Dunham ore formation. The slate toward south end of drift find little bands Jasper alternating with slate without any evidence of break between. From the shaft to the south as far as railroad track is a mixture of slate and ore. At the dumps the mixed material has the yellow color of

mustard in irregular blotches over it. Some of the jasper bands are as good jaspilite as main ridge to the north, but the material, as a whole, has a decidedly different aspect, whatever the significance may be.

At a little pit to the south-east pure ore and jasper breccia are apparently not intermixed with any scales or fragments of quartz, but are overlain by the scales which is brecciated at the contact in places. In the intermediate pit the contact has a steep southern dip.
At the NE pit the ore and jasper breccia is in a little E. plunging anticline (25°-30°). Not ore is the scales brecciated at the contact but on the south side of the pit it has breccia bands within itself.
In the brecciated places there is considerable vein quartz. There is here no transition between the jasper and ore and the scales. There may be an unconformity, but if there is it is obscured by brecciation.
An idea of section from main jasper belt through the pit. Thus anticline of scales containing jasper bands.

If we were to place breast in series would put it at top of the breccia.

No H1138 Ore breccia
H1139 Slate breccia between slate and jasper where both are brecciated.

H1140 Jaspilite and ore from about 6 ft. above pure conglomerate which looks fragmental.
H1141 Band of breccia in slate.

Myrgeleon Shaft	53
Carpenter Ave	2
Chapin Mine	14.15.16.17.51
Cuff Mine	7
Cundy "	18.50
Curry "	53.
C & N W R.R. Cut	3.5.48
Florence Dist	3.4.12
Forest	53.
Indiana Mine	7
Keel Ridge Mi.	18.49
Keyes Lake	37
La Salle's	30.36
Lake Superior	19
Little Poplar	1
Millers Mine	51
Norway	13.19.
Oswald's Mine	13.
Pine River	2.4.21.30
Rock Dam	41
Sunnies	8.9
Sagola Trough	20.
Sec. 15 40-30	19.40
" 23 40-31	10
" 24 40-31	3.5.48
" 25 40-31	11
" 26 40-31	10
Traders Mine	6.48

Closed 14 = .2 mm Open 15 = .2 mm
1 = .014 " 1 = .013 mm

Obj 6. 24 = .1 m
1 = .003 mm.