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Vermilion district: [specimens] 40589-40642. No. 330 Summer of 1899

Leith, C. K. (Charles Kenneth), 1875-1956
[s.l.]: [s.n.], Summer of 1899

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U. S. GEOLOGICAL SURVEY
FIELD SECTION BOOK

9-891

LAKE SUPERIOR DIVISION.

INSTRUCTIONS.

1. Ordinarily at least two pages of this book will be devoted to one section. On the left-hand page, place a map of as much of the section as has *actually been seen*. Denote rivers, lakes, marshes, etc., by the usual topographical signs. Denote the ledges of rock, when no structure is made out, by cross-hatching, making the cross-hatching cover as nearly as possible the areas occupied by the exposures. If the rock is a massive one, but still more or less plainly bedded, use the same sign with a dip arrow and number attached, showing the direction and amount of the dip. Denote a shaly or other very plainly bedded ledge by right parallel lines, and a ledge having a secondary structure by wavy parallel lines running in the direction of the strike, with dip arrow and number attached as before. The greatest care must be taken to avoid confusing slaty or schistose structure with bedding, and in all cases where there is the least doubt about the true bedding direction, indicate it by a query. To each exposure on the face of the map attach the number of the specimen representing it. In mapping the section count each of the spaces between the blue lines as 100 paces, and twenty of these spaces to one mile, or 2,000 paces. Usually the southeast corner will be placed at the bottom of the page, or at the first black line above the bottom of the page, and at the right-hand side. If, however, for any reason, it is desirable to show portions of an adjoining section, the southeast corner may be shifted up, or the map may be turned around and the north placed at the left-hand side of the page. The ruling of the left-hand 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 $2 \times 2\frac{1}{2} \times \frac{1}{4}$ inches will be allowed, but in all other cases *large-sized specimens*, trimmed to a size of $3 \times 4 \times 1$ inches, must be selected, in accordance with section 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. 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.

Vermilion district, Summer 7 1899

C. K. Leith

Jim Fitzpatrick, Compassman

40589-40642

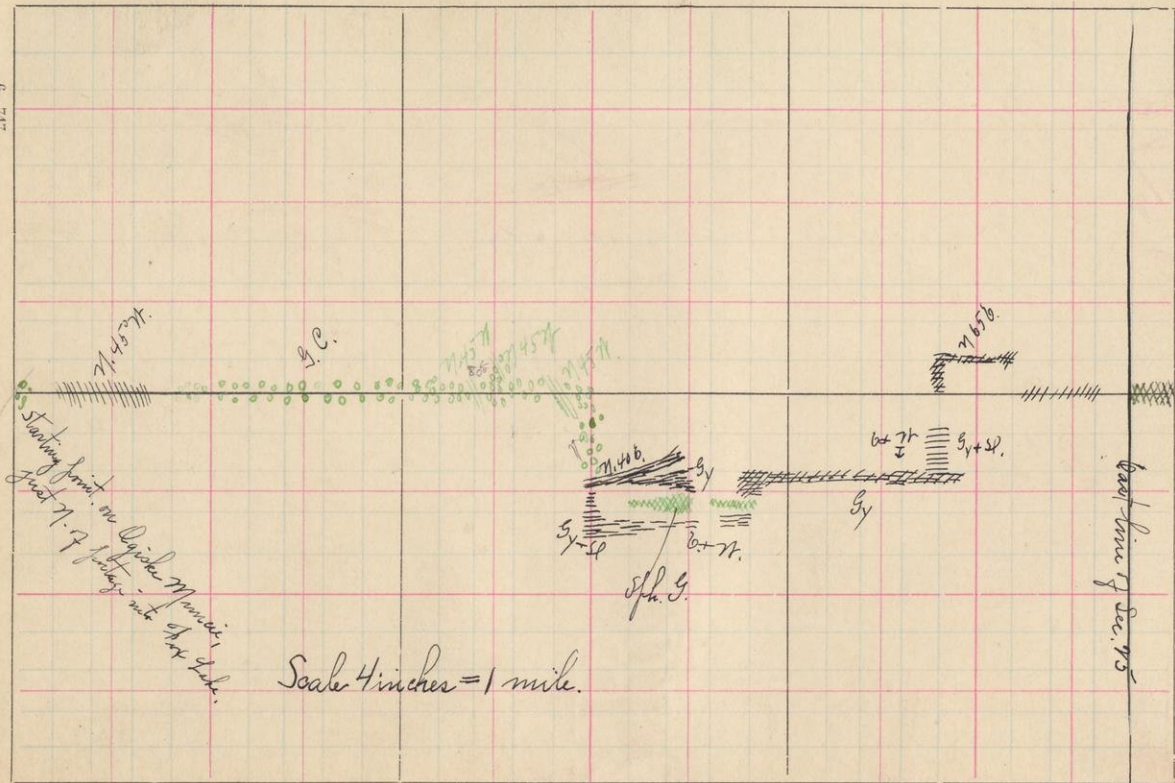
Notebook 330

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B.

East line of Sec. 15



Sept. 12, 1899.

Started in on the south shore of Lake Ogiske Muncie, just northeast of the portage trail near the contact of the sediments and the greenstone conglomerate. From here, ran in a general easterly course to a point south of Frog Rock Lake, and from here north to Frog Rock Lake, returning by way of canoe left there by packer. The object of the trip was to see if I could discover the relations between the typical greenstone conglomerate and the Agamock slate series, and also to check up the position of the greenstone cores. Greenstone conglomerate in frequent exposure is crossed. Up to 1200 east are numerous exposures of the typical greenstone conglomerate. At 1200 east is the typical banded slate and graywacke, but I could not discover its relations to the slate or conglomerate which occurs on both sides of it. The strike is north 40° west.

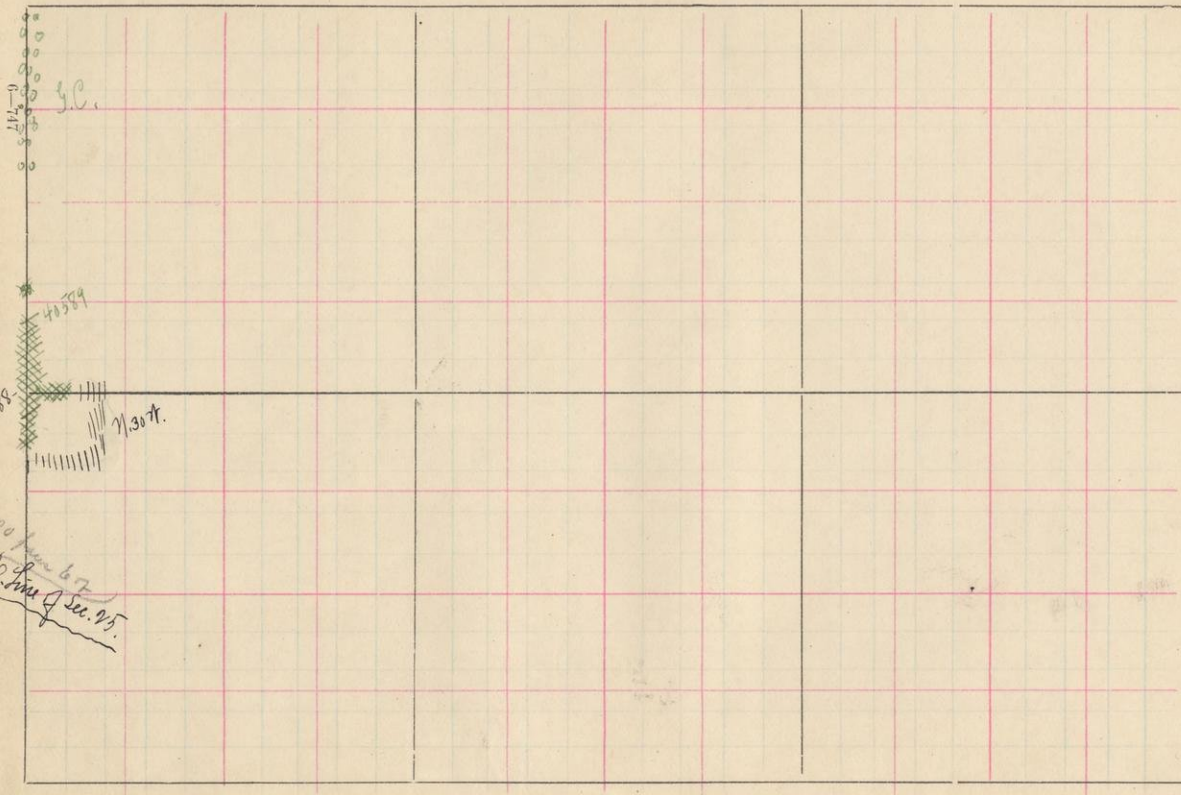
At 1300 east, 100 north, typical coarse greenstone conglomerate is found, until there is a distinct banding with strike north 45° west, i.e. parallel to that of the slate. The dip, as nearly as I can make it out, is 80° west. At 1450 east, 135 south of the line, is a big exposure, in which the typical greenstone conglomerate, with well rounded fragments six inches in diameter, is perfectly interbanded with a large quan-

S.

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tity of finer banded slate and graywacke, striking north 45° west, and dipping 80° south.

Continuing east to the east line of Sec. 25, we have frequent exposures of the graywacke-slate with numerous strikes. In general, to the west the strike is east and west, while to the east it swings higher by striking north 65° east.

About on the east line of Sec. 25, we find what I called greenstone in my run of last year. Continuing still

east, this material is found to give way for 200 steps to typical banded graywacke and slate, here, however, striking north 30° west.

40589 is another specimen of the greenstone. Running south 200 paces, then west again, the graywacke-slate series is found to cut off the greenstone (?) on the east and south, until a point 50 paces south of where we strike it, is reached.

Then went south on the line 100 east of the section line. The greenstone continues for 200 paces. At the northernmost point I take another specimen

Still continuing north, at 625 north of our line (our arbitrary line) we struck greenstone conglomerate in poor ledge, but the undoubted material. This part of the run is exceedingly difficult, as the wind-fall and balsam thickets are very thick.

Continuing north, the greenstone conglomerate is found in interrupted exposure as far north as the little lake.

Also continues around this lake.

S.

T.

R.

6-747

Starting point is stream near the H. line of
 19-65-5 See map in preceding
 book opposite p. 31.
 Scale 4 inches = 1 mile.

el. bounded
 N. 60° W.
 To strike Hamak
 stream about 7.500 ft.
 (Faint)

It also continues around this lake. This material at the lake I had previously mapped as greenstone, but now see that it is undoubtedly conglomerate.

At the northernmost of the two little creeks running ^{into} out of the east side of this little lake, I ran east 1150 paces, all the way in greenstone conglomerate. Then ran south to see if my former determination of the slate and greenstone conglomerate contact was correct.

My former run had brought the graywacke-slate series up almost to the 16th line. At 750 south, the graywacke-slate series is found just across a swamp, as I had previously mapped it.

Off-set to the east 100 paces, trying to find the strike, but found none, although there is a structure in the slate which I cannot say definitely is bedding, which strikes about 30° east of north. At 100 east on the south side of this swamp, is a moss covered exposure of the greenstone conglomerate. Its relations to the slates, I cannot make out. Running north across the swamp, greenstone conglomerate is again seen; but here there is again a good exposure of typical banding graywacke-slate, which gives a strike of north 65° west. Here again I cannot make out the relations. These facts, however, make it apparent that the line of contact is an irregular one, and that the swamp is not the dividing line. If there is a gradation, as Van Hise thinks, these facts would need no further explan-

ation.

Other Main Lake

Magnetic attraction
in swamp.

10711

10884-7

Main Lake

Other Lake

40591. 10711

40570 S.E. 3

40500-3
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40594
52700

40593-7
40596

Main g. sfl. in base.
Main g.

Pyrophyte

J 7.656

7748

J 7706

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September 15th.

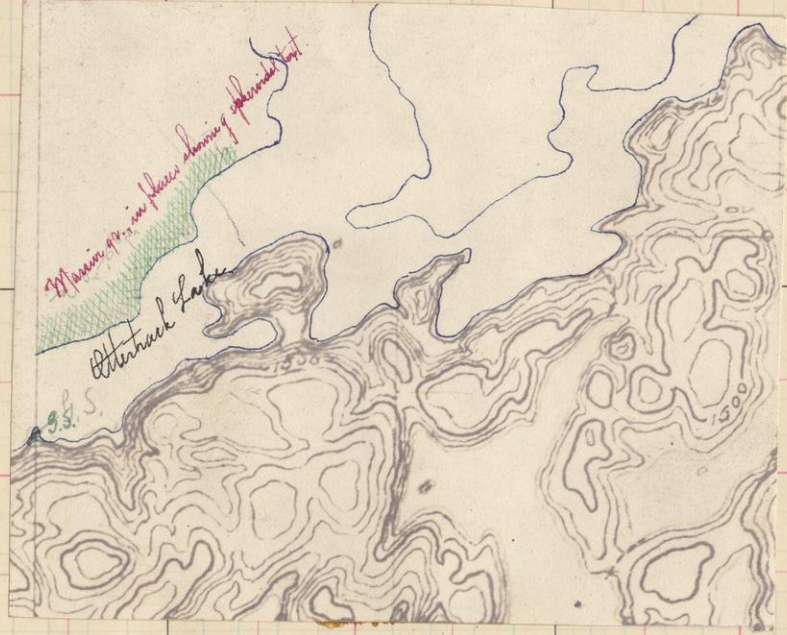
Made a reconnaissance of the north shore of the west end of Ottertrack Lake.

Massive spheroidal greenstone, in high exposures, continuously occupies the north shore. Along the narrows in the central part of the lake (see map) I went ashore, and went inland for 300 paces, then west 500, and then back to the shore. Throughout this run, the spheroidal greenstone shows its usual characters. Skirting down the shore in a canoe, at the point indicated on the topographic map, I ~~landed~~^{landed} again, and went north to see if I could cut off any jasper belt. The typical massive greenstone is found to continue from the shore 884 north, in practically continuous exposure.

From here, off-set west 400 paces, and then went south to Ottertrack again.

At one place, from 600-700 north of the starting point in both north and south runs, there is a strong magnetic attraction. In going both north and south, the attraction was noted in the whole swampy depression, and it is perfectly possible that iron formation material occupies this depression.

From this point worked west along the shore. At the point indicated on the map, occurs the break between the greenstone and the slate series. A sharp topographic depression separates the two formations. This I followed north from the shore for 100 paces up



on the greenstone side, and down on the sedimentary side; but could find no trace of a contact. 25 paces is the shortest distance separating the two. The greenstone series is very schistose and chloritic next to the topographic break.

On the other side of the break, the sedimentary is a very fine grained slate 40590 conglomerate, somewhat fissile (40590).

*sample
in. Jeffers*
Continuing along the shore, the next point is found to be a very siliceous and greenish, banded rock, which turns out to be a banded slate. It is more greenish, and has a little different aspect from the typical Knife Lake slates.

G. S. J.
Crossing the little bay to the north (see map), there are high ledges of exceedingly fine grained and siliceous 40591 greenstone (40591).

1.5
At the eastern tip of the little bay this material seems to become more siliceous in going south toward the banded slates. In the bay, about 10 paces south of the last exposure, of siliceous greenstone, like 40591, there are exposures of banded jasperized siliceous 40592 material (40592). The strike is north 65 east. This material would be called jasper. The two specimens are not so ferruginous as the greater part of the ledge, but they are taken to show the possible origin.

Next visited the little islands which I sketched in on the topographic map.

At the southernmost one is some very

1.5 interesting geology. The ^{north} north side is occupied by strongly crinkled jasper, 40593 represented by specimens 40593 and 40594. 40594 40593 is very siliceous. 40594, on being split, shows a peculiar concretion of limonite.

Occupying the main portion of the island, to the ~~south~~ ^{north} of the jasper, is a greenstone conglomerate, containing fragments of material apparently identical with itself, and several fragments of black chert, ranging in size from 2 inches to 2 feet. It was impossible to secure a good specimen of this conglomerate, so that its character cannot be shown, but the flat surface of the massive exposure shows the fragmental ~~ferm~~ specimen of the rock, but in which the fragmental forms are not apparent. On fresh fracture, the fragmental form would not be suspected. Some of the green rock here may, indeed, be massive greenstone, as in part of it I can see no fragments.

The relations of this rock to the jasper, I cannot make out. The jasper nearest the greenstone conglomerate has certain peculiar characteristics. Some bands in it may be sedimentary. The fragmental greenstone on the other side of the contact lies between the jasper and the massive siliceous greenstone, occupying the main shore a few paces to the north. It has the position it would have if it were a basal conglomerate of the jasper series; but the relations are

so obscure that this is mere conjecture.

G.P.
40596 On the next little island to the southwest, there is a porphyrite, with large white phenocrysts of feldspar, averaging an inch or more in diameter. These phenocrysts have rounded outlines, and give the rock very much the appearance of a conglomerate; but the regularity in size and the cleavage of the feldspar clearly show the true character of the rock.

c
40597 Returning now toward camp, we touched the point just east of these islands, and collected specimen (40597) from a belt of the intrusive intermediate rock, which is found in sharp contact with the slate. The southern edge of this belt of intrusive rock is in the lake. Parallel to the contact of the two rocks, there has been some shearing. On the sedimentary side of the contact the rock is a good conglomerate.

Sunday, Sept. 17th, - Ottertrack Lake.

Again worked the point and the islands to the west, on the north side of Ottertrack Lake, near the portage into Knife Lake. The relations are found to be the same as described yesterday. The ledge of jasper represented by (40592) is found to strike north 65-70 east, which strike is the same as that of the slates. The slates occur to the south of these depressions after an interval of 20 paces on a little point. The rock of this point is an exceedingly siliceous greenish slate, which I was very doubtful about on first examination. In places it is so massive and so green that I was inclined to call it an eruptive; but on top of the point it is found to have a white weathering, banded surface of a typical siliceous slate. This slate has quite a different appearance from the normal Knife Lake slates. It has a much more uniform texture, is very siliceous, and has a decided green tinge. This same rock is found to the south of the jasper on the mainland, just west of the two little islands worked on yesterday. North of this slate on this point, on the next projecting point to the south of where 40590 is taken, is a typical banded graywacke and slate, and wide bands of conglomerate. The conglomerate seems to be a true greenstone conglomerate, and on fresh fracture would

undoubtedly be called an eruptive. However, there is no question as to its character.

Continuing west, just before reaching the narrows of little Knife Lake portage, we passed by a large mass of porphyrite, like 40596. Then we ran on to a narrow band of jasper on the lake shore, much contorted, but striking in general north 65 east. This material is apparently overlain by the greenstone structurally, with sharp contact, although there is a schistose zone a few inches wide at the contact. The jasper seems to be about 5 paces wide. Following the band a little to the east, a true greenstone conglomerate comes in next to the greenstone, and in a position which I should say would put it under the jasper.

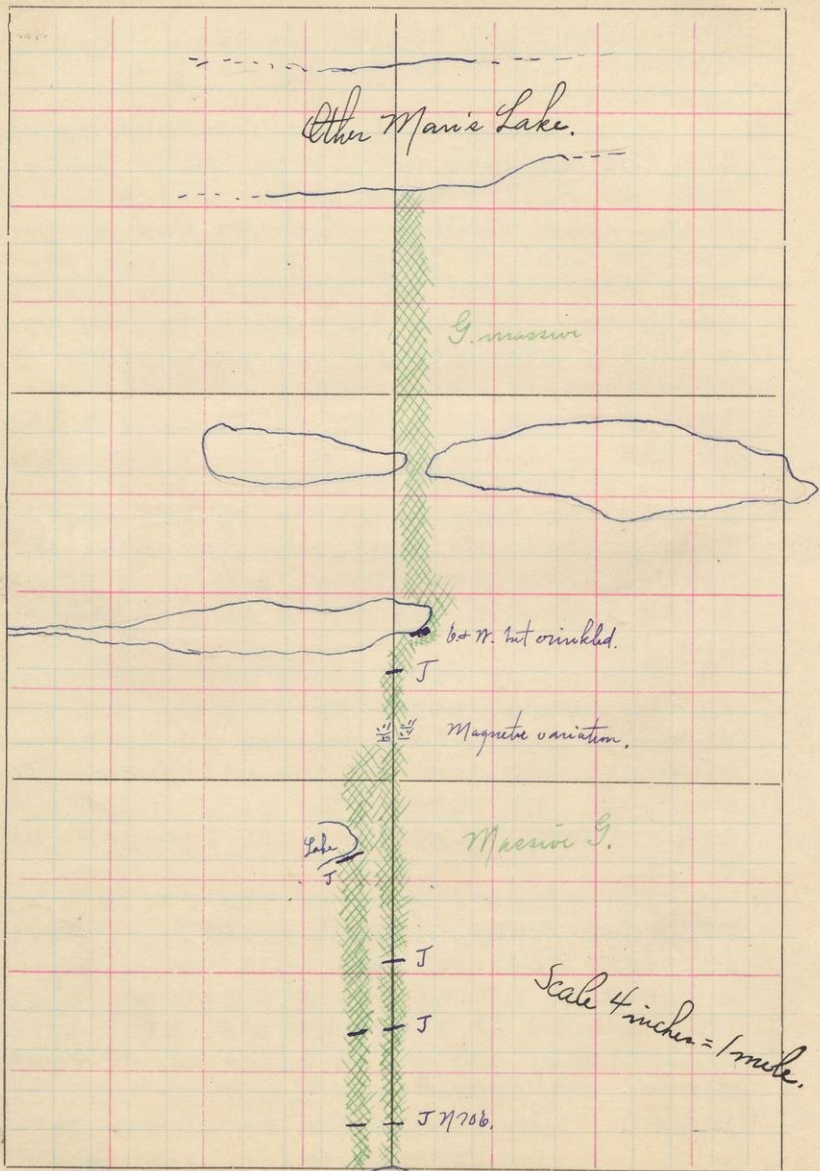
Now going west along the lake shore in the canoe, past the jasper, the greenstone is found to continue in massive exposure for most of the distance. However, at one place, the conglomerate was again found hanging on the face of the cliff.

The significance of the facts I have recorded today, is not clear. However, it seems that we have here certainly a basement of massive greenstone, above this a band of conglomerate, containing greenstone, and a few black chert fragments, and above this a narrow band of jasper. In places the conglomerate does not appear, but the jasper over-

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lies the greenstone directly. Above this jasper are the typical Knife Lake slates, showing slate and conglomerate characters. However, between the jasper and these typical sediments at one place is a zone of siliceous material, of which I am doubtful. The question arises as to whether all the jasper seen is the base of the Knife Lake series, and not the lower jasper associated with the greenstone.

Ran north from the west end of Ottertrack (see opposite map).

50-100 paces north is massive greenstone.

100 north is a narrow belt of ~~greenstone~~ ^{jasper(?)} about 5 paces wide, striking north 70 east, which hangs on a south-facing escarpment of the massive greenstone.

Massive greenstone continues to 517 north, where again is jasper. The exposure is moss covered, so that no relations of strike are obtainable.

1182 north we strike an east variation of the compass of 30 . At 1375 north we strike a little lake, massive greenstone is crossed to this point.

At 1875 north, we cross a little creek, which runs across a narrow connecting the two lakes.

Greenstone continues in massive exposure clear through to The Other Man's Lake, at 2600 north. The greenstone, as a whole, is rather coarse grained,

and would be called a dolerite. No spheroidal forms were seen, although such may be present. The ledges are wet from yesterday's rain, so that such a structure would not be particularly apparent.

Returning south, at the southeast end of the little lake, 1400 north, is crinkled jasper, in moss covered exposure. The general strike is about the same as the rest of the jasper, so far found, a little north of east. At about 1300 north, or 100 south of the little lake, is another patch of red jasper, hanging on the north escarpment of a little knob of greenstone. At 875 north, 100 west, is another patch of jasper, hanging on the face of the greenstone.

At 350 north, 100 west, is a small patch of jasper, hanging on the face of the greenstone. From these occurrences of jasper, it is clear that through this area there are innumerable small patches of jasper associated with the greenstone. The few found were only the ones which happened to lie directly in our course. It was interesting to note that they invariably hang on the greenstone escarpments. This is the position they would have if they were remnants of a jasper formation stratigraphically above the greenstone, which had been folded together with the greenstone and subsequently eroded.

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T.

R.

are there not
hundreds more?

September 18th.

With Van Hise and Clements revisited points where 40590-40597 were collected. on the previous days.

The siliceous material south of the jasper (40592), on the little point projecting west, Van Hise thinks is undoubtedly a true slate.

sl 40598 40598 and 40599 are two more specimens collected from this point, showing the banding of the slate.

The resemblance of this material to the material I have called siliceous greenstone (40591), just to the north across the little bay, should be noted.

Touching on the northernmost of the two little islands, Van Hise thinks that the main mass of the northern part of the island is greenstone, although in the central part it contains undoubtedly jasper fragments, and a part of it may be conglomerate. The exposure is obscure, and it is largely a matter of opinion as to how much should be called greenstone and how much conglomerate. I am still inclined to think that the whole of the northern part of the island is conglomerate.

40600 1.5
Beginning at the jasper, and going north, the jasper is found to contain 40601 bands of novaculitic material (40601 40600 and 40602) in approaching the contact, as noted on a previous day. Still closer to the contact, this material increases in abundance, and here 40602

was collected, which is entirely novaculitic. There is a clear transition from this novaculite material to the typical jasper, About 4 ft. from the typical jasper, the so-called novaculite grades into a schistose, apparently brecciated rock, which may possibly represent a conglomerate (40603)

We next went to the point in the narrows north of little Knife Lake portage where the jasper comes in on the shore. Here again, there is apparently a brecciated or conglomeratic phase under the jasper, and in the jasper itself there is a schistose zone, with roundish areas in it, which closely simulates a conglomerate. The brecciated pseudoconglomerate, beneath the jasper, that is, to the north of it, Clements thinks is merely a brecciated phase of the spheroidal greenstone. The spheroidal greenstone in massive exposure forms the main part of the hill, with the jasper and conglomerate hanging on the south face of it.

The porphyrite, which occurs along the shore, lies to the south of the jasper where the two can be traced together, although to the east the porphyrite apparently comes directly against the greenstone, and the jasper disappears. The relations are not quite clear, as the porphyrite becomes very schistose, and in such a phase closely simulates a sheared conglomerate. The feldspars become chloritized and black, and re-

semble chert fragments.

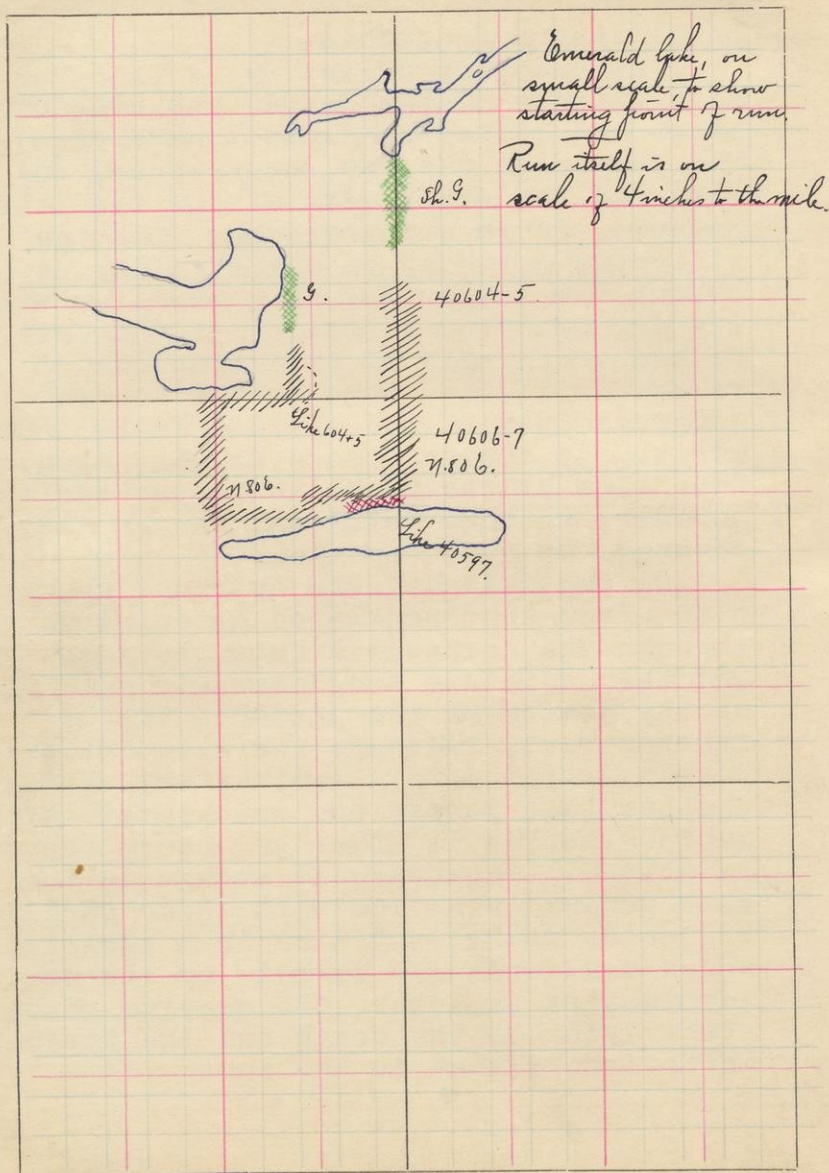
The question arises as to the true significance of the jasper and conglomerate and siliceous slate I have seen. The jasper in the two occurrences, one east and the other west of the two little islands, is in a depression, with the siliceous material on either side, as though the jasper was in a syncline with its accompanying slates. At the east, on the south side of this syncline of siliceous slates, come in the coarse conglomerates of the typical Knife Lake series, as though unconformably upon this fine siliceous slate-jasper series. However, no true relations can be discovered.

On the islands, the apparent gradation from the brecciated material up through the novaculite into the jasper, and the schistose conglomeratic material at the bottom of the jasper a little farther west, indicate the association of the jasper with a sedimentary series. Whether this jasper and associated sedimentary series is lower or upper, cannot be stated. However, it occurs in the same general syncline with these peculiar siliceous rocks, and lies in a position which would readily permit of its determination as lower, the massive greenstone lying to the north and the typical Knife Lake slates to the south.

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T.

R.



September 19th, - Emerald Lake.

Started in on the shore at the place indicated on map on opposite page. Here is a post marked W. 252. Ran south from here to cut off the boundary of the greenstone to the north and the slates to the south. Starting at this point, there is a line well cut out for some distance to the south.

The spheroidal greenstone occupies the shore, and continues south for 300 paces.

At 370 south, appears a fine grained graywacke and slate, showing coarser and finer phases. These coarser and finer phases can scarcely be considered to form a banding, although there is doubtless banding in a large way.

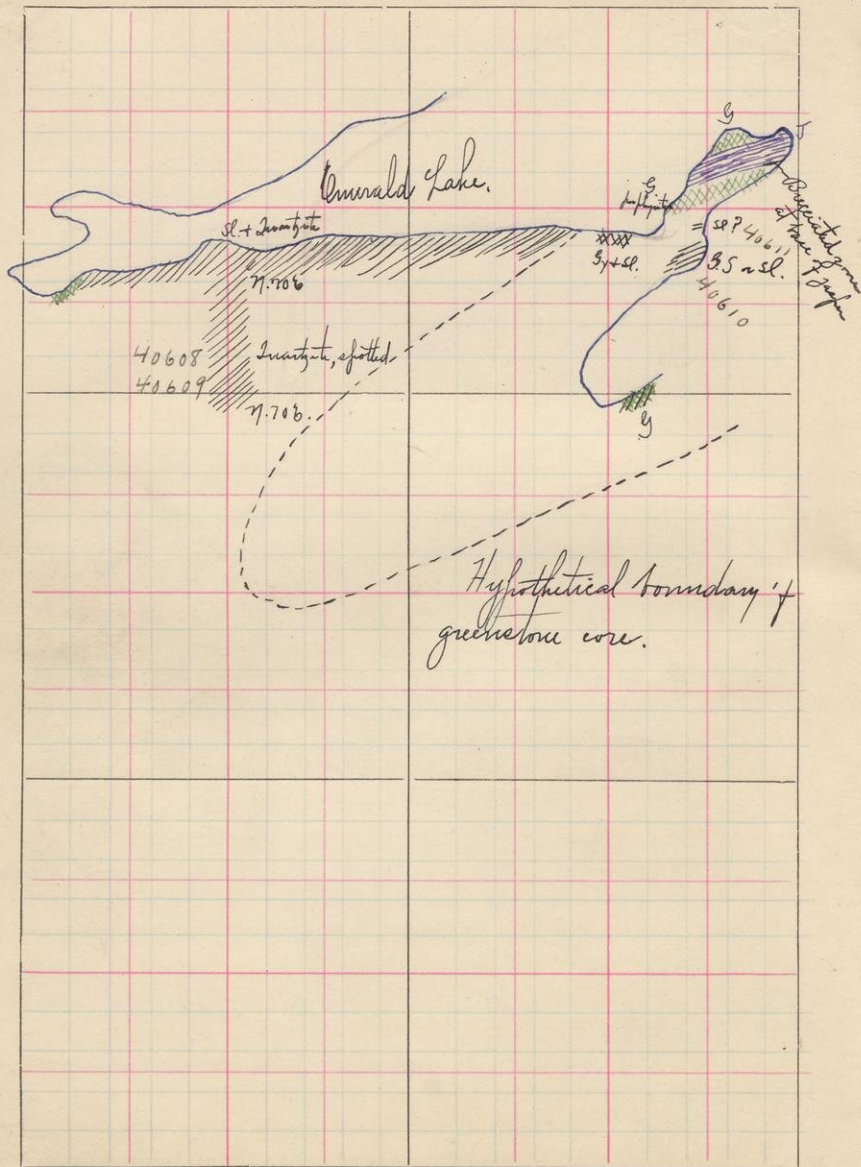
40604 40604 and 40605 are specimens of
40605 this rock. This material, in zones of alternating coarseness and thickness, as represented by the two specimens, continues in frequent exposure to 700 south. The schistosity is remarkably uniform, striking north 80° east. At 820 south, the typical sedimentary banding and white weathering of the true slate series first appears, striking north 80° east. Here two more phases
40606 of the sedimentary were collected (40606
40607 40607).

Up to this point, I was somewhat doubtful about the character of the slaty rocks, thinking that possibly they might be fissile green-schists. Until we

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reached this point, the slaty rocks do not look characteristic of the Knife Lake series. However, I think they are undoubtedly sedimentary. The specimens will determine this definitely

The typical Knife Lake slates continue to 927 south, where we strike a little lake, which we off-set to the west. At the lake shore is a large mass of intermediate or acid intrusive material, similar to 40597.

After running west for 500 paces, we ran north, until we struck another little lake. This we off-set to the east, following the course indicated on the map. The boundary of the greenstone and the sedimentary series on this north line is found 600 south of the starting point. Here there is an interval of about 50 paces of low ground between the two series. The line of contact, therefore, is a diagonal one, running north-east-southwest.

In general, the sedimentary rocks just south of the greenstone have a decidedly greenish tinge, do not show a typical banding, and might well be taken for green-schists. At about 800 south, on the eastern course, these peculiar rocks go away to the typical white weathering Knife Lake slates. In coming back north of the western course, the same thing was found, the slates becoming greenish in approaching the contact with the greenstone. On this northern run, however, there is no question of

confusion with the greenstone, for the greenstone, when we strike it, is uniformly massive, and has the typical igneous textures.

After coming out on Emerald Lake, we worked the point and south shore of Emerald Lake around to the portage trail where the camp stood.

At the point marked on the opposite map, just north of where we made the run, is a very fissile greenish rock, 40610 which probably is green-schist (40610), yet there is a slight variation in texture, and the rock may be sedimentary. The relations of this rock to the massive greenstone to the south are not apparent.

Continuing along the shore a little farther, in a topographic break, is a 40611 greenish slate (40611). This again may be either sedimentary or green-schist.

Continuing to the northeast, along the point, we strike the typical green-schist, having more or less of fissility; but, in general, rather massive. This occupies the south side of the point, and cuts diagonally across it, the jasper occurring on the north side of it. The relations of the two were studied in detail, but there is little to be found here. Along the contact, the jasper is very much brecciated and quartzose. At one place, at the place indicated on the map, the jasper has a very brecciated and pseudo-conglomeratic appearance close to its contact with the greenstone. This is almost exactly the same as that seen on the east end of Ottertrack

Lake, where the jasper hangs on the south-facing escarpment of the greenstone with its intermediate brecciated zone. The greenstone, in going southwest, across the point, is seen to grade into the feldspar-porphyrityte, with the large feldspars seen yesterday. However, here the feldspars are almost completely altered to epidote, giving a yellowish color.

Crossing the jasper, the contact with the greenstone on the north side was studied, but nothing new was discovered. The greenstone is, for the most part, very fissile close to the contact. It contains numerous fragments, and has a ridgy surface, such as would result from the weathering of a conglomerate. However, in breaking the rock, the fresh surface is seen to have typical igneous textures. The chert fragments are apparently the result of the shearing of infiltrated quartz veins. Many of these have been subsequently jasperized, and are now true jasper fragments.

I then worked down the shore to the west portage trail. The greenstone, green-schist, and jasper were passed, as shown on the map.

Then we strike into a typical banded graywacke, slate, and quartzite, particularly the latter, which continues down the shore to the last little bay in which the portage trail begins.

At the place indicated on the map, I ran south to see if I could cut off

the belt of quartzite, but at 500 paces south the series, almost entirely massive quartzite, was still continuing. With the predominant quartzite are bands of finer material which enable one to get strikes at various places. These are found to vary from north 65° east to north 80° east. (40608) represents the quartzite, which is seen to be rather impure. (40609) is a spotted variety found forming the large exposures in the southern part of the little run to the south, about 500 south of the lake. This rock is also found interbanded with the slate.

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September 20th.

Ran a course north 30° west across strike of the sediments from the point on That Man's Lake, indicated on the opposite map. The object was to cut off the boundary of the granite. The shore is occupied by slate and graywacke, with a strike of north 60° east. This material has been specimened by Van Hise. The graywacke contains minute jasper-eyes. This banded material continues in frequent exposure to 350 northwest, where there is a schistose rock which I am doubtful about, like 40612. It is more greenish than the series just past over, and has the aspects of a green schist. Still the characters are not decided enough to warrant me in definitely separating it from the sedimentary series just crossed over. This material continues to the marsh 1000 paces northwest, where specimen 40612 was taken, as indicating the character of this doubtful rock.

On the farther side of the marsh, the typical banded greenish slate and graywacke, mostly graywacke, appears and continues to 3200 north, where is found a typical hornblende-schist (40614) containing a stringer of black chert. Can this hornblende-schist be one of the hornblendic graywackes described by Clements from Pine Island? Between

this rock and the greenish graywacke series there are not continuous exposures. Where our course crosses them there is an interval of about 25 paces.

Off-setting the lake, as indicated *Hb. sc* on the map, hornblende-schist continues and becomes more fissile and even 40615 grained (40615), until we reach a place 4000 northwest, where comes in a hornblende-feldspar-schist, which closely resembles a schistose granite. It is the same rock that we have before found in approaching the contact with the granite. No quartz is apparent in it.

At 4290 northwest, we strike Louisa Lake. Where we strike it, there is a stretch of open water of perhaps three miles which can be seen. On the shore of this lake there is a schistose granite or perhaps more accurately, a hornblende-feldspar-schist. *Mr. or Sgts* I can discover no 40613 quartz in it (40613). However, the rock has all the appearance of a granite, and would undoubtedly be so mapped. It includes numerous angular fragments of a dark hornblende-schist from minute size up to those of three or four inches in diameter. A small piece of this hornblende-schist is shown in the hand specimen. One or two chips of a larger specimen were also collected.

In general, in coming north, we have passed from a series of exceedingly uniform schistose greenish rocks, with uniform and parallel schistosity. Much the greater part of the series is sedi-

mentary, but the part indicated on the map may be a schistose greenstone. Can it be that the hornblende-schist here is really a more advanced stage in the metamorphism of the graywacke series? The similarity of some of the least hornblendic rocks first struck, to hornblende-graywackes discovered by Clements, on Pine Island, leads to this query. On Pine Island also there was an apparent gradation from slightly hornblendic graywackes into typical hornblende schists, that is to say, no break was discovered between the two rocks.

Running south, a specimen of the hornblende-schist is collected just before leaving the area of typical hornblende-schist to go into the sedimentary area. This specimen is from a layer of banded material in which hornblende has begun to develop. Farther on a specimen of still less hornblendic

M.S. 40616 material is collected (40616), and then

40617 comes a rock like (40617).

Both going up and coming back, at a distance of about 1200 paces from the lake, I crossed a band of schistose conglomeratic-looking material which I could not place. I would call it a 40618 sheared amygdaloid (40618).

From 1200 from the lake to within 300 from the lake, is the peculiar greenish schist, which in the morning I 40619 was inclined to call green-schist (40619). It is porphyritic, but the surface shows an undoubted banding. I was not able to discover the break between this material and the typical

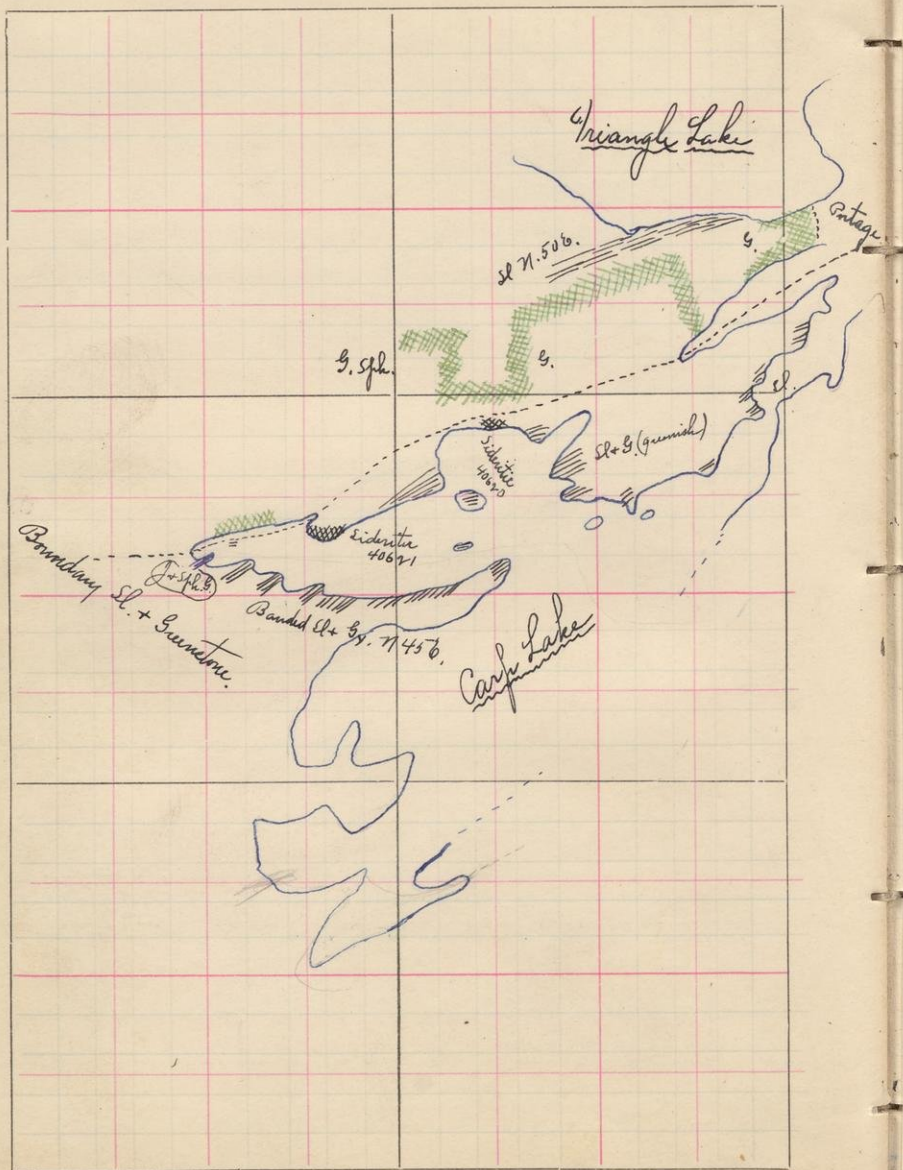
material and the typical banded gray-wacke and slate to the south. Within a space of 100 paces I did not decide definitely just when I crossed from the one to the other.

40624 is a specimen of the typical hornblende-schist, the most finely fissile and banded phase, from the northern part of the run.

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September 21st.

Went to Carp Lake to see if the slates carried west by Van Hise as far as Triangle Lake connected with the Carp Lake slates as he supposed. As far as I had time to follow out the belts at this day, the greenstone continues in a rather wide belt in frequent exposure, as far west as the west end of the lake. The map will show the approximate location of the greenstone anticline. When I left the greenstone to the west, it was apparently continuing in as wide an anticline as ever, and if the slates to the north swing around the west end of this anticline, they must do so at some place farther west.

At two places, indicated on the map, typical spheroidal characters were seen in the greenstone, showing that the greenstone is the basal spheroidal greenstone.

Close to the contact with the sedimentaries to the south, I at first had some difficulty in making the discrimination between the greenstone and sedimentaries. The greenstone is exceedingly massive, almost flinty, greenish rock, which I would be attempted to place with the sedimentaries if it were not for the fact that where this character is most pronounced, there also, in one place, the spheroidal structure is well developed.

The sedimentaries close to the green-

stone are very green, and I had some difficulty at first in drawing the line, but in studying the outcrops further I was able to discriminate the two.

Y. carbonates
Close to the contact with the greenstone at several places in the sediments, I find a dense sideritic greenish chert, which I think comes just about at the base of the sedimentary series. (40620-21) are specimens of 40621 this rock.

Carbonates
At the west end of the north arm of the lake, on the little point just opposite the greenstone, there appears a series of banded rocks, which are in all respects similar to the banded slates and jasper seen by Clements and myself on That Man's Lake. Here, however, the jasper is almost in contact (interval of 2 ft.), with the spheroidal greenstone, which appears in a little patch to the south of it. The cherty rocks interbanded with the jasper occur on the north side of the point away from this spheroidal greenstone. The occurrence of the greenstone here probably simply indicates that we are near the base of the sedimentary series, the greenstone being brought up by a little subordinate anticline. (40622) shows the character of the banded rock.

Carbonates
Just east of this, on the little island, this rock continues, and there it seems to have more of the slaty and gray-wacke phases (40623).

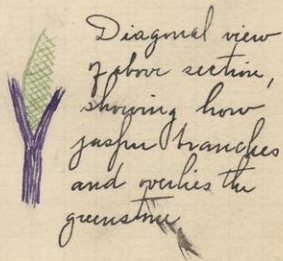
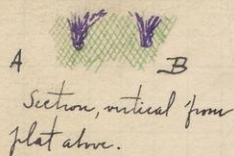
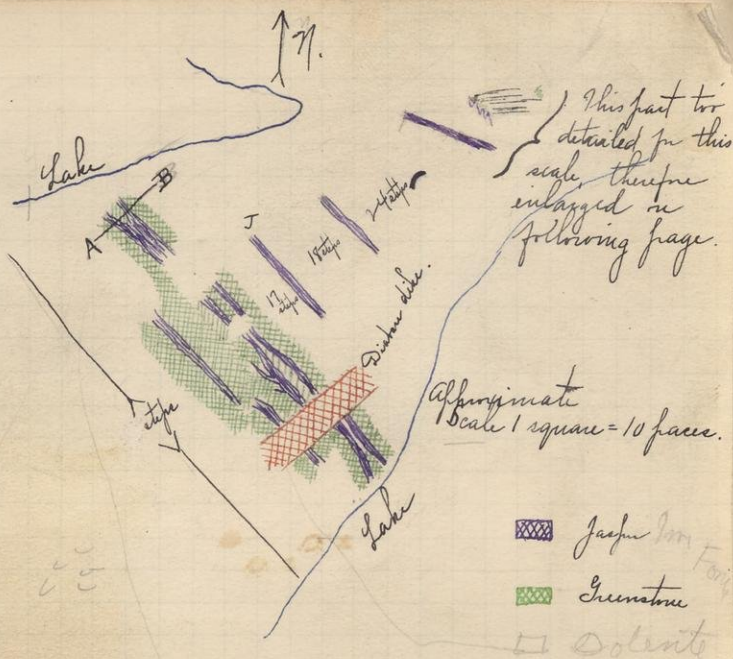
On the next point to the southeast, just across the bay, the typical banded graywackes and slates come in, with a strike of north 45 east.

The sideritic rocks close to the contact of the greenstone, the banded jaspers and slates at the west end of the lake next to the contact with the greenstone, and the occurrence of typical slates to the south, all point strongly to the existence of an iron-bearing horizon at the base of the slate series.

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Hb. F. P.

40625 Specimen of pebble from the greenstone conglomerate on portage trail between Moose Lake and Wind Lake. Is this granite? So thought to be by Van Hise; but I can see no quartz in it.



Sketches showing approximate distribution of jasper belts on a little isthmus in the northern part of Sec. 4, about $1\frac{1}{2}$ miles south of Moose Lake. Belts are from 4 to 10 acres wide.

Appendix p. 15 of

September 23rd-24th.

With Van Hise and Clements worked the south shore of Moose Lake. (See notes by Van Hise) A number of minor corrections on my map of this area were made.

40626 is a specimen of the jasper regarded as vein material in the greenstone, from the little belt about . *one*... miles south of Moose Lake. (See location on map) This belt was followed for 100 paces farther east, and at the east end of the little lake on the little neck between this lake and the next one, this same belt is found. However, here it is found to be divided into two belts, and very much sheared and broken, so that we have many inclusions of the jasper in the greenstone. Here, also, the material is a true red jasper, rather than the coarse actinolite-magnetite-schist, which it is at the location to the west. All were inclined at first to call this jasper a part of the same belt followed from the west, but it is not continuous exposure, and may well be a different jasper.

40627 A specimen from a diabase dike from location indicated on map. This dike is found to continue across the neck. Here it is 15 ft. wide. In the middle it is somewhat *or* closer than on the sides.

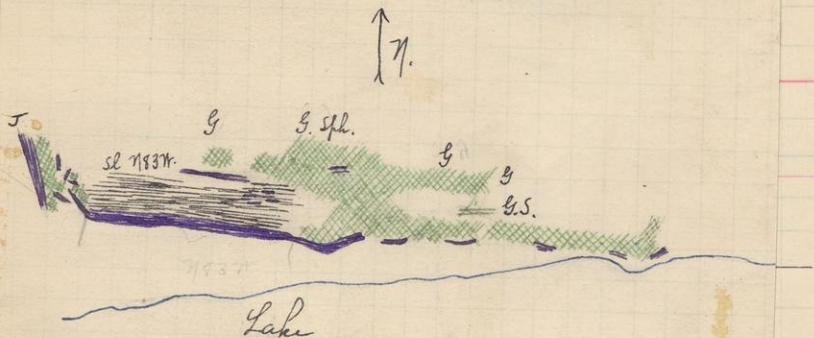
A little farther east on this neck, we find closely associated with the

No 5. See

Missing

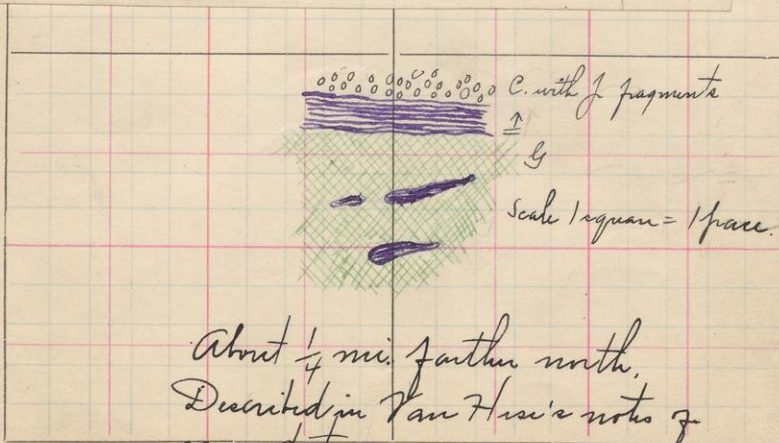
(opposite p. 15 of preceding notebook)

40627



Scale 1 square = 5 paces.

Same location as preceding plat.



About $\frac{1}{4}$ mi. farther north.
Described in Van Hise's notes of
same date.

jaspers a series of finely banded, slaty rocks, which we are doubtful about. On the weathered surface they look like the cherty white-weathering slates. However, just north of them we find a typical spheroidal greenstone, which is very acid and slaty. A specimen taken here looks exactly like the slaty material which is finely banded just a few paces to the south. (40628) is a specimen of the greenstone from one of the spheroids. (40629, 30, 31) are specimens of the finely banded slaty rock to the south, which it is thought may be sedimentary.

Whatever the origin of these apparently sedimentary rocks, they are identical lithologically with the material which yields slate fragments to the conglomerate just south of Moose Lake.

40632 is a specimen of the jasper from this place.

40633 is a specimen of dike rock from south of Moose Lake (see map).

40634 is a pebble of jasper from the conglomerate south of Moose Lake, showing zonal alteration.

October 4th.

Visited the burnt forties with Dr. Clements to look over the jasper. In going south to the big conglomerate hills, the green-schist jasper complex was crossed just before reaching the crest. We have here large fragments of jasper totally enclosed in the green-schist. I had before thought that this was a clear case of intrusive relations. Dr. Clements and I decided that while from this exposure alone this would undoubtedly be supposed to be the case, taken in connection with other occurrences in the district, it might be a case of close intricate in-folding.

Next studied the jasper, to look for slaty phases associated with it. None such were discovered. However, on the south side of the conglomerate ridge the jasper is in one place rather peculiar. It is banded, greenish, and slaty (40638). This occurs on the southernmost flank of the hill. Just across the valley, about 20 paces to the south, is the greenstone.

40639 From the top of the east end of the conglomerate jasper hill, a specimen of the typical black jasper was taken.

In bands in this jasper are some peculiar rocks, which we cannot name.

40640 They are represented by specimens:

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40642

The jasper of this hill is, in general, black jasper, but a little red jasper also occurs.

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40637

From N. hill of Burnt Point.
Collected on trip with Van Hise
and Clements.

Banded rocks associated with the
jasper.

