Menominee Iron Range, Mich: [specimens] 41142-41276. No. 392 1899

Bayley, William Shirley, 1861-1943
[s.l.]: [s.n.], 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 ¾ 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.

41142-41276 Notebook No. 392.

Menominee Iron Range.

Mich.

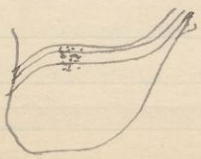
1899.

W. S. Bayley.

Perkins & Norway

Made cross section of Perkins mine. Here slates are on both foot and hanging walls. Mine ferruginous slate of the same kind is in the centre of the pit. No pure ore or jaspilite formation was found although jaspilite bands occur in the slate. The dip is to the South. About 125 ft from N. side of pit is an outcrop of limestone

In the Norway pit find the same conditions obtaining except that here is a very pronounced band back of breccia the most ferruginous portions are mined as ore. Nowhere was seen any broad band of pure jaspilite. Narrow bands however are present in the slate. The slate has steep South dips on South side, rolls over so as the flatter in middle then up steep again on the North side



In some places the vein is sufficiently thick to make a distinctly subordinate anticline. At places the band of breccia enclosing and sharply across the slates, which are regularly laminated. On both sides the breccia is not sufficiently rich to be mined. but in centre it is richer.

In order to produce so broad a belt of breccia there must have been important faulting, so it cannot be said that layers match on opposite sides of fissure as shown by diagram.

The ore seems to the slates enriched by secondary concentrations along the fault breccia as every gradations from poorest to richest slate mined as one is met with, and gradations to breccia are common.

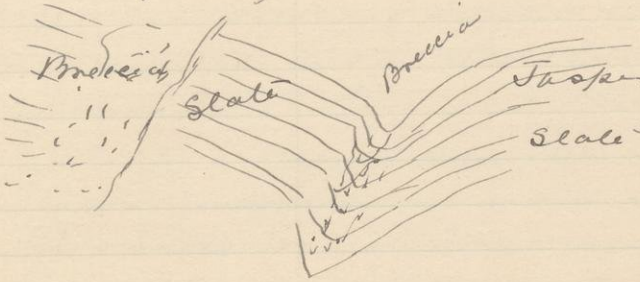
The character of the material taken from this is like that from Sand of slate band at Quarry. It contains much of the green matter and is

Not a jaspilite formation.

Cyclops mine.

Green's pit.

At the east end of Greens' pit ore and jaspers are at the top of an anticline pitching synclinal fold in slate pitching 10° E. The upper jasper bands & the ore become less jaspery and grade into heavy ferruginous slates. The west limb of the syncline is cut off abruptly by a great mass of slate breccia which locally contains considerable ore-a portion of which has been mined. A cross section looking E. is roughly as follows:



The breccia of the north fault is 30-40 ft. broad. Here and there it shows bedding layers running for some distance, thus indicating that the rock is a crushed rather than a fault breccia, though there is slight displacement.

In the next pit west a vertical wall on the west side, measuring 100 ft across and 50-60 ft high shows a depressed syncline of jaspers overlying slate. The north side of this fault is a regularly banded slate free from jaspers. It is overlain by clean but broken jaspilite rich enough in places to be mined. Within the jaspilite are layers having a greenish color, but these are subordinate. Following these as a guide a minor syncline fold in the jaspilite is made out. The fold is uncertain. On the south wall is another sharp contact of jaspilite with

slate. As the beds are twice as wide at the top as at bottom as their contact accords with bending of the jasper there is no doubt of the existence here of a syncline. Nor can there be any doubt whatever, taking into account what has been seen elsewhere, that the one formation overlies a slate. This bed is more broken on the south side but its character is unmistakable.

41142

At the dump of the little tunnel found definite fragmental jasper of which there is only in the district. Two specimens.

41143

41144

Iron Hill

On South side of the western ledge found chert-breccia or conglomerate which is similar to and apparently identical with the chert breccia found in the Devonian Reservoir. This ledge is surrounded on the west and North by a marble conglomerate. This makes a distinct embayment in the chert breccia. It is so-called because 95% of the pebbles and breccias are limestone. The remaining fragments are almost wholly chert of varieties almost identical with those in chert breccia. One large fragment (6 in. in diam) of quartzite was found. The fragments of limestone and chert vary from those of minute size to those a foot or more in diameter. The dense matrix appears to be mainly finely ground limestone and chert with some quartz from other sources. The pebbles are arranged with their

longer axes parallel to the strike and dip of the beds, i.e. nearly in an E-W. vertical plane. Many of the pebbles of the limestone have their previous structure arranged in different directions. Many of the pebbles have their bedding nearly perpendicular to this plane in the rock. The pebbles and matrix alike are cut by many fractures which have been cemented by quartz. In many places there are two regular directions intersecting each other diagonally and having acute angles between and each. These displacements have taken place along these fractures clearly showing that powerful stresses have been at work since the deposition of the conglomerate. The maximum stresses must have been N & S. The rock has been called conglomerate rather than breccia, because of the well rounded character of the limestone peb-

bles, fairly rounded chert ones and because matrix is thick and thin around pebbles according to the regular system in conglomerates rather than in the irregular masses characterizing breccias.

The conglomerate is believed to mark a considerable time break because of presence in it of chert fragments — the consolidation and concentration of chert in the upper portion of the limestone formation being probably a slow process. Moreover the areal arrangement of the chert and limestone conglomerate shows that former must have been a protruding ledge produced by differential erosion, on account of hardness of chert, when the conglomerate was laid down. The distribution of the two rocks might lead to the view that the chert breccia is younger but controverting this view is

the fact that chert pebbles exist in the conglomerate and no limestones ones are in the breccia.

41145 Fragment from the conglomerate.
41146 Chert in Iron Hill iron formation
41147 Graphite slate - Kramer's Pit

The limestone conglomerate is evidence either for considerable break at the top of the limestone formation before the main Menominee iron formation was deposited or else at and to Lower Huronian time. In latter case erosion must have cut through all the Lower Huronian formerly higher than the limestone.

After writing the above examined ledges again and others to the East. Upon the South face of this same ledge is a patch of chert-breccia which seems to be similar to the chert breccia thought to be older than the conglomerate. On other limestone conglomerate ledges to the East

Similar patches of chert breccia were found in both sides of ledges. And one very clear case is the easternmost ledge where a thin layer of chert showing distinct bedding faces both side of ledge curves up in little synclinal over it for a short distance and becomes lost and quickly disappears from view. One of the ledges showed quartz veins of large size but these seem to be different from the chert. The ledges on the S.E. side of the hill showed lime-stone and chert breccia intercalated and heavy ledges of chert excluding limestone from the eastern end of the hill. These ledges have an E-W extension several times their breadth. The appearance of this end of the hill very strongly suggests that the chert breccia is in a series of plunging folds overlying the limestone. The limestone conglomerate when traced east and west

becomes more and more breccia like and finally becomes a rock that anyone would pronounce a breccia if taken alone. Certainly no line of demarkation can be placed between the breccia and the conglomerate. All this suggests very strongly that the supposed sedimentary conglomerate is a pseudo-conglomerate? Especially is this true when studied in connection with the limestone breccias. At one place a distinct rock like limestone conglomerate is between solid ledges of limestone, in fact cuts diagonally across them. It is possible that the explanation is that an intra-formational conglomerate was first formed locally, that chert was deposited upon it and later the whole was again strongly crushed and brecciated. If any of the limestone conglomerate is a true sediment-

no other explanation of all the fact occurs to mes mind.
Taking all the phenomena together the conglomerate - whether real or pseudo can hardly be regarded as evidence of important structural break unless the break is in the cherty-limestone formation.

The pits about the hill were next examined. Those on north side are in Pats Dam sandstone. As the conglomerate is at the base of the shafts have penetrated a certain formation.
Pits with S.E. are mainly in slates which are ferruginous in places and graphitic in other places. They contain heavy beds of ore and sometimes of chert. In places the slates are graywacke like and show fragments of quartz.
Similar slates form low hills south of the limestone and are

said to occupy the valley between the hill and the foot of the limestone bluffs. This is on the authority of Mr Kramer who explored by pan and auger. The ledge is reported to be but 2 or 3 feet beneath the surface. The shales appear to be like the Hamburg but are not sufficiently different from the intermediate shales of Norway and perhaps to make it certain that they are of a different formation.

H1146 } These specimens are from
H1147 } this shale area.

Hamburg Slates, south
of Lake Hamburg and S. W of Norway.

From the North side of the ridge
South of the Swamp from where
very calcareous. The iron carbon-
ate is abundant as shown by
the brown weathering. In one place
the ledge (10 ft. wide) is nearly all
limestone. Not all the ledges on
the line were examined but some
were found that did not contain
an abundance of carbonate. The
steepest North slope is at a place
where the carbonate bears layers
of chert from a fraction to several
inches across. In several places
these layers were seen both in
the process of development. In
places the slate associated with
the carbonate and chert is very
ferruginous. Under proper
conditions cannot see why
an iron formation should not de-
velop from such a carbonate
as occurs on this line.

At the west end of Hunbury Hill a much squeezed chloritic rock occurs in north side which was taken to be very much altered Greenstone. To the south of this and separated from it by a little valley is a broad ridge of carbonate slates similar to those on the ridge to the south-west. No chert was found here nor any pure carbonate, but there is no doubt that these ridges belong to the same belt as those west. In places the carbonate slate has becomes veritable cleavage cutting directly across the bedding. To the south of the carbonate slates, on lower plateau but separated from them by a little interval are siliceous argillaceous slates much veined by quartz but apparently bearing no carbonate. They are like the slates at the east end of the hill.

If the carbonate slate belt were more ferruginous than the place

between the argillaceous slate and the greenstone would be favorably situated for the formation of an ore deposit. But at Hamberg hill no chert beds were seen.

H1148 Limestone from N. slope of hill south of the Swamps Farm.

H1149 Slate from same place

H1150 Chert " " "

H1151 Chert associated with carbonate from same place.

Loretta Mine

The Loretta iron formation seems to be more slaty and quartzose than elsewhere. However it is not dissimilar from certain of the intermediate slates. Especially those of the drift near Cyclops. Underground the formation may be typical as best one appears to be like the high grade Pewabic one, suggesting that the two ore formations are the same. The peculiar feature of the district is the fact that the various

ledges of the broad belt of limestone all dip 30°-40°. The ledges were not thoroughly examined to be sure that the supposed bedding is not cleavage, but this was not thought likely.

H1152 Loretto #1 ore

H1153 Ferruginous shale associated with Loretto ore.

H1154 Jasper associated with same.

H1155 "Basaltic limestone" Uranium mine. This seems like a mixture of limestone and shale near contact.

H1156 Dyke W. Vulcan.

Brier Hill

About 50 steps S. of the limestone in end of Angus trough is a row of ledges which consist of one, jasper and chert conglomerate having interstratified layers of ferruginous quartzite. Just below these are layers of slate which may be limestone slates. These quartzites traced along their strike to the east are followed almost to their end by the limestone, where the two are almost in contact. Here is seen the coarsest one and jasper conglomerate found any where. The beds grades upward into a siliceous slate gradually containing less and less of one. Gradation may be seen as a series of ledges and ribs between the quartz conglomerate first described and the rail road cuts where slates are exposed.

Crossed hill diagonally to the S.E. met an interval without exposures then follows a broad belt of siliceous slates which

may be seen to grade upward into the Sauk iron formation. Here the gradation appears to consist of slates becoming more and more ferruginous than in the interpolation of seams or beds of jasper between slate layers - though beds of jasper do occur. Returning now to the limestone and following it to the East a true jaspilite belt is found extending to the Curry Shaft. The belt extends from Curry to and through W. Vulcan. Numerous open cuts in this interval exhibit the succession which is everywhere the same as east of Gaastra. At bottom is a clean cut jaspilite with continuous bedding thinly jasper and bands of specular ore. Upon this belt of jaspilite is a belt of breccia which is believed to be mainly a brecciated conglomerate. This grades up more or less rapidly into siliceous slates. These be-

ing also brecciated in places as hereto fore described.

The main part of the old open pit running seems to have been upon this breccia conglomerate. At one place the clean regularly banded jasper is sharply separated from the breccia. In the lower portion of the conglomerate are bands of jasper, but when these are examined they are seen not to have the clean, sharp appearance of the jasper beneath the conglomerate. It appears in many places to have granules of jasper and quartz scattered through it. In and through this conglomerate are some veins of jasper similar to the under jasper beds. But in some places these are clearly of secondary origin. At the pit is a series of plunging folds as a result of which the ore and the jasper conglomerate wanders over the original jasper in an anticline.

Going South from these pits siliceous slates are finely exposed - exhibiting clearly the transition of the conglomerate into jaspers siliceous slates and these into ordinary slates. The pit and drift cuts entirely through the siliceous slates and at the South side again enters jasper: Here the gradation is somewhat different from that at Briar Hill. Jasper appears first as a few bands in the slate. These become more numerous as we pass South until the whole becomes an iron formation.

To the East of this locality is a large open pit exposing the entire width of the iron formation both South (100 ft wide at surface). On the North side of the pit are the siliceous slates. The jasper has a different appearance from the jaspilite to the North. It seems to be some-

What greener, has scaly streaks
in it that looks fragmental
and has less continuous jas-
per in it. In places this sucke-
en jasper gets to be a chert
bearing bands and shale & one
which decays to the like Jogebig
chert before known stratigraph-
ig position for the beds.
At present one is being taken
out from little pockets that
lie perpendicular to strike &
beds, where veining and brec-
iation occurs.
Just south of the jasper is a
green schistose rock taken
to be a modified Erupting and
above this is a black scale
(6-8 ft) and above this silvery
fissile scales. There has evident-
ly been marked movement
in the greenstone, there being
in it one band of rubble 2 ft.
wide.
The contact between the green-
stone and the chert is sharp.

The fissile slates breaking into minute laminae with wrid forms show that there has been great movement between the jaspers and the slate formation, but that this movement is distributed through a considerable thickness of slates. The silver slates have maintained their character better than the black slates. They are slickensided and fractured, and are broken into blocks across their bedding. The North jaspers need no special description. It is like the Marquette hard ore jaspers. Lower down or where thickest it may take on the character of the soft ore jaspers.

General Notes

The ore and jasper conglomerate at the Aragon trough is not severely crushed although in places pebbles are somewhat flattened. This is explained by the presence of the conglom. near the crest of fold or near its trough, as shown by flat dips. This beautifully confirms supposition that conglom. are less apt to be obliterated at axes of folds than on limbs. It is believed that this conglomerate is equivalent to conglom. at top of Negaunee and equivalent to that which comes from the drift at Cyclops. If structure is thus understood this drift should cross anticline of slate and in its center reach low enough to catch the lower part of the siliceous slate formation.

It is believed that the conglomerate formation is continuous with conglomerate breccia of the Iron Work of the Curry mine. Moreover it is highly probable

that it is a continuation of the Conglomerate breccia at the Norway pit. If this is so the Lingam of the Conglomerate & Conglom. breccia marks an important break below which is the Lower Menominee series and above which is the Upper Menominee. At places below the break as at Brier Hill, the Lower Menom. Jaspilite may be entirely eroded. In other places as at the deeper workings of the Lingam the one formation may be of considerable thickness. This theory applies to the district seems to explain all the facts. It explains:

1 The variable thickness of the Negaunee formation - a fact remarked by all the Mining Engineers.

2 The clean cut character of the Jasper of this formation as contrasted with that of the Upper formation

3 The thin beds of breccia in one, as at Norway - this one being

essentially the same as at Ishpeming.

4 The entire absence of the Negaunee formation on Sec 2. E of Lummers where graphitic slates are in contact with the marble — followed to the South by the Hanbury slates.

5 The absence of conspicuous exposures of iron formation material on North side of limestone ridge and the sparseness of such exposures about other limestone ridges. In these localities doubtless the Negaunee formation is largely eroded and indeed only remnants are certainly known on S. side of Southern limestone.

6 The presence of black slates below the Loretto syncline and the presence of a 30 ft. bed of limestone in these slates as shown by diamond drilling — similar limestone is in the Hanbury slates. The very thin belt of limestone North of Loretto and indeed along this part of the belt being

the only remaining portion of the Lower Menominee above the Quinnesec that has escaped Erosion.

7 It explains the difference in the Jasperites of the Iron ores and the Jaspers ~~between~~ below the Siliceous Slates. The latter being unconformably ~~between~~ beneath the Siliceous Slates and the former interstratified with Slates grading into the Siliceous Slates.

N.B. At time of copying these notes cannot see that any of the above explanations are satisfactory.

The Menominee district to be in Succession and in character would be intermediate between the Marquette and the Gogebic combining many of the characteristics of both. more especially with reference to the persistency of the Upper formations.

In the Lower Marquette is the

fullest succession in the Dunk
Shore. In the Menominee district
there are only 3 members of the
Lower Huronian and in the Go-
gebic only remnants of the lime-
stone and Jaspilite.
In the Marquette the lowest iron
formation is a great producer. In
the Menominee it may exist in
small quantity. From the Goge-
bic it is absent.
Of the upper Huronian, both in
the Marquette and the Menominee
there is a producing iron forma-
tion at the base. In the Marquette
district it is a marked jaspery and
ore conglomerate. In the Menomi-
nee it is a conglomerate breccia
In both districts it is at the con-
tact of the two formations and
is marked by a row of openpits.
In the Gogebic district there is
no such iron formation because
of the entire disappearance of the
lower formation. There is in the
matter of a recomposed formation

The Marquette and Menominee formations are similar.
Above the basal iron formation the succession in the three formations is practically similar:-
1. Siliceous slates
2. ore bearing horizon
3. Great slate formation
Hamburg = Michigamme = Upper Slate

In the Gogebic district the iron bearing formation is a perfectly persistent belt from E of Sunday Lake to 8 or 10 miles W. of Penokee Gap. 60 miles. In the Menominee district the formation is known to be persistent for several miles from Iron Mt. to Wausedah. It may be persistent to North & S. beds of limestone and about other limestone beds. That it occurs in places is shown by the Loretto mine, and the pits near Menominee Camp 6.
In the Marquette district this iron formation is quite unimportant

ing a few patches of ore having been found in it.

In the Crystal-Falls - Florence district this same formation is producing. The importance of the upper Menominee iron formation as compared with the formation in the Crystal Falls district may be explained

1. by fact that this horizon is brought to the surface persistently by Major faulting of the district as shown by the lower formation in pitching folds. In the district to the west there is no certainty that this is the case. The ore formation being brought up only here and there, the country being otherwise occupied by slates.
2. The position of the ore in the formation is largely controlled by the dynamic subordinate pitching folds which have furnished ideal conditions for ore concentration. These troughs are formed in the upper formation by the rigid

characters of the underlying Calcareous
3. Comparative manners of land
areas may have been a factor in
the one formation itself having
different compositions in different
places. It is certainly the case
that the original rock of the upper
one formation varied greatly in
different districts both as to its
thickness and as to whether
carbonate was of prime importance
or only of subordinating
importance, and finally as to
how heavily the carbonate was
impregnated. These differences
are all well illustrated by the
contrast between the Jurgens
and Torgeby carbonates.

Chapin Mine

Section of Cross cut between Hamilton and No 2 Shaft.

Beginning at Hamilton Shaft

41160 found first limestone - not far from contact.

41161 Coarse quartzite, just south of contact

41162 More ferruginous phase, little further south.

41163 Slaty quartzite, south of 41162 and intermixed with it.

There appears to be a gradation between 41161 and 41163 through 41162. The width between 41161 and 41163 must be about 50 ft.

The slaty quartzite (41163) grades

41164 upward into quartz slate. This passes into a very ferruginous

41165 slate and south of this comes the first belt of ore.

Between the 1st and 2nd belts of ore

41166 is a quartzose slate practically identical with 41164

South of the slaty ore, slates again

41167 appear and these grade into slaty jasper, the jasper bands

just appearing in the slates finally replacing them completely and changing them to a jasper formation. The relations are apparently the same as those at the south end of drift at W. Vulcan. Specimen #1167 was taken from near the jasper.

#1168 Jasper South end of drift.

#1169 Slate from south end of drift from which drift went in toward Miller's property. Drift and drift are the way in this slate each about 200 ft.

Ludington open pit.

The section across the open pit for the Ludington working shafts shows, beginning at the north:

#1170 20 ft feldspathic quartz slates showing minor crinkles, bearing

#1170a quartzite layers near the top.
6 ft. fissile slates
1 ft quartzose slates bearing large grains of quartz and considerable ore.

H1171 Specimens
H1172 from
H1173 this
H1174 Quarry

H1175 1st belt of Jasper 4 in wide 24 feet. Jasper & Slate. Jasper band being more prevalent to the South
H1176 dark colored Slate
H1177 light colored Slate further South
H1178

The majority of the Jasper bands continue for short distances only. They are discontinuous and many of them are in void masses surrounded by Slates. This Jasper is Secondary. The 24 ft of Slates is similar to the Slates in the C O & W R. R track west of this place.
The contact between the Slates and the ore is sharp. The ore is soft and is stained into little cavities. It was evidently an important adjustment plane. Above the soft ore which is one or 2 ft in thickness is a slaty one 13 ft.

H1171 Specimens
H1172 from
H1173 this
H1174 Quarry

H1175 1st belt of Jasper 4 in wide
24 feet Jasper Slate, Jasper band
being more prevalent to the South

H1176 dark colored Slate
H1177 light colored Slate further South
H1178

The majority of the Jasper bands continue for short distances only. They are discontinuous and many of them are in void masses surrounded by Slates. This Jasper is Secondary. The 24 ft of Slates is similar to the Slates in the C.P.R.R track west of this place.
The contact between the Slates and the ore is sharp. The ore is soft and is stained into little balls. It was evidently an important adjustment plane. Above the soft ore which is one or 2 ft in thickness is a slag ore 13 ft.

thick. The upper, dark, surface is sheared and broken as in the dark surface. The contact between the ore and jasperite of the dark is rather sharp but wavy and diagonal to the areas of heavily ferruginous jaspers grade into opt rich ones.

41179 Next layer 110 ft jaspers

41180 Next layer shales lining dark side of the pit.
Contact between the jaspers and the siliceous shales of the dark were not exposed. Interval about 6 ft.

Old Ludington

41181 Quartzite conglomerate from the dump heaps of the old Ludington mine. Great quantities of this rock, quartzite and slate pebbles with those in Chapin Mine occur in the dumps.

41182 Much of the conglomerate is highly calcareous

41183 Large specimen of jaspered ore and slate.

S. T. R.

Also called Slate Lake!

6—747

Traders Mine

41184 Graphic Slate from pit N side of
rail road track - west of Traders pit
41185 Slate from cut N.W. end Traders
pit. The central part contains gran-
ules of limonite which look as if
they might be pseudomorphs after
carbonates. This material undoubted-
ly grades downward into lean
41186 Traders ore Lean ore from N.E. part
of the pit is believed to be fragmen-
tal because of abundance of spal
of hematite in it which instead of
being in continuous layers as
in genuine iron oolitic jaspers, are
detached and the whole has the
appearance of washed fragmen-
tal ore and jasper sand.
41187 Washed conglomerate Cliff end pit
E. end. May be brecciated ore and jas-
per.
This latter resembles strongly the
conglomerate ore from some of the mines
in the Saginaw range at the base of
the Dolomite formation. Suspect the
true history of this deposit is that al-
ternate bands of rich iron and jas-

per, and running transverse to the present schistosity, have been shattered by washing so that the more siliceous bands are discontinuous and the pieces are thus like fragments. Think that both pseudo-pebbles and matrix alike are both detrital — each pebbles being composed of many grains of ore and jasper.

41188 Micaceous hematite schist making part of E. wall of Clifford pit. So called slate foot wall of present mining. Believed to be washed detrital ore and other material in which secondary mica has developed and ore pebbles have taken on a specular character.

The Traders and Clifford pits are in material more like the very schistose basal Palpeming specular ore than anything else in the district. It is believed to be at this same horizon bottom of recomposed ore and jasper. The great amount of detrital material here suggests that remnants of the Negaunee formation may exist to the north. The

slates above the one in which the gold appears below the siliceous slates below the Upper Menominee Geographical horizon and the usual gradation between the two is noticed. Between the outcrops of these slates and the graphitic slate [illegible] is sufficient room for remainder of the siliceous slates and upper one formation

Chapin.

At one place in the drift running S. E. from the Hamilton Main Cross-cut saw slate under the one, but with dip of the N.W. Mr. James said this one is the bottom of the old Sarah Lens. [Mr. Sutton thought this not possible]. This observation combined with the dipping in of slates under the one makes it probable that one is in Synclinal in slates. It is probable that we have here a minor fold of slates under the one but that bottom of the one has not been reached. Various minor folds were

found in the slates and the ones which are rather acute and the sides of which quickly become nearly parallel. Thus the folds become isoclinal, being overturned with axial planes dipping north. Taking all the facts into account the most probable explanation of the structure from the Willis Hill to the South is a line similar to the north is that which makes the slates the same and anticlinal. The Chapin ore bodies lie in synclines while Willis is culmination of main E.W. Monocline belt of Jasper. In the closed synclines surrounded by slates on all sides the top, and pitching steeply to the west the conditions for ore concentration are ideal. The Willis on the contrary is in a culminous belt of Monoclinal Jasper with no bottom of slates and therefore Willis is in the same position as the Harrison Shafts at Muncy. Where there are important pitching folds in the S. Jasper belt.

as at Penobscot, a large ore body may developpe. The only difficulty in the above explanation is the apparent closing of slates above the small lenses of chalcopyrite, and the narrowing zone of the big lenses at the top. Was it ever proven that slates do close above the ore body for its entire length?. The probable explanation of narrowing above and closing in of slates is perhaps the pinching out of the lenses which are soft by the hard siliceous slates. The pinching out would not occur until the end of the faulting period after the alteration of the ore formation had progressed far. Pinching out of soft formations surrounded by hard ones near the centers of synclines and anticlines is common on one side in this case we have the hard jasper formation at Mullie Hill and on the other side the great limestone and directly in contact with the ore is the resistant siliceous slates. The

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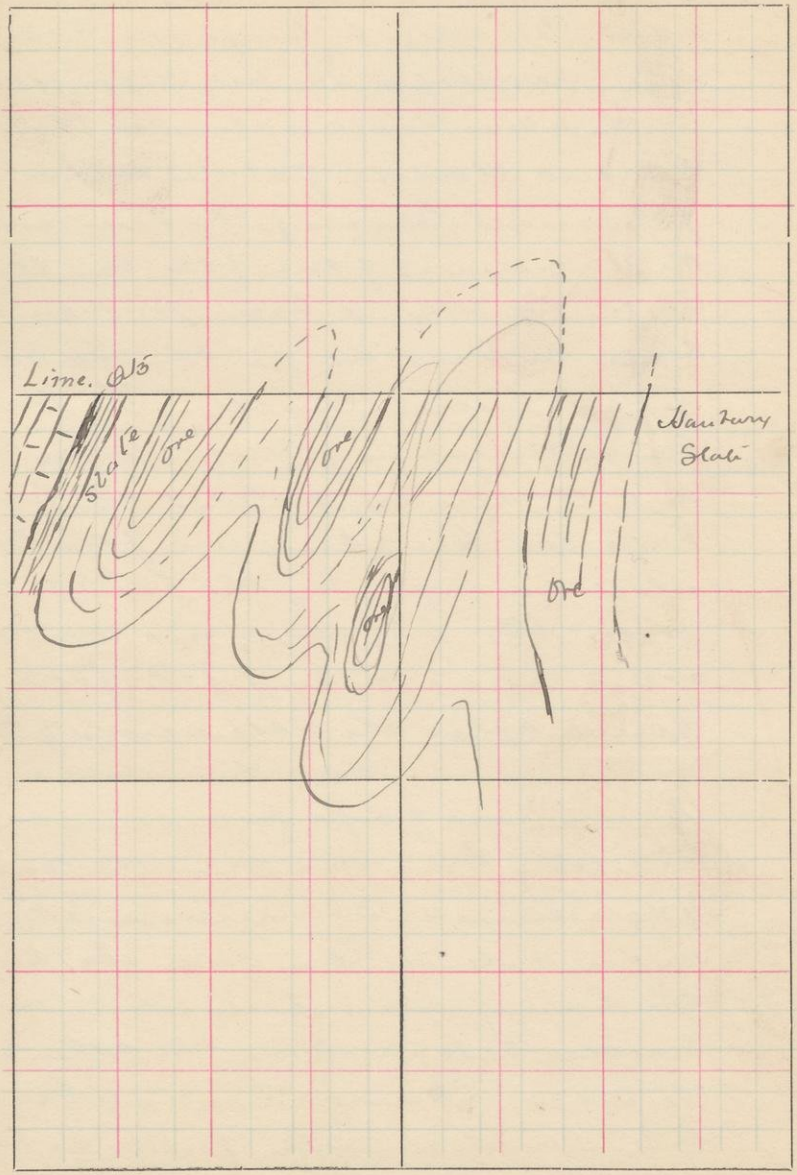

quartzite in the limestone, as already said. appears to grade into quartz slate and this into ordinary slate. It is at the bottom of the quartzite that the unconformity is.

See rough sketch opposite.

N.B. Trouble with this structure is that there is no place for the Upper one formation - or if one is upper no place for lower!

Ludington.

The coarse quartzose slate just below the one at open pit of Ludington gives evidence of clearing up of waters from condition of mud deposition, and the preparation for a new clastic sediments of the new formation. This exactly parallels Gogebic.

It looks as though the slates on the South side of the pit are like those on South side of Chapin pit.

The one shipped from this shaft is an evenly banded black and

H11189

Shining dark red one. The ~~black~~ Soft portion is soft and without luster. The red portion has a slight lustre as though partly composed of limonite. Here and there it is broken across leaving little cracks lined with calcite crystals.

411190 Under Vaney's

411191 Jasperoy "

411192 with calcite vein along bedding.
Old Ludington
on the Dump near the S.E. Shaft of the mine in the NW ¼ SE. Sec 25 the iron ore is banded as at old Ludington. The jasper is clear but the pieces is pinched out

411193 Evenly banded.

411194 In places the one is cut by joint planes producing rhombs, and some specimens are knobby as

411195 though speckled with garnets.
Good Specimens of fold were observed on dump of which two were taken:-

411196 One showing gentle folding and pinching out of jasper, and the

H1197 other showing joints and the enrichment by ore along the joint planes.
About 60 paces north of the little pit is a shallow depression as though made for foundation of house. In this is specimen one that looks as though
H1198 it might be recomposed. The jasper however, looks only slightly fragmentary if at all. as limestone must be near the ore and jasper are probably recomposed.
H1199 The pit is in what looks like fragmental ore and jasper - though it may be the upper ore.
At the dump heaps of the shaft at west end of the pit found large quantity of coarse quartzite. Specimen
H1200 containing undoubted specimens
H1201 of jasper. The one is in places dense, perhaps micaceous, but it though resembles the upper ore.
Perhaps, as at Chapin, the quartzite is immediately on top of the limestone. There is no question but that we have here a fragmental series but the ore may be up in it and

the quartzite may come from the bottom of the shaft as it appears at top of the dump. The quartzite appears in bands with thin layers of slate.

41202. Most typical jasper.

41203 Lens surrounded by slate seams. No well defined slate is on the piles, though there are specimens that look as though they may have been slates, which were subsequently enriched by ore.

At the westernmost shaft the same rocks occur on the dumps. They look a little more slaty but can find no distinct slates.

41204 Manning ore

41205 Specular ore

41206 Jasper

The shaft in center of Sec 25 is now being worked by the same Hyde.

41207 On dump back of this shaft and on dumps of next pit find practically same jaspers etc, and banded ore as further East.

41208 Big specimen showing jasper.

Penrhos Quarry

The Penrhos one is black, banded. Sometimes soft, sometimes hard with often glistening crystals.

Tyrone Does not differ in appearance from Penrhos but occasionally is white. Visible through the presence of serpentine

41209 Verona is a banded one with parallel and curved one and jasper layers.

In the dump heaps of the Penrhos chips are considerable quantities of fragmentary quartzite with jasper pebbles showing that some of the deposit at least is recomposed.

Folding in the jasper seems not to be as prevalent as it is at many other places in the range, the readjustments having taken place largely through brecciation

Large specimens were taken illustrating:

1 jointing.
2 Passage of banded into breccia
3 cementing of breccia by calcite

4 passage of jasper into ore where former
5 was curved.
6. fold in ore.

At Spencer's Exploration in the center of Sec 25 is a large dump in which found

41211 ovoid of jasper
41212 banded ore and jasper
41213 } Slates - calico - look like altered
41214 } Hanbury. They are not as silicous as the intermediate slates. These I had called 'marble slates' three years ago..

In this same dump found also many pieces of a rotten quartzite that looks like the basal quartzite at the Chapin with considerable ferruginous material.

At the W. Ludington Exploration in the W ½ Sec 25 a drift has been put
41215 into the hill. At first banded slates were brought out slates that look like the Briar slates, then lean
41216 ore banded with fragmental jasper

There is little to guide me as to relations here but I think we have the upper formation without recomposed one

4-12-07 jaspers associated with the ones.
At the pit a little further north
4-12-18 the one looks a little more like the recomposed one, though whether it is or not am not certain.
Sandstone was encountered immediately in the work of the pit
At 175 N. 50 E of mouth of the foregoing drift is another drift in the hill near its top. From this an immense amount of material was taken out, but it looks to me like ferruginous sandstone. It is a rotten cancellimary stuff in part
4-12-19 and a banded material which I think is a mixed sandstone and ore.
At pit 25 E. of drift is quartzite.

About 200 further west are two pits from which good deal of material was taken but it was too much broken up and so weathered to

yield much information.

41220 Jasper from this pit
There also seem the calico slates
on dump.

41221 From pits to north. Ore and
41222 jasper.

41223 Red slate from pit near W ¼ post of
Sec 25.

From old shaft at W end bluff
NE ¼ Sec 26 T. 40 R. 31.

41224 banded ore
41225 ore
41226 ore
41227 jasper
41228 Slate or slaty ore
It is more difficult to determine
structure here than elsewhere as
can see nothing but dump heaps
These contain banded ores, slates
richly ferruginous and fragmental
jasper. The ore has a fragmental
look. All the pits examined seem
to be in the same rock.

41229 Slate

41230 Specimens from pit 50 E. 175 S E of
41231 Shaft. Slates and ore in Dump.

At 300 S E of same Shaft is a Drift in the hill 4ins passing through red,
41232 rotten Slates, with Dip of cleavage 45°S. At then passes into one formation. The ore is Specular and
41233 micaceous and
41234 the jasper fragmental bearing
An Examination of the Slate on the Dump shows that the bedding is
Not parallel to the schistosity
41235 Some of the ore is beautifully
mottled showing Continuities of ore
in a jaspery matrix
About 300 further East is another
large, red pit on the Dump of which
are
41251 Specimens, rounded ones { see p. 54
41252 fragmental jasper. " " "

N.B. These pits are located in map
made in following season and
nos of Specimens inserted on same.

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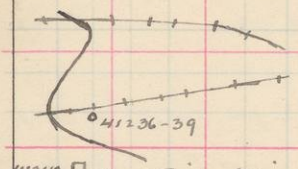

41240 □ Keel Ridge Mine
41241

Keel Ridge Mine

About 100 paces N. of the old Keel Ridge mine, between the railroad and road and 60 paces East of crossing of road is an old pit on dump of which find Schistose, Gray recomposed one, hard gray mine massive one and in places

41236 Graphitic Schist

41237 Siliceous one,

41238 Schist banded with green chalcedony

41239 and banded Jasper and one, the former containing "Slate of coal".

Price?

On the dump of the old Keel Ridge is an enormous quantity of fine laminated fissile Slate and another much more compact

41240

In drift south of the shaft there is also a band of iron formation, followed by fissile Slate that weathers like the Sandberg Slates, Especially the graphitic kinds.

41241

In the open pit to the west found iron formation (banded) on N. side of pit overlied by slates little syncline pitching west about 17° 20°.

41242 One

41243 Jasper

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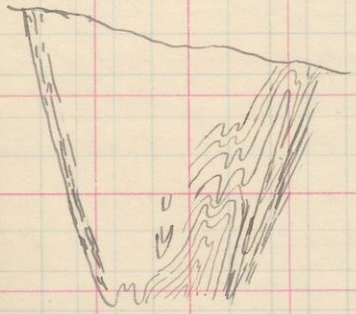
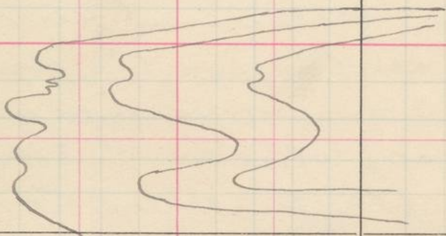


E side Reed Ridge
Pit

The formation looks like the upper
one. On the East wall of the pit are
numerous synclines and anticlines
but cannot determine pitch
41244 The ore grades through the two
41245 rocks 41244 and 41245 into a rot-
ten red slate, which at the extreme
South side of the pit in top looks
41246 like the graphite slate.
In one of the more Easterly pits
41247 found iron formation to the North
41248 then banded cherty layers and ore,
41249 then chert, followed to the South
41250 by slates.
Since find synclines in these
slates in abundance and arrang-
ed in accordance with the expected
arrangement of minor synclines
in a major one it is thought that
the lower iron formation must
be absent and the upper one
is in a synclinal and anticlinal
fold and thus is thicker than
at most places.



Folding of jasper bands top W End of Cliffs Pit. Scale 3 ft in bet. blue lines.

Traders Mine

Made a detailed map of Traders & Clifford pits on detail sheet which is not incorporated with these notes.

The one at Clifford pit is mostly schiste near the anticlines and synclines mapped on western edge, and most conglomerate at the N.E. side. The faults are beautifully seen in surface at west end, top of pit.

A little S.W. of Main Shaft at the Clifford pit is a new exploration Mc Clintock from dumps of which took two specimens

41258 one like that at Clifford
41259 Entirely one see p. 55.

The Fleischein Shaft Mot. is 340 W. 100 S of Main Shaft. In this according to Capt Carbis the shaft went through sand, then 30 ft. red slate, and balance in gneiss. The drift runs a little N of North from Shaft, first through

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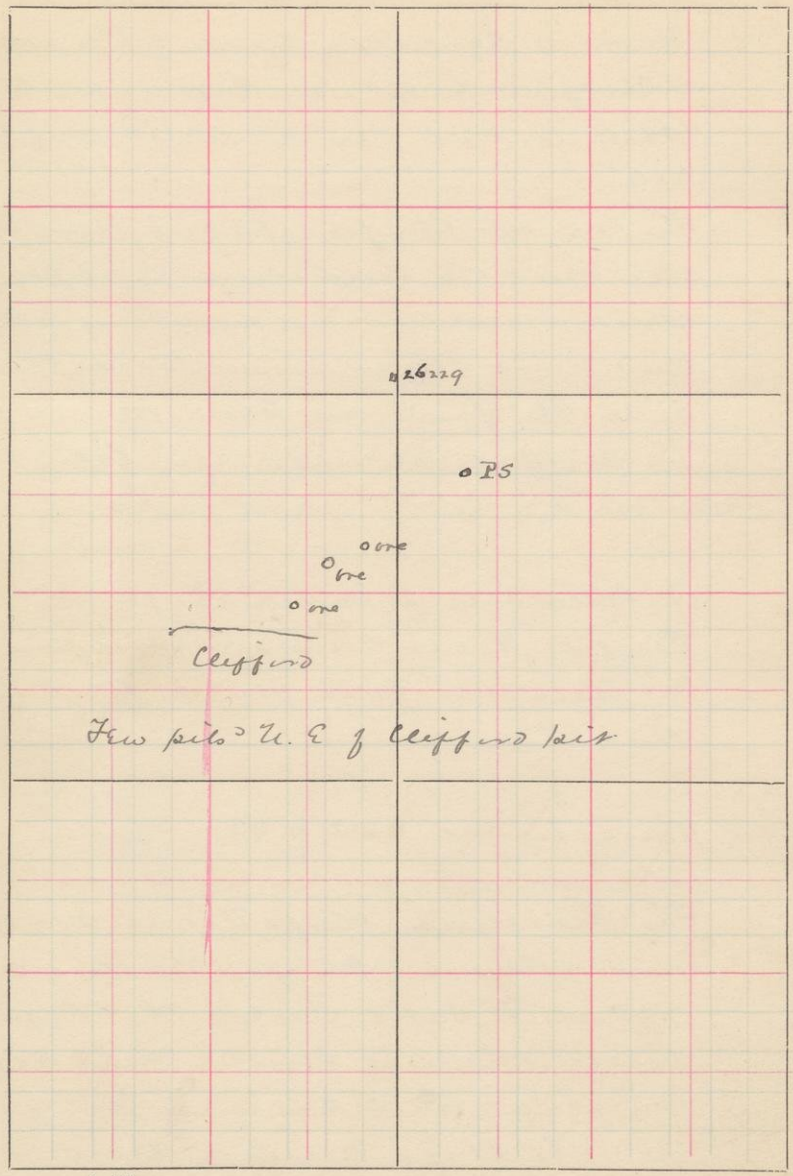

15 ft. of quartzite, then 250 ft of ore then talc red slate. From Dump rock

41258? Specimen quartzite

A row of test pits put in a line running a little N of W. from Fleischem No 7 to a little S.E. of Traders were in red slate. A row running N.W. was in ore. See plats of mine & outer walls for records.

Capt also says that N of W Shaft of the Comet mine a conglomerate was struck and sunk about 200 ft. a red slate.

Lake Antoine

The westernmost ledge of chert on the South side of Lake Antoine is South of the western end of the Island and about 100 paces East. It is S.W. of point on the Main land The bedding seems to Dip N at 65° 75 paces S and from 50 to 60 paces E is sandstone. 70 paces S W is another sandstone ledge and at 100 paces a little S of E is a third.

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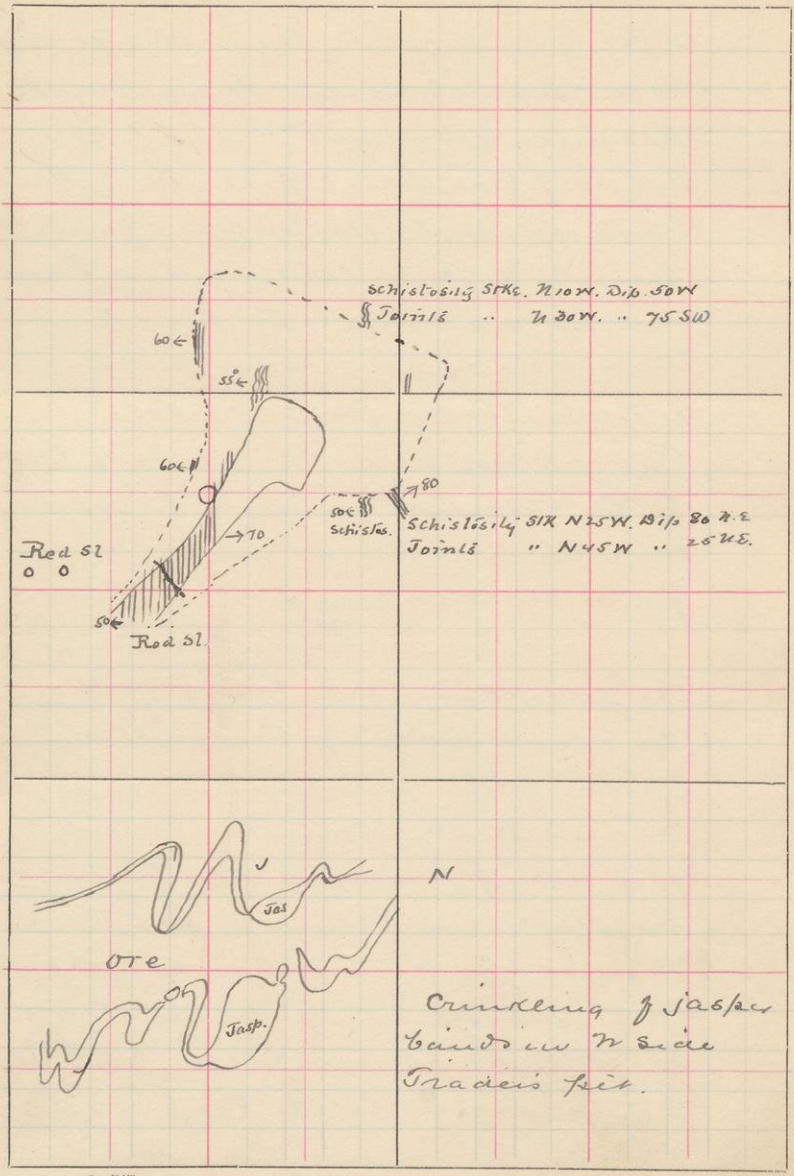
Schistosity Strike. N10W. Dip. 50W
Joints " N30W. " 75SW
60
55
60
80
50
Schistosity
70
50
Red Sl
Red Sl
Schistosity Strk N25W. Dip 80 N.E
Joints " N45W " 25NE.
J
Jas
ore
Jasp.
N
Crinkling of Jaspers
trends on N side
Tracies Hill.

Trader's Mine

Examined again the pits from which Specimens 26229 and 26230 were taken in Sec 17. 20-30 N.W of the Clifford pit.

The dump heap for Southern Shaft is full of banded ore that is so fine grained that it resembles the alder formation (Negaunee) The jasper is in even bands and is only occasionally lenticular and the texture is not fragmental In a few specimens, however, the fragmental texture is prominent.

H1251 banded ore

H1252 banded ore and jasper

H1253 banded ore and fragmental looking jasper

H1254 jasper

H1255 fragmental jasper from the pit North.

H1256 Ceylon ore. N.E. corner Clifford pit

H1257 Knotty ore. S.E. " " "

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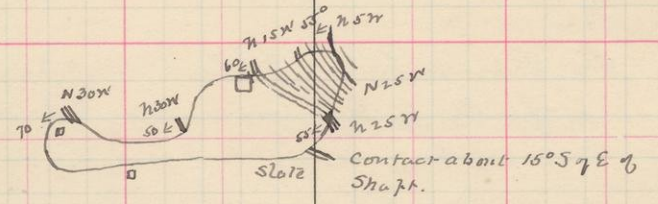
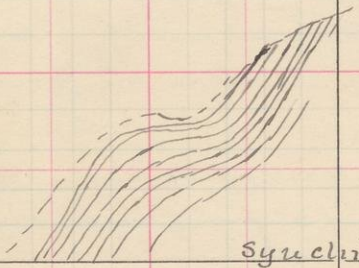


Plan Cornell mine



Syncline N. corner E End Cornell Mine.

Cuff Mine

The rocks on the dump of the Cuff mine are

41259 one conglomerate with jaspers and one fragments

41260 } banded ones
41270 }

41271 with thin jasper seams

41272 } and white chert seams
41273 }

41274 and red slates

Map of pits around the mine and trench W East is given on p. 57.

There is a little exposure on the surface but is shows almost nothing. The banded one is exposed and near the sandstone.

A number of pits however have been sunk and these show banded ones like 41260, red slates like 41274 and conglomerate ones like 41259.

Took my 2 specimens

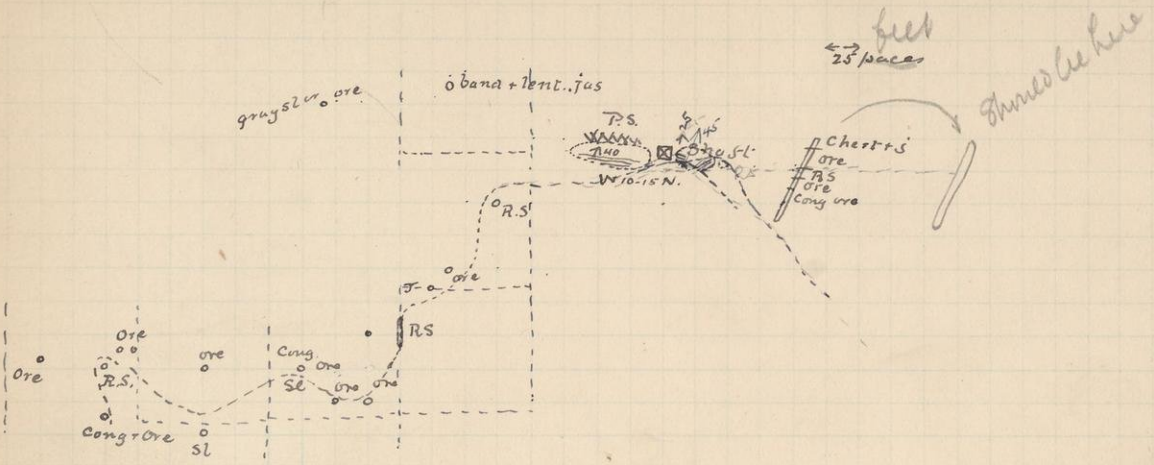
41275 gray slate in beam one from N.W. pit. The trench W the East of Shaft has its north end in banded one. Then jasper slates and conglomerate one as pleated. Jasper at north end is frag-

41276 mental, It seems to contain small grains of jasper.

	Pewabic	Genoa	Toledo	Tyrone	Walpole
Fe_2O_3	90.54	62.86	76.86	87.54	84.44
Al_2O_3	1.05	1.10	1.10	1.42	1.03
Mn_2O_3	.19	.13	.20	.22	.17
CaO	.91	.79	1.00	1.20	.60
MgO	1.22	1.07	1.22	2.11	1.38
P_2O_5	.027	.016	.018	.234	.272
SiO_2	4.32	32.89	18.50	4.91	11.46
S	.002	.005	.005	.001	.004
Water	1.46	1.18	1.40	2.19	.85
	100.069	100.041	100.365	100.124	100.206
Fe.	63.39	44.00	53.76	61.49	59.11
P.	.012	.007	.008	.103	.120

Analyses of Pewabic ores
Dried at 212°
Furnished by E. E. Brewster, Iron Mt.

Dried at 212°



Cuff Mine and Vicinity

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