Vermilion district: [specimens] 40541-40588. No. 329 Summer of 1899

U. S. GEOLOGICAL SURVEY

FIELD SECTION BOOK

9-891

LAKE SUPERIOR DIVISION.

INSTRUCTIONS.

1. Ordinarily at least two pages of this book will be devoted to one section. On the left-hand page, place a map of as much of the section as has *actually been seen.* Denote rivers, lakes, marshes, etc., by the usual topographical signs. Denote the ledges of rock, when no structure is made out, by cross-hatching, making the cross-hatching cover as nearly as possible the areas occupied by the exposures. If the rock is a massive one, but still more or less plainly bedded, use the same sign with a dip arrow and number attached, showing the direction and amount of the dip. Denote a shaly or other very plainly bedded ledge by right parallel lines, and a ledge having a secondary structure by wavy parallel lines running in the direction of the strike, with dip arrow and number attached as before. The greatest care must be taken to avoid confusing slaty or schistose structure with bedding, and in all cases where there is the least doubt about the true bedding direction, indicate it by a query. To each exposure on the face of the map attach the number of the specimen representing it. In mapping the section count each of the spaces between the blue lines as 100 paces, and twenty of these spaces to one mile, or 2,000 paces. Usually the southeast corner will be placed at the bottom of the page, or at the first black line above the bottom of the page, and at the right-hand side. If, however, for any reason, it is desirable to show portions of an adjoining section, the southeast corner may be shifted up, or the map may be turned around and the north placed at the left-hand side of the page. The ruling of the left-hand pages is also arranged so that, if desirable, a larger or a smaller scale can be used, eight inches, two inches, one inch, or one-half inch to the mile. With the two-inch scale, the squares outlined in black represent sections, and those in red, quarter sections and "forties," while the space between the blue lines is 200 paces.

2. On the right-hand page place the notes descriptive of the exposures. Begin in each case with the number of the specimen, placing the number on the left-hand side of the red line, after which give in order on the right of the same red line the position of the ledges as reckoned in paces from the southeast corner of the section and the dip and strike when observable, the latter always being expressed from the north; for instance 4025, 250 *N.*, 300 *W.*, *Strike*, *N.* 78° *E.*, *Dip* 50° *S.* Then follow with a full description of the ledge. When topographical maps are used for locations this paragraph applies only in part.

3. Collect a specimen from every ledge, or wherever there is a change of rock on any one ledge, taking care to get fresh material, unless for a special purpose the weathered surface is desired. In case of trips made on foot or in canoes, for long distances, neighboring ledges, unquestionably of one kind of rock, need not be specimened. The position and extent of the ledges not specimened should be marked on the map, with notes that each is of a rock identical with specimen so-and-so. Under the same conditions small-sized specimens, trimmed to a uniform size of 2 x 2½ x ¾ inches will be allowed, but in all other cases *large-sized specimens*, trimmed to a size of 3 x 4 x 1 inches, must be selected, in accordance with section 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. Specimens should not be placed together without protection in the collecting bag, as the fresh surfaces, important in determining the character of rocks, are thus destroyed. They should be damaged by no temporary mark, but the numbers should be at once marked in at least two places upon the inclosing paper or cloth bags. Specimens may be permanently marked in camp by painting the numbers upon them in white upon a black background, using Silver White and Ivory Black oil tubes for color, with turpentine as a diluent.

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

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

C. K. Leith. Vermilion district

Summer of 1899

Jim Fitzpatrick, Compassman

Specimens 40541 - 40588

Notebook 329

S. T. R.

The outline of the iron-bearing formation from Ely eastward, and the location of all mines and shafts was made on this and following days on a tracing of the large scale topographic map of the Ely area, This tracing is with Vermilion maps in office.

August 2nd.

(See opposite page).

Took a general survey of the jasper belts east of Ely, from the Zenith mine to the river.

At the Savoy mine, or Section 26 mine, there is no exposure of jasper. Crossing the country between here and the Zenith mine, along the pipe-line, a number of test pits were seen, but none of them were apparently bottomed in jasper, except at one place, where there was a small amount of jasper exposed. This location is shown on the topographic map. The jasper is here exposed in a long trench, and it is apparently striking in the direction of a line connecting the two mines. However, the exposure was so poor that I could not be sure of this.

I next met Mr. Cowling, Superintendent of the Oliver Co. mine, and from him learned:

(1) That the jasper belt, from the underground workings at the Pioneer, Zenit and Section 26, has an average strike of N. 70° E., and sometimes runs up to N. 45° E., and sometimes almost east and west.

(2) That the Oliver Co., since taking possession, has done practically no surface exploration, and had no records.

(3) That test pitting the underground work shows that the Pioneer, Zenith, and Section 26 are all on the same jasper belt.

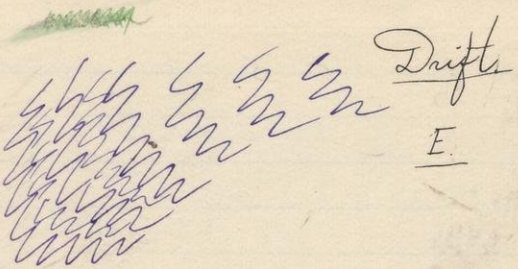
40543 Specimens of the ore from the Savoy mine.
40544

From the man in charge of the drill at the Zenith mine, I learned the following:

(1) The jasper formation pinches out northeast, just before reaching the river.

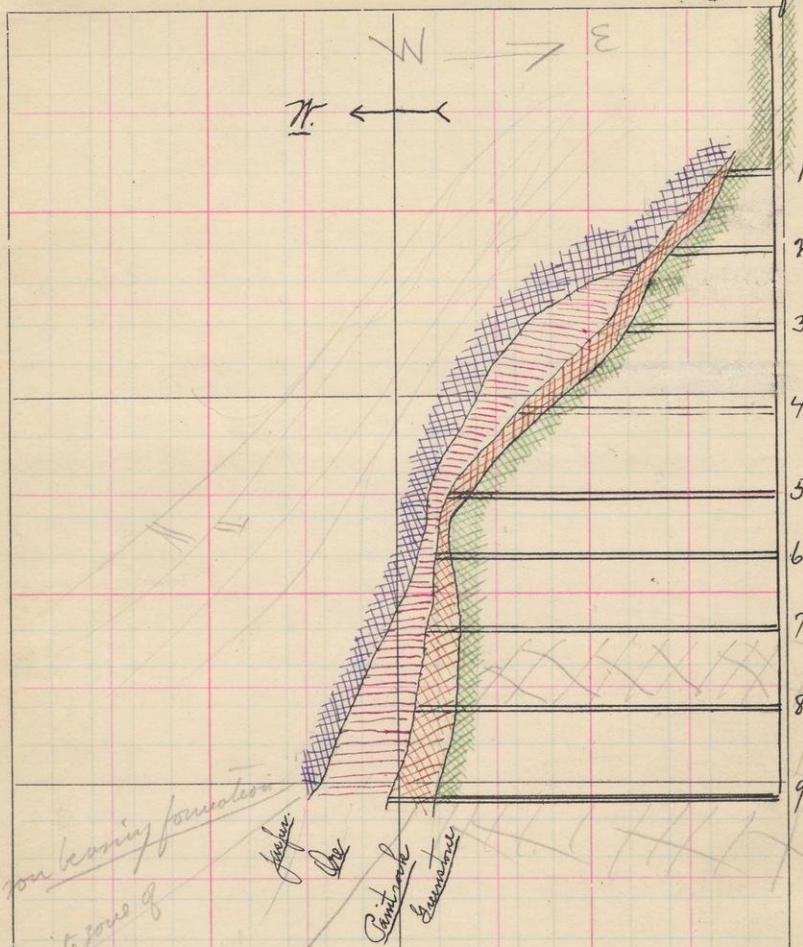
(2) The ore bodies dip to the east, so that the diamond drills should go Northwest to cross them. This is the reason why the Minnesota Iron Co. did not strike the ore body in its exploration. The Minnesota people drilled in from the northwest toward the southeast.

Coming back to camp, followed out the jasper in the east half of Sec. 25, just north of the road. The distribution is indicated on the topographic map. The Pittsburg and Lake Angeline Co. has a diamond drill at work here. They report that nothing but greenstone can be found to the west of their drilling, and that the jasper extends indefinitely eastward. I followed it to the east, but found it soon to be covered by the drift, and finally the hill goes into the swamp. Where the jasper appears, it is extremely folded and crumpled. Indeed, this is the most crumpled jasper of any I have seen in this part of the district. Little can be made out of the structure, as the folding has been so close and minute. In general, I would say that the area of jasper is an anticline, pitching to the west somewhat as follows:



Just south of the road, on the east line of Sec. 25, massive greenstone and ferruginous, brecciated greenstone appear in a cut. The ferruginous material looks like ore. It is very much brecciated, and has a red color, but in breaking the individual fragments, they are found to be greenstone. Massive greenstone is on both sides of the brecciated ~~face~~ phase.

S. T. R. A Shaft.



Section in A. shaft of Pioneer Mine.

Scale - 1 thin square = 20 ft.

6—747

August 3rd,- PIONEER MINE.

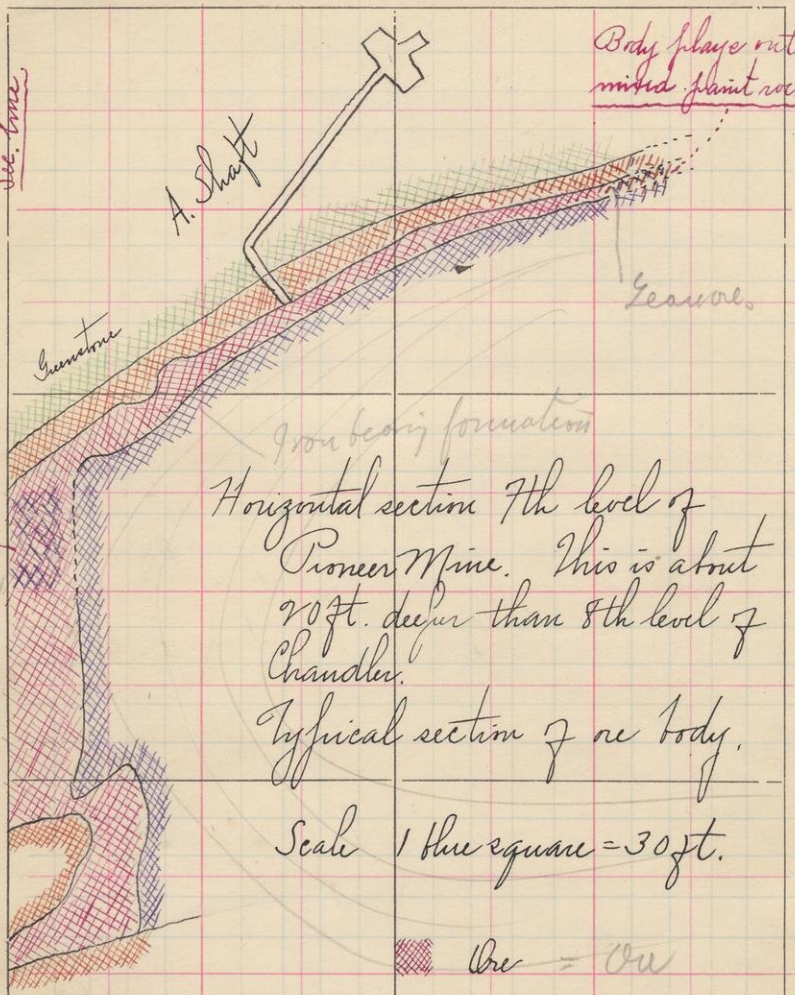
The ore body pitches off to the south-east at an angle of about 45° . The strike is N. 60° E. At the third level, the ore body is about 45 ft. wide; at the 5th level it narrows down to 15 ft. Below this it widens out again slightly. Exploration is not sufficiently advanced to ~~check~~ determine the character of the bottom.

Greenstone is on the north and west followed by about 30-25 ft. of paint rock, and then comes the ore body. The jasper forms the capping. The jasper capping continues right through to the Zenith and Section 26 mines. The ore and paint rock are believed also to continue right through, the paint rock throughout forming the footwall.

At the Savoy the same relations occur, with the exception that the paint rock is missing, the ore resting directly on the greenstone, with the exception of a possible belt of perhaps 5 ft. at the south-west end.

At the Section 26 mine, there is a slight break in the continuity of the ore and greenstone. Here the greenstone is very much brecciated and impregnated through and through with iron. The Mining Engineer informs me that the north ore body is dipping to the north about 45°, while at the Savoy the body dips to the south. This was the reason that the Minnesota Co. drilled in the direction it did at the Savoy.

S. T. R.



Horizontal section 7th level of Pioneer Mine. This is about 70 ft. deeper than 8th level of Chandler.

Typical section of ore body.

Scale 1 blue square = 30 ft.

Ore = Ore

Paint rock.

Jasper. Iron bearing formation

Green = Greenstone

The caving system is used entirely. The sub-levels are 16-25 ft. Drifts are run out to the foot-wall, and material caved from above, until they get to falling material in the ground above.

The ore is not assorted at the mine; only one grade shipped, as all the ore is used by the same company.

Soapstone averages 90 to 92 ft. around N., W., + S., sides of Pioneer + Chandler mine

Jasper capping dips 45° E.

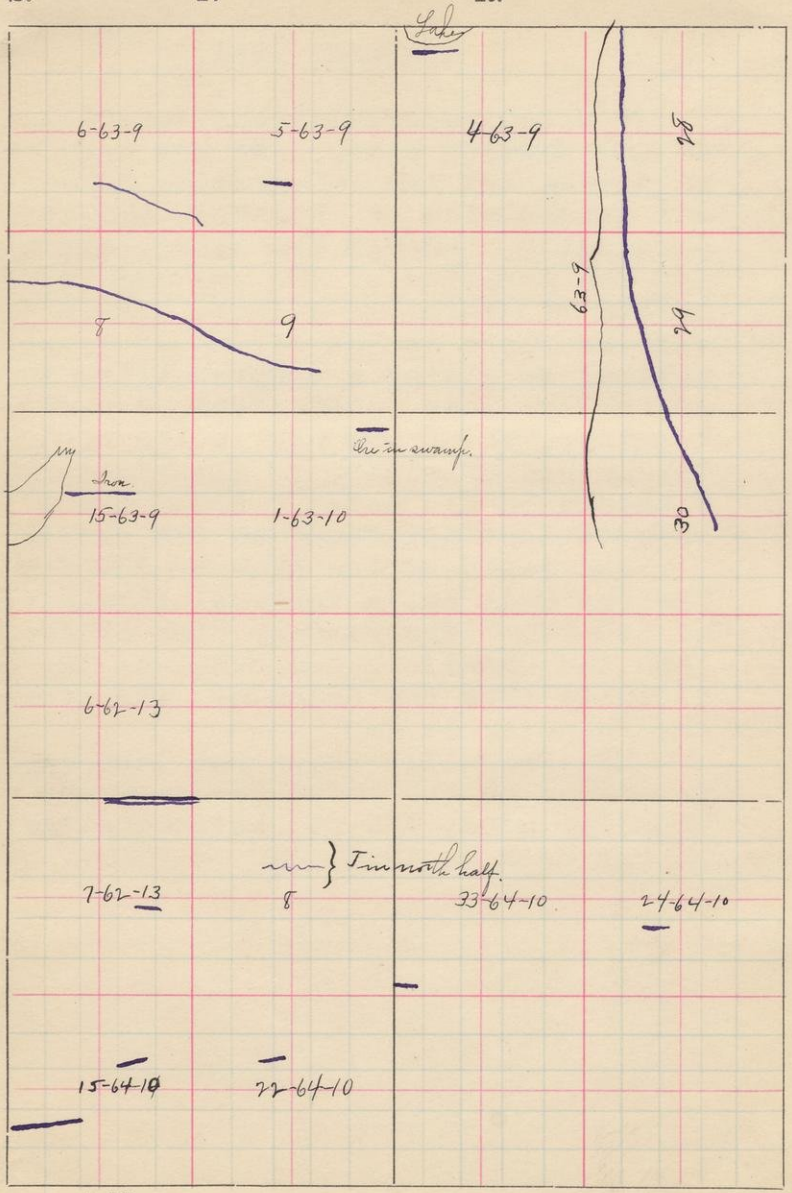
CHANDLER MINE.

Visited Superintendent Penguilly, of the Chadler mine. He was very kind in giving all the information asked for, and accompanied Dr. Clements and myself personally through the mines, explaining the position of the ore body and the method of mining in detail. From the various plats in the office, I selected several as giving a comprehensive idea of the ore body. Of these, I made tracings, which are now in the office. The method of mining is described by Clements in his notes. Below are a few observations not found on the plats:

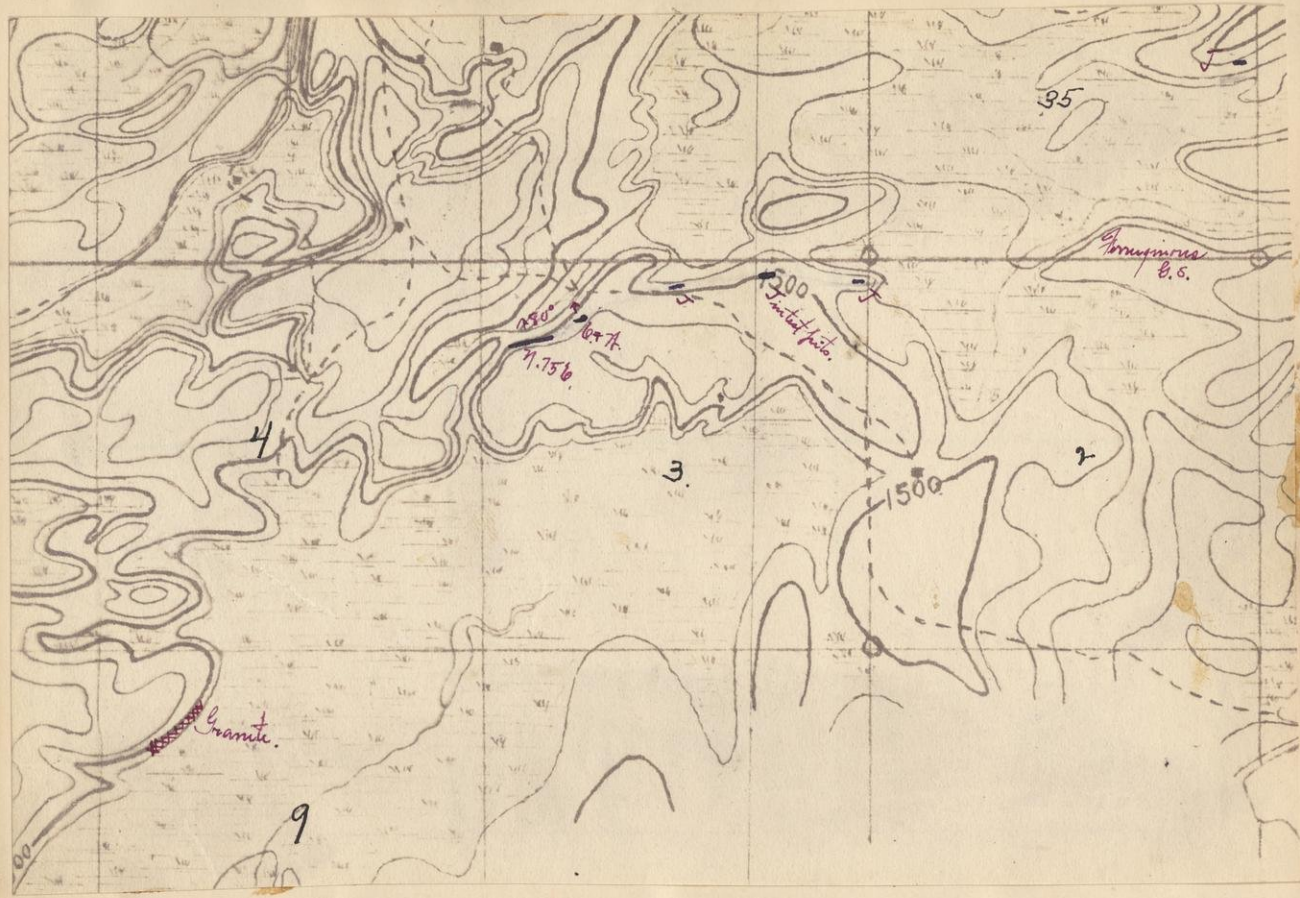
The depth of the mine is 730 ft. The ore body has a vertical thickness of 500 ft. The Pioneer mine is deeper than the Chandler, and receives the drainage from the Chandler, therefore the Chandler is dry.

Mr. Penguilly says that leaf copper was found on the third level of the Chandler mine, 135 ft. below the surface, so far back as 1889.

S. T. R.


Lake
6-63-9
5-63-9
4-63-9
28
8
9
63-9
29
Ore in swamp.
Iron
15-63-9
1-63-10
30
6-62-13
7-62-13
8
Timber half.
33-64-10
24-64-10
15-64-10
22-64-10

On the opposite page and the 2nd page following are indicated a number of belts of jasper, whose location was given me by Mr. Penguilly, of the Chandler mine, and (a few) by Leith, the Ely Explorer. Most of these belts are on our maps, and others have been looked for and not found All should be checked up to see how far they have been covered.


35
Tonquinoise
C. S.
1500
Limite de fonte.
1.756
4
3.
2
1500
Granite.
9

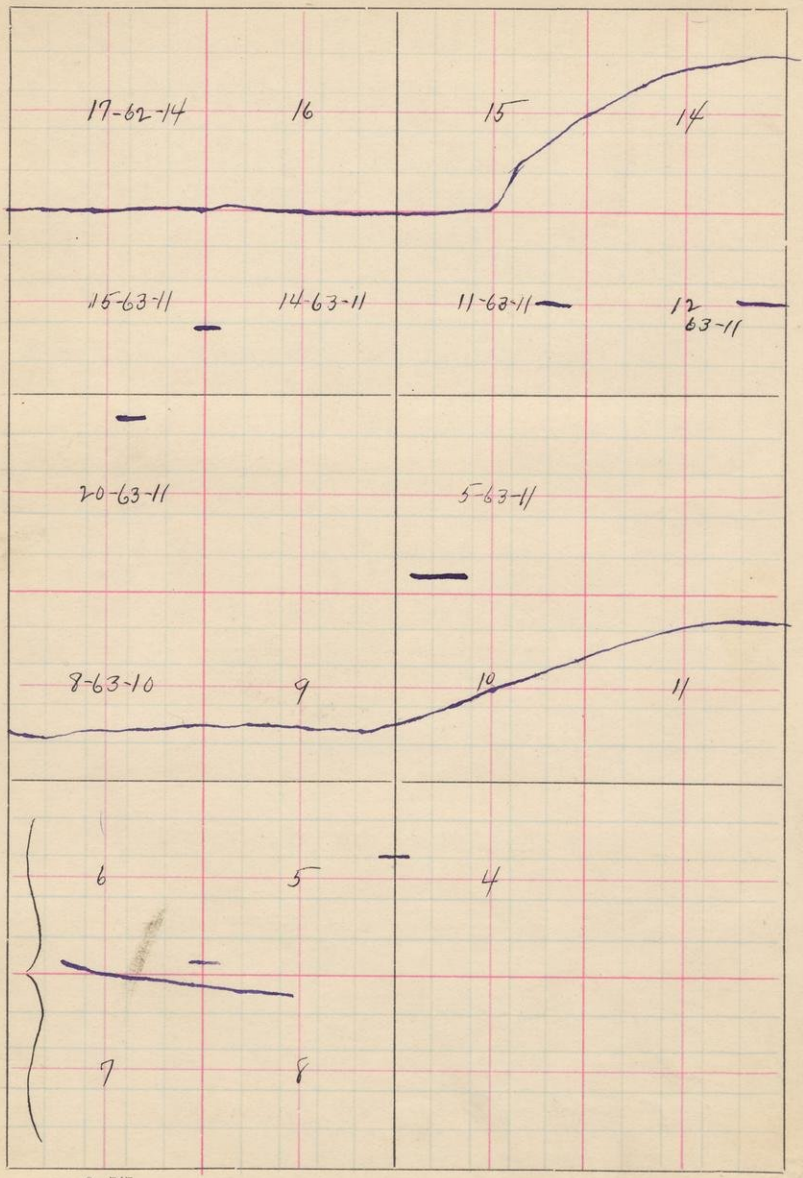
August 5th.

Traced out jasper belts south of Ely. We went down the road passed the cemetry, southwest of Ely, into the northeast quarter of Sec. 8, to 500 south 200 west. For the entire distance no jasper whatever is found, and no attraction makes itself felt on the needle. In running south through Sec. 4, greenstone was found in frequent exposure about to the southwest corner of the section. This is the spheroidal greenstone.

From the point farthe~~r~~est southwest in Sec. 8, worked northeast along the edge of the swamp, using the topographic map for location. Along the edge of the hill in the northwest quarter of Sec. 9, granite forms a low escarpment, averaging about 5 ft. high, directly overlooking the swamp. This is a broad red granite of undoubted character, and surely in place. (See distribution on map)

Now followed to the northeast corner of Sec. 4, where Clements had previously found jasper. This jasper we located at 215 east, 140 south, in Sec. 3. Its true position, according to the topographic map, is noted on the map. The corner was shown us by a farmer living there, so that we are sure of the location in paces. The topography is wrong, as the jasper occupies the hill, which is shown on the map to be further south than this location.

S. T. R.


17-62-14
16
15
14
15-63-11
14-63-11
11-63-11
12
63-11
20-63-11
5-63-11
8-63-10
9
10
11
6
5
4
7
8
63-9

6—747

The strike is 15° north of east, and the dip high to the north about 80°.

Diredtly north of the jasper is a banded eruptive ~~slate~~, which is undoubtedly a part of the massive greenstone occupying the hills all about here. Between this and the jasper to the south there is a drift-covered interval of about 10 ft. The jasper beyond this interval strikes and dips in exactly the same direction as does the green-schist. There is here again a suggestion of the jasper being a replacement in this banded material. In following the belt to the west about 500 paces west of this point, I find banded material, with certain of the bands rather ferruginous, indicating again a possible gradation to jasper. The jasper belt continues about 100 paces east and west, and is about 10 paces wide.

40541 Specimens of the banded green-schist
40542 and jasper, respectively.

Continuing east along the strike, the jasper is found in a narrow exposure 10 ft. wide along the road, at 450 east, 140 south, dipping to the north, and striking east and west.

At 1000 east there are one or two small lenses of jasper about a foot wide in the greenstone, partially covered with drift, not large enough to map. Between these points there is a great deal of jasper debris, making it fairly

certain that the belt is continuous.

At 1430 east are two test pits in the jasper. These pits are walled in so that I cannot see the jasper to get the strike.

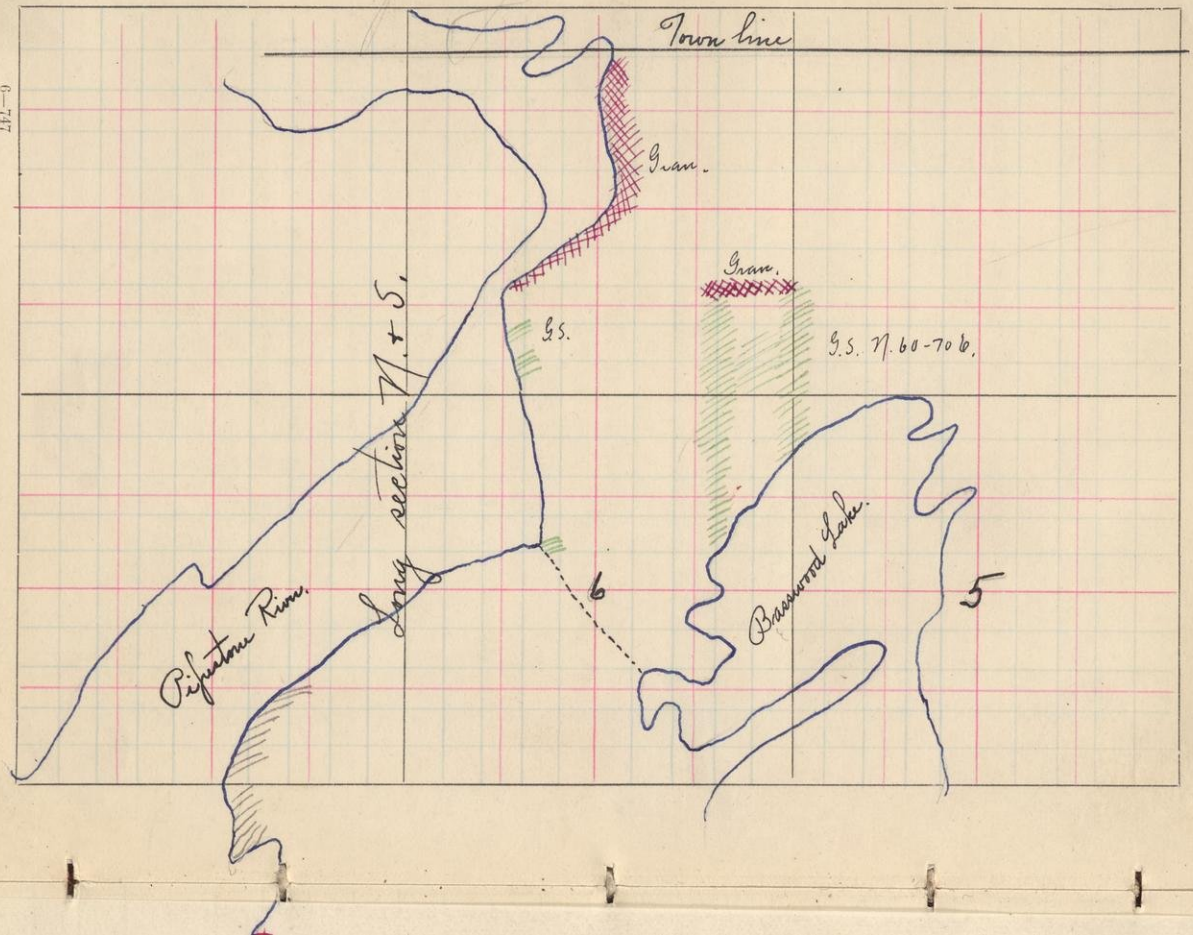
100 south, 35 west of the northeast corner of Sec. 3 is jasper and greenschist in a test pit. The strike is about 15 south of east, and the dip steep to the north.

Continuing east along the line in the swamp, there is found to be a very heavy magnetic attraction all the way. On reaching 1050 east, ledges of greenschist, in places highly ferruginous, begin to appear. These are in places so ferruginous as to resemble an ore, and are undoubtedly the cause of the influence on the needle.

Continuing east to the line, we turned north and ran to the east quarter post of Sec. 35 to look for jasper, there marked on the map as being just east of the quarter post. We found the quarter post, and scoured the area for 300 paces east and north, but no jasper was found.

In talking with Archie Phillips, the Explorer of the Minnesota Iron Co., a few days later, I find that the jasper here occurs about 50 paces west of the quarter post, rather than east. He put up the quarter post himself, so he knows the location.

Not on topog. sheet.



August 9th,- BASSWOOD LAKE.

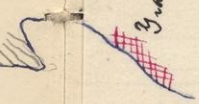
Worked on the northeast cape in Basswood, and traced out the boundary of the granite and green-schist.

The results are given on the plat on the opposite page.

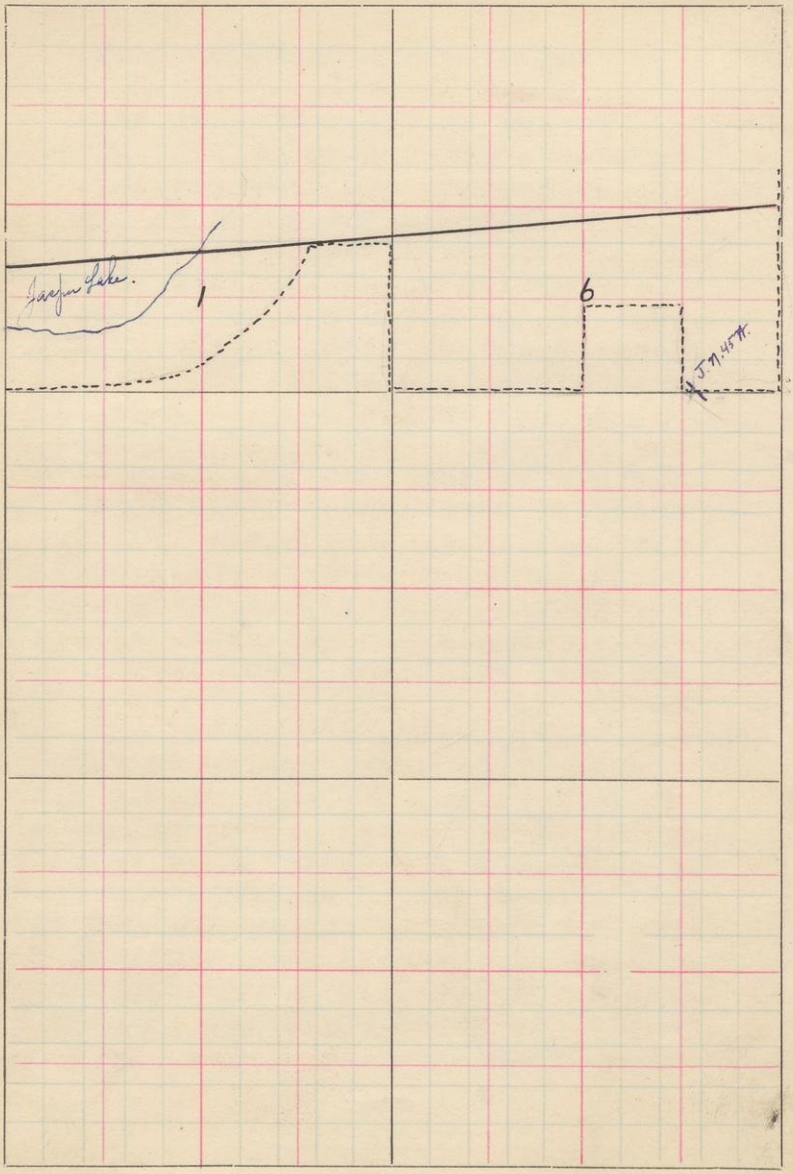
Starting in at the lake shore, 400 west of the north and south line between Secs. 5 and 6, I ran north through greenstone to granite.

At 229 north from the lake, is a moss-covered exposure of granite. 378 north from the lake is a moss-covered knoll of hornblende-schist. 479 north from the lake is green-schist. At 900 north is green-schist, which continues for about 100 paces, striking north 60 east. At 1000 north, the solid granite appears, which continues indefinitely north.

Off-set east 500 paces, and then ran south. The green-schist is found again at 1000 north, 500 east of the starting point at the lake. The contact of the granite and green-schist is therefore a diagonal one. At the eastern end green-schist may run up farther than indicated, because just north of the exposures found is a considerable interval of no exposure before granite is again found.



S. 1+6. T. 63 R. 10-9



August 11th.

Followed out jasper bands south of Jasper Lake. First took a little trip off west of the portage, to see if there is any continuation of the jasper there. I could find none. ~~My course is indicated on the map.~~ The high knobs here occurring are composed entirely of massive greenstone. Moreover, there is no attraction, except close to the lake, just west of the trail, where there is a variation of 25°. The country is very heavily timbered, and it is just possible that there is a very small area of jasper just west of the trail; but it is not thought probable, as this small area was thoroughly scoured.

Then ran east, along the south shore of Jasper Lake. The jasper found last year was again seen, 100 paces east of the portage. This is as described last year.

From here east there is some jasper debris along the lake shore, but no jasper was found in place, until we reached a point 800 paces east of the portage trail, where on the north slope of the hill is another exposure of jasper, striking 50 north of east, and dipping north at a very steep angle.

We then worked northeast, around the east end of Jasper Lake, until we reached the north line of Sec. 1; then east on this line, until the north corner between Sec. 1 and 6 was reached; then south, to the south corner between Secs. 1 and 6; and then the course indi-

cated on opposite plat. The object of this run was to find belts of jasper supposed to exist south of Moose Lake. Secs. 1 and 6 are short north and south, being but 800 paces from the north to the south corner. Both corners and the quarter post are clearly marked.

Found nothing but greenstone in very frequent exposure for the entire distance, until a point 1600 east on the south line of Sec. 6 was reached. Here on the north face of the hill, sloping into a little lake, is a small exposure of jasper, striking north 45 west. This is not a good, clean jasper, but should perhaps be called a ferruginous green-schist. However, it is well banded and very ferruginous, and would have to be mapped as jasper.

Along the south line of Sec. 6, as far east as the quarter post, there are most beautiful exposures of spheroidal greenstone, showing spherulitic textures. The spherulites are sometimes three or four feet in diameter, and these large spheroids are often little more than masses of spherulites, showing beautiful radial structure or weathered surface. This is evidently but a continuation of the belt of surface volcanic material seen south of Jasper Lake, and specimened there. A flow structure is everywhere apparent.

Continued east to the southeast corner of Sec. 6, and then north to Moose Lake. No jasper whatever was

found in the course. The country is fairly well exposed, and there is little chance that I passed over any jasper within 100 yards of my course. There is still the chance that jasper may be found in other parts of these sections, but I crossed the parts where the jasper was supposed to be.

S. T. R.


Moose Lake
29
28
32
33
5
4
64-9
N.40 W.
N.45 E.
N.50 E.
N.80 E.
N.30 W.
N.60 W.
N.70 W.
N.30 E.
40550
40633
Grav. P.

Sunday, August 13th.

Mapped the formations south of Moose Lake, using the topographic map, and platting the rocks in the field with colored inks. The map is given opposite.

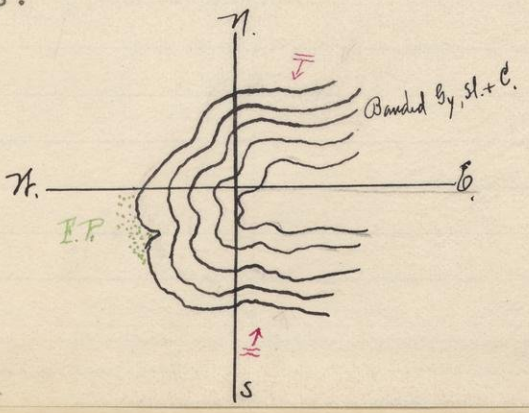
Beginning at the portage trail, with the conglomerate there appearing nearest the lake, I followed this west, and found it running out in a tongue about 100 paces east of the section line. On the south side it is cut off by greenstone of two distinct ages. Nearest the contact, and in direct contact with the conglomerate, is a greenstone weathering salmon pink, containing fragments of an older and darker greenstone, which is very hornblendic. The contact lies about parallel to the strike of the conglomerate, which here is north 80 east. This is banding. This pink greenstone is also found on the north side of the western end of the tongue. On the south side of this pink greenstone, about 10 paces away, comes in a coarse heavy dolerite, containing many fragments of other greenstones. The relations of these two rocks I do not know, although the three were in direct contact. The contacts are approximately parallel, but are so sharp that they must be eruptive. Later work with Van Hise and Clements showed that the coarse greenstone farthest from the conglom-

erate was probably the basal greenstone.

Then went back to portage trail, and about 200 paces south of the meander corner took up the second belt of conglomerate, and followed it west. It can be traced continuously west to a point 50 paces west of the line, where it can be seen in contact with a feldspar-porphyrite. The contact is a sharp one, and I should say that the porphyrite is certainly intrusive.

The belt of conglomerate was traced west to 580 west of the line. Then went south. At 430 west and 600 south of the meander corner is a beautiful exposure of banded conglomerate, graywacke, and slate, striking north 50° east.

145 west, 150 south of the corner on the high knob there occurring (see topographic map) is a high escarpment of beautifully banded conglomerate, graywacke, and slate, showing well developed sedimentary banding, which strikes parallel with the contour of the hill, thus:



On the west slope the conglomerate is in direct contact with the peculiar speckled feldspar-porphyrite, before mentioned. The contact is here undoubtedly intrusive.

Visiting this exposure a later day with Prof. Van Hise, it was thought by Van Hise that this porphyrite might be older than the conglomerate, although the contact was a sharp one, and resembles an eruptive contact.

On the northeast the dips are uniformly to the southwest; and on the southwest they are uniformly to the southeast. It would look like a syncline, but at the extreme end, where one could tell, the ridge is broken down sharply, and the bands are greatly crumpled, so that it is impossible to say surely. It is certain that the bands bend around as given on the sketch, but whether an anticline or syncline cannot be proven, although my opinion is that it is a syncline.

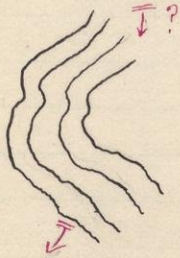
The conglomerate abounds in jasper fragments. These fragments are angular, and are not replacements as was previously thought possible.

At 390 west, 275 south (see topographic map) a narrow band of the sedimentaries, containing numerous jasper fragments runs a little south of west right by massive spheroidal greenstone. I followed the contact along for 150 paces, sometimes getting it as close as six inches, but nowhere did I get the actual contact. Close to the contact the sedimentary is greatly sheared

and is here weathered, making the exposure poor. At one place a dike of greenstone was found cutting the sedimentary, but this dike could not be traced into the main greenstone mass here occurring, although it may do so.

From here, traced the sedimentaries to the east, at first following the boundary of the sedimentaries of the spotted porphyrite on the north, and then following the boundary of the conglomerate of the spheroidal greenstone on the south. The boundaries are given on the topographic map opposite p.....

On the high knob next south of the one described with the peculiar synclinal structure is another blow-out of conglomerate, with a structure which I should guess to be the same. However, I cannot be sure of this. I find the facts somewhat as follows: The dips are to the southwest on the south side of knob, and on the north side, while not clear, it is apparently in the same direction, somewhat as follows:



We have here now an irregular monocline, but whether this represents a syncline or anticline, or only the limb of one or the other, I do not know.

Continuing to the southeast, the sedimentaries strike about parallel to the boundary of the spheroidal greenstone, the strike increasing from north 80 east at the west to north 30 west at the east end. The dip, so far as any dip could be made out, was uniformly to the south under the greenstone. The contact of the sedimentaries and the greenstone is unsatisfactory. In general, it simulates an eruptive contact. In some places it is a very sharp one, but in only one place did I find an inclusion of the sediment in the greenstone, and this may be due to infolding. Another complication is that wherever we have the undoubted spheroidal material, it is several feet away from the contact of the conglomerate and the greenstone, and the material which is at the contact is a coarse dolerite or fine-grained aphanitic yellow-weathering rock. These rocks seem to grade into the spheroidal greenstone, and are probably a part of it; but it is peculiar that these rock layers are always between the conglomerate and the typical spheroidal greenstone.

At 1000 south, 1400 east the spheroidal greenstone takes on a tuffaceous aspect (40545). The specimen is taken from the interior of one of the

40545

spheroids. This material comes within a few feet of the contact, but no actual contact can be found. This tuff resembles much of the so-called greenstone conglomerate to a remarkable degree.

Another thing of importance is the abundance of the jasper throughout the conglomerate. For the entire afternoon in the belt nearest to the greenstone there is an abundance of jasper, some of the fragments reaching the size of a foot or more. These are certainly not replacements.

In the south half of Sec. 32 (see place on topographic map) there is a contact of massive, fine-grained white weathering greenstone, with the graywackes and slates. This contact is again a very sharp one, and strikes me as probably eruptive. What greenstone it is, I do not know,- whether spheroidal or some other,- but it seems probable that it is a phase of the spheroidal greenstone.

1288 south, 675 east of the starting point on the lake on the north escarpment of the coarse dolerite bluff, is a narrow belt of banded ferruginous rock, 40546 which might be called jasper. 40546 represents two specimens of this rock. It occurs at the contact of this coarse dolerite with a finer grained greenstone on the north, which I took to be the spheroidal material, although no spheroids can be seen right here. An examination of this material shows it to be

a banded feruginous green-schist, which has the large quartz eyes so characteristic of the iron formation near Gunflint Lake. The strike is north 40° west, and the dip north at a steep angle under the coarse dolerite. The topographic map is here faulty.

40547 40548 40547 and 40548 are specimens of the coarse dolerite and the finer greenstone eruptive.

Visited this outcrop later with Van Hise and Clements, and traced it a little farther west, and also carried it some diatance to the east in broken exposure. The distribution is indicated on the map.

At 710 north, 1975 west of the southeast corner of Sec. 33 (location by Clements) I visited the conglomerate exposure marked there by Clements. The conglomerate is described as being immediately overlain on the north by coarse greenstone or dolerite. Along this hill there is a very sharp contact, which can be followed for 50 paces, which resembles an eruptive. However, instead of the conglomerate being overlain by the greenstone, it is certainly underlain. At three or four places the greenstone can be seen dipping steeply under the conglomerate.

In general, for the two days work it would be said that the relations of the conglomerate and spheroidal greenstone are proven. In all cases where an

actuak contact is observed, it is the coarse dolerite or fine grained greenstone next to the contact which cannot certainly be identified as spheroidal greenstone, although it apparently grades into this spheroidal greenstone. Where the spheroidal greenstone does come close to the sedimentary, there is always an intermediate zone of a few inches of schistose material, which naturally weathers out, leaving no exposure. At one place, a dike of greenstone in the sediments is found at a distance of six feet from the main mass of the spheroidal greenstone. Is it an off-shoot from this greenstone? At only one place does the eruptive contact have a decided dip, and at this place it is under the conglomerate. The fact of the banding of the conglomerate striking parallel with the contact of the greenstone, would bear in favor of the infolding of the two, and this may be the explanation. However, the sharp contact, in general, gives me strongly the impression of an eruptive contact.

August 15th.

Worked Sec. 28 north of the portage trail south of Moose Lake. Results are on map opposite p. 45..

At 750 east, 650 north from the meander corner, granite-porphyry dikes in the conglomerate are very abundant. They strike north 40° east. Here also the spotted porphyrite comes in, turning north 40° east, parallel with the ridge. This is found in contact with the granite-porphyry, and both are sheared, but the greenstone is in the form of a banding or dike, with the porphyry on both sides, so that I think the greenstone is the younger.

The green-schist on the knob 1020 paces north, 865 east, looks like a sheared form of the feldspar-porphyrite so frequently seen in intrusive relations to the west.

At 880 south of the northeast corner of the section, on the high hill (see topographic map) is a massive rock 40549 which I am in doubt what to call. It is an intermediate rock of some description, may be a sedimentary. In going south, this rock is seen to become conglomeratic, and therefore it is here undoubtedly a graywacke. However, both conglomerate and graywacke are very aphanitic, being almost hornstones in texture, yet there is no question as to their sedimentary nature. As we go south, the pebbles become more and more numerous.

40550 40550 is material from the eastern end of the Moose Lake-Flask Lake portage trail. This material I before called greenstone; but on closer examination there seems to be just a chance that it may be graywacke. It contains rare fragments of another greenstone.

August 16th.

With Clements, worked over the area south of Moose Lake. The main contact of the greenstone and the sedimentary running southeast through Sec. 33 was followed. The bedding was again observed wherever it could be clearly seen, to be almost exactly parallel to the contact. The dip in all cases where it is apparent is to the south under the greenstone. The contact is a very sharp one, and normally would be called an eruptive one. However, there is a complete absence of dikes running off from the main mass, and there are also no fragments of conglomerate caught in the greenstone. It begins to look as though we had a spheroidal flow practically contemporaneous with the conglomerate, although older than most of it, as it yields many fragments to it. In that case, our contact is a small and normally unconformable one of an interbedded flow.

Special attention should be called to the zonal structure in the jasper fragments in the conglomerate. This structure is very uniform and striking. The centers are of red, and the peripheries of black. The zonal structure is perfect and must have been induced on the fragments after the fragments took their present form.

The granite-porphyry cuts the conglomerate, and this and the conglomerate are both undoubtedly cut by the white

feldspar porphyry. They both are intrusives, and can be seen at many places. The contact of the porphyrite with the conglomerate can be best seen on the end of the syncline in the northeast quarter of Sec. 32.

At 1145 east, 2225 south, of the meander corner of the south contact of the conglomerate with the greenstone, the conglomerate is found on the northeast, and south sides of a tongue of greenstone. On the north flank of the greenstone is a narrow belt of jasper about 20 feet long, and 6-8 inches wide. (See Sketch below)

On the other side of the valley to the east, we have relations somewhat as follows:

Where the greenstone is sheared at this place there has been infiltrations of ferruginous material along shearing planes, giving a rock resembling jasper in appearance.

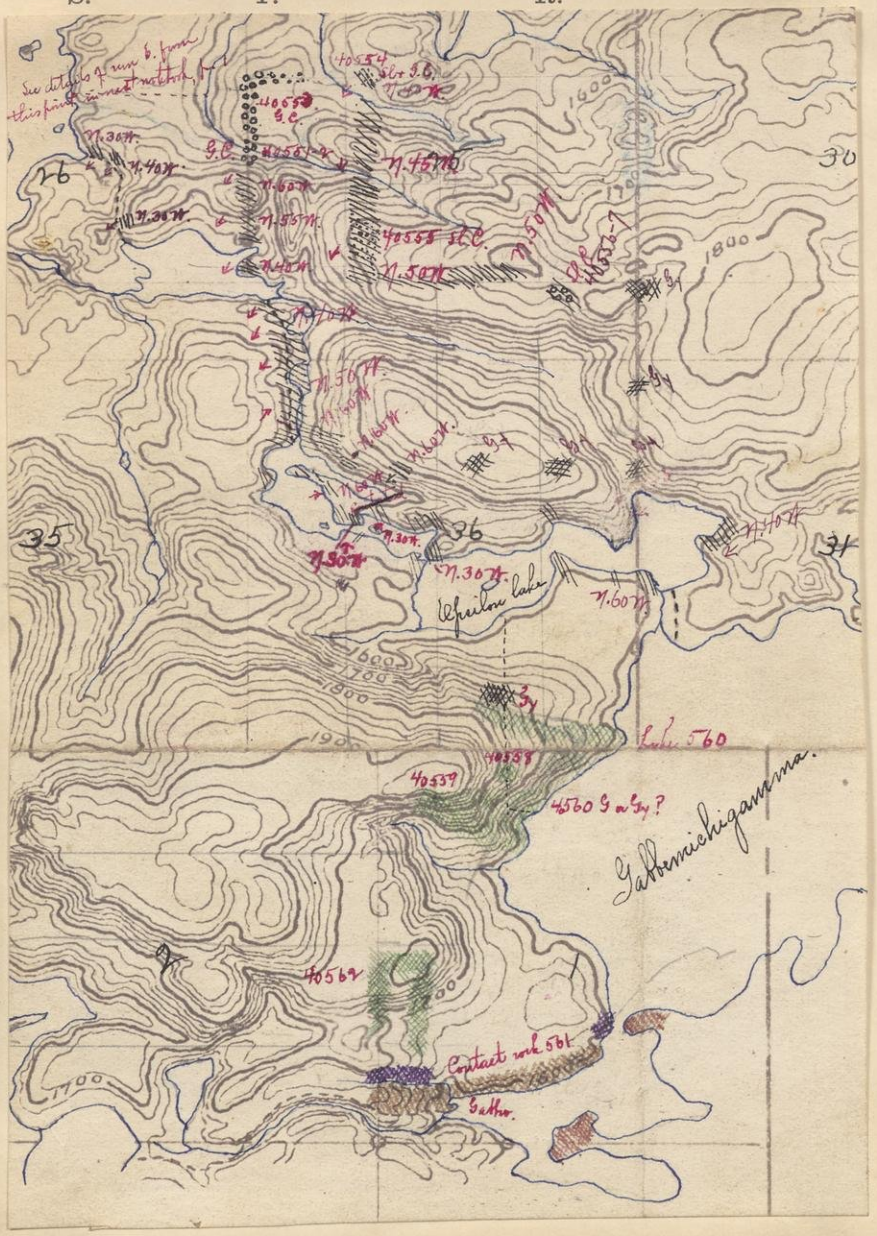
This set of exposures was visited at a later day with Van Hise and Clements (See notes of later day).

At 800 north, is conglomerate.

At 1300 north, porphyrite.

At 1400 north, 250 west, spheroidal greenstone.

S. T. R.



See details of run S. from this point in next notebook, p. 1
40554
Slr + G.C.
N.40W.
40553
G.C.
G.C.
40551-2
N.45W.
26
N.30W.
N.40W.
N.60W.
N.30W.
N.55W.
40555 sl.C.
N.50W
N.40W.
N.50W.
Gr
40556-7
1600
1700
30
1800
Gy
N.70W.
Gy
N.50W.
N.60W.
N.60W.
N.60W.
Gy
Gy
Gy
N.60W.
35
36
N.30W.
N.30W.
N.40W.
31
N.30W.
Epsilon lake
N.60W.
1600
1700
1800
1900
Gy
Lake 560
40558
40539
4560 G or Gy?
Gabbemichigamma.
2
1
40562
1700
Contact rock 561
Gabbro.
1700

August 24th.

With topographic map started at the meander corner at the east end of the little lake in the southeast quarter of Sec. 26, southeast of Ogiske Muncie. Zig-zagged north, east, and south, through Secs. 25 and 36 to follow out the sedimentaries, and see how they strike. Most of the observations may be seen on the map.

Normal banded sedimentaries, mostly graywacke, but with bands of slate, continued from the shore to 1025 north (the shore is 500 north). Here there appears on the north side of a little depression an exposure of green-
40551 stone conglomerate (40551) in which are narrow bands of the normal graywacke.
40552 is a specimen with a graywacke-like material associated with the greenstone conglomerate. This material continues north in a continuous exposure to 1375
40553 north, where I took another specimen of the conglomerate.

At 1500 north, 550 east, is an exposure of the greenstone conglomerate, fine-grained, but interbanded with the typical banded slate seen to the south. The strike is north 40° west, and the dip to the southwest. This is the first undoubted strike that I have been able to get in the greenstone conglomerate here.

40554 is a specimen of the banded slate interbanded with the greenstone conglomerate.

S. T. R.

Aug. 73. Outlined the greenstone mass north of the east end of the south arm of Knife lake, zigzagging from the west end toward the N.E. The results are on above plat. Searched for evidence of relations of G.S. Sediment, but found none,

The greenstone conglomerate here is much finer grained than the material to the west. In places it is scarcely more than a coarse graywacke.
Going south, the material becomes finer grained, until at 960 north, 575 east, we have a typical banded slate and graywacke. The strike is north 50 west, and the dip steep to the southwest.

At 780 north, 575 east, there is a typical slate conglomerate, interbanded with the banded, fine grained slate and graywacke.

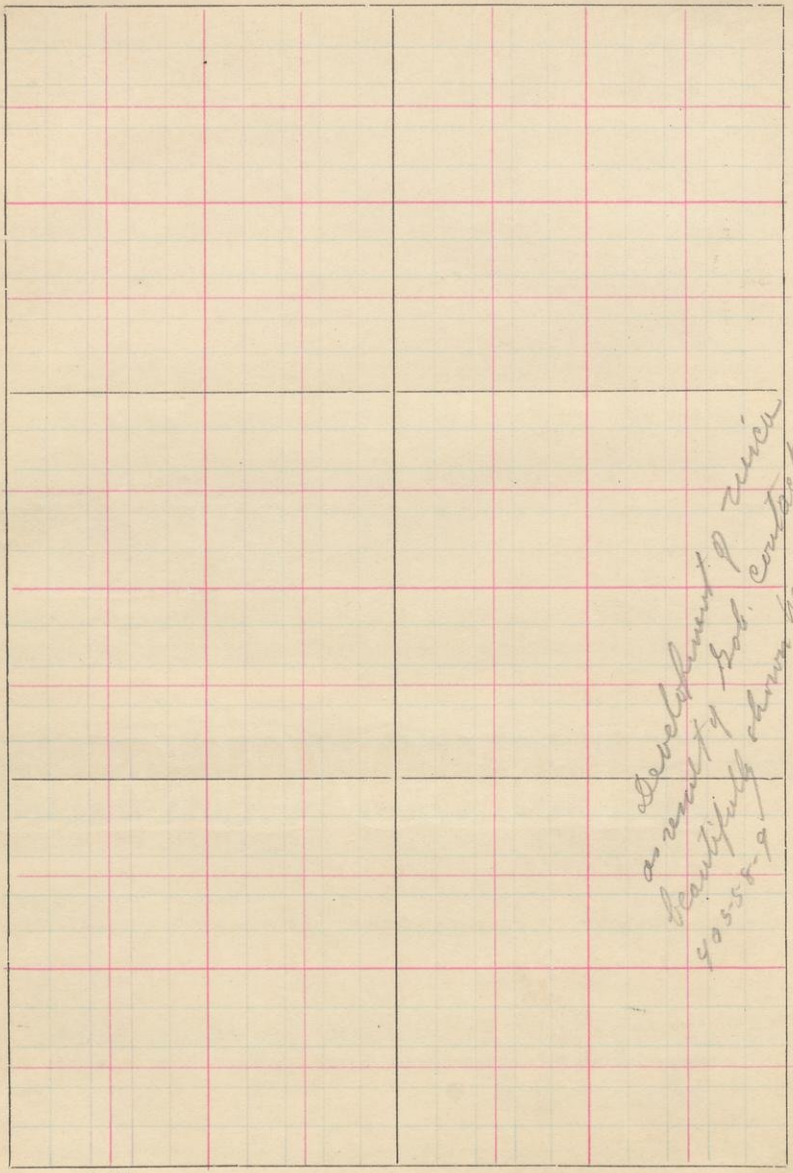
In general, therefore, the sediments become coarser grained to the northwest, and there is an apparent gradation from the typical banded, fine grained slates and graywackes into a coarse greenstone conglomerate, so that all are probably of the same series.

At 500 north, ran east.

At 1690 east, 300 north, is again
40555 the slate conglomerate (40555). However, here besides the slate fragments, there are numerous fragments of greenstone.
40556 showing part of a greenstone fragment in this conglomerate. .....

40557 Greenstone from knob in Knife Lake, just northwest across the lake from the old camp ground.

S. T. R.



Development to recur as result of Bob. contact Beautifully charm her is 40558-9

August 25th.

See map opposite page 27

Ran in from Lake Gabbemichigamma west on the town line, south of Sec. 36, to cut off the end of the greenstone.

After leaving the shore, there are no exposures until we reach a point 500 west.

40558 is probably a graywacke, but I am not sure of it.

Continuing west for 300 paces farther, but as there were no exposures turned south. At 400 south, ran west to 1000 west. The course is indicated on the map.

At a point 1000 west, 400 south, of the starting point, are numerous exposures of a rock which looks in the hand specimens remarkably like a sedimentary, but which in the ledge looks like a green-

40559 stone. (40559). This rock continues east to within 50 paces of the shore.

40560 At the shore is graywacke (40560)

Then went to the southwest corner of the lake; ran in on the portage trail to the section line; and then north to cut off the contact of the gabbro and the rocks to the north, whether sedimentary or greenstone. At 500 north, a specimen was taken of the contact rock

40561 just north of the gabbro (40561). Small stringers of gabbro can be seen

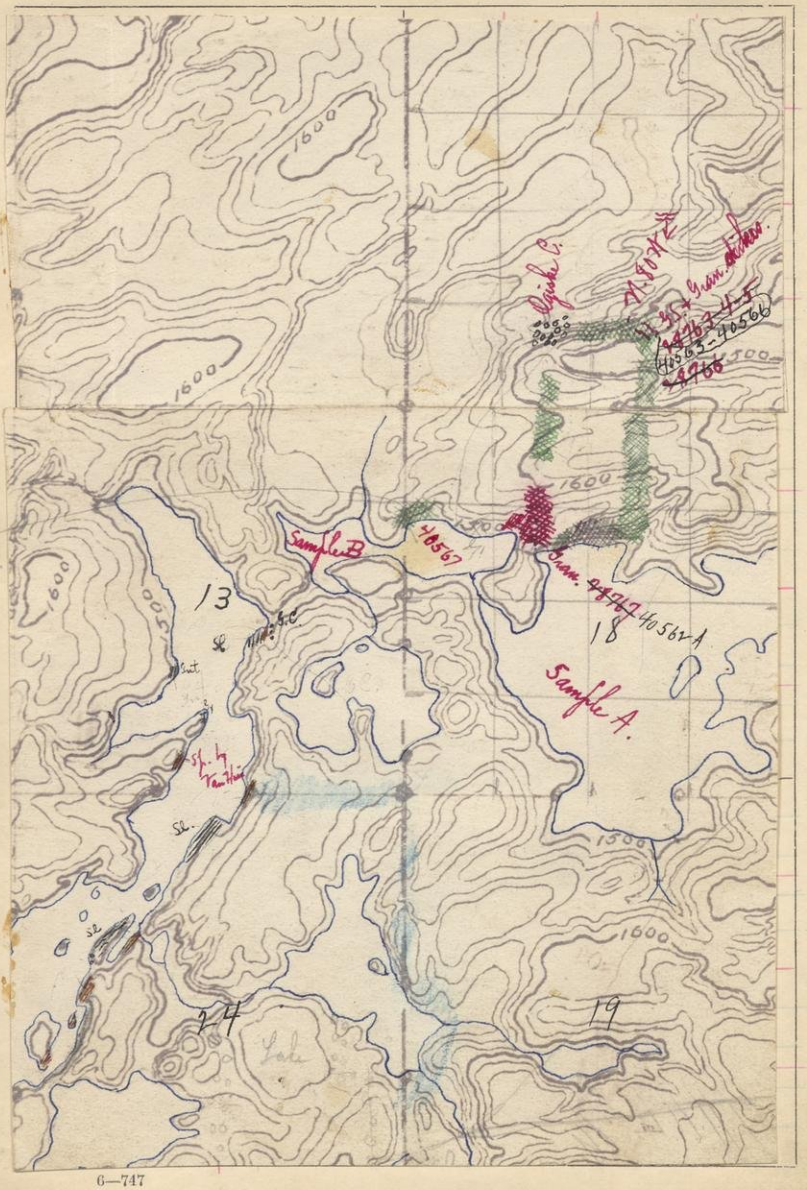
40562 in direct contact with this rock.(40562) greenstone (?) from 650 north of the portage trail.

Returning to Lake Gabbemichigamme, we took a run across the point into Lake Epsilon, taking the course indicated on the map.

At 440 south of Epsilon Lake, we find the typical graywacke. The material I have called greenstone, like (40559) continues from 600 south practically south across the hill.

S. T. R.

wrong location



/// = Limestone

August 26th.

Ran north from the little lake northeast of Ogiske Muncie to cut off the boundary of the greenstone and sediments beginning at the portage trail (see map).

For the first 300 paces, we have almost continuous exposures of a rotten
40562 feldspathic granite (40562A)
(A) This rock was visited a later day in company with Van Hise and Clements, and its character checked up.

After an interval of no exposure, at 510 north, we reached the massive greenstone. This continues to 733 north.

At 917 north, appeared fine grained sediments which at 1000 north pass into the typical Ogiske Muncie conglomerate, containing jasper fragments, etc.

Running east, the conglomerate continues to 175 east. At 200 east, the massive greenstone appears again, and this oon grades into the typical green-schist with granite dikes to the east. The strike of the Green-schist at 508 east is north 80° west, and the dip steep to the south.

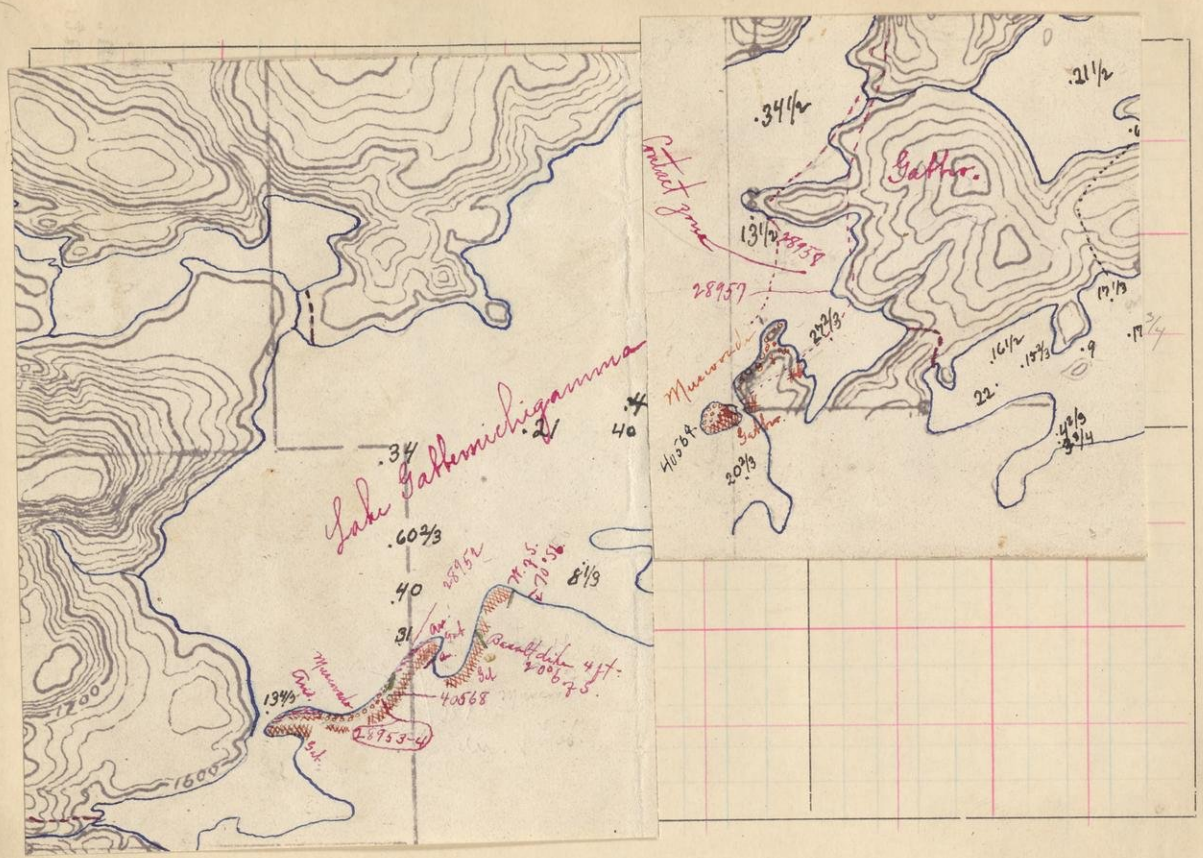
The contact of the greenstone and the sediment is therefore somewhat diagonal, as shown on the map.

At 508 east, apparently cutting the typical green-schist, is a coarse dolerite (40564). It is very massive, while
40564 the schist is, of course, very schistose. The contacts cannot be followed, but for

the above reason the dolerite is believed
40563 to be intrusive. (40563(is a specimen of the green-schist.
40565 is a specimen showing the contact. Near the contact the dolerite is finer grained than a few feet from it, as can be seen from the speciemns.
40566 is a specimen of the typical massive greenstone, immediately to the south of the green-schist, intruded by granite.

Returning to Frog Rock Lake, I again visited the granite mass there occurring north of the portage trail, and tried to follow it out to the east and west. On the east, the greenstone continues right up to it, and the rotten granite appears after an very short interval.
40567 On the west, ran north from the lake shore, and ~~cut off~~ the coarse greenstone. The granite is therefore apparently a knob surrounded on all sides by the greenstone, but still there is plenty of room, both east and west, where there is no exposure, for the granite to get through.

for the distance was in


Lake Gatlemichigamma
Gather.
Contact zone
Murmured
Gathr.
Gathr.
Murmured
Gathr.
Beach slide 40 ft.
.34
.60 2/3
.40
.31
.13 1/3
.34 1/2
.21 1/2
.16 1/2
.15 1/3
.9
.17 1/3
.17 3/4
.22
.20 2/3
.8 1/3
.40
.32 1/4
1200
1600
28952
28953-4
28957
28959
40868
40875
40876
40877
40878
40879
40880
40881
40882
40883
40884
40885
40886
40887
40888
40889
40890
40891
40892
40893
40894
40895
40896
40897
40898
40899
40900
40901
40902
40903
40904
40905
40906
40907
40908
40909
40910
40911
40912
40913
40914

August 29th.

With Clements, visited the Animikie exposures on the edge of the gabbro on the south shore of Gabbemichigamme. At the bold bluff where Winchell had described the gabbro as overlying unconformably the Animikie, we found the Animikie in general underlying the gabbro close to the water's edge. The Animikie, as nearly as we can make it out, is in a number of minor rolls. In places it disappears under the water. Both the Animikie and gabbro weather in approximately the same colors; and it is almost impossible to tell where one begins and the other ends. In the Animikie, the quartzite bands are interleaved in a very intricate fashion with bands of gabbro or dolerite material, with large shimmer plates. In the space of a few inches a number of such bands can be seen. These bands are found at one place way to the top of the gabbro bluff, well in the gabbro. The dip of the Animikie here at this cliff is from 20-30° south.

From here worked west along the shore, and soon came upon a rock which resembles a conglomerate. However, we took it to be simply the gabbro material including fragments of an underlying rock, which is probably the Animikie. 28953 is a pebble, and 28954 represents the matrix of this material. The matrix is a gray feldspar-biotite rock, and looks like granite. It is, however, probably a phase of the gabbro. The

pebbles are all fairly well rounded, which is a surprising thing.

Continuing farther, the Animikie appears again in some places in very typical characters, and continues to the point. Its dip is fairly uniform 45° south, but it has numerous minor rolls which can be seen beautifully from the lake shore. Next to the Animikie in a number of places we find Winchell's fine grained phase of the gabbro, the muscovado.

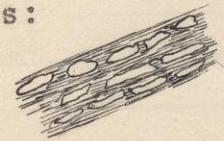
40568 is a specimen of this rock. It can be found in sharp contact with the Animikie, and can be seen itself to grade back step by step into the massive coarse grained gabbro. The gradation can be see inside of 10 paces.

At one place, indicated on the map, a narrow band of typical basalt, 14 inches thick, with a very marked saal-band, cuts the conglomeratic-looking contact rock. The dike is nearly horizontal, and has typical basaltic parting. This is found about a foot above the water's edge, and is followed about 25 paces.

Working around the south shore of the lake, two basaltic dikes were seen with their characteristic parting. Their position is indicated on the map. Still farther around to the east on the point just before reaching the portage trail into Peter Lake, we find the so-called conglomerate again. Its extent is sketched on the map.

Following the material around the island west of this point, we find numerous fragments which are very well banded.

40569 is one of the specimens showing banding. However, the banding becomes almost too large to explain. Bands of this material 12 or 15 feet long are seen, folding and curving through the rock, and the question arises whether we have not here the contact of the Animikie with overlying altered gabbro. However, there seems to be all gradations through smaller areas of banded material into true fragments in the muscovado, so that these large banded areas are taken to be inclusions. Certain of the bands are broken up, and the fragments partially rounded, giving an idea of the way in which the pebble may form from such a band, thus:



Some of the exposures look like this:

August 30th.

Sed-Sed contact

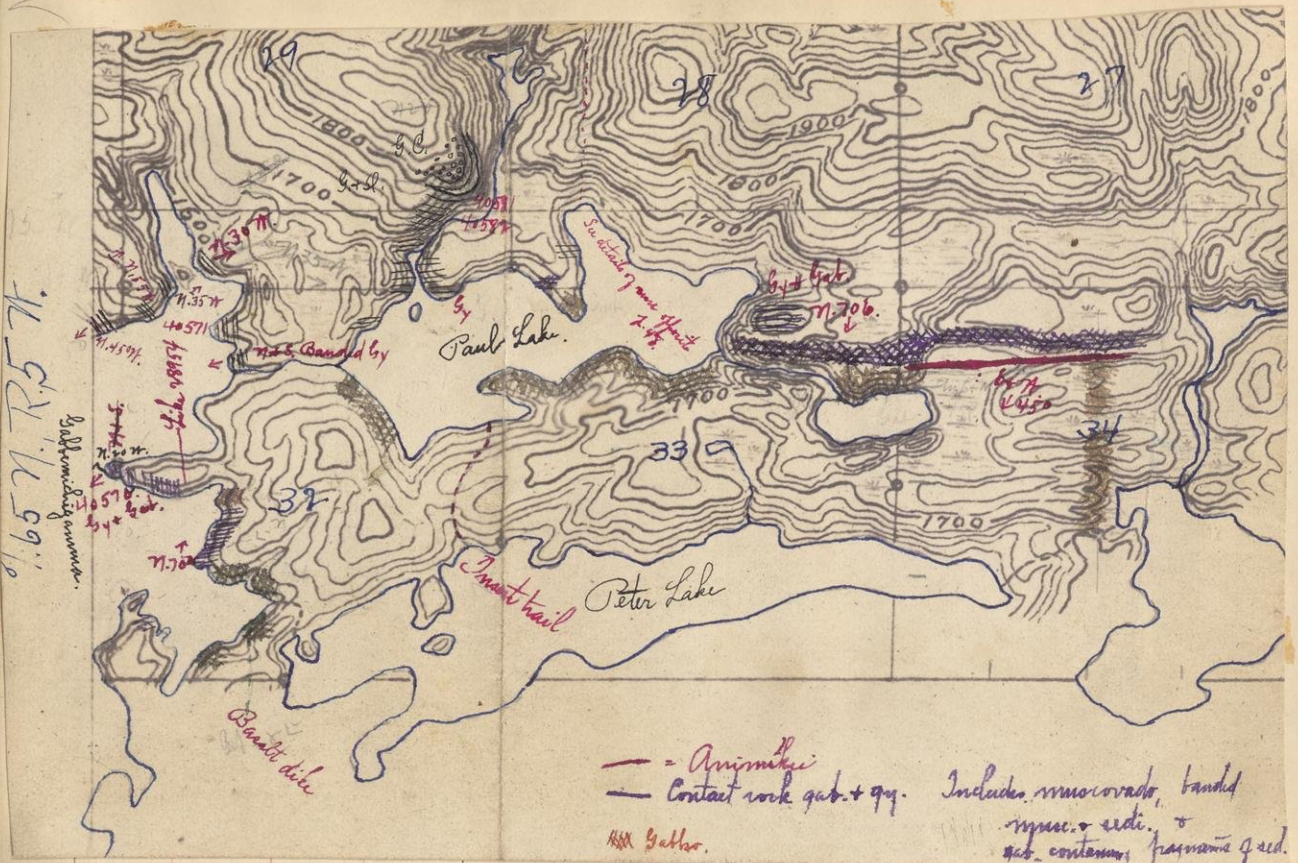
Continued the work on Lake Gabbemichigamme. We ~~find~~ found the contact rock around the northeast side of the lake. As we approach the old camp ground the rock is found to alternate with finely
40570 banded graywacke (40570), which is similar to the graywackes of the regular Agamock Lake series to the north. The relations are very complex in detail; but, in general, the gabbro or muscovado lies on top with fragments of this material in it. Occasionally it can be seen in bands parallel to the strike of the graywacke. Near the end of the point where the old camp ground is, this banded graywacke strikes 20° west of north, and dips to the southwest at an angle of 80°. At this spot the muscovado can be seen in bands parallel to the bands of the graywacke, although in one place it apparently wedges out below, thus:

Sed-Sed contact

40571 is a specimen of the typical graywacke from the point. It has a reddish tinge. Compared this with specimen of doubtful rock collected a few days previous on the west shore of the lake. This rock also has this peculiar reddish tinge.

This material is followed around the north shore, and is found to be continuous with the graywacke-slate series of the portage trail running through the Agamock Lake series.

We have, therefore, the gabbro of the south shore in places overlying the true Animikie, with typical characteristics and at other places on this shore, and in all places on the north and east shores, the gabbro overlies the Agamock Lake slate series and contains numerous fragments of it. The fragments are very well rounded, and the gabbro material close to the conglomerate is always the muscovado phase or the micaceous feldspar-hornblende rock, which looks like a granite. This material grades within a short distance into the normal gabbro.


29
28
27
1800
1700
1900
Paul Lake.
Peter Lake
33
34
37
Trail
Basalt dike
= Anisinkite
Contact rock gab. + qy.
Gabbro.
Includes monzonite, banded syenite + red. to gab. contains fragments of red.

August 31st.

With Clements, took up the Animikie where I crossed it last year in my run north from the end of Peter Lake. From this place, I followed the Animikie to the west. The results are indicated on the map.

Gab-Sed contact

At the east end of the ~~the~~ little lake in Sec. 33, just south of the east and west line, is a knob of typical
40572 banded graywackes (40572). These are banded in bands varying from an inch to several feet in width, with the typical muscovado. The muscovado also is seen to curve around fragments of the typi-
40573 cal graywacke slate (40573). Interbanded with the graywacke are also regular green bands of a green rock, which I do not
40574 know (40574).

Gab-Sed contact

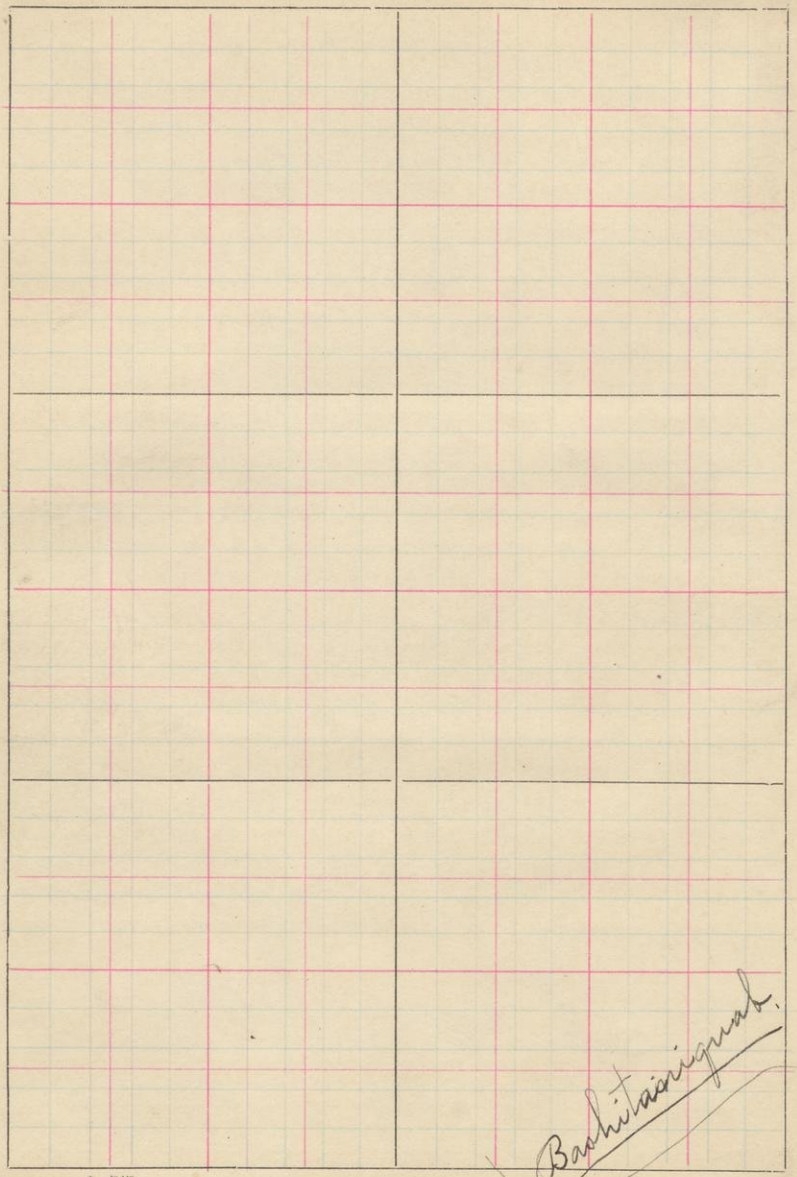
Contact

On the knob just south we have the typical massive muscovado, which soon grades back into the normal gabbro.

We have here, therefore, clearly the graywacke-sedimentary series interleaved with gabbro flows, which near the contact take on the muscovado phase.

The strike of the sedimentaries is north 80° east, and the dip is high to the south.

S. T. R.



Sunday, Spet. 3rd.

With Van Hise, Grant, and Clements worked along the contact of the Animikie east of Fay Lake.

40575 is a specimen of the rock hanging on the face of the vertical cliff, just south of the drill hole near our old camp at the east end of Fay Lake. The vertically dipping rock is the typical banded Animikie quartzite and iron ore. Just north and northeast of this exposure are exposures of the greenstone conglomerate, which we followed during the day (see Van Hise's notes). At this point the greenstone conglomerate comes within 5 ft. of the Animikie. In the interval there is no exposure. The specimen taken Van Hise thinks may be an intermediate phase between the greenstone conglomerate and the Animikie.

The Animikie here strikes north 68° west, and dips practically vertical.

During the day the greenstone conglomerate was followed east to this point. Much of the area of the greenstone conglomerate had previously been mapped by Bayley as massive greenstone (see Van Hise's notes).

40576 Specimen of sheeted granulitic gabbro of the lake southwest of Peter Lake, collected by Van Hise and Grant. (See description of Grant, in Vol. 4 of

of the Final Reports of the Minnesota Survey) The top and bottom of the specimen are parallel to the sheeting, while the other sides are parallel to the jointing.

September 6th.

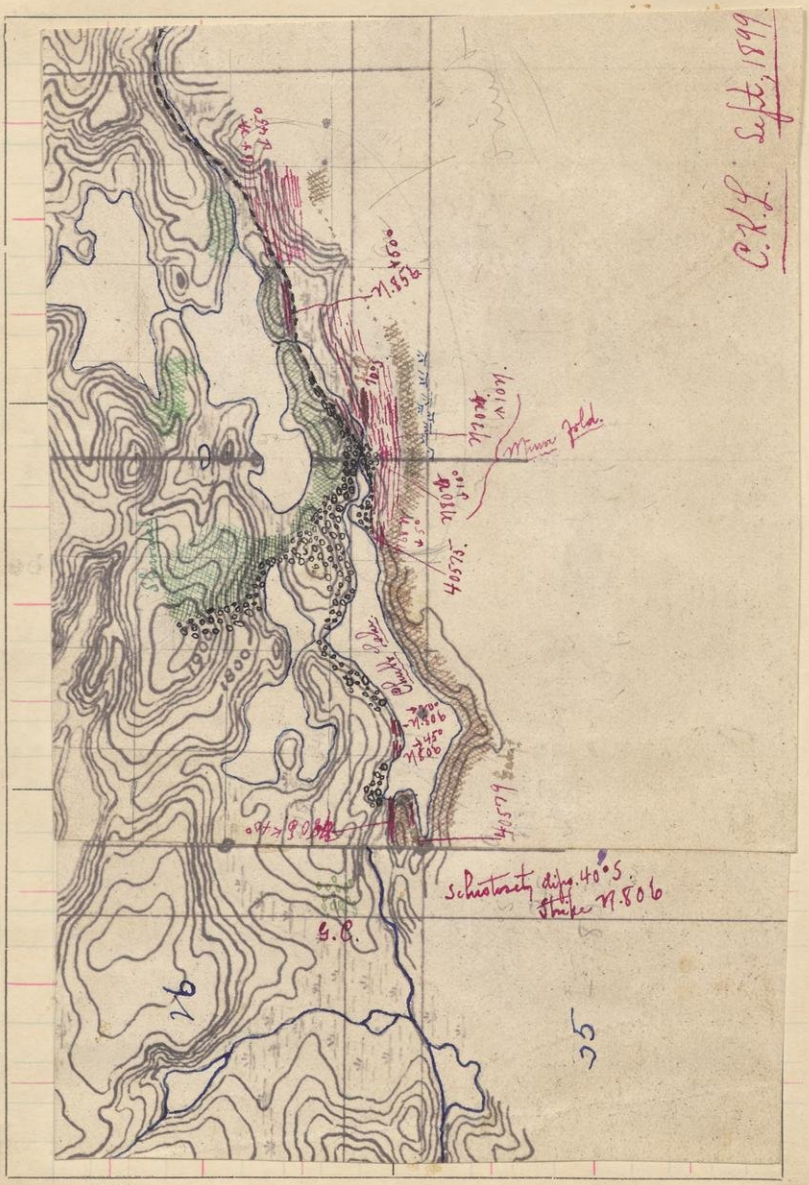
With Van Hise, Grant, and Clements went to Gun Flint Lake, Loon Lake, and Mayhew Lake. (See notes by Van Hise in his note-book)

40577 is a specimen of the titaniferous magnetite from the north shore of Mayhew Lake.

.....

40578 from a gabbro sill just west of Dowman's Custom House, at the west end of Gun Flint Lake. This gabbro has large feldspars, and the specimen is selected to show their possible orientation. The sides of the specimen are marked as follows: (1) Parallel to the dip of the top of the Animikie and parallel to the parting of the sill; (2) south face along the vertical parting; (3) irregular fracture on the east end at right angles to the other two. In this general direction is longer set of less regular joints.

S. T. R.


C.N.L. Sept. 1899
Mount Pola
Schistosity dips 40° S.
Strike N. 80° W.
S.C.
35

September 7th.

Mapped the greenstone conglomerate east and north of Fay Lake, starting from the meander corner on the little lake northeast of Fay Lake, near the end of the portage trail. Results on opposite map. From here ran south.

Greenstone conglomerate is crossed in frequent exposures to 345 south from the meander corner.

At 352 south the Animikie appears striking north 80° west. 20 paces farther on the strike is north 70° west, and the dip is 80° to the north. The Animikie continues to 415 south.

At 425 south, solid gabbro may be seen.

The south corner of the section is struck at 560 south of the meander corner on the lake from which we started.

Off-set 250 paces east, and then ran north. Gabbro continues to 160 north.

Then comes in Animikie after an interval of 15 paces. The Animikie continues to 338 north (See strike and dip on map).

At 350 north is gabbro, fine grained, and presumably a sill.

Beyond the gabbro, Animikie again appears, and continues to 413 north, where we find another gabbro sill. Just before reaching this sill the Animikie has a very flat dip to the south 10-20°. This observation is taken on the escarpment looking north over the stream.

Just below this again is flat-lying

Just below this again is flat-lying Animikie, dipping 70° south. The sill is about 15 ft. thick.

Animikie is found on the north side of the stream for about 20paces.

Here we find massive greenstone, commencing at 550 north.

Off-set east and south again into the Animikie, which was found to have usual strike; then east,and then north. Results on map.

Zig-zagged as far as 900 east, north of the road. The Animikie with the usual strike occupies the south slope of the hill just north of the road. On the north of this is an interval of from 10-15 paces without exposure, and north of this comes in massive greenstone. At no place was I able to find the two any closer together than 10 paces. It is possible that greenstone conglomerate may go through this space, but close search for a considerable distance revealed no conglomerate whatever. As seen below, the conglomerate is probably ended a little to the west.

Returning, examined the trenches about 500 east of the line on the road running east from Fay Lake, and there found the Animikie, and what I called the greenstone in contact. There is no conglomerate to be seen.

Then ran north to the little lake, and worked along the shore of the lake, via the old portage trail, and found greenstone for all the distance.

Then worked west. At 246 west from the meander corner at the end of the portage trail, we struck true greenstone conglomerate. Up to this point there are various phases of greenstone and green-schist. However, there can beno question as to their character.

From the Fay Lake end of the portage trail worked west and north to cut off the boundary of the greenstone and conglomerate. The result is shown on the map.

At the north end I had some difficulty in distinguishing the conglomerate from the greenstone. Only by the very closest observation can a line be drawn, and even then the line may be off 20 or 30 paces. Certain exposures look like truly massive igneous rocks, but on close examination they still may be found to have a few roundish pebbles or fragments which place them with the clastics.

At 1370 north, 780 west, off-set west, and the greenstone immediately becomes very coarsely crystalline.

In coming back south to Fay Lake to the west of my northward run, I cross large exposures of beautifully developed spheroidal greenstone. It is clear that the main mass of the greenstone to the east and north here is the spheroidal material.

.....

40580 Specimen of gabbro sill, collected by Van Hise near camp at the east end of Fay Lake. The top and bottom of the specimen are parallel to the bedding.

specimen are parallel to the bedding of the Animikie. Does it show parallelism of feldspars?

Bob Contact

. . . . . .

40579 From the west end of Fay Lake on little point.

Saturday, Sept. 9th.

See map opposite p. 38.

With Van Hise and Clements worked the hill north of Paul Lake. Here found the greenstone conglomerate forming the top of the hill, with slates curving around them, as shown on the map. On the east side of the hill the higher parts of the greenstone conglomerate become distinctly banded, so that they give a strike. Here, interstratified with them, are narrow layers of material not perceptibly different from some of the Agamock slates. The interval between the greenstone conglomerate, recognized as such, and the Agamock slates is in all cases as much as 10 paces or more The strike of the Agamock slates and of the bands in the greenstone conglomerate are the same on opposite sides of this interval, at the one place where distinct strikes were observable in the greenstone conglomerate.

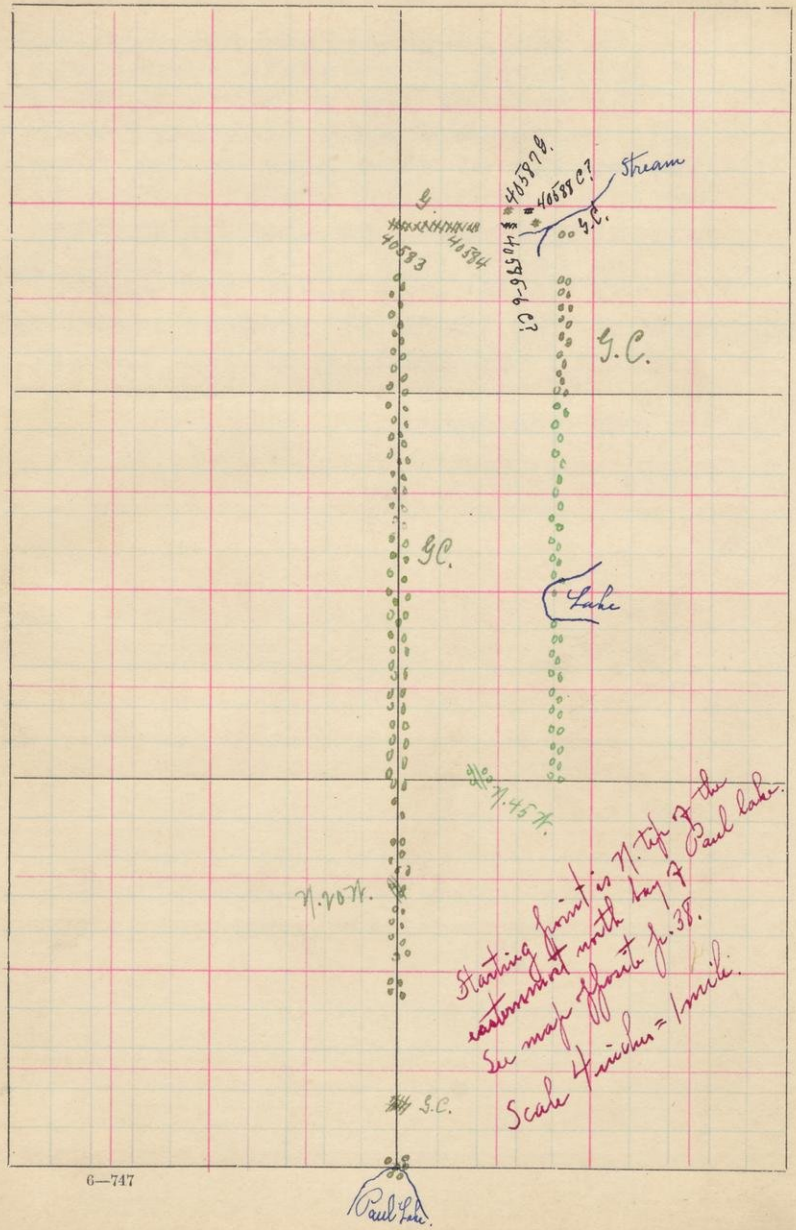
40581 spotted slate, similar to those seen southwest of Snowbank Lake. These are common in this area. The specimen is taken from the south escarpment of the hill, overlooking the little bay.

The persistence of the topographic break between the greenstone conglomerate member and the slate series is significant. This has been noted a number of times before today. The Agamock slates here have bands of some coarser, slightly conglomeratic, material in them.

In the conglomerate are distinct beds of graywacke of moderate coarseness. In the beds of the Animikie slate are beds macroscopically identical with them. The strike of this band in the conglomerate is north and south. This is slightly folded, so that it strikes on the north side north 10° east, and on the south side north 10° west.

40582 One of the bands of igneous rocks parallel to the banding of the slates, which might be mistaken for a coarser band in the sediments.

S. T. R.


40598
40588 C?
Stream
40594
40593
40596 C?
G.C.
G.C.
Lake
N.45 W.
N.90 W.
S.C.
Starting point is N. tip of the
easternmost north bay of Paul Lake.
See map of part of T. 38.
Scale 4 inches = 1 mile.
Paul Lake

6—747

September 11th.

Ran north, from the northeast arm of Paul Lake, to cut off the greenstone conglomerate and sedimentary series. At the shore is greenstone conglomerate.

From 150-200 north are several exposures of rock, which appears to be fine grained grit, but which is probably a part of the greenstone conglomerate series. On fresh fracture it might be called the Ogiske conglomerate, but on the weathered surface it is the typical greenstone conglomerate.

450 north is typical coarse greenstone conglomerate in small exposure. The pebbles are two inches in diameter.

From here to 721 north, there are frequent exposures of the typical greenstone conglomerate. However, all are moss covered.

At 721 north, an upturned root has laid bare an exposure of the typical coarse grained greenstone conglomerate, showing a decided banding. There is, in general, a coarse graywacke band about 12 inches wide running through the conglomerate, with coarse bands of conglomerate on either side. The graywcke band is itself banded in fine bands of coarser and finer material, so that altogether we have a beautiful and typical banding. The strike of the band is north 20° west. The dip it is impossible to get from this exposure, although it is apparently steep to the east.

Continuing north, the greenstone conglomerate exposures are very frequent to 2300 north of the starting point on the lake. The country is heavily timbered and moss covered, but exposures stand up everywhere. The conglomerate varies from rather fine grained conglomerate, the fragments averaging perhaps one-half inch in diameter to a coarse grained conglomerate with fragments 8 or 10 inches across. There seems to me to be a general coarsening of the conglomerate in going north; but this is not particularly striking, and another observer might not think it true.

40583 Across a topographic depression at 2450 north, the massive greenstone appears.

From here ran east along the south-facing escarpment of this hill. The greenstone continues at first fine grained, but at about 200 east, taking on

40584 the character of the typical porphyrite.

At 266 east, 2450 north, we ran on

40585 to a siliceous conglomerate or breccia, which is rather peculiar.(40585) is perhaps a typical specimen of this material. It is seen to be made up largely of chert. It is interbanded with material which

40586 looks like slate in the ledge (40586), but which I am uncertain of. I would ordinarily call this rock a slate, but there seems to me to be a possibility that it is simply a chert form of 40585, and that the banding is only apparent. On the ledge, this banded structure, whether sedimen-

tary banding or schistose, strikes north and south, and dips 70° west.

This siliceous conglomerate slate (?) can be traced east and west along the strike, however, for 20 paces. On the west side it is separated by a sharp topographic break about 5 paces across from the greenstone. On the east side the exposures are too irregular to say that there is a marked topographic break, but about 5 paces separates this series of rocks from the nearest greenstone.

Now going back north away from the escarpment, the greenstone is found forming the main mass of the hill, apparently coming right across the strike of the structure of the banded rock, whatever this may be.

40587 is a specimen of greenstone from 20 paces behind the banded rocks on the escarpment. However, the pseudo-conglomerate is also found here, and to the north, perhaps 25 paces from the escarpment and 5 paces east of 40587. Here the upturned root of a tree gives a complete section of material like 40587 to typical pseudo-conglomerate. The gradation is apparently complete. The massive, fine grained greenstone apparently goes right over inside this pseudo-conglomerate. A single hand specimen would show both the massive greenstone and the material containing the angular fragments. I was unable to knock off such a specimen, but a number of small

chips were obtained right at the contact. One of them shows both kinds of material. The typical massive material close to the contact is 40587. The material taken right at the contact and just on the other side, and not more than an
40588 inch across, is 40588. There is absolutely no break.

In general, I am inclined to believe that we have here not a sedimentary series, but merely a brecciated and silicified zone in the greenstone, the material which looks like slate resulting from the farther mashing of the breccia. If the material is a sedimentary, as it may very well be, it will have to be mapped as a small patch hanging on the south face of the greenstone hill.

Running south, the greenstone conglomerate is found immediately south of the creek at 50 south.

Continuing south, the greenstone conglomerate is in practically continuous, though broken and moss covered, exposure, as far south as we went, 2450.

From here, off-set west to canoe.

At 200 east of the canoe, and about on the same line north and south, I was able to get a good strike in the greenstone conglomerate. This is north 45° west. The banding is exposed by the upturning of a tree trunk. Here there is coarse greenstone conglomerate of one side of a finer band, the other side of which is covered up. The dip can-

not even be guessed at from this exposure.