Marquette Range: [specimens 25455-25559]. No. 150 1893

Van Hise, Charles Richard, 1857-1918
[s.l.]: [s.n.], 1893

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U. S. GEOLOGICAL SURVEY

FIELD SECTION BOOK

Marquette Range

C. R. Van Hise

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.

#150

Not Platted
25497 to 25516 inc

Marquette Region

C. R. Van Hise.

1893.

1893.

Dishpenning, Sunday July 30.

In the afternoon walked over the greenstone ridge west of Lake Bancroft. All of the exposures of slate were found to be the actinolitic variety such as occurs on the south slope of the bluff just north of Lake Bancroft. The northern greenstone ridge is lined by many of the ordinary mass of greenstone & green stone schist and this is cut by dykes of 2545 greenstone which has a red weathering and shows that it is granite before it is closely examined. The remaining greenstones on this ridge were not closely examined with reference to their schistose character.

The question arises whether or that are not all Precambrian schists and whether the appearance of the serpentinous slates at this place is not connected with this. If it proved to be the case, The ledges of iron formation N.W. of the Bluff and E. of the Car P.R. to and found to be typical chert and iron.

Close to the exposures of actinolitic slate north of L. Bancroft were found numerous boulders of magnetite but were not found in place.

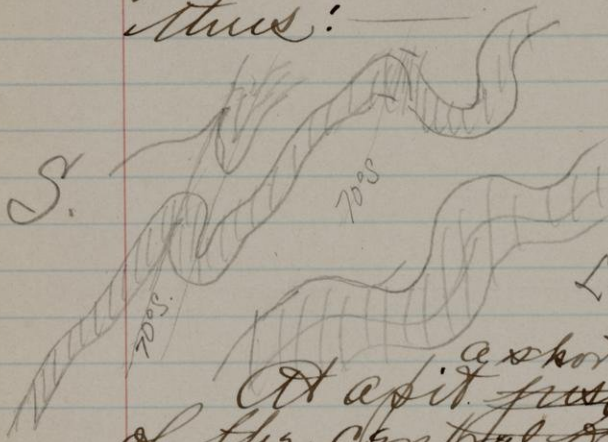
Monday

Ishpeming July 31-1893

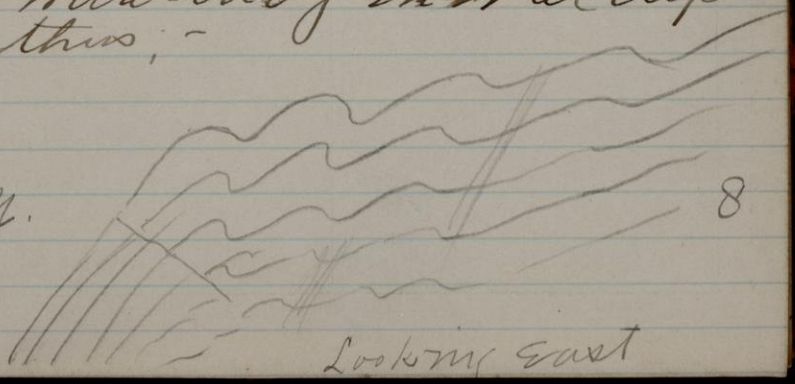
Drove to the Fitch Mine N.E.¼ 24-47-28. At the open pit of the mine the strike is N40°E and the dip from 20° to 50° to the N.W. This pit and all the exposures here found are upon Hanbury and the strike of the various ledges strongly set that this is the W. end of a western plunging anticline.

Driving now to the Saymaw the outcrops and open pits about the mine were carefully examined. At the westerly open pit in the jasper, whether original or recomposed uncertain, there are several minor anticlines and synclines both limbs

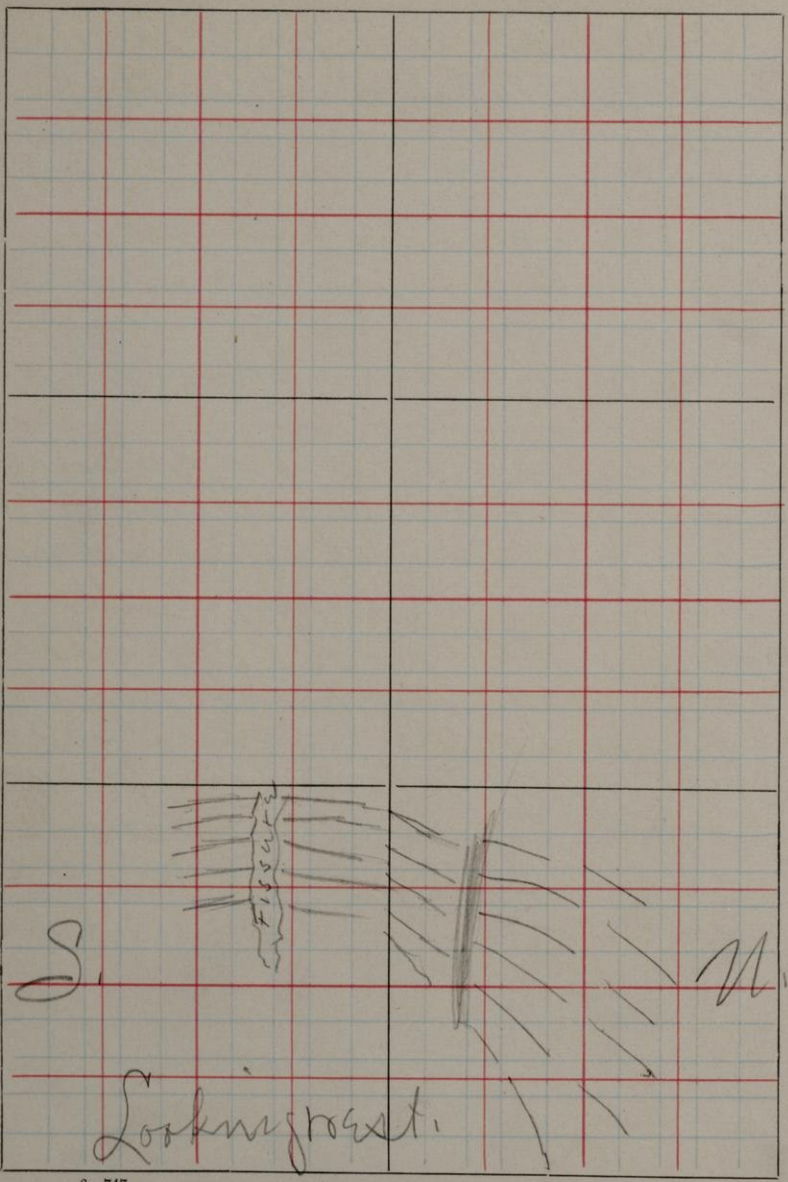
of which dip in the same direction to the South thus:



At a pit a short distance ~~south~~ of the Central Opening is a typical banded chert and one which is intricately folded into over turned folds which dip to the north ~~but the fences~~ and this corresponds with the general dip thus:-



S. T. R.



The same phenomena were observed a little to the southward in a little cut but here there are southward dips as well as northern ones. Near the east end of the series of openings is a road cut in which the jasper dips to the south at angles varying from rather flat to 40°. On examining the openings as a whole the Upper Huronian conglomerate comes well up and capping the jasper, in several places ~~can~~ reaching quite to the south side. At one opening near the east end the quartzite seems to be in an anticline

12 thus:-

See opp. page

From all of the facts observed it appears wholly possible that at the Jasmian is a sharp anticline overturned toward the south. In this case the upper conglomerate and quartzite between the jasper and the hill of lichen-like slate to the south. The latter would thereby in the upper series and stand as the equivalent to the homogeneous slates associated with the freestone conglomerate near the railroad to the north. The bluff of grandstone just south of the log cabin camp in the east half of 20 was examined and while the main mass appears to be massive freestone the south and southwest

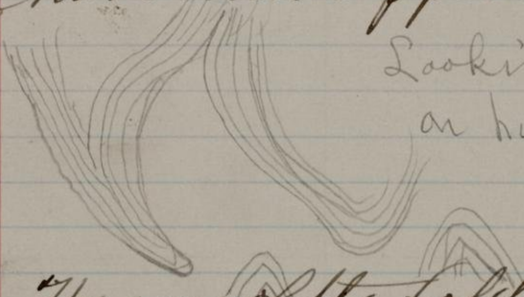
Page 7 missing
in original

ends are typical green
stone schists and green
stone conglomerates, the
whole may be the same
thing. Sandy on the side
of one of the knobs of
greenstone and in other
places interbanded with
it in layers varying from
a few inches to several
feet are small exposures
25456 of actinolitic slate. Whether
the greenstone is intrusive
within the slate or the lat-
ter is interbedded with
or upon the volcanic
fragmentals was not de-
termined. But the green-
stone appears to have in-
truded itself into the
slates the whole of which
may be no more than
great blocks which have
been caught up by the
greenstone.

Shipping. Aug. 1st 1893.

Walked to the place from which specimens 17893 & 4 came Sec. 4-47-27 and found there to be gravestones. The outcrops of chert and jasper in the N.W. ¼ of Sec. were examined. Practically continuous outcrops of the jaspilite banded chert extend for 150 paces south 2° W and 50 steps south of this banded jasper. The ledges of chert and ore also extend for 200 steps east of 2° W and 50 paces north of the last point is that from which 17895-7 were taken this being a contact pit between the iron formation and upper slate. The chert and jasper exposed in this vicinity has usually a very regular strike and dip 5° N 85° E

dip 65° S. In a few places minor folds and brecciation was observed. Next went to the ledge represented by 22008. This is graywacke slate showing a general E&W strike but being compressed into many minor folds, which on the flat surface have this appearance—



The axes of the folds are almost vertical. The material from the large open pit west of the camp and the railroad. This was found to be a soft ferruginous chert containing much ore

22457 Specimen shows the phases of the cherty bands.

The strike of fanny mond
chert in ledge from which
19945-6 was taken was
found to be N 65° 70 W instead
of E & W. as platted, dip 55° to
60° S. E. Then walked over
the Greenstone ridge north
of Lake Bancroft the most
northerly ridge in place
to become a greenstone
conglomerate. This is cut
by latter massive green
stones. The greenstone of
the central and southern
ridge is of the massive
15458 type. From the actinolite
slate on the central
ridge was taken specimen.
The chert of the pits a short
distance S. E. of center S. 20
was examined and found
to be ordinary typical
fanny mond chert.

Dishpenning Wed. Aug 2-93.

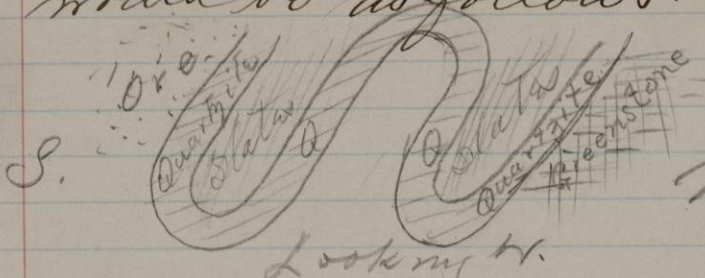
Morning spent in examining my Teal Lake Range. The old crop and pits at the west end of the greenstone ridge were first examined. In all respects these have the characteristics of the Lower Huronian formation. The strike of the ledges is N80°85°E and the dip 85°S. Following along the north ~~slope~~ of the greenstone numerous pits were seen having like material. In the depression east of the first chief test pits have extended to the swamp finding similar material. The southern most pit is partly between the greenstone cliffs to the east and west. Going now to the Clear Lake Hematite the deep vertical shaft after leaving ore

formation ran first into
26461 quartzite iron stained
26462 and below this into slate.
If one can judge from the
order in which the ma-
terial is deposited at the
dump heap. From the ore
formation passed through
before the quartzite is
reached were taken spec-
25459 imens 26459 & 60 to rep-
26460 resent phases which Thomp-
son considered to be most
like what he had regarded
as Upper Huronian. Be-
tween the Clearland Hem-
atite and the Cambria is
a large test pit containing
26463 typical banded ore and
chert. On the railroad back
near the Cambria quartz-
ite a similar to that from
the Clearland Hematite
is observed and north of
this the slates. The slate
ridge north of the mines

was also closely examined and was found to have a uniform slaty cleavage which dips at a high angle to the south but the numbed- ding cutting across this cleavage indicated that it is near the crown of a sharp anticline. ~~The~~

The work of the morning left little doubt in my mind that the Teal Lake Range belongs with the Lower Hermitage formation and that this formation was around the western end of the greenstone ridge and perhaps along the valley between and the two ridges. This would require ~~that~~ some overturning to the north. The quartzite and slates below the ore belonging above geologically. The section from the greenschist

would be as follows:—



Now went to the Old Jackson Open pits and at the southwesterly one found the jasper to be folded in a series of westerly pitching rolls the strike of the axis of the central fold is N 75° W. The dip of jasper or the pitch of the axis 45° W. The overlying quartzite has a N & S and strike and dip to the west 20°. We have thus here one of the westerly plunging synclines of which there are several at the Jackson. Those at the west end of the main pits are extremely compressed so that the

alternating jasper and quartzite have nearly vertical contacts and each is repeated by folding two or three times. The axes of the folds being nearly horizontal. The slate is in place so much sheared as to resemble eruptive soapstone.

25464 Specimen of ore picked up showing very close folding

25465 Specimen of soapstone from north side of New York open pit so much sheared as to resemble slate

Bayleys Camp on Carp River Sec 6-47-25
Wed. Aug 3.

Walked from camp to Eagle Mills ~~just~~ A short distance north of camp are quartzite and slaty quartzite which strikes nearly E&W and dips at a high angle to the south. The heavily bedded quartzite underlies the slaty quartzite. The limestone ledges at Morgan Summit have a nearly E&W strike and dip at a high angle to the south. For the most part the bedding is regular but there are minor folds with E&W axes nearly horizontal and also minor folds with axes in direction of the dip showing E&W pressure. The most of these minor fold appear rather to be produced by accommodations between the beds than be a general folding of the

type. Interstratified with the limestone are beds of red clayey slate exactly like that in the Grosse Lake cliff. The proportion between limestone and slate is also about the same. The narrow beds is nitrous quartz etc which has been much impregnated by feldspar. In the second band like the great bed in the Michigamme Mica schist on south side of Lake South of Michigamme.

In the limestone are layers of feldspar, varying from those of minute size up to 4 in. across, or at least of a mineral which looks like red feldspar. (can this be) Whatever the mineral it is clearly crystallized or else vein material

We now went to the exposures of slate S. of the railroad, a short distance, perhaps ½ mile E. of Eagle Mills. The N. end of the long ridge was found to be the

crown of an anticline, with an E. & W. axis, and pitch to the W. from 7° to 10°. The valley S. of the ridge joins that to the N. just W. of this point, thus making a V of low land or sand plane, and so causing the topography to correspond to this fold, and perhaps indicating that the anticline is a major one.

We now drove to the ferruginous slates on and near the road south of Dr. McKenzie's farm. There has been a good deal of test-pitting here. The slates are apparently regularly laminated, except for minute wrinkles. They have a cleavage which cuts across the true bedding, but the strike of the two are nearly the same, indicating that the folds have nearly horizontal axes. Some of the slates are plainly fragmental, but others become so heavily ferruginous as to resemble the least altered phases of the Lower Huronian ferruginous slates. For the most part these rocks are free from cherty limestones, but these are found up to 3 or 4 inches across. The dip of the slates is to the S., and N of them comes in a layer of quartzite. The ferrugi-

rous slates clearly appear to be a part of the general area of slates, graywackes, and quartzites of this part of the district, and are regarded as Upper Marquette.

We next visited the section which the Carp River makes through the Teall Lake quartzite. Here the slate layers of the fragmental series have been much crushed, and in places take on a very

character, which renders them difficult to discriminate from the more sheared phases of the schist. However there always seems to be a difference. The schists have a great uniformity, which the slates do not possess, there being alternations of materials of different characters. Further the schists break in a different manner, the fracture being about equally well in the entire zone. That is, they cleave as though they were a mass of crumpled fibers piled up, rather than like leaves, as do the slates. But notwithstanding this general difference, at one place E. of the Carp, it is exceedingly difficult to say where the schists end and the slates begin. While this is true

it can not be doubted that a break exists between the two.

Republic, Aug. 4 + 5.

I again made a section across the members of the Republic trough, beginning near the large boiler house near the S. corner of the horseshoe. The jasper does not appear to be a formation separate from the actinolite schists, but to grade into them. Near the Upper quartzite the jasper is red. As stated in previous notebooks, in passing to lower horizons, the quartz bands gradually become white the rock at the same time taking on an aspect similar to the actinolite schists. In going to lower horizons, the regularly laminated white rock grades into the actinolite-magnetite-schists of typical character. These in turn in passing toward the lower quartzite begin to have layers of a quartzite like appearance, and in the exposure nearest to the lower quartzite, the 2 rocks are interlaminated.

25-469
25-467-8 The exposure of quartzite to the S. nearest to the above carries apparently in

it some actinolite, and this grades
2547/66 into massive coarse vitreous quartzite

As before determined in another section, we thus have from the base up in this place a transition from the mechanical sediments of the lower quartzite to the non mechanical sediments of the typical actinolite magnetite schists, and from these into the jasper.

The above quartzite is in the locality described by Brooks as a quartzite exposure unconformable with the granite. Now passing N along the face of the granite, or at the N. part of the slope, in a short distance, not more than 100 steps, is found a great boulder conglomerate, resting upon the N. face of the granite ridge. The granite is for the most part a mere facing, although in places it is 10 ft. thick; for the granite appears both above and below the conglomerate. The conglomerate contains very numerous well rounded pebbles, and even boulders, of white quartz, but far more numerous pebbles and boulders of granite, some of them 3 or 4 feet in diameter, although the more usual size is from a

few inches to 2 feet. In all respects these granite fragments are similar to the solid ledge adjacent, from which they were doubtless derived. At one place a stringer of conglomerate extends down into the granite.

There appears to be no reasonable doubt that the quartzite, actinolite magnetite schists, and jasper series belong above this conglomerate, and that the whole rests unconformably upon the granite, the latter being a surface of erosion at the time of the deposition of the lowest member of the series.

The section at the Klondike shows the same transition between the actinolite magnetite schist and jasper, but the stages were not observed to be so complete, probably because of lack of continuous exposures. The actinolite-magnetite-schist has the usual banded appearance, brittle fracture, regular lamination, and red cleavage along the lamination, while above the quartzite comes in another actinolite magnetite schist, which has the rough appearance upon the weathered surface, and peculiar toughness, charac-

teristic of this horizon at Michigamme. Also the layers are thicker, and many of them have more the appearance of a crystalline schist, than the lower actinolite-magnetite-schist. This upper actinolite-magnetite schist is folded in the most complicated fashion. As seen on horizontal surfaces, the layers are usually seen turned back on themselves in a sharp V shaped fashion.

The lithological differences noted here and at Michigamme between the upper and lower actinolite-magnetite-schist, suggest that the peculiar characters possessed by this rock may be used as criteria for separating them when only one is exposed. The Humboldt exposures undoubtedly belong in the lower actinolite-magnetite schist series.

On the Marquette & Northern R.R. a short distance W of the bridge is a great exposure of peculiar greenstone, which on the weathered surface has a rough

appearance, due to the protusions of rounded crystals of amphibolite. The peculiar appearance presented is often associated with the weathering of a surface volcanic, but this exposure does not appear to be of this character. At the SW end of the exposure, the rock is in contact with actinolitic upper quartzite, and also one band about 2 ft wide has intruded itself along the layers in the main, but has crossed them in a minor way.

Trips in company with Mr. Seaman

Marquette, Aug. 31, 1893.

Along the N side of 34-48-25 is a conglomerate which contains numerous Jasper and white schist fragments, and appears to rest unconformably upon the white schist. This apparent unconformity is only indicated by the fragments, there not being any discordance between the two which could be made out. If the white schist fragments are not really of the same character as the underlying semi-crystalline white schist, there

would not be sufficient evidence of discordance. This macroscopically appears to be semi-crystalline, but might be either a sheared acid eruptive, or a somewhat metamorphosed fragmental. Seaman thinks this rock to resemble the cherty quartzites at the base of the Lower Marquette series

25473 Ordinary phase of white schist. In places
25472 it becomes red

25474-5 Specimens of conglomerate containing chert, jasper, and white schist pebbles

25476 Quartzite above conglomerate

We now went west to a point N of the small lake in Sec. 29. Here S of the road a white

25477 semi-crystalline schistose rock, similar to that in Sec. 34 is exposed, and it has very intricate relations with the plainly fragmental slate. The schistose rock contains veins

25478 and irregular oval layers of ferriferous dolomite, just as in the white schist of the Basement Complex S. of the Cascade Range.

25479 In places is found a rock, which appears to be a more sheared phase of 24478. It resembles a decomposed granite. In other

25480-1 places a red or gray felsitic looking rock, but probably graywacke, is infolded with

25482 the slates in a most intricate manner.
25483 The slate in places contains pebble-like areas apparently derived from the white schist or graywacke. In places the slate is much sheared, and contains layers of coarser material, which have been broken on account of their brittleness. These pebbles may be produced by a more or less intense stage of dynamic action. The slate as a whole has been closely folded, the sides of the folds being parallel, that is, overturned. One closely compressed sinclinal figure is well exposed in cross section. It has been pushed over from the N or under from the S.

Sep. 1.

In company with Seaman, Hubbard and Bayley, I went to a point on the Carp River Sec 6 T 47 - 2 - 5 - where Seaman found an almost ⊥ cliff, upon which is exposed a conglomeratic slate and quartzite resting
25484 unconformably upon black slate. The contact appears clearly to be one of erosion, the discordance not being great, but decided
25485 Pebbles of gray slate, schist + ferruginous slate from the conglomerate. The conglomerate is only a few feet in thickness, and quickly passes

25486 up into gray slate, but in this slate there
occur sucial layers of conglomerate.
25487 A specimen of conglomerate from one of these
layers, it being the full width of the conglo-
merate belt interlaminated with the slate at
this horizon. The slate and conglomerate
soon pass up into ferruginous intricately
25488 interlaminated slate and ferruginous quart-
25489 zite, and this into ordinary vitreous quartzite.
This latter quartzite Seaman says to be
continuous with the upper quartzite at Goose
Lake. Therefore he regards the slate, which
he places in the Mesnard series, as unconfor-
mably below the Upper Marquette series. The
evidence of this unconformity is mainly, as he
says, the way in which the upper quartzite
now comes in contact with the slate, and now
with dolomite in the Marble series.

Sep. 2.

The party of the previous day went to Goose
Lake. We saw the succession at the lake and S'ly
of it. Also we examined the slaty quartzite
which is in a series of minor rolls with eastern
pitch. The place where the limestone passes
under the slaty quartzite, there being a layer
of chert breccia, was also examined. It was

agreed by all that this was a breccia, rather than a conglomerate.

We next visited the ledges near the center of Sec. 22, where exposures of the white schist, not like the semi-crystalline slate and schists, rest below a quartzite conglomerate, which appears to carry fragments of the schist. Everything below the quartzite is supposed to be a part of the Basement Complex.

We next found the ridge of Goose Lake slates and graywackes in the N W part of Sec. 22, N ½ of Sec. 21. Seaman called attention to various conglomerates along E side of same. He thought them to be interlaminated with the Goose Lake slates and quartzites. Whether this was correct, or whether the conglomerate is really above the slates and quartzites did not appear quite clear to me.

25490 Chuky-looking quartzite from ledge along east side of ridge, but a little distance from the small prospector's camp.

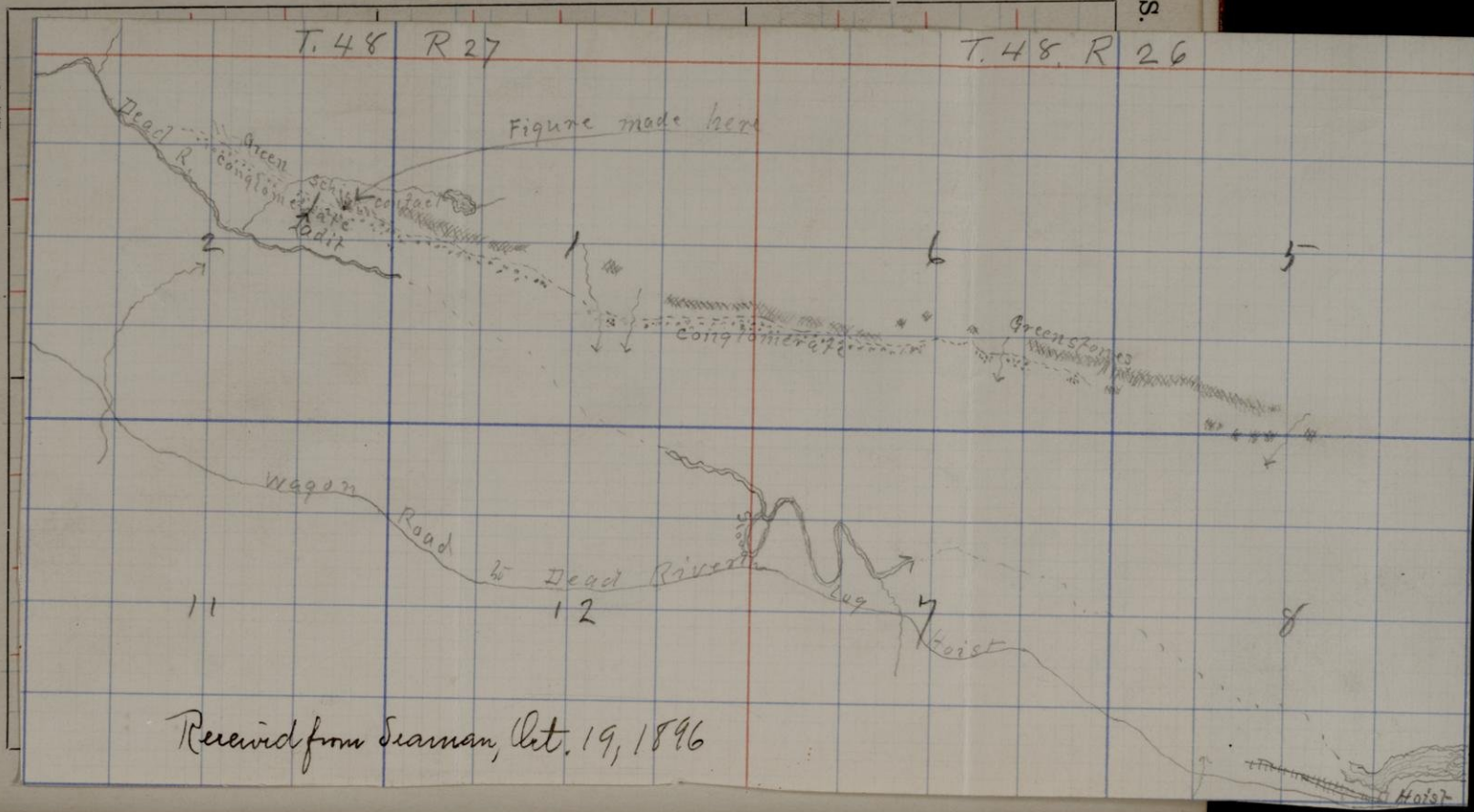
25491 Slate and quartzite east of and above 25490
492 along E. flank of the exposure from which
493 490 was taken. Are these recomposed rocks resting above and composed of the detritus of 25490, or are they all interlaminated?

Seaman thinks the slates, graywackes and conglomerates, etc., of Secs. 22 & 21 to belong to a lower series than the quartzite, supposed to be unconformably above the slate examined the previous day.

We now went S in the S.E ¼ of Sec. 21. Here is a range of white cherty quartzites or white semi-crystalline schists, which appear to be overlapped unconformably by quartzite with the basal conglomerate. The conglomerate and quartzite run up little N & S valleys, and occupy slight depressions on the top of the schistose quartzite, these depressions apparently having been little valleys before the deposition of the upper quartzite. The lower rock is stained along veins by iron oxide like that under the conglomerate near the center of Sec. 22. It is not like the Goose Lake quartzite. Does this schist belong with the Basement Complex, Lower Marquette, or Goose Lake series?

Sept. 3.

The same party went to Sec. 15-48-26 in the Silver Lake area, where Seaman showed us, running in an E & W direction, the typical iron stained basal quartzite of this area. along the railroad track above this quartzite is



Received from Seaman, Oct. 19, 1896

25494 typical ferruginous chert of the iron formation. Resting again unconformably upon
25495-6 this is a chert and ore conglomerate. Near the top of the ledge of the ore formation the chert is broken, and the detritus of the higher areas has sifted down into the cracks of the ledge. A little way down the cars and apparently above the conglomerate is the typical black banded slate of the Silver Lake area. It was thought that the lower quartzite is equivalent to the Lower Marquette, and that the conglomerate and slate is equivalent to the Upper Marquette. While this equivalence is thought to be the most probable, the lower quartzite is not sheared, but merely cemented. However the same thing is true of the lower quartzite of the Cascade range. Nothing which in any way resembles lithologically the Mesnard series was seen, while each of the other series has typical representatives.

Ishpeming, Sept. 4.

Seaman, Hubbard and I drove to the old ~~Humboldt~~ Holyoke Mine in Sec -48-27. Here is found the typical Basement Complex, consist-
25497 ing of green schist,
25498. white schist

25499 felsite, etc. The relations are the usual in-
tricate ones of intrusion. Upon this complex
25500 rests a schist conglomerate, which contains nu-
25501-5 merous fragments of jasper, chert, actinolite mag-
netite schist, and other phases of the iron formation. These run from particles of small size to great blocks 6 or 8 feet across, some of which are folded in the most intricate manner. The
25506 conglomerate also contains fragments of granite, felsite, etc., - all of the phases of rock, in fact, which are found in the immediately subjacent Complex. The schist of the Basement Complex is cut through and through by dikes, but none of these cut the conglomerate. The relations of the two are shown by figure on opposite page. In places the schist conglomerate is so sheared that when pebbles are absent it is difficult to distinguish it from the green schist of the Basement Complex. The conglomerate
25507 passes up into slate, which contains layers of
25508 coarse graywacke. For this area these slates and conglomerates constitute the basal members of the Silver Lake series. The conglomerate is thought probably to be in large part a volcanic clastic, but little rearranged by water. It is found as far east, according to Seaman, as Sec. 9-45-26.

A little way to the N of the conglomerate and a short distance N., along a road, is found in the green schist layers of cherty jasper a ferruginous slate, at least 5 or 6 feet wide. This shows a strike similar to that of the so-called gold and silver veins of the district, and I have little doubt that all of them are of vein origin, but some may be the source of the ferruginous material in the Holyoke conglomerate.

25509-12

Directly on the road to the Pine Center Prospect, just N of the mine, are outcrops of ferruginous carbonate, with chert and jasper. These specimens suggest that the carbonate has been replaced in the more siliceous phases of the vicinity by the cherty and jaspery material, and thus we can carry back the origin of the ferruginous material in the green schist one more step. Seaman says that another larger layer of ferruginous material is found in the green schist within a short distance.

25513-4-5

Almost immediately adjacent to the road, near the brook is a belt of green schist, containing fragments of chert, but nothing else. While the hand specimen has strongly the appearance of a conglomerate, a close examination of the ledge shows that the fragments have been formed by dynamic action, being

25516

broken from a vein of chert.

On our way back to Ishpeming Seaman informed me that jasper pebbles are found in the quartzite (on N side of first road) along the Holyoke road, just N of the Repus Gold Mine.

Sept —

Seaman, Hubbard and I walked from Gautchie's to the Wheat Mine. We found the Goose Lake cherty quartzites to extend to the N from the S end of the granite in Sec. 23. In passing along this ridge the material appeared to be typical Goose Lake quartzites and slates. However
25517 25518 this cherty and sericitic quartzite is directly overlain by conglomerate, containing pebbles of
25519 25520 slate, which apparently are from the Goose Lake series. This conglomerate is interlaminated
25521 with ferruginous slate and
25522 graywacke. The question arises whether these slate pebbles are derived from the Goose Lake slates by erosion or by dynamic action, whether in short the fragments are not autoclastic. The dip of the conglomerate (Bayley's No. 17389) is to the N, and the cherty quartzite also appears to dip in the same direction.

Almost immediately to the N of this ridge, with but a little break between is olive colored

crystalline looking quartzite or novaculite. This is stained in the most intricate way by
25524 iron oxide, becoming on the top red quartzite. In places both phases appear to be conglomeratic. This rock has the aspect of the Goose Lake material, as does also the material extending to the N in the NW ¼ of the SW ¼ of Sec. 23; but this quartzite also appears to grade down into the conglomerate containing pebbles of the white schist and granite. The quartzite and conglomerate to the NW of Bayley's station BK. dips N, and contains much quartz as pebbles, and also pebbles of white schist.

We now went SW of the great granite conglomerate near the center of Sec. 22. The slates and quartzites which were found have a cherty broken aspect, and were regarded by Seaman as undoubtedly of the Goose Lake or Mesnard series. Going over the ridge of slate conglomerate in the SW ¼ of the NW ¼ of Sec. 22, we crossed a little valley, and came upon the typical Goose Lake cherty veined slate above described. The conglomerate of this area did most certainly seem to me to be of the same age and later than the white crystalline schists. Whether later than any of the Goose Lake slates and quartzites it is as yet impossible to say. It is possible that

two conglomerates are present in this area, but the evidence is far from conclusive while the presence of the pebbles of cherty slate in the conglomerate would be almost desisive evidence that the conglomerates holding them are later than the Goose Lake cherty slates, if these were not possibly of dynamic origin. The likelyhood that they have been produced by dynamic action is the greater since we know that Reibungs breccias closely resembling the conglomerates have extensively developed in the Goose Lake slates and quartzites.

We now passed W into Sec. 21. Somewhat S of the E&W ¼ line a peculiar chistose quartzite is found. This is overlain to the N by vitreous quartzite. Going S across the great bluff most of the rock is quartzite, some exposures more crystalline than others, much of it brecciated and having a conglomeratic appearance. Nothing was found which was regarded as earlier than the quartzite, except small areas of white schist like that in Sec. 22. This Seaman suggested is a dike, and he regarded much of the quartzite as belonging to the Mesnard series, although he thought it possible that the later quartzite might mantle over this in places, as on the ridge in Sec. 21, mentioned

in the notes of the previous days. The cherty quartzite at the foot of the hill on the S he unhesitatingly placed as Mesnard. In several places on the ridge a fine grained brown quartzite and a dense slate were found which dip to the S. Seaman suggested that these are Mesnard, and that they pass under the jasper formation.

Sept. 6.

Seaman, Hubbard and I went to Negaunee and then N to the quartzite range. Upon walking over the same, we again found that the E end contains much cherty slate and cherty quartzite, the two minutely folded in places into crinkles, and in other places waved by E-W pressure, the whole sheared and veined, and altogether having a very crystalline aspect, much resembling the Mesnard series. It is regarded by Seaman as here belonging, who believes that the newer quartzite comes in across the plain from the E., approaching nearer and nearer to the quartzite in the Teal Lake range, and finally overlapping it, making up all or most of the range N. of the point where crossed from the road N of Negaunee. He bases the supposed discordance between the two upon

the more crystalline character of the part called Mesnard, and upon the difference in strike. He says that the lower is folded, veined and cut by dikes, while the upper shows no such evidence of dynamic movements. This, however is surely but partly true, for the supposed upper quartzite is so brecciated in places as to have a conglomeratic appearance. At one place 2522 5-6 a slate rock, perhaps a dike, butts directly against the quartzite to the W. Seaman thinks the rock is a dike, but it rather appeared to me to be slate faulted against the quartzite, it appearing to be like the more crystalline slates to the E. If this is true, it might explain how the upper quartzite runs farther back west of the fault.

We again visited the conglomerate N of the quartzite range W of the road cutting the range N of Negaunee. We looked here for quartzite pebbles, and while the fragments are mostly vein quartz, certain pebbles seem to be from a quartzite. The conglomerate also contains jasper fragments. The slate above the quartzite was found to be folded instead of having monoclinal dip, although the cleavage is all in the same direction.

Marquette, Sept. 8

With Bayley I made a cross section of the Mesnard series S of the prison. This part of the section consists of a central anticline and a southern syncline. The N syncline of the series is on the other side of the Carp. The whole section across the series is therefore a double syncline with a necessary central anticline. The base of the anticline is quartzite, the central part slates and limestones, and above the limestones is another quartzite. Also the folds have been buckled by an E & W pressure, so that near the prison the entire section is quartzite. The folds in this saddle dip to the E. on the E, and W on the W. As a consequence when the slates and limestones appear to the W. where the fullest exposures are seen, the limestone appears in two sharp fingers, just as does the upper quartzite in a series of fingers W of Ishpeming. Still farther to the W. the central anticline sinks, if it does not disappear, so that the limestone series occupies the entire width of the area between the main quartzite belts

In the quartzite below the limestone S of the Prison is a narrow persistent layer of conglomerate containing white quartz and rather numerous

jasper pebbles, which serve to clearly give the strike and dip, and thus determine exactly the structure. For instance where the limestone has disappeared, this is found on both sides of the S syncline, is traced around the E end of one of the western fingers, and is found on the S side of the limestone. After the limestone member appears the dip of the conglomerate layers is toward the granite.

Sept. 9

I made a cross section of Mt. Misnard. On the N side of the Mt. is broken quartzite. Going S a white schistose quartzite appears, and then in a depression between the two peaks the slates of the Misnard series, and after this the limestone making the highest part of the ridge. Near the S flank of the mountain, the quartzite again appears, that is, the quartzite above the limestone. The whole dips at a high angle, about 80° to the S. From this section it appears, thus, that the structure from Mt Misnard S to the granite is as follows:

At the anticline between the two synclines the erosion has cut deep enough so that only a lower quartzite is exposed. The S syncline is overturned to the N, so that the dips are S most of the way across the section. In some places, as a consequence of the folds themselves being pitched, the erosion has cut low enough so that only the lower quartzite is found. In passing E or W from such a locality when the limestone first appears the minor folds of the S syncline cause the limestone to appear in fingers. E. of the Mesnard section the central anticline is less prominent, so that the lower quartzite does not appear in the central part of the section. N of Mesnard the 3 ridges crossed in the section correspond in a major way with the structure. The Mesnard range is the N side of the N syncline, the central anticline makes the central ridge, and the S range includes most of the S syncline. The quartzite forming the projecting point in Lake Superior and the islands to the E is probably a continuation of the quartzite on the S flank of the Mesnard, i.e., the upper quartzite.

25528 Specimen of this quartzite from the Mesnard.

S of the S range the contact with the granite was examined. The rock immediately

underlying the quartzite and conglomerate is a coarse sheared granite or schistose granite. The pebbles of the conglomerate are here not granite, but white quartz, chert and jasper, and apparently quartzite. The conglomerate corresponds in character to that shown me by Seaman on the N side of Sec. 34-48-25. The question arises whether the schist below this conglomerate in Sec. 34 is also a sheared granite.

With Bayley I again visited the State Road granite conglomerate, and the exposures of slate adjacent to the little lake in Sec. 29-48-25. I looked for jasper pebbles in the conglomerate, but failed to find any. Again we examined the folded slate just S of the conglomerate, and I became convinced that the apparent pebbles contained in the same are not really pebbles, but merely rounded fragments of the more siliceous layers, which have been broken and rounded by dynamic action. So severe has the folding been that not only have the coarser grained more siliceous layers been crushed, but the parted fragments have been so separated from one another in places as to appear to be independent of the layers. Yet when the several ledges are examined all stages of the process are seen from the continuous layers to the slates containing the pseudo-boulders.

The rolls of the slate as seen at one place have the opposite sides of the folds in the same direction, toward the S thus:
The folding therefore corresponds with that at the Mesnard and at the S range, where the quartzite apparently dips under the granite.

25529-32 Specimens from the coarser grained phases of the slate, which on a former visit were thought possibly to be a crystalline schist. I feel certain now that these rocks are clastic. The four show a gradation in the amount of contained carbonate. The more calcareous of the specimens resemble the calcareous limestones of the Mesnard area, and the two are thus united lithologically in this particular.

25533 From vein of dolomite in the siliceous slates. Some of same are several inches across.

25534 Ferro-dolomitic graywacke from same locality, from a pseudo-pebble formed by dynamic action. This pebble is exactly like the belts of graywacke represented by 25529.

Sept. 9.

I visited Picnic Islands and examined the peculiar relations of the red and black rocks which there occur. The latter make up the main mass of the islands, and in places the red rock appears

to be clearly intrusive in dike-like forms in the black rock. In other places the two are very curiously intermingled, and it is difficult to tell their true relations. The most plausible explanation which occurs to one is that given by Williams that the 2 rocks were plastic at the same time.

25535-7 Phases of the black rock. The last contains red feldspar. This composes the island at the NW end of the group.

25538-9 Red Rocks.

25540-7 Specimens showing the complicated interpenetrations of the red and black rocks.

25548 Schistose dike about 2 or 3 feet wide cutting black rock.

25549-50 Diabase dike about 30 ft. wide. First from side of dike; second from center. This dike cuts island represented by specimen 25536.

The islands are beautiful striated and deeply grooved in places by glacial action, the direction of both being N+S, but in one place the striae were seen to cross the grooves at an angle of 15° or 20°. The grooves were almost as deep as in the limestone at Kelly's island.

The dip of the green schist in the Basement Complex S of the Menard series is away from the latter. The dip of the schist N of the same series at Marquette, and on the way to Presqu'Isle,

is to the N, i.e., is again away from the Mesnard series. The Mesnard series upon the other hand, has a dip in a common direction all the way across the two folds S of Marquette.

25551 Matrix of pseudo-conglomerate just W of Spruce St., Marquette, at depression between two exposures

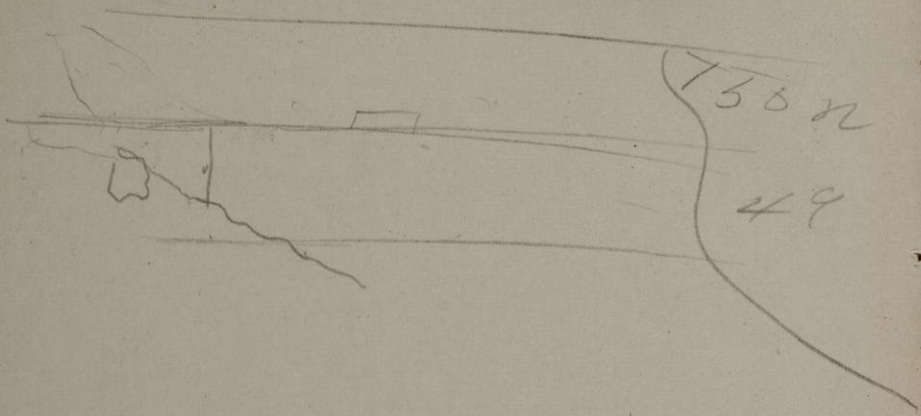
25552 Conglomerate showing 2 small granite pebbles. The pebbles in the specimen are of small size, but in the exposure large boulders of granite are seen. This locality was photographed in a previous year. It has the appearance of a fine grained conglomerate, but the conglomeratic-looking belt cuts across the schistosity of the ledges, and it corresponds to a little depression between two ledges of green schist. The westernmost ledge has the eastern extremity of the jasper and actinolite-magnetite-schist belt which extends W from this point for several blocks. This does not appear at all in the ledge to the E. This fact, combined with the cross direction of the pseudo-conglomerate, leads to the conclusion that the most plausible explanation of the facts is that there is here a cross fault, and that the pseudo-conglomerate is a fault breccia. If this is the true explanation, the fault must be of some magnitude, in order that there should be produced a zone of fault material 15 ft wide, and to carry granite some distance along the

fault zone, this rock not appearing in the immediate vicinity. However a little farther W is a broad dike, 50 or more ft wide, of granite cutting the green schist. It appears to be a fine grained felsite at its sides, and a genuine white granite near the center.

25553 Indurated feldspathic sandstone from new copper mine, Vernon Co., Wis.

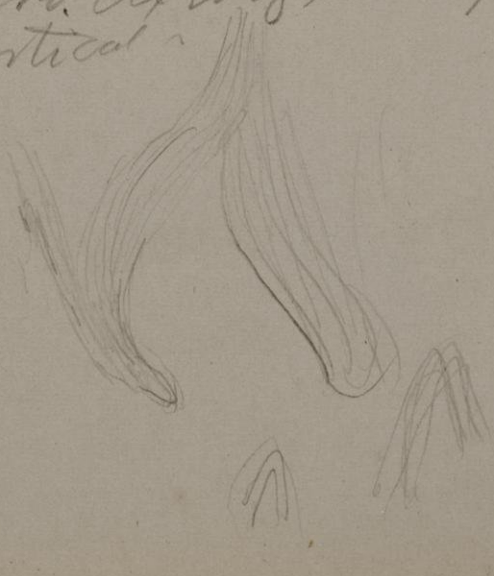
25554 Jasper from Jasper Bluff east of Ishpeming.
555 Slides only. Slides cut from rocks for Educational
56 Series furnished Diller.
57 Slides 12679
58 12680
12681
12682
12683

25559 Samples of rock taken from the Scotland, S.D., artesian well, at a depth of 592 ft. Archean
See letter from A.E. Swan, Letter-file.


730 N
49

~~Ledge~~ Practically continuous
ledges of I. S. min S. from
Lutte 22006. Last Ledge
typical Jaspery I. (30°)
Ledges continuous for
200 p. E 22006 and
200 E - 50 N of 22006 is
Kings pit 17895-7.

Ls Sp. 22008 - slate with very
close corrugation with axes pres
sever. Axes of little folds almost
vertical.



Dip 55°-60° S } E. of. Carp.
S N 65°-70° E

Dip 65° S. } N½ S. 4 ir. of pit.
S N. 80°-85° E

~~Bayley's pit Spec. 1893-7~~
~~50 N - 50 E of Northerly Ledge~~
~~of Luther's I. C. No.~~

(S N 80°-86° E - D 80°-85° S) exposure

~~Jamestown~~