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Thompson, J. R.

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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 page is also arranged so that, if desirable, a smaller scale can be used, two inches, one inch, or even 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, for instance 4025, 250 N., 300 W., *Strike, N. 6° E., Dip, 50° E.* Then follow with as full a description of the ledge as possible. 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, but chips of them must be taken. 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 $2 \times 2\frac{1}{2} \times \frac{3}{4}$ inches will be allowed, but in all other cases *large sized specimens*, trimmed to a size of $3 \times 4 \times 1$ inches, must be selected, in accordance with section 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. In all cases collect chips for slicing. 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. It is desirable that specimens 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.

Ishpeming Mich Nov. 7. 1891

Specimens from Lake Superior Iron
Co's mines.

70080 #1

Paintrock or soapstone taken from
"Hematite" mine 400 ft level, chamber 14E

This paint rock separates two bodies of
ore being the hanging wall of one
and the foot wall of the other

70081 #2

Paintrock or soapstone, taken from
side of cross cut in chamber
21 E. 400 ft level of the Hematite mine

Its relations are shown by the
following sketch



Location of this specimen. ~~It~~
While the lamination of the main
body of paint rock conformed to its
general direction the lamination
of the tongue was as indicated by
the heavy lines in the sketch

70082 #3

3

Slate ore from the 600 ft. level of the old hard ore mine. This is a typical piece of hard ore, usually called slate ore on account of its fracture or cleavage and to distinguish it from granular ore which breaks in irregular chunks and has a coarse granular structure.

70083 #4

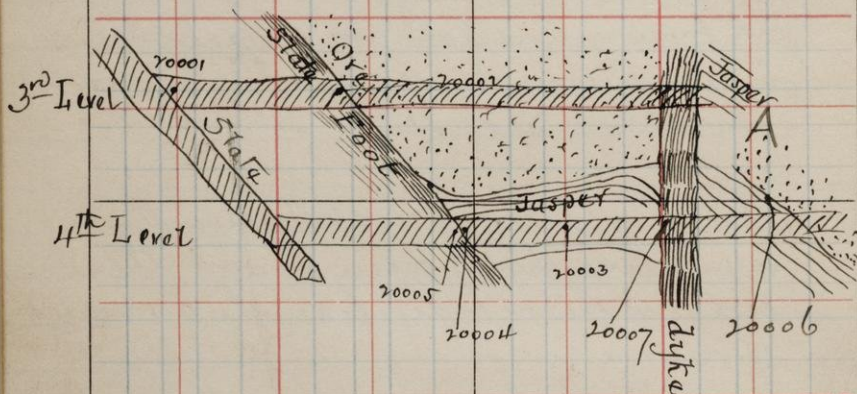
This is a piece of soapstone (ruptive or sedimentary, which?) occurring at the side of the ore body like the preceding specimen.

70084 #5

Three pieces from the same body of soap stone but farther away from the ore body. The smaller pieces show joint cracks filled with a different sort of material. The smallest piece is principally this joint crack filling with just enough of the soapstone to show its occurrence.

T.

R.



5

Jan'y 23. 1892

Mines belong in F. Schlesinger at Megamun
known as Buffalo, So. Buffalo, Tuen, and
Prince of Wales.

70001 This is the regular foot wall rock of
the main body of ore. It occurs
on the 3rd Level at No. 1 Tuen shaft.
This slate is dipping at 50° to 60° to
the north. About 75 feet north of
the shaft, is found specimen
70002 which is the slate at about
one foot distance from its contact
with the ore body. At this
point there was no particular
structure to the ore body but else
where the ore is quite stratified in
structure.

70003 This specimen came from the 4th level
of the same shaft, as indicated by the
sketch on opposite page. The jasper
here is in the main not far from
the horizontal but is in detail
undulating. This specimen is some
50 or 60 feet north of contact plate
between jasper and foot wall
slate.

T.

R.

State

Jasper

dyke

20004 As indicated in sketch on previous
20005 pages these two specimens are
of jasper and foot wall slate each
taken as near to the contact plane
as possible. The ~~last~~ strata of the
jasper butted directly against the
contact plane as per sketch

20006 Is a specimen of (paint rock?) immediately
underlying the ore. The miners claimed
that a thin seam of paintrock lay
between the ore and the underlying
jasper. In some places it was undoubtedly
mined away and I am somewhat
doubtful that the specimen taken is
paintrock & not ore. If present the
seam is very thin and the immediately
underlying jasper is ~~only the~~
essentially the same as specimens
20004 and 20003

20007 This is a very evident dyke cutting
right through the jasper which
dips to the north of the on both
sides of the dyke. It is 10 to 12
feet thick and the jasper on
both sides is quite folded in
small detail but keeps its general

9

dip, and on the south side the layers of jasper butt directly against the side of the dyke.

This dyke was followed up to the 3rd level. There ore was found to the south of it and jasper to the immediate north. Following the dyke west however some 100 feet it is found to pinch out to an edge and then to disappear entirely. The rock in the dyke where in contact with ore is sometimes quite impregnated with iron and is called paintrock.

There have been in this mine several veins of paintrock, precisely similar to this evident dyke. There was one about 12 feet wide which was found on the first level, and maintained its ~~perfect~~ vertical position for some 250 feet, having ore on both sides of it, as shown by mine workings. Other dykes similar in nature have been followed right to their connection with the foot slate and there, the mining captain said, the rock of the dyke & the foot wall slate could not be distinguished.

70008 This is a peculiar occurrence. It is from a seam of rock about 16-24 inches thick which traverses nearly if not quite the whole mine but very differently from the system of vertical dykes. It dips to the northwest at an angle of about 20° and has ore both above and below it.

70009. Specimen of the jasper above the ore but also lying very near to it. In some cases there is a sharp line between the ore and the hanging jasper. In other cases there is more or less of a gradation, the ore becoming more siliceous &c.

70010 Crystalline diorite in σ^{10} / South Buffalo shaft on 4th level. The specimen was taken near ^{1 ft} the contact with the slate of specimen #70001. There seems to be here a sharp division between the two, marked by a layer of soft slaty material which was evidently also a channel for water percolation (see specimen #20014.)

13

Refer to sketch opposite #20001.

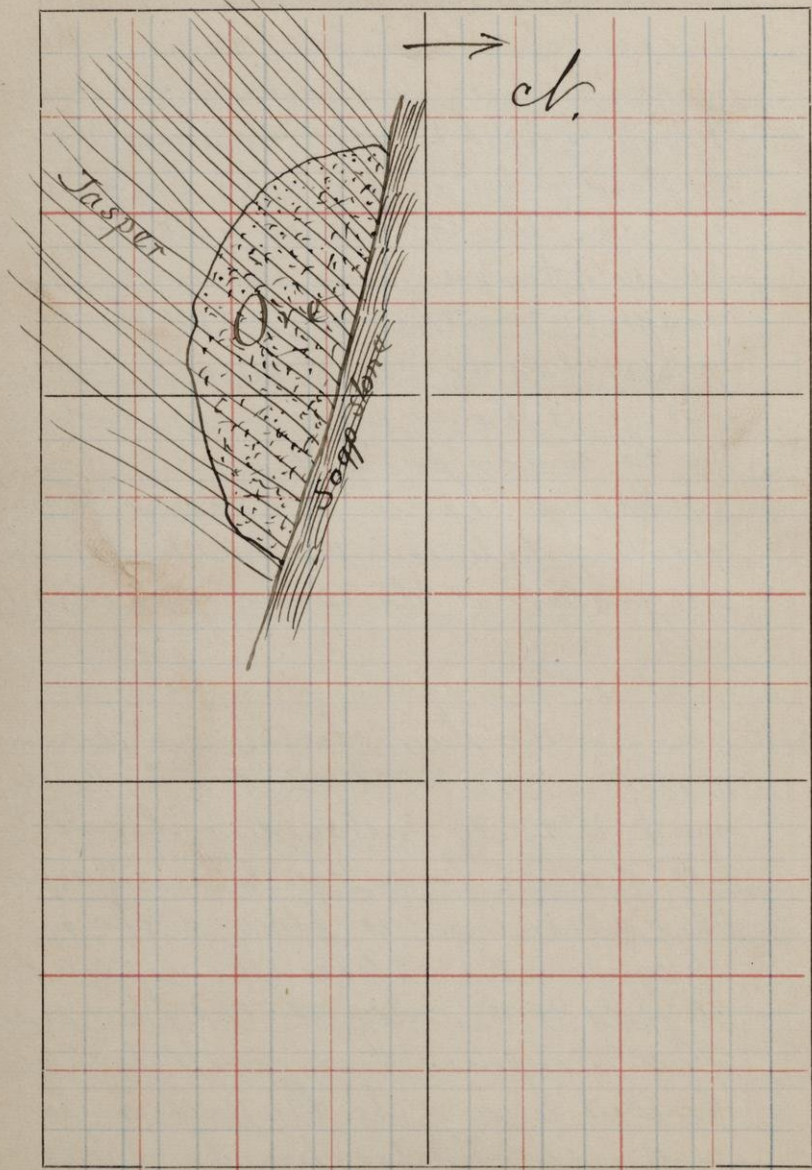
The ore came down very close to the back of the level over location of 2000475. I was careful to note however that the slate maintained nearly the same dip as on the 3rd level and that the place of the ore was taken by the jasper. I noticed also that the jasper had the same small foldings which I have previously noticed in the main ore body.

I had no chance to examine the relation between the ore body and the jasper at the point marked A

20001 This and the three following specimens are from the ore deposit of the Buffalo mine. Entirely independent though, not distant from the Queen deposit. This specimen is from a vein of soaprock apparently dipping slightly to the ~~west~~ south. Only one side of it is exposed however. It bounds the West lense of the Buffalo on the north side. Not far from this point to the west the ore is replaced by jasper

T.

R.



15
in contact with the soapstone
70012 is exposed only a little on the
same ore body as #70011. This forms
a foot to the ore dipping at about
 45° while the ore ~~plate~~ strata
strike nearly square against the
contact plane as follows.
The material immediately in
contact with the ore is extremely
soft, ~~as~~ decomposed, and wet. Some
of it is in comparatively large amount
white like the spots of the specimens
resembling somewhat ~~that~~ impure kaolin.

70013 Are specimens taken about two feet
70014 apart. 20013 is more laminated
in place than appears in specimen
while 20014 is thoroughly solid and
crystalline, 20013 grades into
~~material~~ into schistose rock essentially
like #20011 and lies similarly in
relation to the ore body as shown
by sketch.

The soapstone is ~~probably~~ probably
more irregular than shown as I
~~have~~ saw it exposed in only a few
places.

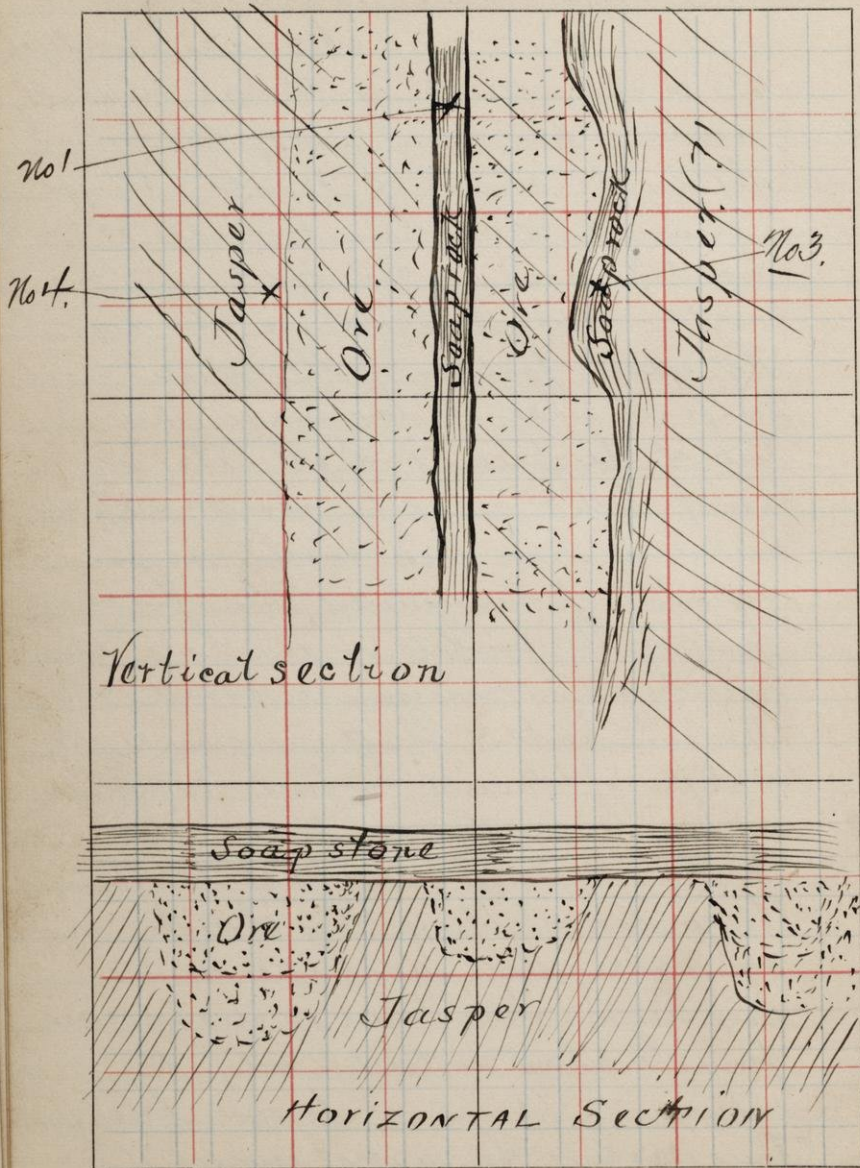
July 5, 1894 Lucy Mine
17
Stegannu. click

This is an interesting mine because it is away up on a side hill and seemingly in the midst of diorite bluffs.

The ore seems to occur in bunches or pockets and is nowhere in a well defined vein or body. The upper portions of the mine near surface were of low grade ore but at the present depth the ore is of better quality about 58% in metallic iron and with varying amounts of manganese. In fact some of the pockets of ore have run very high in manganese about 12%. The main No. 5 shaft is sunk in a dyke of diorite which is plainly apparent on the surface and further west joins itself to the large diorite bluff. The dyke is very irregular in shape and dimensions. Sometimes it disappears from the shaft entirely only to return to it at a lower level. Thus making the general course of the dyke vertical.

T.

R.



The main part of the mine dips to the South West, but the ore bodies extend downwards nearly vertically. A vertical section through the main ore bodies N.E. & S.W. is nearly like sketch, while the horizontal section gives the idea that the ore is not continuous along these dykes but is replaced in places by the jasper.

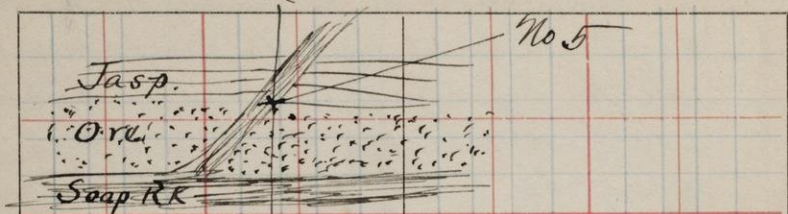
Of course it is to be remembered that these simple sections are really much complicated by all sorts of "bulges" "swells" & irregularities of in all the soapstone dykes as well as by some in the much disturbed jasper itself.

- #1 #20015 Specimen of soapstone or paint rock dyke lying between two bodies of ore
- #2 #20016 Rank jasper on north side of dyke occurring in the shaft (No. 5). Further East on the same level there is ore on both the N. side of this dyke.
- #3 #20017 Paint rock from 3^d level.
- #4 #20018 Jasper from ~~the~~ 3^d level. This jasper is almost immediately in contact with the ore.

T.

R.

a



B.

No. 5



Section on A. B.

#5
#20919

Soaprock occurring as shown
in the two sketches on the opposite
page.

#6
#20020

Specimen of ore found on 330' level
This evidently carries some manganese
Soapstone of No. 5 shaft dike on 370'
level or bottom level of mine. The
soapstone is here quite thick.

#7
#20021

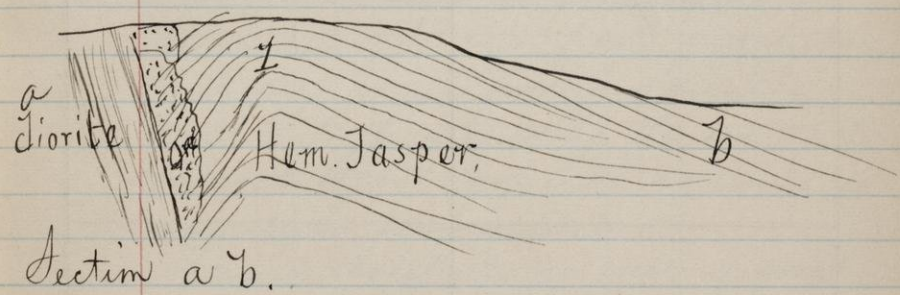
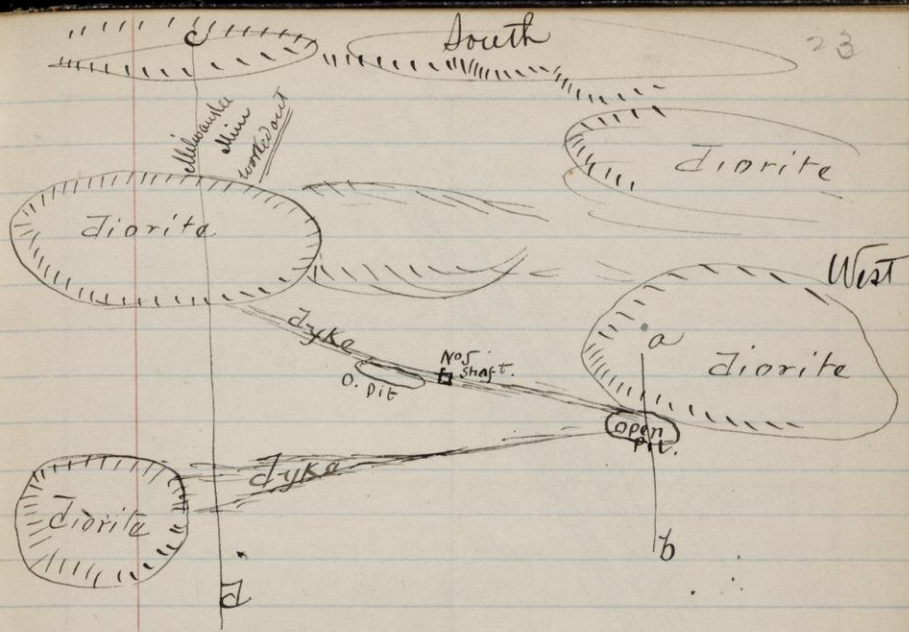
Specimen of crystallized manganese ore
taken from "vug" and the smaller
piece shows the character of the
ore lying immediately around
the "vug". The "vug" was full of
water and was evidently at
water channel. Besides the
manganese large amounts of

#8
#20022

crystallized manganese ore
taken from "vug" and the smaller
piece shows the character of the
ore lying immediately around
the "vug". The "vug" was full of
water and was evidently at
water channel. Besides the
manganese large amounts of
"barytes" or "heavy spar" beautifully
crystallized are found and then
the two minerals occur very
intimately associated, viz. "barytes"
and "pyrolusite". I send a
large specimen of this barytes to the
U. W. cabinet.

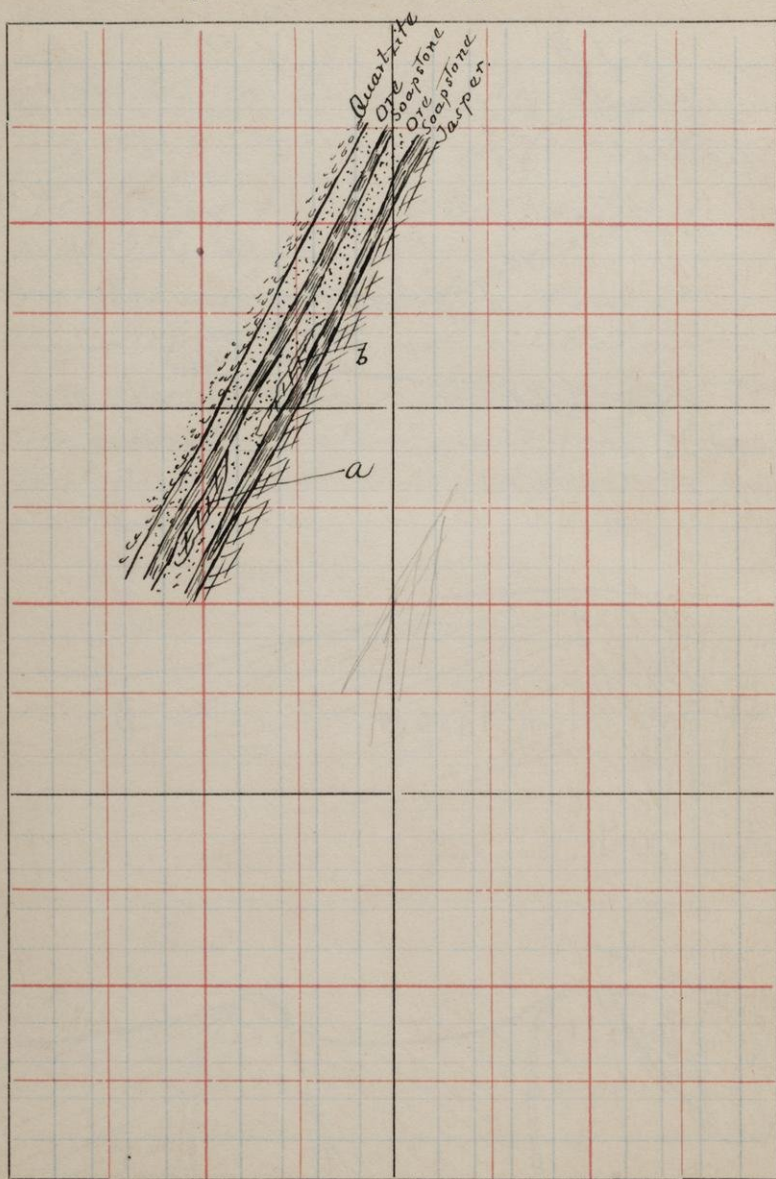
The sketches on the opposite page show very crudely the general plan of the Lucy mine. Everything south of the north dyke dips to the south west.

The fold indicated in the sections at points "1" & "2" is not a local one merely but is I think one of considerable extent, and may I think perhaps be shown to extend for several miles.



T.

R.

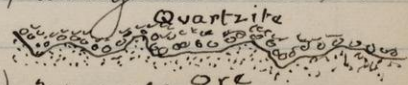


26

Feb. 9. 1892 American Mine
Located in the S.W. of S.W. of Sec 32
T 48. R. 28.

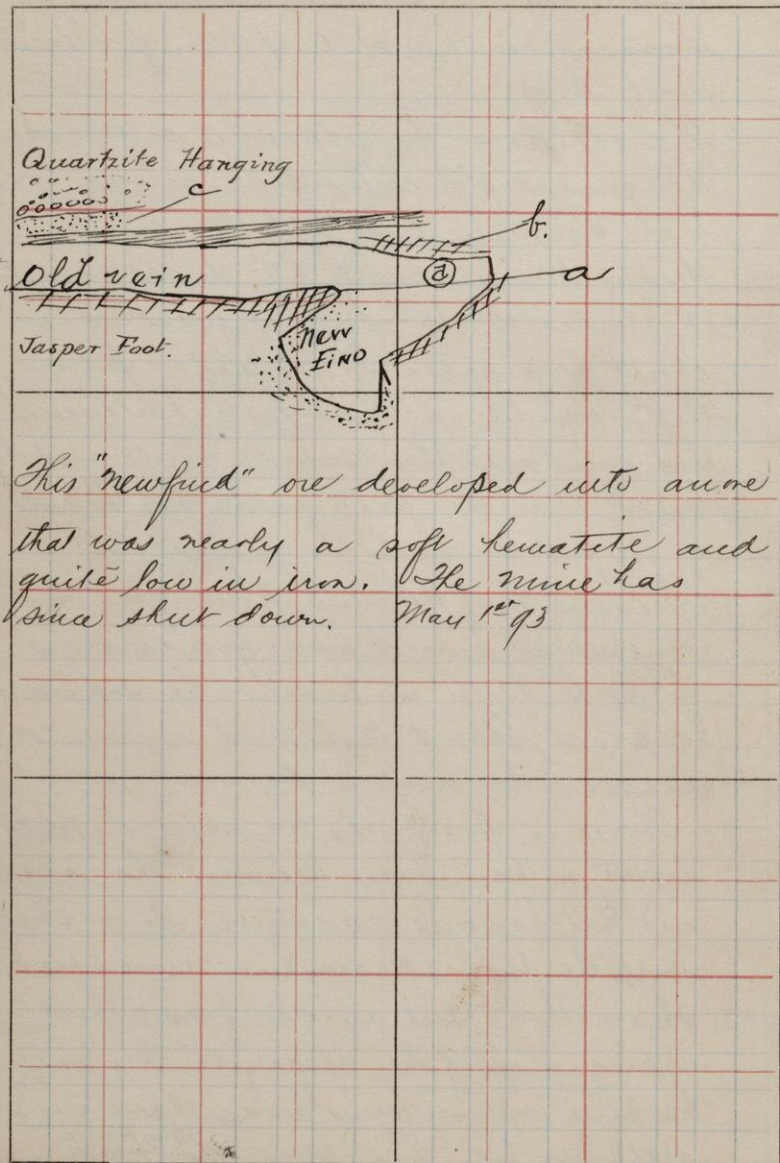
The sketch on the opposite side shows the general structure of the mine except that the vein dips a little more steeply being about 80° to the south. It strikes 10° - 15° North of west and is about a quarter of a mile from the Granite. What lies between this vein and the Granite I do not know except that the foot wall for a distance of 100 feet or more is jasper.

The width of the vein from quartzite to jasper varies from gradually from 6' to 16' including the seams of soaprock. About $\frac{2}{3}$ of that amount is usually the soaprock.

There is positively no well defined limit or boundary between the ore and the hanging quartzite. In a small way the two specimens numbered #70028 show this. But aside from this impregnation of the quartzite by ore the pure ore is very irregular in its outlines like this  so that you can find no well defined

T.

R.



This "new find" ore developed into an ore that was nearly a soft hematite and quite low in iron. The mine has since shut down. May 1st 93

dividing plane between the two.

#20023 is a specimen of the ore which is of a high grade Fe. 64-65% Ph. 0.35-0.40

#20024 Is a piece of the regular jasper footwall underneath the lower soapstone

#20025 On the 4th level of the mine the ore has made in a new manner see sketch. At "c" of the sketch a 4' ft vein of ore was left standing with the seam of soapstone against it as represented while the ore was worked out of the "old vein" At "b" a bunch of jasper seemed to make against the soaprock and then the ore vein they were working on soon pinched out with jasper on both sides. Whether the vein "a" "c" continues is not known. However the ore opened out in what is called the "new find" as indicated some twenty feet wide and surrounded as shown. Specimen #20025 was taken at pt marked "a". In the back or top of this place where the mark (d) is in sketch was found a "bug" or watercourse ~~not~~ ~~not~~ with

29

much lime crystals lining it. Or rather the crystals looked more like crystals of dolomite to me.

#20026 is a specimen of the soaprock, occurring in the vein. (compare it with specimen #20019 which I know is a dyke)

#20027 is a specimen of jasper replacing the ore on the foot wall as shown on general sketch at point marked "C."

20028 is the quartzite hanging. This is not the pure quartzite but is such as occurs almost immediately in contact with the ore.

Feb. 15, 1890 "Negaunee" Mine ³¹
Negaunee Mich

The ore deposit of this mine was discovered by the use of a diamond drill. The opening shaft was sunk 432 feet to the first level. The ore body was then followed up on the foot wall for about 200 feet but then played out, with apparently no connection with surface. I think that it is not to be doubted that some of our ore bodies do not reach the surface of the ledge.

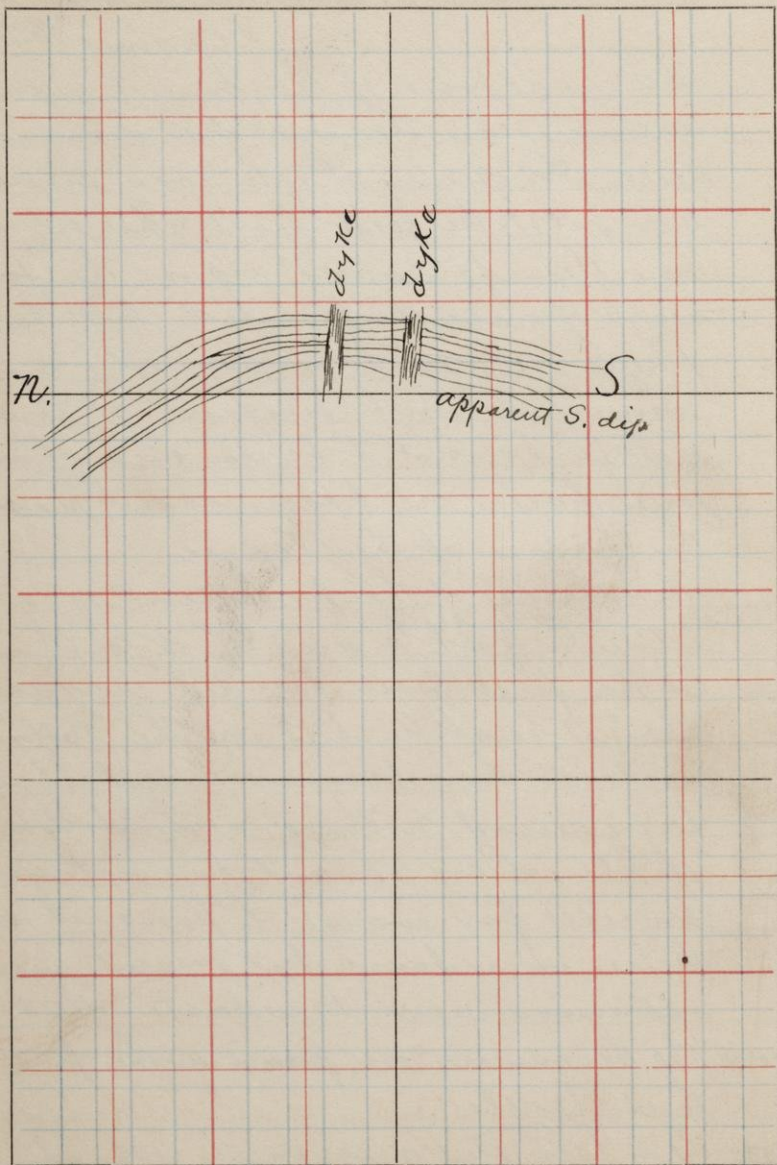
The strike of the formation is a little E. of st. E. and W. of S. W. On the first level the dip was about 24° to the st. W. but on the bottom levels it has become much less being almost nothing on the bottom of all. Development has not yet proceeded far enough to prove it dips to lie in a basin, but present *indical* appearances seem to indicate that.

#20099 Is the ordinary ore found on the first
three levels.

#70030 is a hard blue or, very rich, which is found in irregular bunches or masses

T.

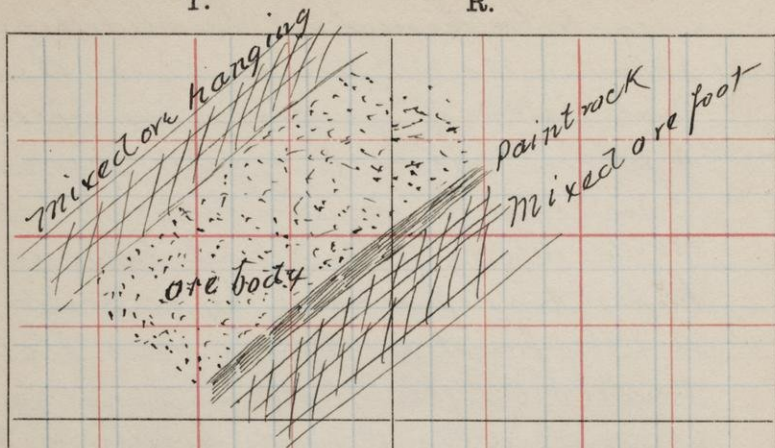
R.



irregularly throughout the ore today.
 #20031 is evidently a dyke back in the
 foot wall of jasper or mixed ore
 20032 of which #20031 is a fair specimen
 I said that the formation dipped to the et.
 At the W. end of the 1st level however
 the foot was penetrated by a drift
 and the formation showed very flat.
 then No. 1 dyke of which 20031 is a
 specimen was struck, twenty or thirty
 feet further dyke No. 2 was struck. These
 dykes were nearly vertical and ~~struck~~ the
 strike was nearly with the strike of the
 formation. A drift was run west on dyke
 No. 2 however but it soon squeezed out
 at and St. B. a little beyond it ^{end} and
 the other side of it the ground seemed
 to dip to the South. The amount
 exposed was so small to say that it
 was the axis of an anticlinal fold but
 it seemed to be such and the dykes
 seemed to occupy the very axis of the
 fold. However the south dip might possibly
 be only a local affair. These dykes
 were 3 to 5' thick. The sketch shows
 the apparent structure.

T.

R.

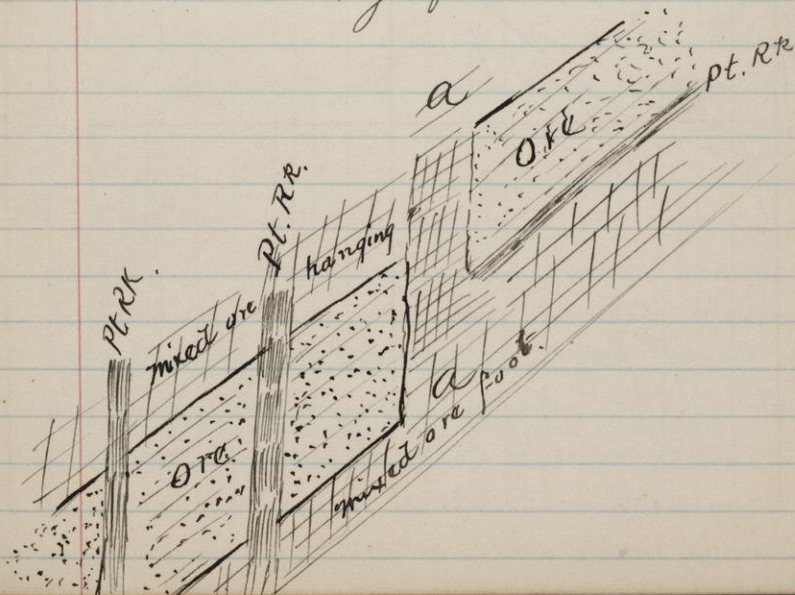


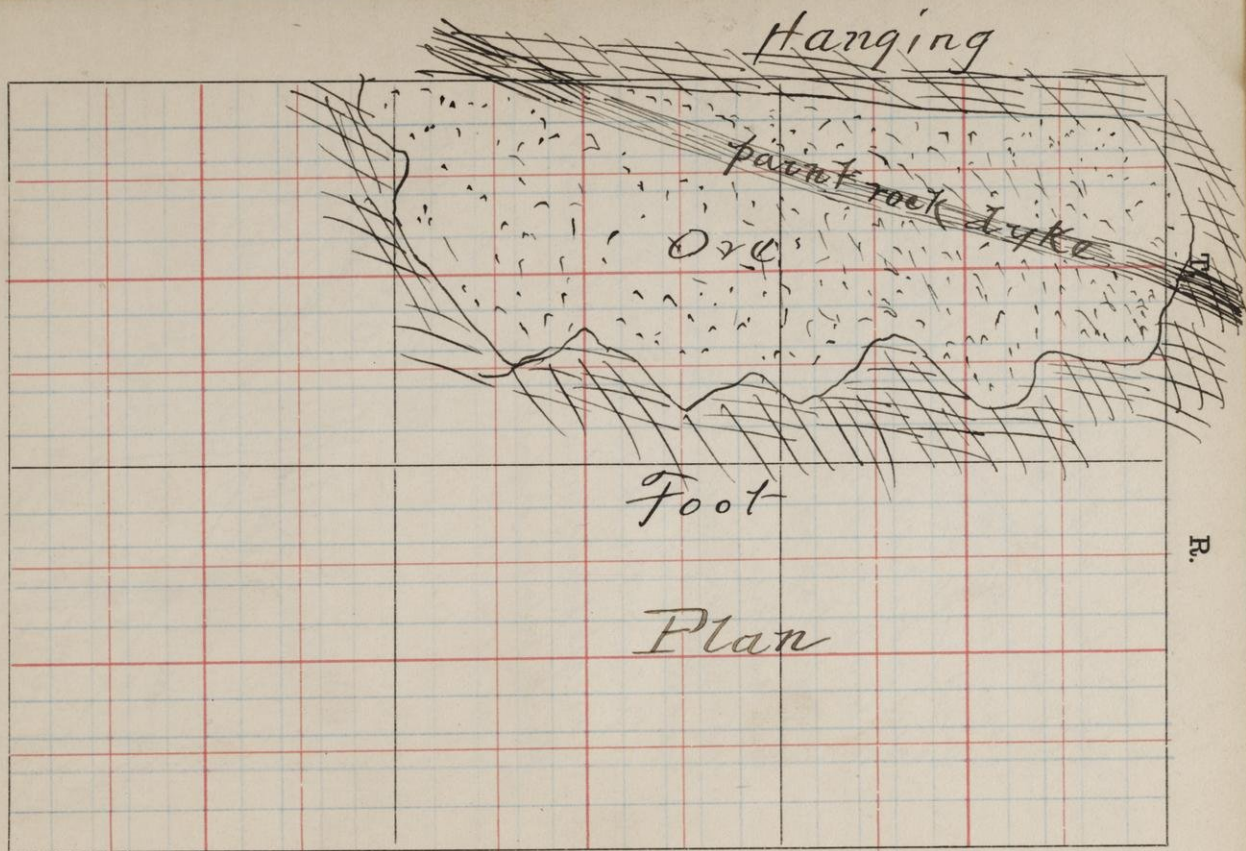
The foot and hanging will average
30-40% in metallic iron.

I have no specimen to illustrate the present item but I have often seen it before that part of the mine was exhausted. On and above the first level, the ore body rested on a layer of very soft paint rock from 1 to 3 feet thick which lay interbedded with the formation. A few feet at the West end of this level however had no such paint rock footwall the material underneath the paintrock was mixed ore precisely like the

20032 #30032. see sketch.

Below the third level the ore body changes some what in character as sketch below signifies





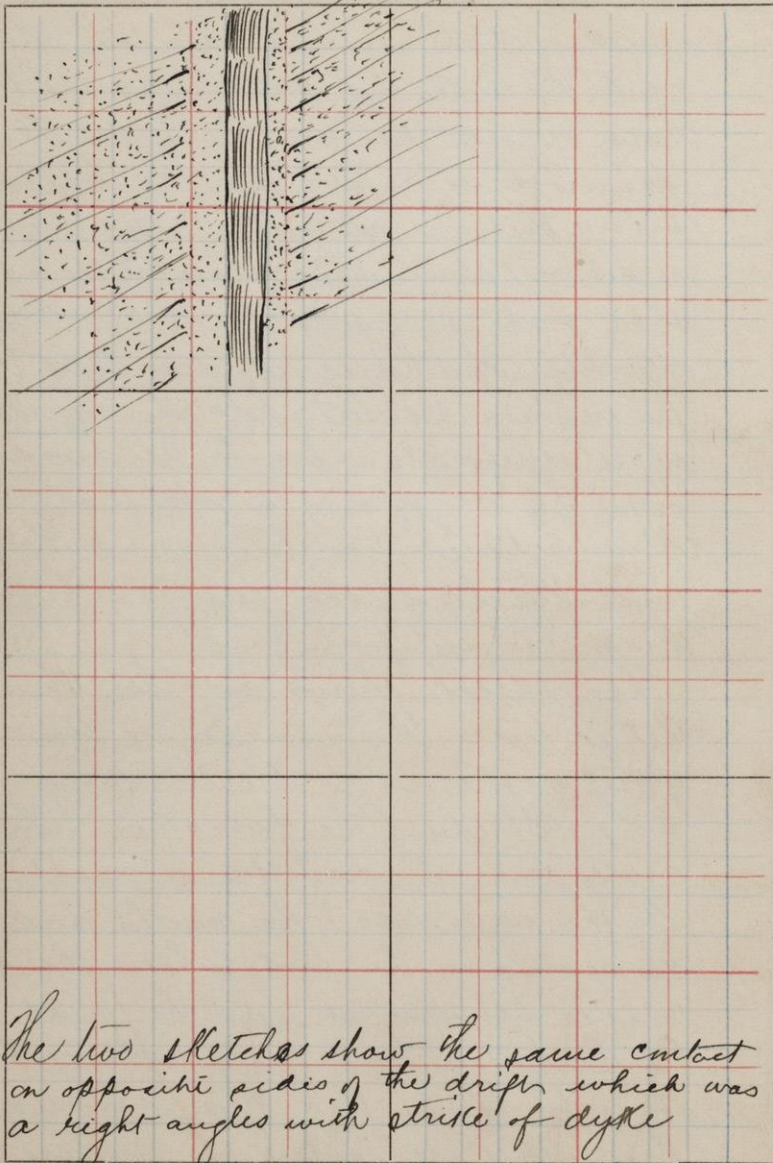
87

The base or "horse" of mixed ore or jasper marked "A" "A" seems to divide the ore body into two parts. Above the horse of rock the ore lies on the fault rock as a foot wall while below the ore ~~gas~~ butts up against mixed ore slick and clean and also quite irregularly see sketch opposite. The hanging according to the captain seems to hold its course very uniformly and to be divided from the ore along a stratum plane between two layers, but some times bunches of rock make which break this uniformity. *J*

The sketch shows another thing that is true. The course or strike of the dyke is a little diagonal to the strike of the formation. These dykes are all parallel or nearly so. As the vein dips to the north one dyke disappears in the foot while the ore makes between it and the next dyke. On the bottom level of all where the strata lie nearly flat three or four of these dykes are crossed in driving through the ore body there some 600 or 800 ft. *There*

T.

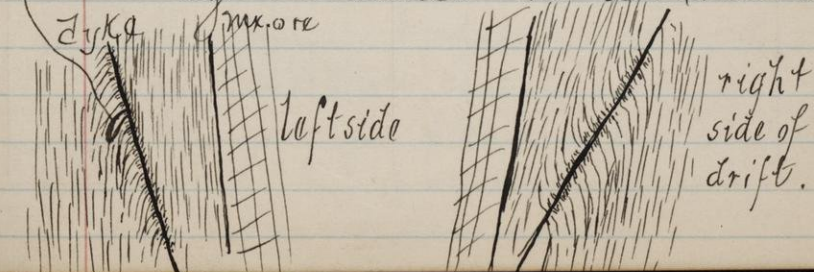
R.



#20033 shows the paint rock of these dykes about 6 feet thick on the 6th level of the mine. see sketch. It is intended to show by the sketch the dip of the ground ~~be~~ on both sides of the paintrock and also the fact that immediately in contact with the paintrock on both sides for 6 or 8 inches there was no apparent structure to the ore while further away the ore took on the regular stratiform structure

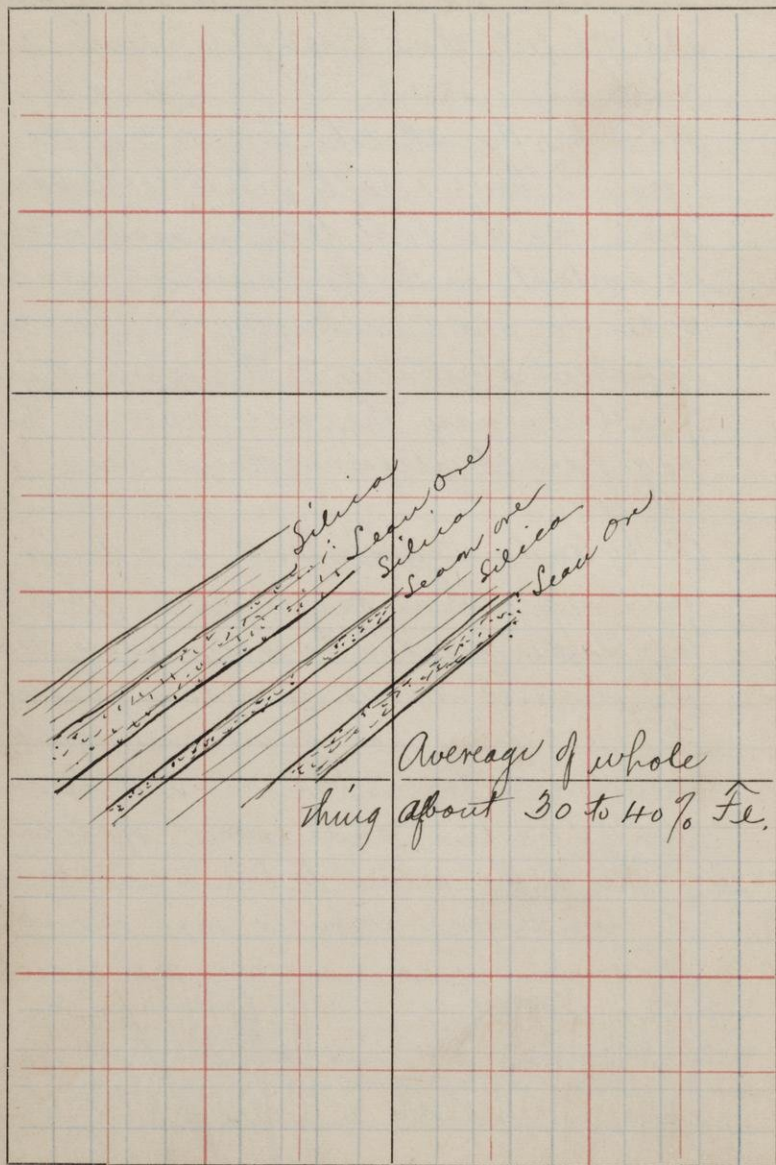
At the East end of this level in a dyke was a peculiar occurrence. Just first this dyke marked the boundary between the ore and mixed ore or hem. jasper. The west side was paint rock quite similar to #20033, (this was next the ore) while the east side was specimen

#20034 This dyke seems to be a combination of two dykes a later one shoved up through an earlier one see sketches



T.

R.



41

The specimen #20031 shows the squeezing and slight bending in plane of foliation schistosity. The end partially painted black was immediately in contact with the dividing line. It was impossible to locate the same thing on the other side of the dyke on account of its very soft nature and very great impregnation with iron.

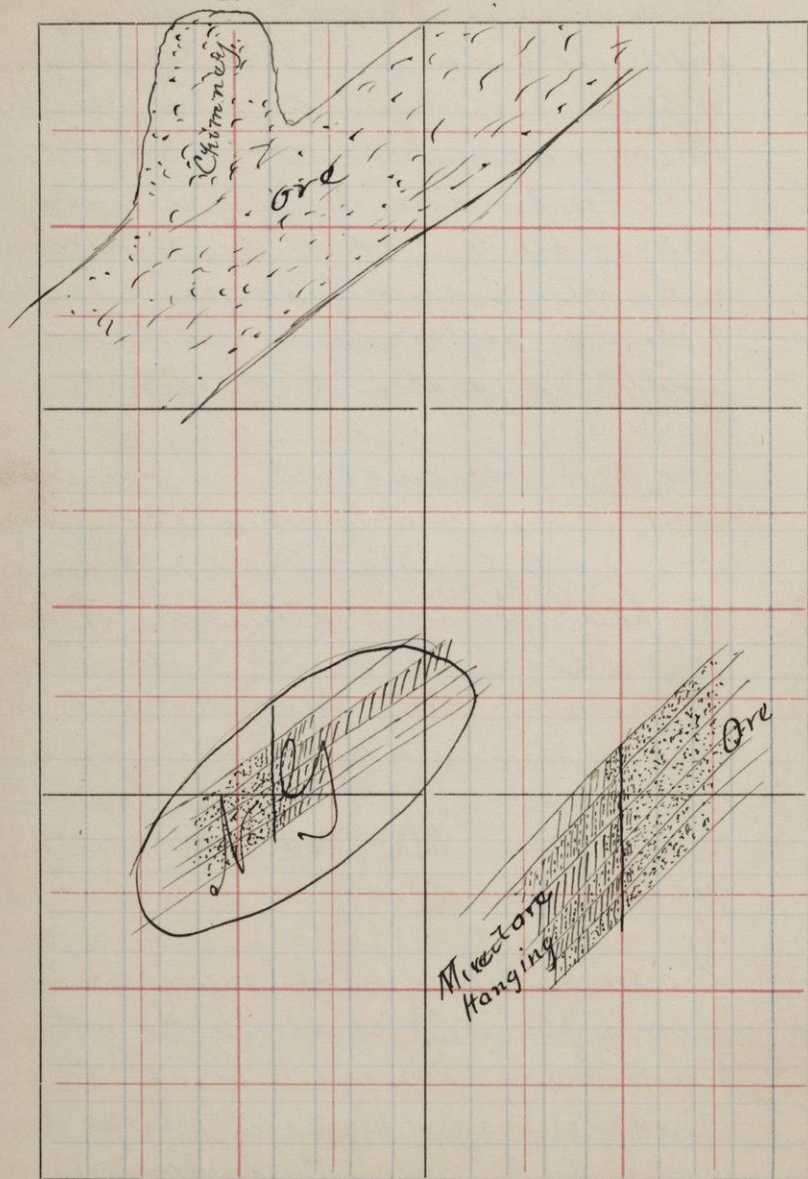
show for the "hanging rock". I found it about impossible to get a specimen of hand size to adequately represent the hanging in its alternating layers of rich and poorer material.

#20035 This specimen does not really do so. The ore streak is tough, the quartz streak brittle and they break apart just between the ~~two~~. The sketch partly represents it.

#20036 This specimen taken from the hanging shows quite a prominent characteristic of the whole mine & also country rock in its smooth cleavage planes in several directions across the line of strata. This cleavage is very prominent and exceedingly diverse in direction.

T.

R.



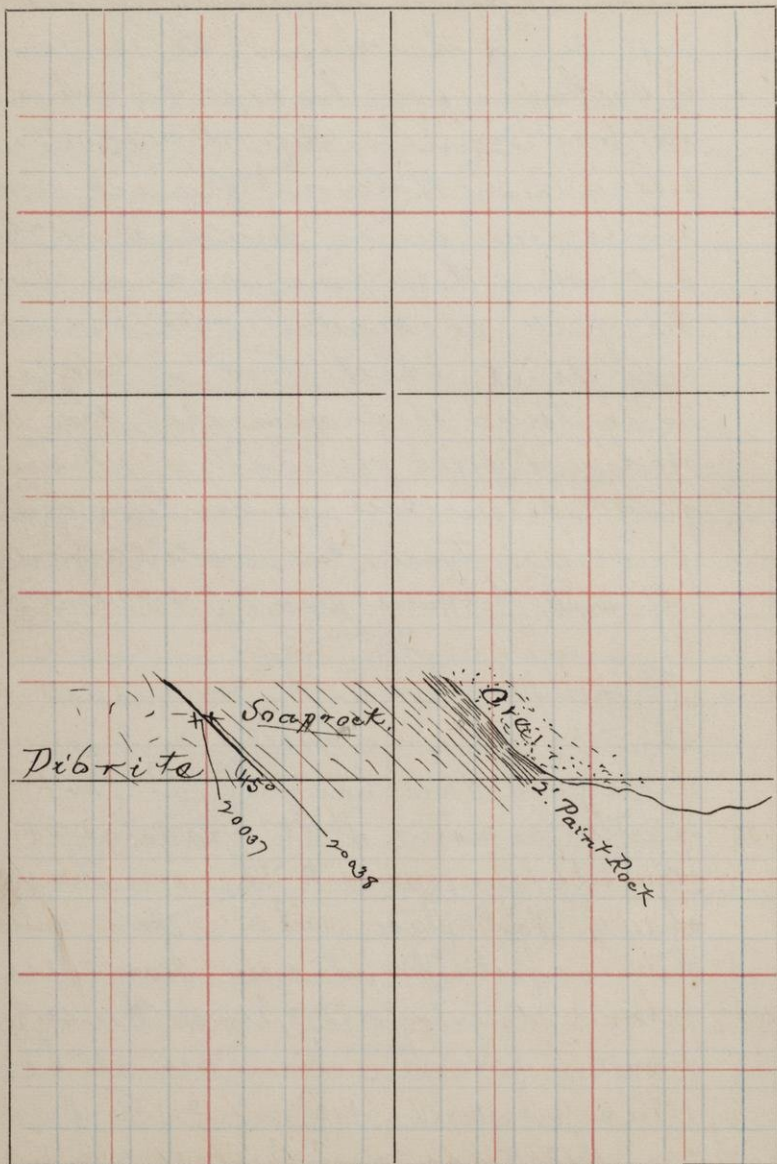
43

In some places especially at the West end of the mine the uniformity of the hanging is broken by chimneys of ore occurring like the sketch. Very near to the one figured was another one quite similar in character but when they reached near the top of it a regular water course was struck which took a very long time to drain. All the ore body is full of water when first opened, but as the levels stand for some time, this water drains off, and the mine seems to be very dry.

At one place where the ore made abruptly against a nearly vertical face of the mixed ore hanging I took particular notice of the gradation from the siliceous seams to the ore. The whole change took place within a span of less than a foot. The siliceous seam became disintegrated & loose. The ore replacing a portion of the silica and then all the silica disappearing, replaced by the pure ore. The stratum meanwhile seemed to keep its definite character.

T.

R.



Feb. 17, 1890. Lake Angelina Mine
"Lake Shaft."

This shaft is on the south side of the tongue of land projecting into the east end of Lake Angelina.

It is sunk in diorite and the drift at its bottom crosscuts the diorite, soapstone, pailitrock until it strikes the ore. The diorite in the shaft was somewhat decomposed by Mr. Bayley collected specimens on the surface exposures of this ledge which must show its solid crystalline structure. The ore occurs here in a shallow basin underlain by diorite. Several long drill holes have shown this to be so besides the mining done in the two shafts.

- #70037 Diorite, massive, but one edge was against the contact between the diorite and the soapstone, which is shown in
- #20038. This is within a foot of #20037.
- #20039 Soapstone still further away from the diorite.
- #20040 Soapstone next to pailitrock
- #20041 Pailitrock, about 2 ft. thick lying next to the ore.

T.

R.

Jasper

Paint Rock

This series of five specimens taken in connection, with specimens marked 815, 816-817-818-819-832- on Eriksen's contour map, or such of the specimens as are crystalline diorite, will I think show perfectly the gradation from the crystalline diorite to the very soft soapstone paintrock lying next to the ore. The contact spoken of as between the diorite and soapstone is not like a contact between dissimilar rocks, but, on one side the soapstone is somewhat laminated on the other the diorite is massive in structure though somewhat decomposed.

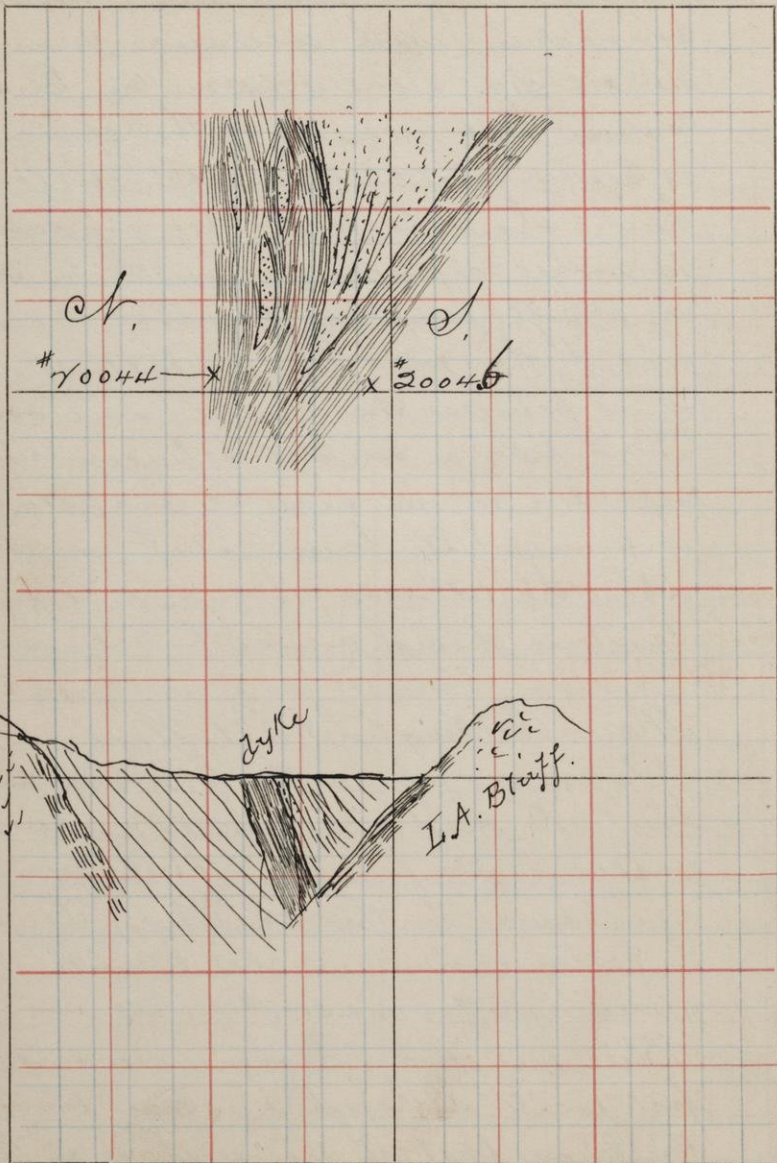
Main Working, P. & L. A. Mine

#20042 Paintrock from the E. end of 2nd level, D. shaft, on south side. The jasper or ore formation here pitches as shown in the sketch. The formation is better shown in sketch with specimens #20044 & 5

#20043 Blue ore always occurring on the foot wall, although in some places, the larger part of the vein is of this kind of ore. However it is quite

T.

R.



219

a characteristic of ore along the footwall
as I have seen it in several mines.
The sketch on the opposite page
shows the appearance at the E. end
of the fifth level where the ore has
pinched out between two pieces
of ~~po~~ paint rock. On the st. side
you will notice the small lenses
of ore included in the paintrock. This
very often happens in the foot wall.
The layers of the ore seemed to point down
to the apex of the V but above they
conform to the pitch of the st. paintrock.
About 3 ft. away from the ore. st. side
Paintrock from S. wall.

#20044
20046

The South wall here is the outside
of the Lake Argentine Bluff, while the
st. wall is a large dyke (see sketch).
This dyke does not appear above the
surface at all but is an extensive one
as shown by the workings of the L. S. I. Co.
at their Sec 16. mine. The material
of the dyke is quite different from
regular diorite when its massive
center is reached but is undoubtedly
eruptive. No evidence that I have
come across so far would enable

T.

R.

#20045

I find that in some way some mistake
was made about specimen marked
#20045 and I can not positively
place it except as a soapstone
coming from the Lake Argeline Mine

51

me to judge whether this dyke is older
or younger than the diorite bluff to
the south which is an interesting question.
Several other specimens of this same
dyke will be collected and some idea
of its relative age may be obtained
later.

#~~20046~~
20047

This is the paintrock which separates
the specular ore from the soft ore
in the L.A. mine. This paintrock is
6-10' thick quite soft & uniform
throughout in character. The specular
ore immediately on this paint rock
does not greatly differ in appearance
from the blue soft ore lying next
to it on the soft ore side, but at
a greater distance the ores are
entirely dissimilar as shown by

#20048 Specimen #20048. Close to the
paintrock the hard ore is quite
without structure, but further away
it gets quite platy, compare specimens
20043 and 20048.

#20049

This is about 85 ft. from the L.A. I Co
mine ^{now 6th level} and is the apparent hanging
of the ore. The large dyke before
spoken of being the regular foot.

T.

R.



53

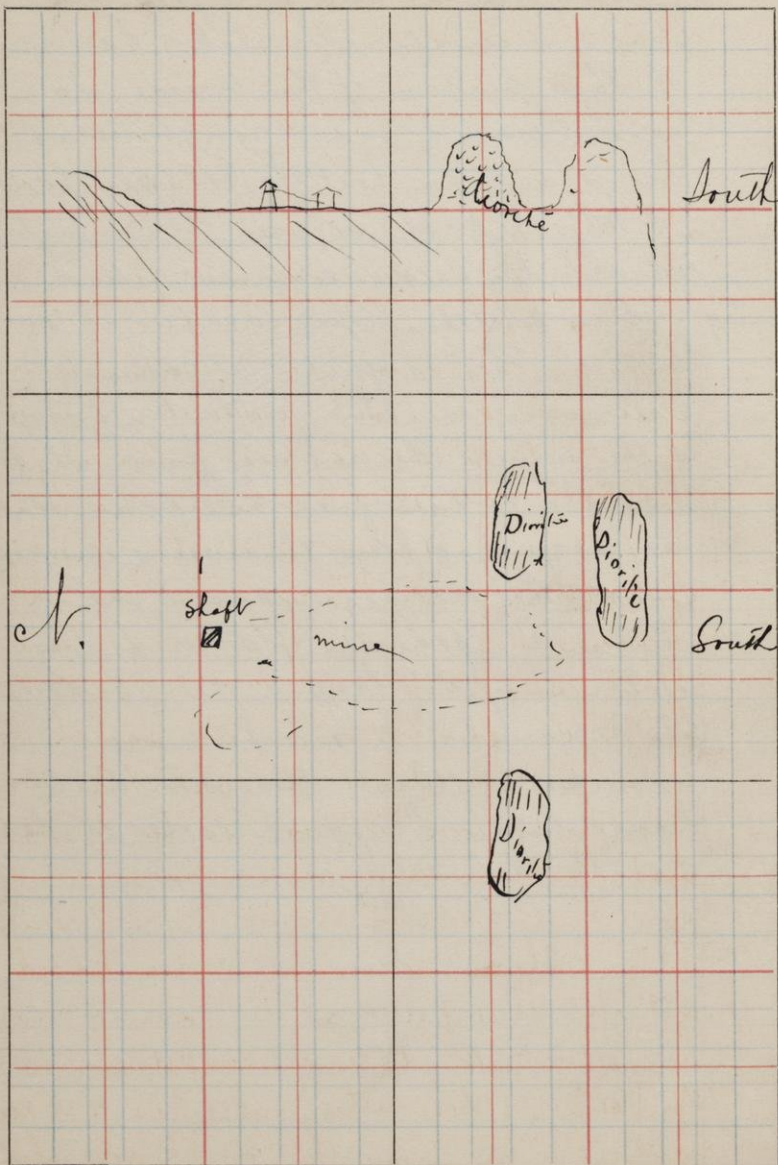
I think this is also a dyke but cant say positively. The peak hanging of this portion of the mine is recomposed ore, conglomerate and the quartzite, but the upper portions of the deposit where the contacts might be seen are wrecked.

#200⁵⁰#9. See sketch. This occurred surrounded by ore. This is quite a common occurrence in this particular portion of the mine, the captain said. It looked like the bottom of a mill pond where the boys had been throwing in rocks. I call the ore "recomposed ore".

#20051 This is a specimen taken from the interior of the large dyke spoken of. The specimen is much more decomposed than diamond drill cores have shown the same dyke to be in Sec 16. L. S. I. Co. workings.

T.

R.



55

Cleveland Hematite Mine

April 20, 1897.

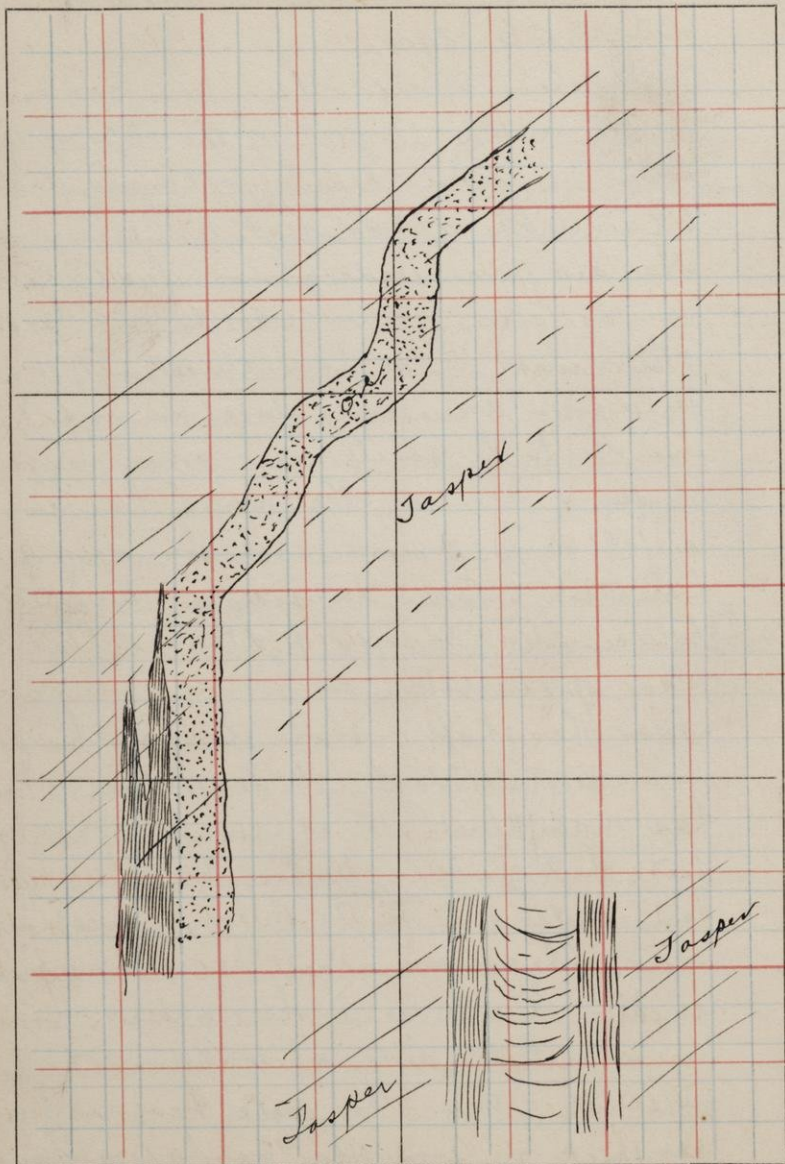
In this mine the ore was found within 10 feet of the top of the ledge and has been followed down to the depth of 825 feet.

The surface indications features are as shown in sketch. To the north of the mine is a low elevation of a slate rock (arenaceous slate Rominger) and to the south are some ragged bluffs of diorite. The mine however in following down with the dip of the formation makes towards a break between two bluffs of diorite (see plan opposite)

Near the shaft. ~~is~~ on the south side is a vertical dyke of soapstone which has maintained its course for 500 or 600 feet. In the upper levels of the mine this same dyke cut ^{out} off the ore body as explained later. These main ore body has been cut off three times in the same manner by vertical dykes of soapstone. but the extent of these other dykes has not been proven away from the ore bodies themselves

T.

R.



There are two bodies of ore in the mine. The smaller one lying about and west of the other I will describe first. It is in reality a chute, or a chimney, ~~of ore~~ extending irregularly through the ground sometimes it follows the dip of the formation at right angles to its strike, sometimes it veers either to the right East or the west of such a course and sometimes it boldly breaks across the strata of the ground in its course until finally it seems to run against a ~~the~~ dyke of paintrock which it follows vertically downward. The sketch gives the idea of its occurrence but does not show how irregularly its course was before it struck the paint rock. When the dyke was first found it was very thin hardly noticeable. One hundred feet lower two thin dykes of soapstone were found with about 10 feet of jasper between them, this jasper being somewhat banded as shown in the figure. Still one hundred feet lower only one thick dyke of paint rock was found being about 8 to 10 ft thick.

Horizontal ~~cross~~ sections of this ore body are of different shapes in different places. At one place the section was nearly square about 25 feet each way. At the 725 ft level it was of this shape ^{sketch 1}.



sketch 1



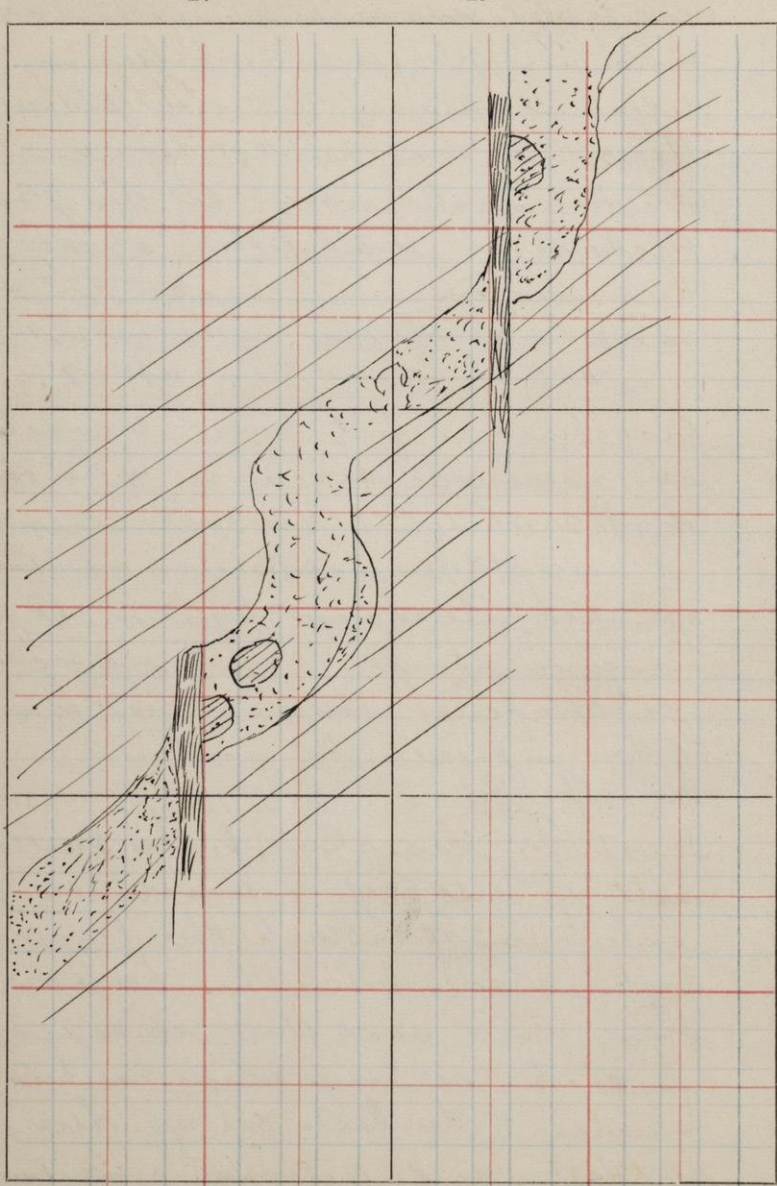
sketch 2.

One hundred feet lower it was longer and narrower and more of the shape of sketch 2. The rock surrounding it except the soapstone is rank gasper. The change from ore to gasper is quite abrupt. A very siliceous gasper being within 2 feet or so of the good ore.

The description of this smaller body of ore is to a considerable extent applicable to the larger body also. There has however been more soapstone in connection with this ore body, which has been according to the Capt. cut off three times by the vertical dykes of soapstone. The ore has also varied east to the east

T.

R.

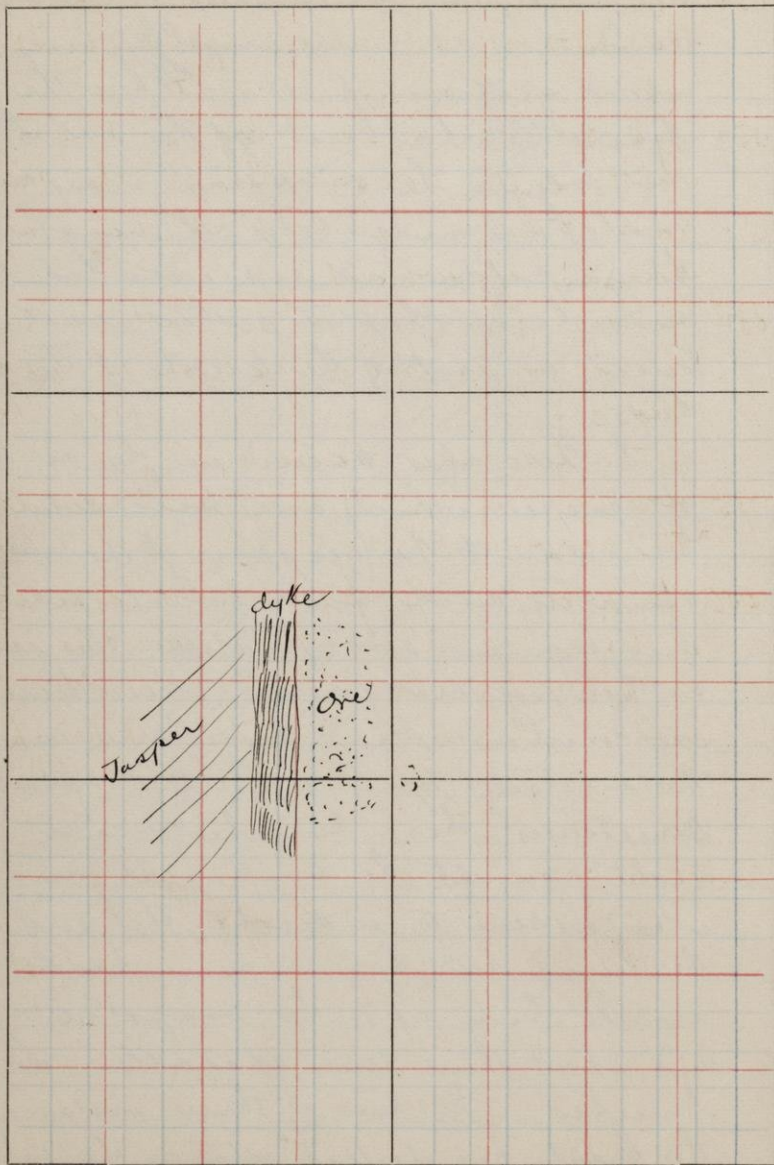


and to the west in making its way downward. I make roughly an ideal section of it. Where the soapstone has cut off the ore, the ore beyond the soapstone may not make immediately through the soapstone as represented but may have shifted either east or west a part of the length of the ore body.

There also occur in the ore bunches of jasper which are precisely similar to the jasper of the ~~for~~ country rock and which retain their regular stratification the same as the regular jasper. These bunches are numerous and large and make the ore itself very irregular apparently. Sometimes these bunches make right against the soaprock and would seem to indicate the end of the lense but the ore may make around them up to the soapstone again and show their true character as bunches. In two or three instances the capst has drifted after on the soapstone and it has picked out to nothing. There can be no doubt of their ~~not~~ being real dykes.

T.

R.



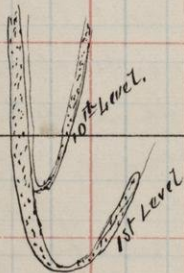
- #20052 This specimen is from the dyke near the shaft and has been persistent for several hundred feet.
- 20053 Jasper about 20 or 30 feet south of the dyke 20052. This is the country rock of the mine but it has various phases of which
- #20054 is one carrying considerable iron. This is some 300 or 400 south of #20053 and nearer the ore body. Close to the ore body however
- #20055 occurs which is somewhat similar to 20053
- #20056 Is a dyke of paint rock beside a body of ore. Its dyke character is plainly apparent (see sketch) where they have drifted through and found the jasper beyond it

T.

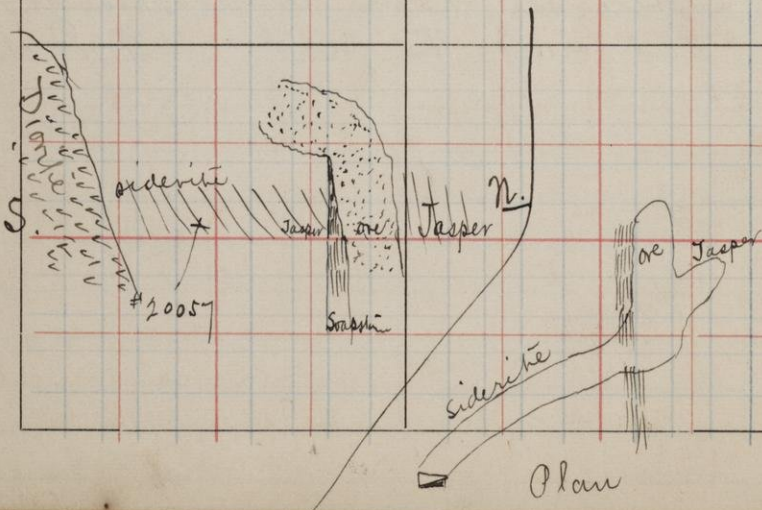
R.



ch.
section



Plan ch.



Apr. 19. 92. Eloro Mine of the Cleveland Iron Mining Co.

This mine lies on the north side of a big diorite bluff. The mine is in a fold of the formation but the ore does not seem to have made on both sides or at least it has not been shown by the mining work. At the 10th level another fold begins as shown by the sketch. The st. side of the large fold seems not to have been ore bearing to any great extent and hence has not been ~~to~~ shown up by mining work. At the 10th level however the south side of the fold seems again to be folded with quite a deposit of ore in the point or axis of the fold.

#20057 This material is called ~~by the~~ Mr. Mills siderite and is different from anything I have seen any where else in this region. Although Mr. Mills claims to have found it in several places. The sketch shows its occurrence in the 11th level or near the bottom of the mine. This specimen carries 26.40% of metallic iron

T.

R.



This sketch is made simply as a probable occurrence as the whole ground is not open for inspection. In that case the siderite would be pretty well protected from leaching and oxidizing action.

The section on the line A. B is actual,

There was no line of demarcation between the siderite and an apparently glassy, siliceous jasper which occurred just south of the ~~deep~~ seam of soapstone which formed the ^{south} wall of the ore body.

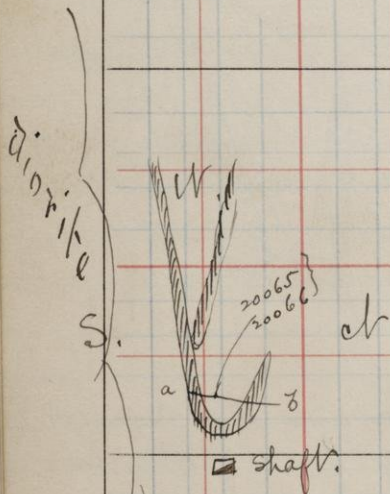
#20058 is this soapstone. By the sketch you see that this soapstone did not reach to the level above and that the ore apparently made over the top of it and along its north side of course. I did not see the siderite but it must be there somewhat as indicated because of the big bluff, so that the completed section might be as sketch shown on opposite page.

#20059 Is taken from the hanging of a deposit of ore and seems to lie quite flat over the ore.

#20060 Is taken from the foot of the same body of ore and is a small & thin body of soapstone lying between the ore and jasper. Miners call both these specimens ~~the~~ soapstone although they seem to be quite different in structure.

T.

R.



C.



2061. This is a specimen of much of the ore mined. Almost all of this ore seems to be recomposed ore, notice the piece of jasper included in the ore. A great deal of the ore while not having the spots of jasper yet has a greenish cast, due to chloritic material included, see specimen 20066 which is not good ore but is typical of the phenomenon.

#20062 } I can not explain the structure
#20063 } from which these specimens were
#20064 } taken. The shaft to the mine is almost all in this material carrying martite crystals in varying quantities. The location of the shaft is shown by the sketch.

#20065 These specimens while rather small are
#20066 important because intimately in contact and show the quick and conformable change from the conglomeratic ore to the ~~overhan~~ overlying clastic rocks. #20066 grades back south to a workable deposit of ore in say 100 to 150 feet.

71

Apr. 19, 1892. Incline Mine of the
Cleveland Iron Mining Co.

This mine ~~is in the up~~ started at
the surface exposure of a broad
pitching synclinal fold. The between
banded red jasper and quartzite
Whatever might have been the
case near surface the ore now
mined is certainly very largely
recompased or either of the
spotted or greenish varieties. It is
also almost entirely ~~also~~ included
within the quartzite horizon. The
~~foot~~ real jasper foot wall being
seldom seen.

#20067 is of the ore being mine. Many bodies
of this which vary in composition
from good clean ore through the
greenish varieties into ~~at~~ the so-called
soapstones are entirely surrounded
by soapstones like specimens
#20068, #20069, 20070 and 20071 which
all, I think, are clastic in origin
and belong to the quartzite
horizon.

#20073 Shows the ~~intimation~~ intimate relations
existing between ~~crystalline~~ coarse

crystalline quartzite and the finegrained material which goes by the name of soapstone among the miners, usually the fine grained bands and quartzite bands are thicker, too thick for a hand specimen, but this specimen shows the typical relationship very nicely, for a hand specimen I think. This particular specimen came from the #6 shaft of the L. S. I Co instead of ~~clear~~ from the Cleveland but explains better than I can in words why I consider some of the so-called soapstones found ~~belonging~~ in the hard ore mines to belong properly to the quartzite formation.

#2007v I did not find this specimen in place but was told by the mining (45.44% Fe) captain where it came from. He said it was overlying the ore of one of the ore bodies which is entirely enclosed in the soapstone as described on the previous page. I can not vouch for that occurrence however as I found the spec

75

rock on the surface where it
was quite plentiful.

Apr. 21. 1894 Volunteer Mine

This is a hard ore mine with
hanging wall of quartzite and
foot wall of jasper dipping
north at an angle of about 25-35°

#20074 is the quartzite hanging.

#20075 is from a pillar of ore and is
about 3 or 4 feet from the hanging

#20076 is a piece from immediately in
contact with the foot wall
The vein here is from 6 to 8 or 10 feet
thick and the quartzite hanging
is very smooth and uniform

#20077 is left as the foot of the vein for
a long distance and is quite
irregular. It is the same as the
one only with more of the quartz
spots in it.

#20078 is the regular foot wall taken from
C shaft.
Much of the ore is very chloritic

in nature and really sometimes grades into a greenish & rock too poor in iron to ship. The ore is all low grade and evidently all recomposed material as it every where has the small spots of quartzite precisely like some of the surface exposure of quartzitic conglomerate. Only in the surface exposure the matrix is all quartz instead of ore.

Notice in #20078 the "quartzite" appearance of some of the silica, which leads me to ~~see~~ the query whether this jasper is not also recomposed material. Mr. Finlay has told me of the fragmental appearance of some of the jasper bands which show on surface. That, if so, would confirm the idea that the ore here is entirely above the ^{faulded} "jasper horizon".

A very peculiar thing about the mine is that in mining they find their best ore immediately in contact with the hanging quartzite #20074. Sometimes this ore gets too lean to work by reason of the quartz spots but drifting through the barren streak

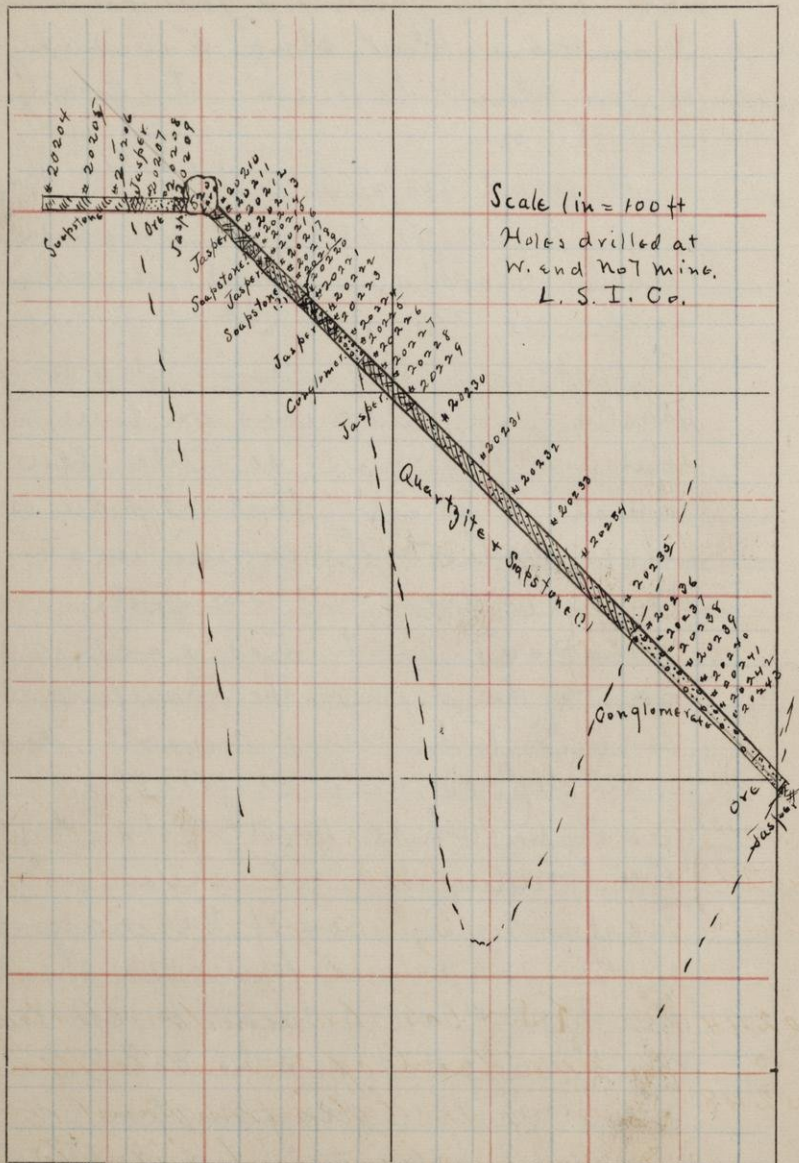
#20079 will usually pick up good ore again. I ~~mined~~ found a thin strip 6" wide lying in one place between the quartzite and the ore.

A short distance east of "C" shaft is a dyke of soapstone running nearly north and south, a very unusual thing. It cuts almost at right angles across dip and strike. My time was so limited that and the mine so little opened up at "C" shaft that I can only surmise that the ground west of the dyke does not exactly correspond with that east. East of the dyke the hanging seemed to be very smooth, and well defined and crystalline quartzite while west of the dyke the hanging did not seem so regular and was of the nature of the soapstones found in the quartzite #20079 was found between such soapstone and the ore.

Some further examination is necessary however to fix it clearly (Mine maps are of no account.)

T.

R.



Nos 20085 to 20203 inclusive are
 20085 } diamond drill cores taken from holes
 to 20203 } Nos 516 and 517 drilled E. and South from
 inclusive } the 350 ft. level about 250' West of the
 new Sec 16. Shaft. L. S. I. Co.

Including about 20 feet of ore mined
 between Nos 20144 and 20145 these holes
 represent a horizontal section of the formation
 for 1050 feet. To the north of No 20085
 is all hematite Jasper (intersected by
 paintrock dykes) until the big Lake
 Superior diorite bluff is reached.
 On the north side of the bluff is the
 section with map and drill core samples
 previously sent to Gladwin. These all
 together make a section of the rock
 formation of about 3400 feet. ch. & d.

20204 } Diamond drill cores from holes drill-
 ed at N. end N. 7 Mine Lake Super-
 inclusive rior Iron Co., 520 ft level.

20244 From L. S. I. Co's diamond drill hole No 490
 to in 440' level of Hematite Mine
 20248 Showing gradation from paint rock
 to green shist and later to di-
 orite

20249	338 ft.	} D. D. Hale # 72, L. Superior Iron Co's Hamatite Mine 340 level.
20250	364 "	
20251	387 "	
20252	405 "	

Four distinct portions of the formation are shown, ^a and five kinds of rock represented. Their occurrence is usually in this order—

- 20253 (1) Quartzite and ore,
20254 (2) Soapstone or paint rock (sedimentary)
20255 (3) Soapstone (eruptive)
20256 (4) Hamatite jasper.

The piece of ore and quartzite shows the intimate association that sometimes occurs. The red paint rock is undoubtedly Upper Huronian and sedimentary in origin. The eruptive soapstone or paint rock is somewhat more fossiliferous and is then harder to distinguish from the sedimentary kind than in the present case.

