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Field notes on north east half of Vermilion Iron Range, Minnesota for 1898: [specimens] 27987-28000, 28801-28889. No. 309 1898

Clements, J. Morgan (Julius Morgan), 1869-
[s.l.]: [s.n.], 1898

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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.

27957 - 28000

28801 - 28889

309

No 2

Field Notes
on
North East Half
of
Vermilion Iron Range
Minnesota
for
1898.

J. Morgan Clements.

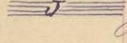
 Dolomite Intrusion!

 Mr. Q.P. or F. Poppley.



Slate, Gneiss, Cgl. etc.

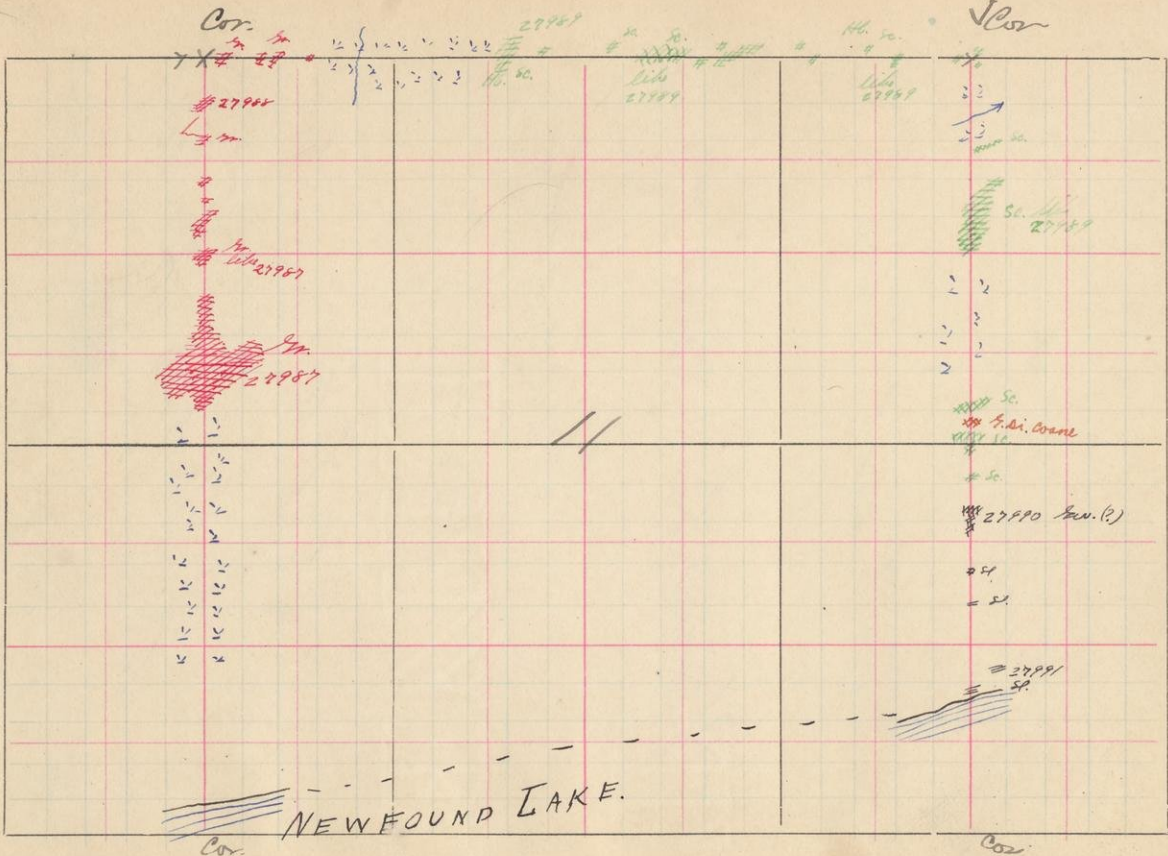
 S.T. & S. + G. Muscovite without
determinable slates of sandstone.

 Jasper.



Slate, Gneiss, Cgl. etc.
Quartzite.

S. 10/11 T. 64 R. 9



6-737

W. C. 1919 map only

21

21

21

21

1.
27987 N 175 W 0 Sec. 10-64-9
Bold hill with large exposure
of pink weathering greenish
grey granite.

27988 N 900 W 0 Sec. 10-64-9
A somewhat finer grained, more
uniform and lighter colored gray
granite than 27987 begins here.
Can get no relations between the
two varieties.

Hb. M. So.

27989 N 0 W 1250 Sec. 2-64-9
The hill here is evidently formed of rock
not drift but it is mostly overgrown
with timber or thickly over covered.

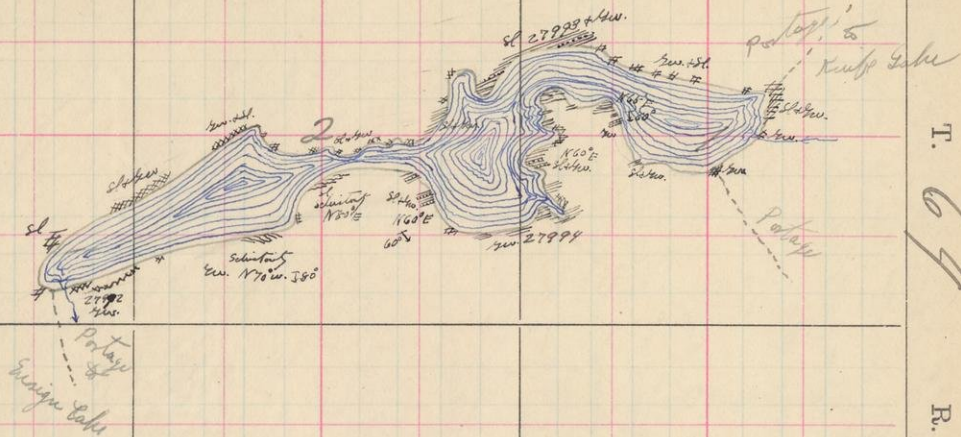
Here and there are exposures of a rock
27989 which looks to me like a
facies of the hornblende + mica schists
which have been found west of
here to lie near the granite.

Can not get strike of schistosity.

27990

27990 N 860 W 0 Sec. 11-64-9
Here is a ledge of rock 27990 whose
character is doubtful. It may
be a basic igneous rock but to

8



6-747

me it looks more like a gray-
wacke. If it is a clastic then
it should probably be correlated
with the graywacke 27893 which
is west of here. N of Moore Lake is
found to south of the hornblende
schists.

The schists north of the rock 27890
may be metamorphosed slates and
graywackes but have seen no
proof of this. Can not get the
relations of 27890 to the schists.

sl
27891

N45° W 1975 Sec. 12-64-9
Very fine slates outcrop on top of
hill and ^{is found} in few exposures from there
on south to lake shore. Strike of
finitely N60° E, dip 90°. Could
not get bedding.

sw
27892

Worked shore of small lake in 64-8
Graywacke showing no bedding
is exposed along south shore.
On the W. side of the bay crossed
by the N-S section line between 1 & 2
there occur good exposures of
interbedded slate and graywacke.

Strike of bedding $N 68^{\circ} E$, dip $60^{\circ} S$.
Schistosity strikes $N 80^{\circ} W$.

sl.

27993

Slate striking $N 50^{\circ} E$, dip about 90° .
Surface exposure and could not get
dip well.

Narrow beds of gneiss are interbedded
with the predominant slate.

Am.

27994

$N 560 W O$ Sec. 2-64-8

Forming the cliffs on the south
shore of the lake at this place
there is found interbedded gneiss
27994 and slate. Strike is
 $N 70^{\circ} E$, dip $80^{\circ} S$. Schistosity strikes
 $N 80^{\circ} E$, dip 90° . Boundaries between
slate and gneiss are irregular
or curved. That is a lenticular slate
body may lie in a mass of gneiss
or vice versa.

$N 1760 W O$ Sec. 11-64-8

Poor exposures of a conglomerate
which looks some like that seen W.
on Ensign Lake occur around here.
Pebbles are chiefly of gneiss but
those of granite porphyry are present.

cgl

4

27995

N1450 W 0 Sec. 11-64-8

High hill here from which one can
recover country in every direction.

Covered with outcrops of coarse conglomerate.
Matrix is greenish on fresh fracture.

On weathered surface large quartzes
and feldspars stand out and make
it look porphyritic. In this matrix
lie pebbles of green schist and
porphyritic gneiss. No other
recognizable varieties of rock seen here.

This resembles the conglomerate
seen N. of Disappointment lake
in Secs. 21 & 22 T 64-8.

Schistosity strikes N 70° E. Could not
get bedding.

sw.?

mt. sw.?

27996

N1600 W 0 Sec. 14-64-8

Outcrop of graywacke (or gneiss?)
In place it is decidedly schistose.

gr. g.
sch.

27997

N1200 W 1000 Sec. 13-64-8

Knoll of medium grained dolomite
No relations to be seen.

2

N1360 W 1000 Sec. 12-64-8

An exposure on top of small hill

show interbedded slate and
graywacke with plications
whose axes strike $N 60^{\circ} E$ and
plunge $60^{\circ} W$.

400 + 20.

27998-9

Worked NW. shore of Knife
lake from canoe.

As I start W. find exposures on
shore are composed of alternating
beds of graywacke 27998 and a
bluish slate 27999. Strike of
bedding is $N 60^{\circ} E$, dip $80^{\circ} 3' - 90^{\circ}$.
Schistosity strikes $N 80^{\circ} E$.

Sediments are in places very
pyritiferous and near water's
edge clastics are not uncommonly
colored yellowish to brown from
the limonite resulting from
alteration of pyrite. Pyrite usually
represented by limonite pseudomorphs.

500 + 20.

28000

Here I come upon first exposures
of a very siliceous hornstone like
quartzite and slate. Strike $N 60^{\circ} E$,
dip 90° . Schistosity $N 20^{\circ} W$. Sedimentaries
are cut by joints running $N 10^{\circ} E$.

28801-234

The siliceous graywacke and slate keep on around shore to N. outcropping on points. At place located by spec. numbers it is intruded by dyke of dolerite fifty feet wide which seems to follow along bedding. Spec. 28801 is from near center of dyke and 28802 is a fine grained phase near the contact. 28803 is contact phase of the ~~the~~ sedimentary (graywacke or quartzite) a few inches from line of contact. 28804 is phase about 12" from contact.

Exact line of contact is rotten & soil covered & no specimens could be gotten showing contact of two rocks.

Is not the very siliceous character of the slates noted in this vicinity due to intrusions of this & other dolerite dykes? That is are not the sediments metamorphosed to hornstones.

28805

This shows another and still finer grained ^{and} ~~more~~ cherty or flinty appearing phase of the siliceous sediments. This weather

almost a snow white.
These flinty rocks appear on
north and west shore of the bay.
One point however doubt
appears which is possibly a
continuation of the dyke
represented by spec. 28801-2

Going on S.W. around shore
the sediments become more
normal. That is they are marine
and calcareous graywackes and
not so siliceous as the rocks
described above. This is a band
of normal sediments corresponding
perhaps to 27998-9.

To south of this the siliceous rocks
are again seen on the islands &
on shore of lake. These siliceous
rocks are evidently interstratified
shortly with the ordinary slates
and graywackes.

Mr.

28806

Here I find a small exposure of
granite 28806 on shore followed by
graywacke to the N. Granite
seems to grow finer grained
toward the graywacke. Along the

show a short distance & the west dolomite occurs.

This as well as the granite is probably intruded parallel to the bedding. Could 28806 be a contact product caused by contact of dolomite with graywacke?

The interbanding of the slate (normal) and cherty phases of the Knife lake slates can be seen on large Eastward projecting point on ^{U. S.} American side at west end of lake.

28807-8 ^{sl} Cherty olive green rock 28807 appears on shore. Strike $N 60^{\circ} E, 90^{\circ}$. ^{2881 dol.}
This has in it a band of dolomite (?)
28808 about 3 feet wide parallel to strike.

This olive green rock seems to be same as black slate 28805 and perhaps owes its green color to presence & action of dolomite.

28809 ^{sl chertaceous} The top of this hill overlooking west end of Knife lake offers opportunity to study relations of

cherts & slates. Here I can see the chert interbedded with the slate and it also occurs in nodules in the slate. Sec. 28809 shows pieces of nodules. Chert also occurs in lenticular bodies in the slate. Slates themselves are apparently very thoroughly silicified.

Is not the silica present in the chert bands & nodules as well as in the cherty slates due to secondary silicification?

Strike $N 60^{\circ} E$, dip $80^{\circ} S$.

Trained portage leading from Knife Lake S.W. into long narrow lake. Starting at Knife Lake and run S.W. and at 60 paces saw cherty slate but could get no strike.

rw.
28810

At 300 paces along trail begin to ascend hill composed of slate like 27989 in places siliceous and graywacke 28810. This graywacke is the predominant rock and is exposed along trail at intervals from 400 to 550. Exposed again from 600-700 and at intervals on lake at 820.



Beginning on N. shore of
long point projecting West
into sec. 22-65-7 I worked
the east + north east shore of
Knife lake from a canoe.

Dolerite appears in small
outcrops on shore of this point
but forms a bold ridge trending
approximately E-W through point.
Where dolerite crops out on shore
land usually runs rapidly back to
the high ridge.

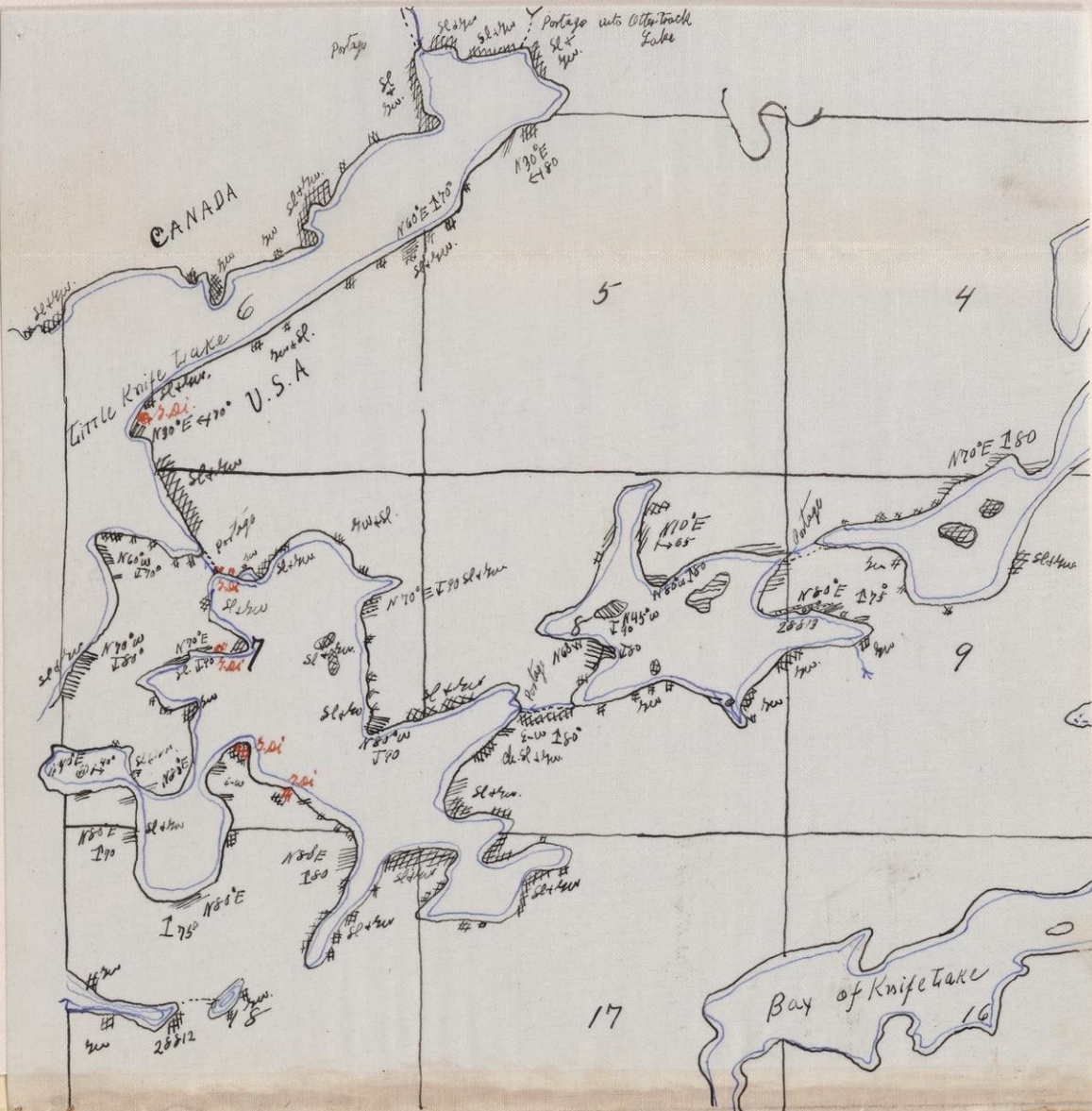
At places it is noticeable that
there is an area of low ground
between the ridge and lake and
in such places I find slates + graywackes
cropping out on shore ^{like} 27998-9.
Strike N70°W, dip 20°. Strike ~~subvertical~~ N80°E

Continuing, find the clay or
siliceous slates + graywackes along
shore, strike N65°W, dip 80°N.
These are here interbedded with the
normal slates and graywackes.

Dyke 4" wide cuts across strike of
slates. slates strike N70°W, dip 70°S.

4.21
Dol. very much altered.

28811



arkose ^{hw}
28812

Very massive granitic looking
rock. Is it an arkose? Forms
bold hills.

Examined shores of lakes in
secs. 7 & 8 - 65 - 6

Dolomite is found interbedded in the
sediments. It is seen cutting across
the cherty slate and graywacke.
The dolomite is markedly finer
grained near the contact than at
some distance from it.

Joints in slate on these lakes
strike $N10^{\circ}E$ and $N70^{\circ}E$.

^{hw}
28813

Specimen to show fine alternating
bands of slate and graywacke
strike $N80^{\circ}E$, dip $75^{\circ}N$

A few bands of conglomerate have been
seen in the sediments. They gave very
small exposures and appeared to be
merely local conglomerate associated
with the slate and graywackes.

Started from south shore
of lake Kakaguabic to run
south to determine northern
limit of gabbro. As near as
I could estimate started at
point about 400 paces east
of section line between sec. 4/3.

Large knob of bare rock runs out of
lake short distance to N.W. Compensatus
watch had stopped so took time by 10 E winter.

28814

Headland formed of a dark
green rough weathering con-
glomeratic rock. Consists of
coarse and fine fragments of
basic igneous rocks. Large hornblende
crystals - evidently secondary - are
prominent throughout rock.

Pebbles up to 6" in diameter.

Rock is apparently exactly same
kind as that on island just SE of
portage into Kakaguabic from Knife
lake. Only pebbles of varieties of granites
were found in the top.

sl?

28815

5305 paces from starting point
find small exposure of a fine grained
banded sediment. Strike N70°E, dip 65°N.

S.

15

T.

64

R.

7

28

25817

habbo.



habbo.

28

hab.

13

28816

S 860 W 25 of starting point.
Fine grained banded sedimentary
crops out here. Strike N 70° E, dip 50° NW.
We have just crossed a high hill
and find outcrops of above rock
on the south flank. The exposures
continue for one hundred and
fifty paces further and then end.
We now enter + travel over
peculiar country. It is almost
perfectly level but with probably
a very gentle rise to S. Heavy growth
of timber. Birch of large size is
surrounded by dense thickets of balsam
+ here + there are open glades covered
with hazel brush.

It looks to me as though gabbro
contact must be about at S 1200
of lake shore, where topography changes.

This flat country is probably
underlain by gabbro which on
account of easy weathering has
given good soil which covers
rock.

hab.

28817

S 3300 of starting point.

Here near hill top get outcrops of
rotten gabbro. Can't get fresh specimen.

After reaching gabbro -
which can be seen extending
to south in great low hills -
run 250 paces east and then
back north.

28818

28818

Locations now from S. end of traverse!
N 1895 from S. end of traverse.

Exposures of a fine to medium
grained rock begin here and
continue on to N. as shown
on plat. Banding can be
seen on some exposures. Strike
N 70° E, dip 80° N.

Are there possibly contact
planes of the gabbro?

28819-204

At place on road located
by these numbers I find a
massive green basic rock 28819
which includes and meta-
morphoses a sedimentary.
28820 represents a somewhat
finer grained phase of the
igneous rock and is that
part immediately next to the
sedimentary. 28821 is the contact
product of the sedimentary nearest

275202 P.M.?
Pembroke

5. mi. S. of

the enaphite. 28822 shows contact product and enaphite is same specimen. 28823 is a specimen showing phase of contact product farther away from the enaphite.

f.p.
28824

Farther south of that is in shore from this basic enaphite & its contact products I find graywacke and south of it reach a red feldspar porphyry. 28824. It trends N70°E and thus apparently follows the bedding planes of the rediments.

Can not tell thickness of either basic or acid enaphite or relations to each other.

The porphyry contains numerous small angular green chloritic or hornblende inclusions evidently derived from the chlorites through which it cuts.

This feldspar porphyry is but a phase of the granite which occurs on this lake. Connection between similar porphyry with the granite & gradation from one to the other can be seen.

28825-G¹ #16. 2nd
16. 2nd

16.

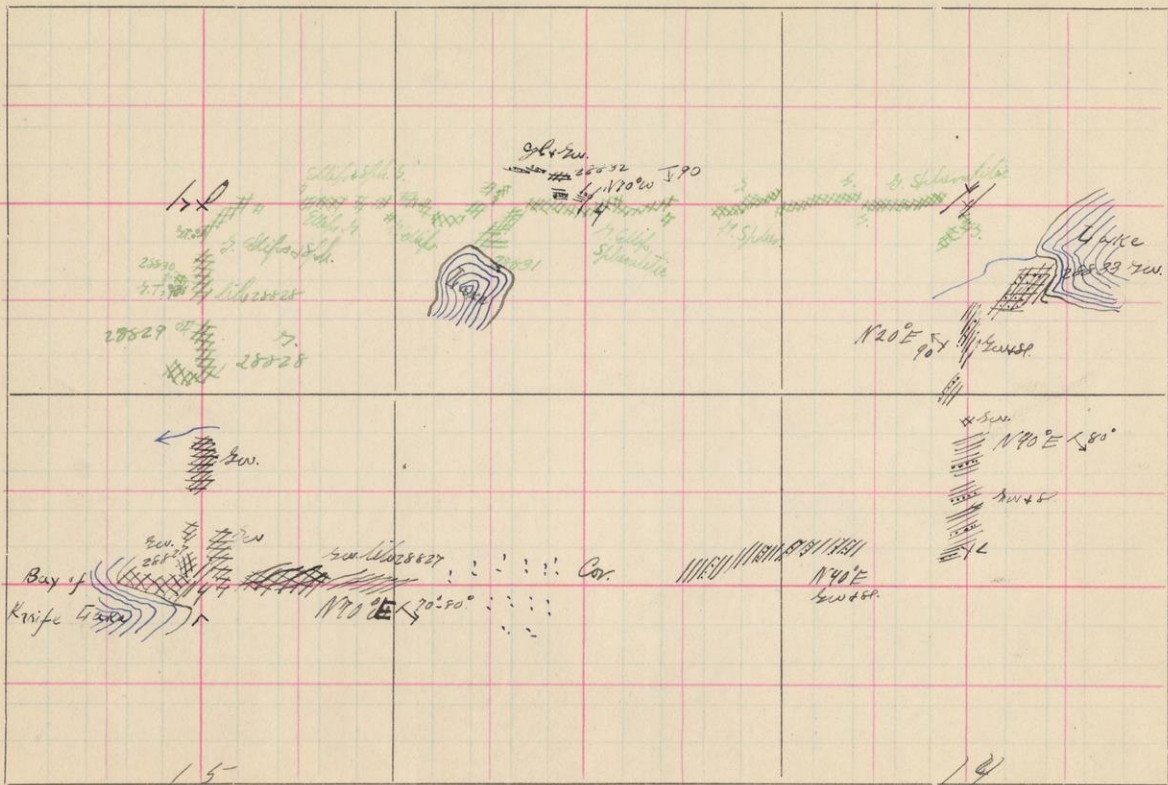
The normal slates and gneisses crop out on S.W. shore of this lake and predominate here in this ridge. However associated with them at this place I find a bed of green fragmental rock 28825 which seems to differ from the other clastics. This looks like a tuff or volcanic conglomerate. Fragments appear to be about all of one kind of gneiss. On N side of this exposed rock it is conglomeratic and grades to S. up into a finely banded fine grained rock 28826. This is followed by normal slates. Strike of slate is in general $N 70^{\circ} E$, dip $80^{\circ} N - 90^{\circ}$.

Is not this tuff practically identical with that on Kakaguabic?

If same then probably we have normal slates etc. with volcanic material tuffs & ash beds interbedded. Focus of eruption near Kakaguabic?

Farther East along lake shore find mass of this volcanic clastic, like 28825, about 20' wide, followed to south by slate & cherty slate 10' wide

S. 10/11 T. 65 R. 6



0-747

followed by rock like 28826 15' wide
and this succeeded by slates.

Largest fragments seen in
28825 were about $\frac{3}{4}$ " in diameter.

Farther NE along shore this
volcanic rock was not seen.
Only slates occurred, striking
N45°E and dipping 80°N.

SW1

28827 N 60 W 1075 Sec. 10-65-6

Start from S. $\frac{1}{4}$ P. Sec. 10, near E
end Knife lake and run north.
Hills near $\frac{1}{4}$ P. and lake are composed
of a feldspathic quartzite some
pieces of which are very dense
fine grained 28827 and resemble
somewhat an acid eruptive.

h.

28828 N 550 W 1000 Sec. 10-65-6

Flare crops out here on E side of
ridge trending about N70°E. a broken
and sheared gneissic eruptive.

h.c

28829 N 720 W 1050 Sec. 10-65-6

Going to N. of and in contact with a
rock like 28828 I find at this place
a conglomeratic (tuff) rock. There is

but a patch 8' x 20' exposed.
It is very rotten so much so that
I can't get good specimen.
Pebbles all seem to be of similar
character as matrix. Fragments reach
3" in long diameter. Some angular
others more or less rounded.

B. Sp.
28830

N 800 W 1075 Sec. 10-65-6

A spherulitic gneiss occurs
here followed to west by tuff
like 28829. To E. occurs more
gneiss. This shows in places
ellipsoidal fracturing and is also in
places spherulitic (variolitic).
Gneiss has been sheared. Usually
each ellipsoid is traversed by one or more
systems of cracks and when such a
rock is sheared there is produced
that which in surface exposures
looks like & is in fact a typical
reibungs breccia. Remnants of the
variolitic (spherulitic) borders of the
ellipsoids which are at times found
among the fragments in such a
breccia enables the discrimination
to be made between such a breccia & a tuff.

In the spaces between ellipsoids & in cracks in the rock I find infiltrated black & ^{volcanic} grey chert & vein quartz.

In places the matrix between ellipsoids is green schistose material in general of same ^{general} character as ellipsoids. At places the matrix is very ferruginous as can be seen on the thick weathering crust.

S. 91
Dobson

28831 N 100° W 300 Sec. 10-65-6
Angular ^{fragments} Exposure of massive rock showing no structure. Greenstone?

NW 4C

28832 N 100° W 8 Sec. 10-65-6

Exposure of graywacke 28832 and conglomerate. Strike of long direction of pebbles - can't get bedding more accurately - is N 70° W.

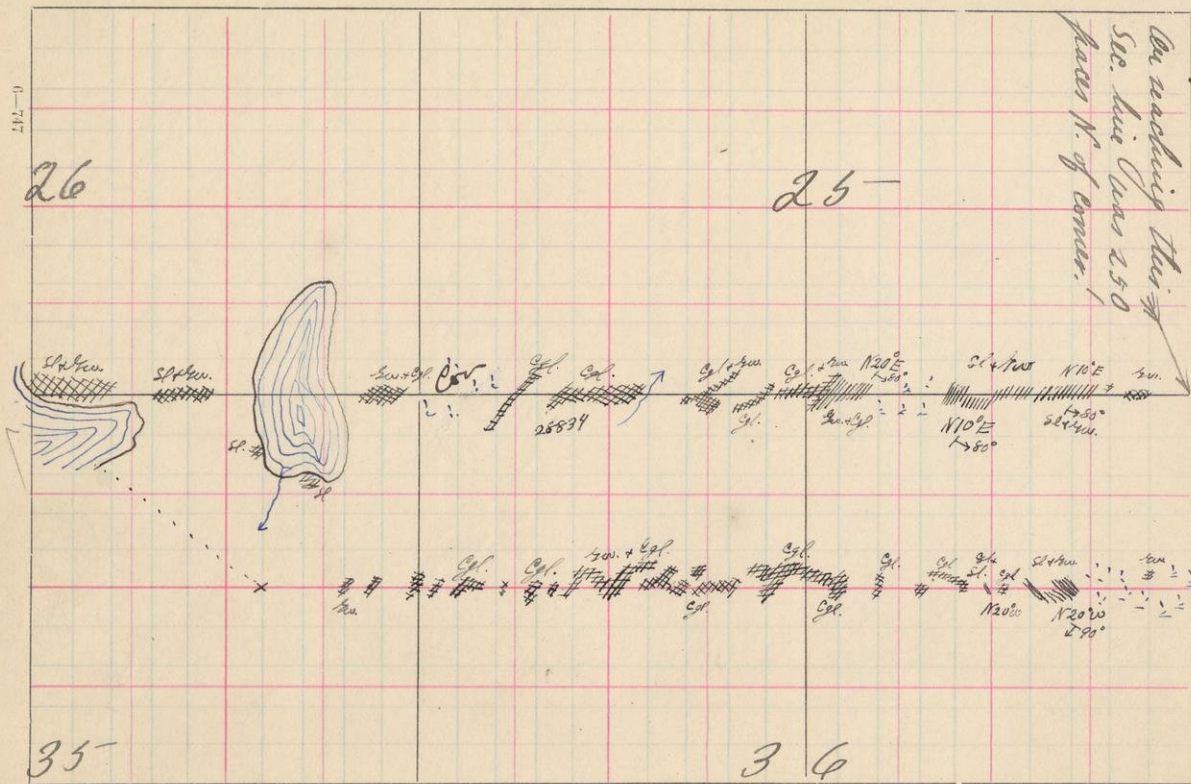
Conglomerate consists of large quantities of pebbles of dark grey and white chert, pebbles of slate and white weathering granite and granite porphyry with large quartz phenocrysts and also fragments of banded ~~white~~ white and grey chert & cherty slate. Largest pebbles 1' in diameter are of

26/25
S. 25/36 T.

R.
1009.

2

On reaching this
S.E. line was 250
feet N. of corner.



granite porphyry. Chert pebbles are most numerous kind.

(H) run
25833

N 800 W 200 Sec. 11-65-6.

Here there is a large hill of massive graywacke with numerous small specks of brilliant red gasper scattered through it.

Grades up to SW into normal Knife Lake slates and graywackes striking N 20° E, dipping 90°.

Started from W.C. on section line between $\frac{24}{35}$ -66-6 and ran E. E 1225' faces came to exposure of a coarse conglomerate consisting here almost exclusively of white weathering granite and granite porphyry. Here and there I see a greenstone boulder. Matrix is greenish. Granite porphyry has large phenocrysts of quartz and looks like so-called Saganaga granite.

C
26834

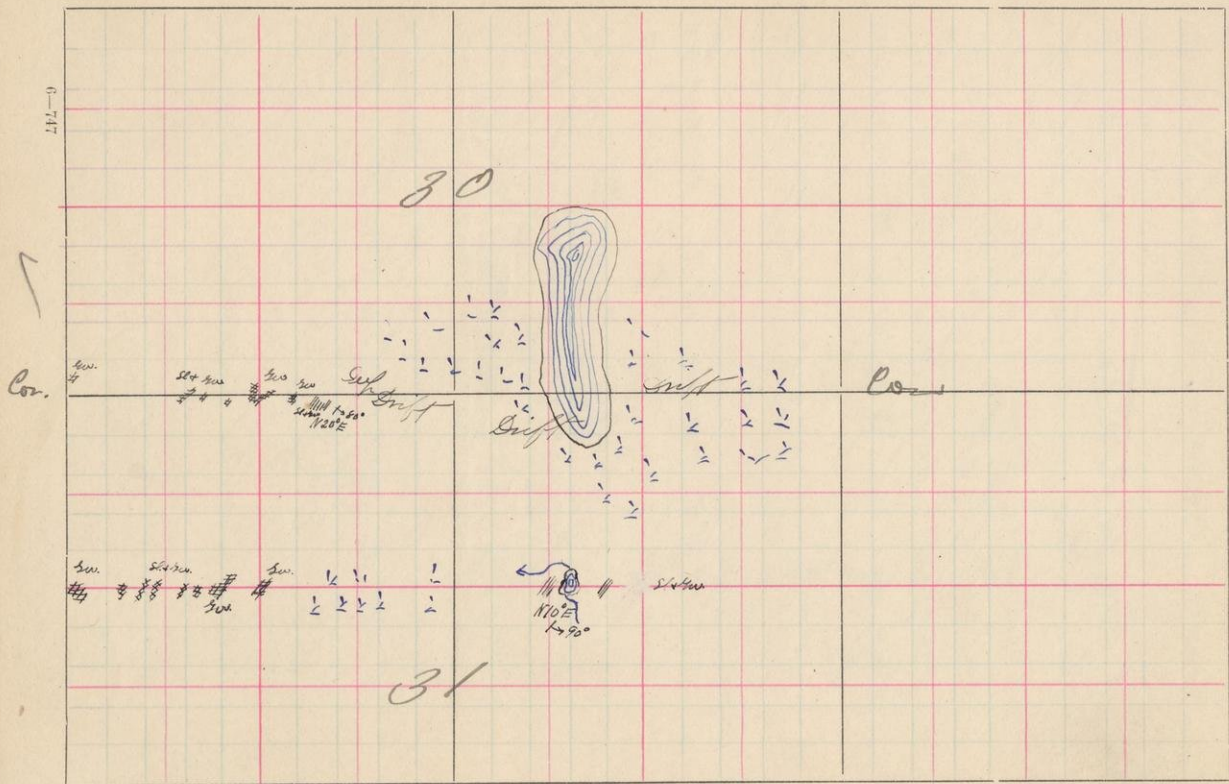
NOE 1340 starting point.

Specimen from granite boulder in the conglomerate. No slate or gasper

S. $\frac{30}{31}$

T. 66

R. 6-



fragments have thus far been seen.

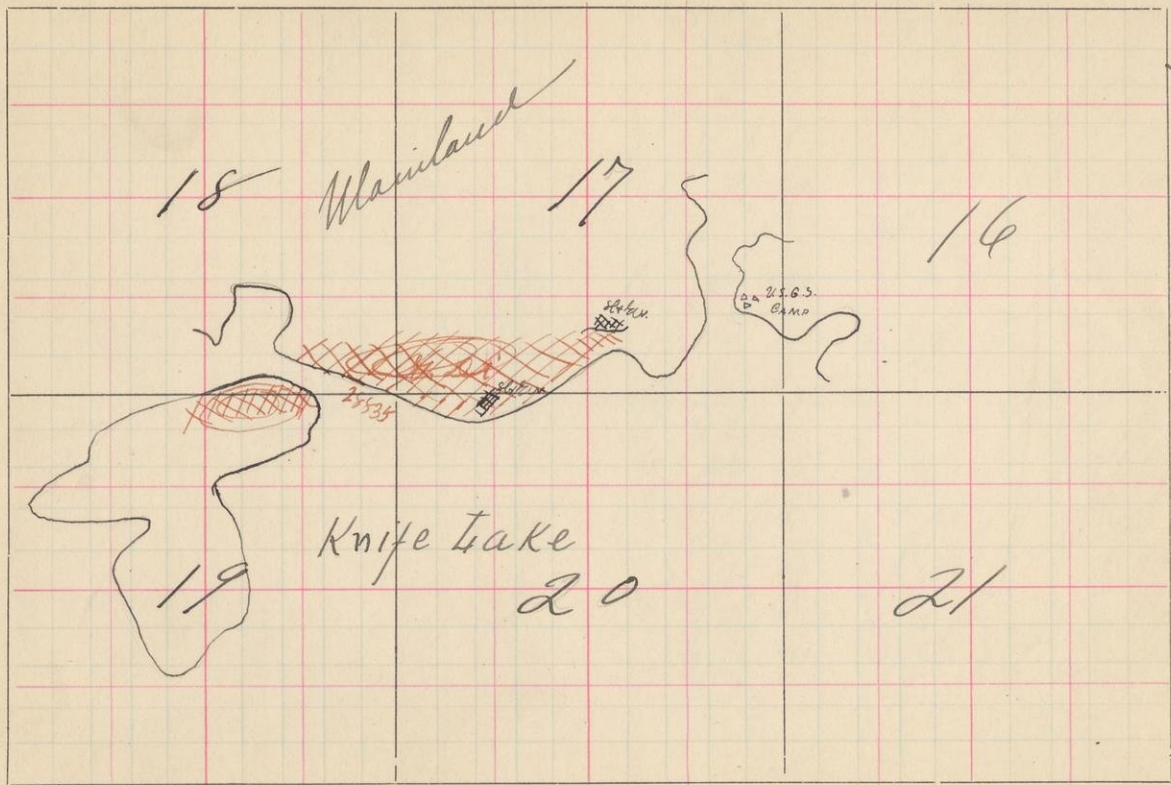
Pebbles of coarse and fine gneiss occur with the granite pebbles.

Many boulders in conglomerate 3' in diameter. All are well rounded.

Cliff shows a fragment of a fine grained gneiss and some of matrix of conglomerate.

In the W 1/2 of sec. $\frac{30}{31}$ find some low rounded exposures of slate and graywacke and then the drift comes in and conceals everything.

S. 18/17 T. 65 R. 6



K. 21
28835-

L.R.

Examined shore as indicated on flat and also went several hundred paces inland. A coarse dolomite forms the ridge and most of exposures on shore with however a few small patches of slates still left on south side of hill.

At place indicated by specimen number there was observed what was taken to be a narrow dyke 10" wide and visible for about 12' cutting the dolomite. It may perhaps be an inclusion in the dolomite.

Dolomite mass trends a little N of East agreeing in general with strike of rediments. It is probably a big sill intruded parallel to the beds.

C₂

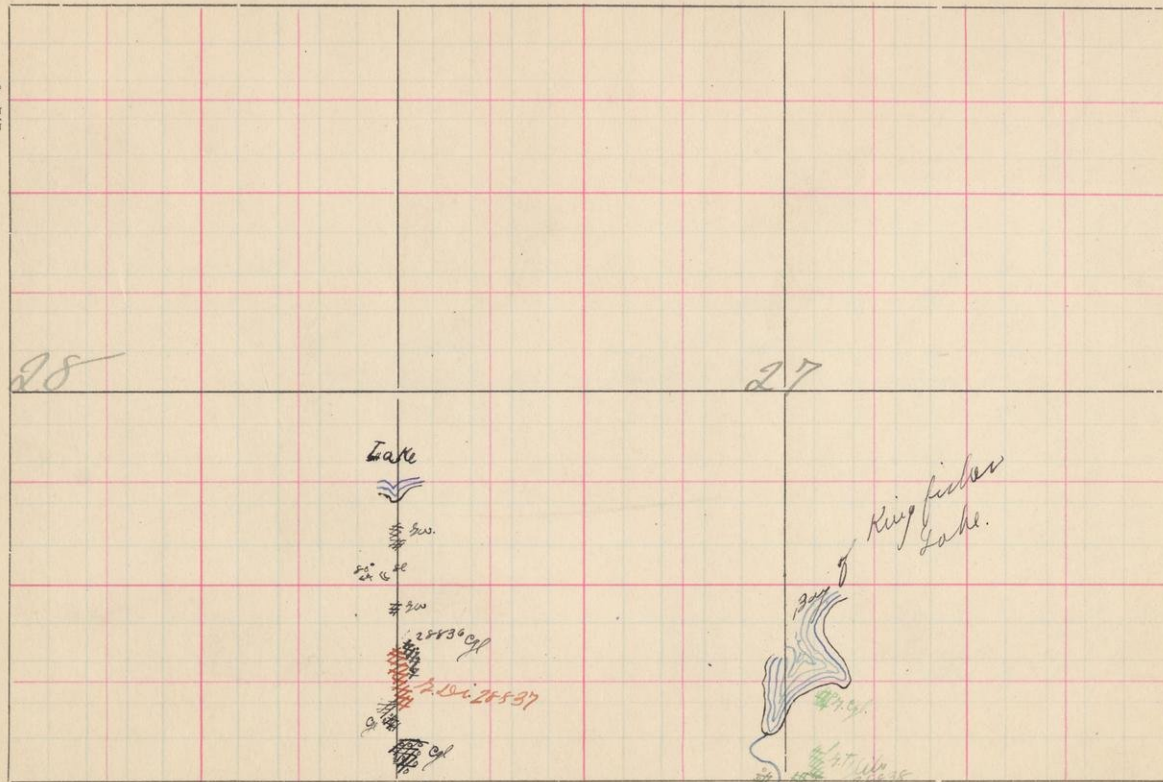
Started at N $\frac{1}{4}$ P sec. 15-65-6
and ran S $\frac{1}{2}$ mile then W. $\frac{1}{2}$ mile.
Conglomerates and graywackes
crop out in area traversed
and in one place a massive
dyke of dolerite is seen & have
been intruded parallel to beds.

✓

Cor.

9. S 25° 21' T. 65-
R. 6
Cor.

6-717



21

2

Started at M.C. on lake shore and ran south.

S188 from lake shore

There is to be seen here a slight bow in the slate. This bends around to NE and S.E. Strike of axis NW. Plunges ~~to~~ NW at angle of 80° .

C

28836

S300 E 20 from starting point.

Rather fine grained conglomerate. Pebbles most numerous are white weathering cherty slate & graywacke and bright red gneiss. Coarse dolomite lies in contact with the conglomerate on the west and is evidently a dyke in the clastics.

Corner planes of conglomerate seen little farther south show large pebbles of coarse granite and gneiss.

on dyke

28837

S600 E 40

Dolomite from dyke forty paces wide in the clastics. Dyke grows noticeably finer on edge than in middle.

28838 S1500 from starting point.

We have been flanking over conglomerate of normal kind but here we come to a conglomerate the pebbles of which seem to be all of greenstone. The matrix is very hornblende. Resembles in my opinion the tuffs on Kaskagwabic and also 28814 from among Knife Lake redunits.

28839

S2435 W 0 starting point.

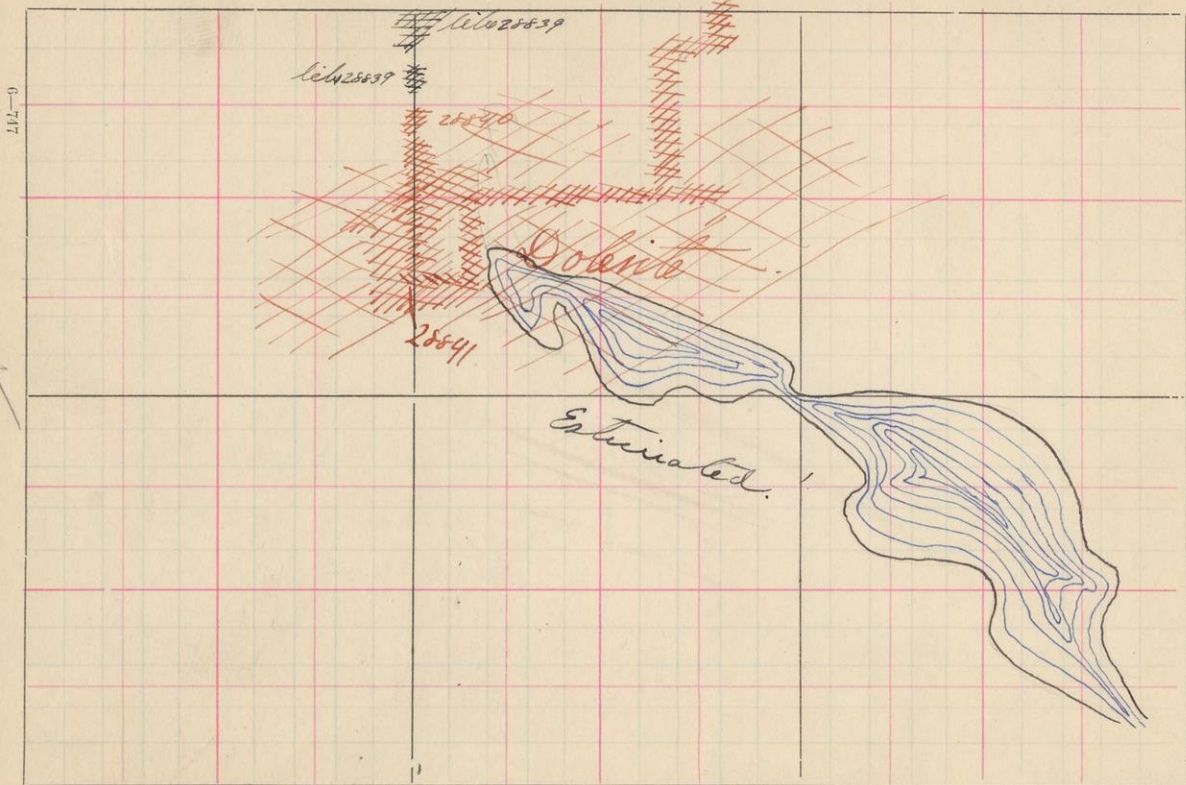
Here in contact with conglomerate is a dense angular breaking white weathering cherty rock (slate). Line of contact of conglomerate and 28839 is about E-W.

28840

S2980 W 0 from starting point.

Here begins exposure of dense bluish green rock 28840. This is evidently a peripheral phase of diabase boss for as I go farther S. it passes over into ophiitic textured diabase which becomes still coarser as I go higher up hill.

S. ³491 T. 64 R. 6



9.51
28841

S3040 W0 from starting point.
Specimen of coarse orthitic dolomite
from near highest point on
hill. This dolomite keeps on for
considerable distance to S.

28842

Ran S. in all 3400 paces. This
is supposed to have carried me about
700 paces into T¹ 64-R. 6. Then ran
E. 1600 paces and then N.

Locations are given from S. end of Brown.

9.55
Met. 21. H. 100
22m

28842-3

N 987 E 1000

The dolomite, forming a great E-W
range extending for several miles,
has been growing finer and
finer grained as we approach its
northern edge. It also becomes
somewhat schistose and at location
I find in the schistose quartzite
stringers and lenticular masses
of Cherty material. This area in
which green schist & chert are asso-
ciated is about twenty five paces wide.
Then comes mass in which cherty material
predominate & only here and there the
coarse hornblende-chlorite stringers

occur. This cherty material 28842 continues out to N. as shown on map. Contact between the greenstone and chert - is this same as 28839 which it closely resembles? - Strikes $N 60^{\circ} E$, dips 20° . Spec. 28843 shows some of the green chloritic material.

sl

28844

N 10 90 from E 1000

Interbedded slate like 28839 and graywacke 28844 seen in exposure at this place. Strike $N 30^{\circ} E$, dip $80^{\circ} S$. Bands more or less contorted. Above strike is general.

Starting on lake shore ran W.
on section his passing over
graywackes, slates & conglomerates.
At corner turned N. Continuing
of various sedimentaries as shown
on map. General strike NE-SW.

On return run through
this section $\frac{1}{2}$ mile east of
North run exposures were not
so good and could not get strike
very frequently. However could
recognize certain of the sed-
iments and connect them with
their equivalents to the west.

28845-6

N 500 W 1970 Sec. 15-65-6.

29.

Bold knob of quartzite which when weathered seems to be feldspathic 28845.

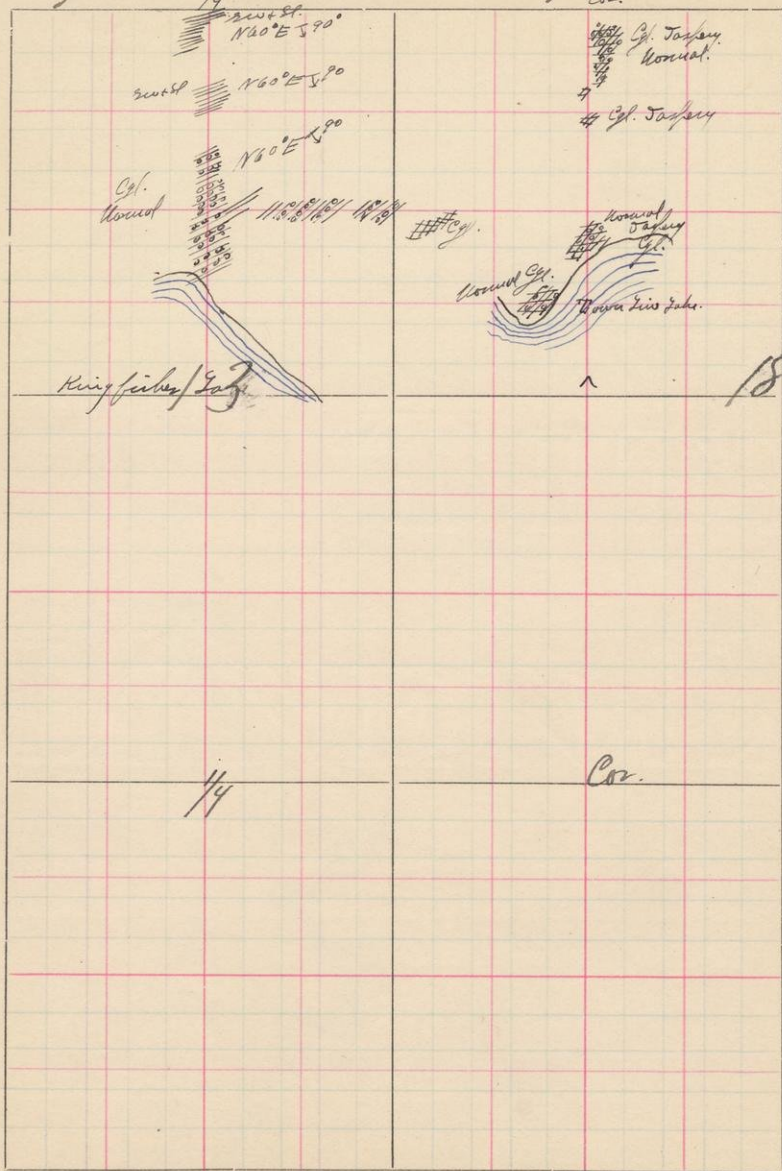
In places I find a conglomeratic phase 28846 in which the pebbles appear to be very similar to the quartzite though some seem to have quartz phenocrysts in them and may be quartz porphyry.

This seems to be almost identical in appearance with that represented by 28827 which occurs $\frac{3}{4}$ mile due north of here.

The fragments in conglomerate are fine or small rarely larger than 1" in diameter. Could this be a reibungs breccia from the quartzite?

S. 13/18 T. 65

R. 6/5
Cor.

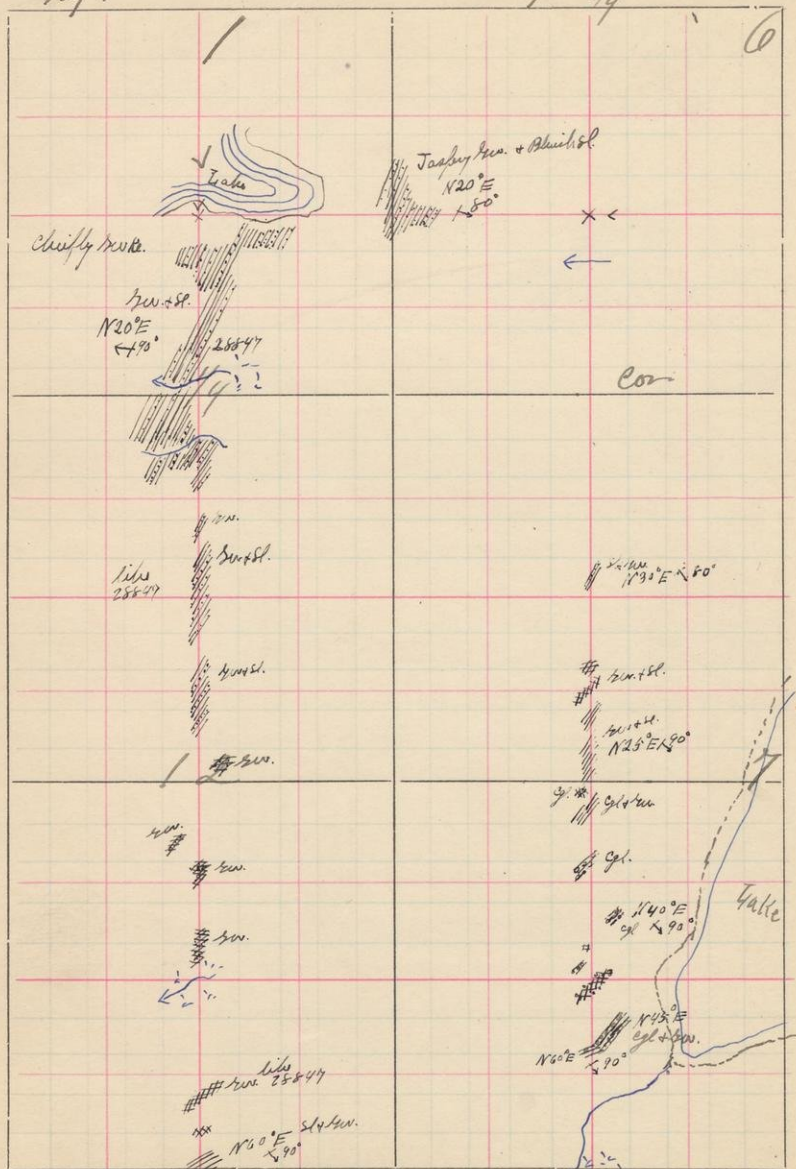


S. $\frac{116}{127}$

T. 65-

R. 6/5 $\frac{1}{4}$

28



6-747

14

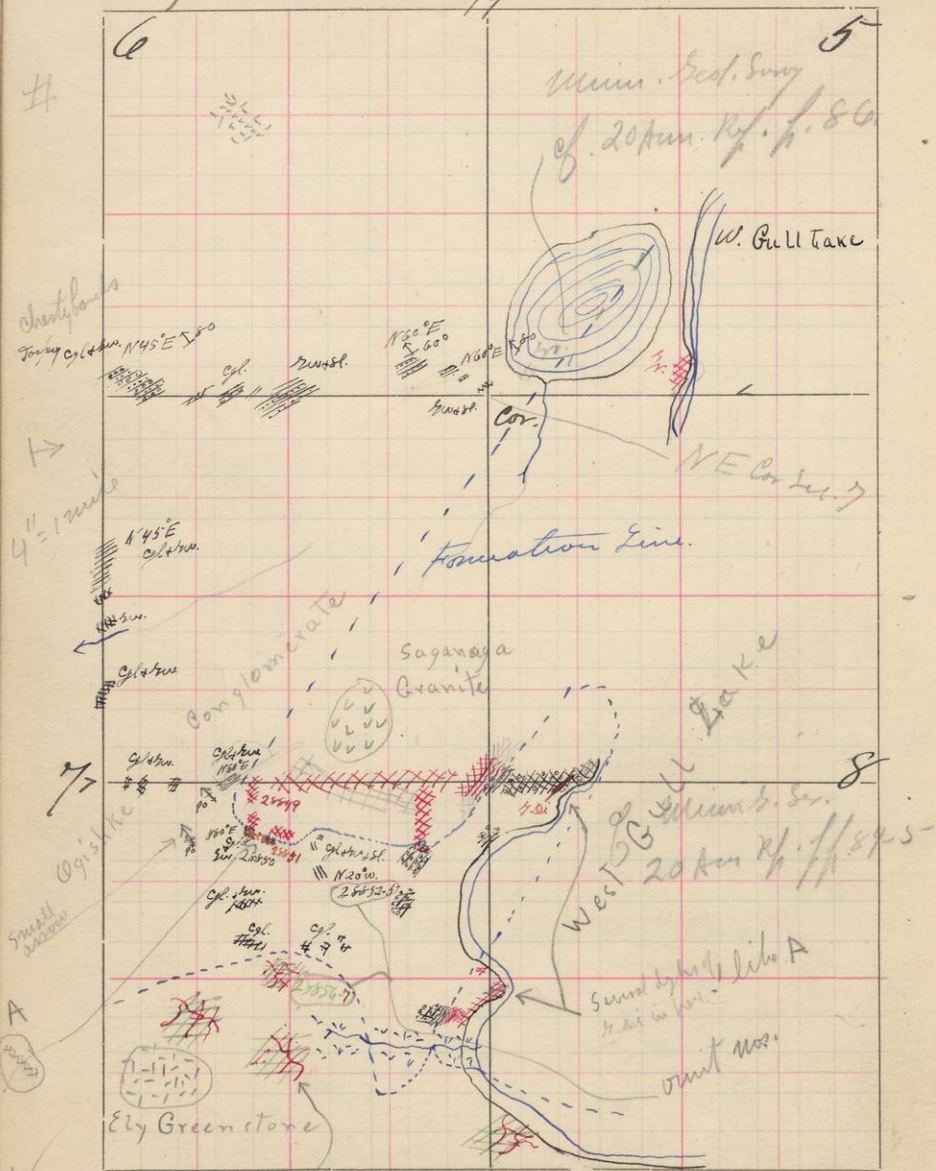
28847

N 150 W 1050 Sec. 1-65-6.

Specimen of graywacke. It occurs
in this vicinity in the large
clean exposures.

S. 6/5 T. 65 1/4 R. 5

28



6-747

Put red in with Sag. Granite symbol Cor. of Sec. 7

28

28848 N1000 W 600 SE. Cor. Sec. 7-65-5

Start at W.C. of Sec. line ⁵⁻⁶⁵⁻⁵ and run W. On shore just ^{to} N of W.C. there is a knob of granit. Going W. we then travel over typical drift country to corner. Just NE of corner there is exposure of graywacke and slate and some conglomerate. Similar exposures keep on to ^{1/4} ~~corner~~ ^{foot} of section. Strike is $N45^{\circ}-60^{\circ}E$, dip $60^{\circ}-80^{\circ}NW$.

Some sedimentaries with the conglomeratic phases predominating however are found along N-S $1/4$ line and E-W $1/4$ line also for some distance as shown on plat. Near the center of Sec. 7 it was not possible to get accurate strikes.

Running E from Center Sec. 7 I reach, just after leaving exposure of graywacke and conglomerate, an outcrop of massive granit similar to that on W. Gull lake. This is cut by narrow aplitic dykes. 28848.

28849 501 N900 W 600 Sec. 7-65-5-

Run south from point where 28848

See
geology
P
all
C
Tuff

was obtained purpose being to
 delineate contact of granite and
 sedimentaries and determine
 relations. Reach at N90°W 600
 a place where the true massive
 granite seems to merge into
 a recomposed rock (arkose) with
 minute fragments of gneiss.
 28849. This recomposed rock
 appears to be only in patches on
 the granite. The exposure is not
 good only about 2' wide. Next to this
 recomposed rock, that is S. of it, there
 is found a basic eruptive dyke ²⁸⁸⁵¹
 about 25' wide trending little S of E.
 This seems to have been intruded
 along the plane of contact of the
 granite with the sedimentary
 rock. South of the dyke I find
 exposure of normal sedimentaries
 graywacke & conglomerate 28850.

iii. porphyrite

Aug. 2nd (Sat)

Now ran south following a
 zigzag course and found
 the continuation of granite 288
 SW. cut off by sedimentaries.
 Granite has been reported from

this vicinity as occurring
interbedded with the elastic
of. *Umicerota ballatus* Sed. Sney.

28852-5

At N 78° W 470 Sec. 7-65-5
there is a good exposure on
which without considerable
care one might consider
such relationship to exist.

Then crops out here a series of
unquestioned slates and gray-
wackes and ^{gabbro + gneiss} conglomerates.

Strike of beds N 20° W, dip 80° E to 90°.

Interbedded with the slates
and conglomerates there are
beds which are strikingly like
the granite of W. Gull Lake.

28852 is a specimen of such a
land and it may be that some
of them are very narrow unfolded
granite ridges. In two places
the slates next such a ridge
was noticed to have a ~~foliation~~
which cut across the bed, N 20° E.

Other of the granites
appearing beds, and these are
by far the more numerous, are
somewhat more greenish

colored, chloritic 28853, than
the granite and some of
them include pebbles of
unquestioned granite.

Mr. 28853 Chip shows much a pebble and
matrix. Could not get good hand spec-
imen. These granite looking
boulders are probably consolidated
beds of arkose, in strict sense.
In some cases these coarse arkoses
grade into fine sands as can
be seen in spec. 28854-5-

arkose

Mr. 28856-7

N 600 W 500 Sec. 7-65-5-

Lying to S. of sedimentaries I
find a fine grained greenstone
which is cut by numerous
ramifying dykes of granite from
fraction of inch up to 2' wide.

This greenstone continues on
to the south in large exposures.
Farther S. the granite dykes are
not so conspicuous.

Sedimentaries lie off to the
west of the greenstone.

Going east I leave greenstone
and find mantling around

its NE & E. slope a conglomerate with gneiss & greenstone & granite pebbles. Cross this belt and reach granite on shore of W. Gull lake.

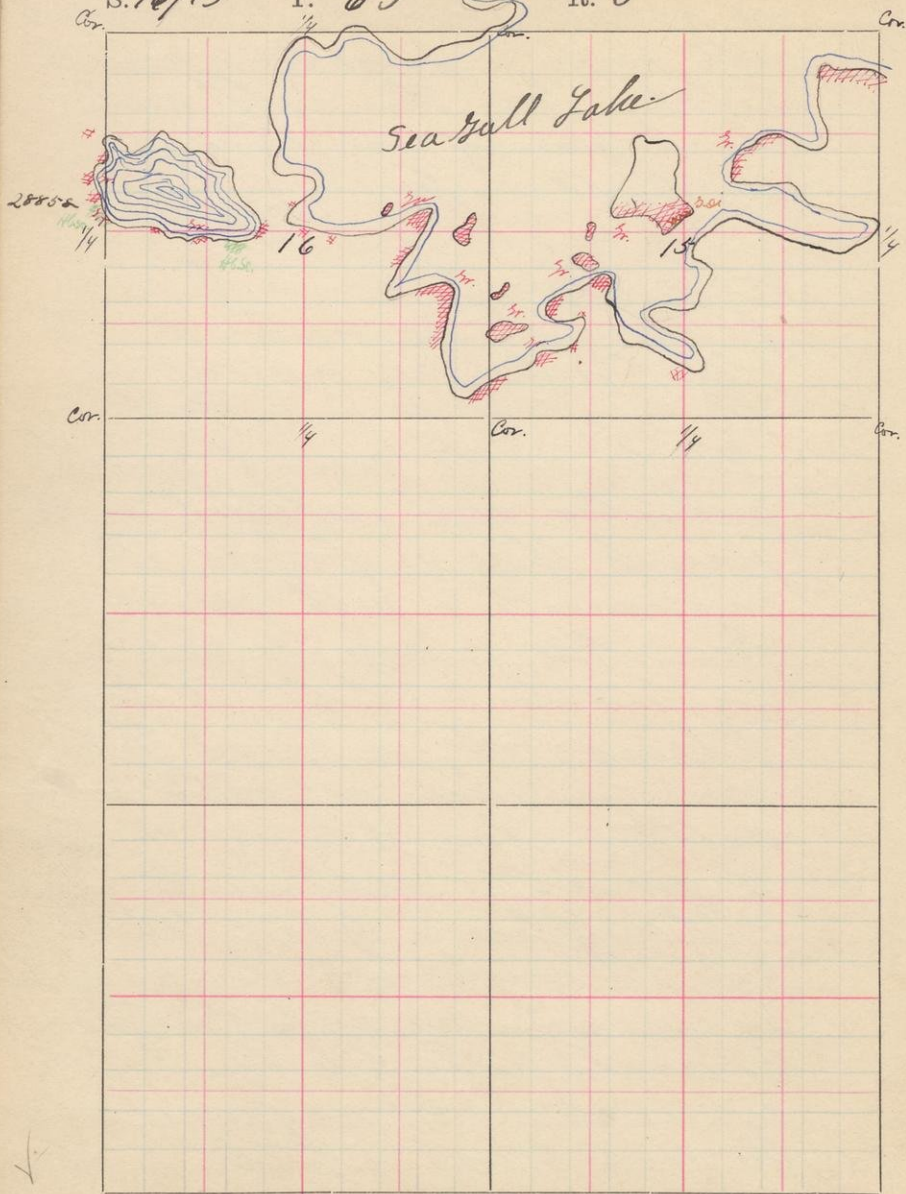
The relations of the various rocks seem to me to be as follows. The greenstones are the oldest rocks. They are cut by the west Gull granite.

Overlying the granite and greenstone and refolded in the granite there is found the conglomerates - with granite and greenstones among its pebbles - gneisses & slates. A dyke of basic rock is found to be younger than all other rocks, cutting along plane of contact of granite & sediment.

At one place a dyke of dolomite cuts the conglomerate. No acid dykes are seen near here in the clastics such as would certainly be found if the sediments had been formed when the granite was intruded into the greenstones.

Sea Gull Lake

S. 16/15 T. 65 R. 6



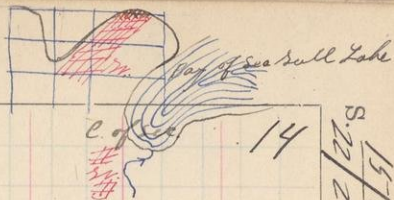
Went from W. Gull lake
by portage into small lake en route
to Sea Gull lake. From W. Gull
across to small lake exposures
of granite are seen. Then continue
S. along W. shore of small lake for
some distance. On SW. shore of
lake there is a bold bluff
consisting chiefly of a fairly
massive hornblende rock which
varies in texture from fine to coarse.
This is cut by and included in
a fine to coarse grained white
weathering granite which in its
coarse phase is similar to
granite north along shore + on
portage. Specimen shows granite
and hornblende rock.

This same hornblende rock
cut by granite dykes occurs on
south shore of small lake around
to E. side when granite begins +
continues around north shore.

Granite is found on shore of
Sea Gull lake as shown on plat.
Land survey outline of lake shore is
very incorrect.

H. 50.

28858



15/14
8.22/23

T.

65

R.

6

C. of Sec. 15

14



14

100%

100%



2855' Field. P. to P.

2000' Field. P. to P.

22

C. of Sec. Lake

Field. P. to P. 2855' and top?

Cor.

14



Field. P.

Field. P.

2855'

C. of Sec.

23

28

28

Start on Sea Gull lake
about at N-S $\frac{1}{4}$ line of Sec. 15-65-5
Granite occurs on and near
shore. Run South over granite
for 300 paces and then connect
at $\frac{1}{4}$ post. About 125 paces S. of
 $\frac{1}{4}$ P the granite ceases and then
comes hornblende schist like
28858 cut by dykes of granite.
Schistosity of schist strikes N60°W.

F. P.
28859

N1530 W1000 Sec. 22-65-5

Continue over green hornblende
schists. Here there are cliffs of
porphyry overlooking small lake.

H. F. P.
28860

N1475 W1000 Sec. 22-65-5

Forming a small knoll at E.
end of small lake and in a
narrow valley with green schist to
N+S. there is a granite porphyry
which appears to be but a coarse
phase of 28859 and resembles
some pebbles seen in conglomerates
in sedimentary rocks west of here.

c

28861

N 1015 W 990 Sec. 22-65-5-

Specimen of a green amphibole schist on N. shore of lake.

tuff c

28862

N 1020 W 970 Sec. 22-65-5-

Just on and for a short distance to the north of the lake shore I find hornblende (amphibole) schist.

At this location I find a mass of rough weathering fragmental looking white rock 28862. Trend is slightly S of E. It is about 20 paces N-S. To N. of this lies a porphyry like 28859. May not 28862 be acid volcanic, surface of flow or tuff?

ca.

28863

N 1000 W 700 Sec. 22-65-5-

At this place the surface of the green hornblende rock to south of 28862 weathers so as to look like a fragmental. Specimens shows matrix in cracks between the fragments. In this case fragments are of same kind of rock. In ledge fragments appear to be of two kinds, coarse and fine grained gneiss.

Q.R.

41

28864

M.F.Q.P.

N 146 W 1000 Sec. 23-65-5-

Ledges of a handsome porphyry appear here. As go N. find the porphyry intrudes and includes the green hornblende (amphibol) schists.

Finally pass the amphibol schists and the granite hills then on Sea Gull lake begins and keeps on to lake shore.

On lake notes at two places dykes of dolerite in the granite. Cf. plat for location of dykes.

S.D.

28865

N 1000 W 1960 SE Cor. Sec. 8-65-5-

Dyke of dolerite is seen here in the conglomerate. It trends NE.

This is the continuation of N-S sec. line between 33-34 T. 65-26

Could get no
location in this
township.!!!

Topographical form
probably developed by
glacial debris from a
high ridge.

2000 fms S. of town line.

Went in west of
 Gobberichogomok into Secs.
 4 & 5 to try and trace out
 boundaries of coarse dolerite dyke,
 sedimentaries lying to S. of it and
 the gabbro which lies still farther
 south. Went in by canoe as
 far as could then not having
 been able to find any connection
 started of for point where ended
 one of my former runs & beginning
 there zigzagged along boundary
 between dolerite & sedimentary
 then back across gabbro.

no.
 M.S. in
 M.S. in
 28866

N 800 W 800 Sec. 3-64-6

Exposure of gneiss or quartzite
 which continues to N for couple
 of hundred feet.

sl
 M.S. in
 M.S. in

28867

N 750 W 250 Sec. 4-64-6

Exposure of banded cherty slate
 somewhat similar to 28839.

Bands are much contorted and can
 get no strike here.

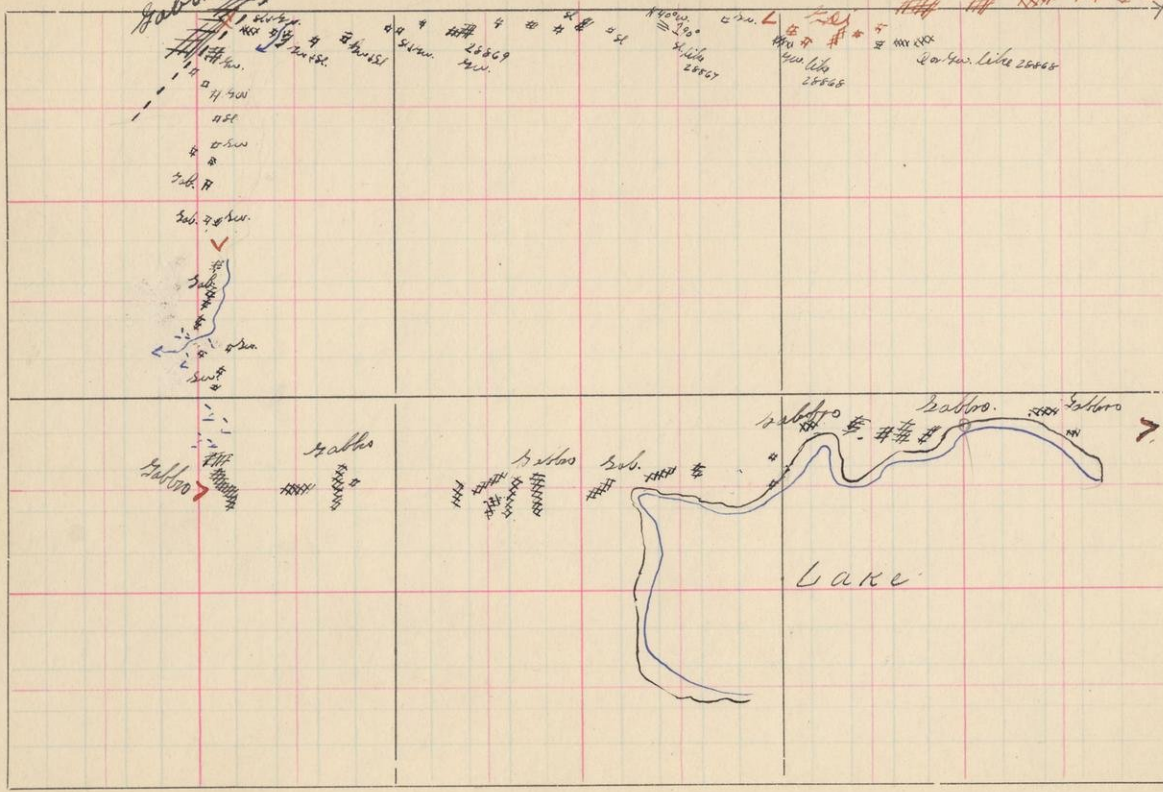
Antelope further west gives strike
 approximately NW-SE.

6-747

from new gate

28870
Babro

2000 paces
5. of town line!
S. Di.
S. Di.



T.

F.

2

28

28

28

Ziczag along dolomite a
sedimentary contact as shown
on plat.

Qu. 50.
M. 50.

28868

N 150 W 1680 Sec. 4-64-6
Here the sediment seems to be
almost a quartzite.

C
cf. 42. pebbles

28869

N 1950 W 1550 Sec. 8-64-6
Clastics show here a conglomeratic
phase with pebbles of a granite(?)
as in specimen. Exposures are very poor.

gab.

28870

N 1950 W 100 Sec. 7-64-6
After passing over outcrops of
slate and quartzite like 28867-8
I reach at this location massive
gabbro. High hills to N. probably
formed by gabbro.

Now run south. For a short
distance pass over exposures
of quartzite. Then quartzite
exposures show gabbro in
them and finally reach
massive gabbro. Either
sediments are cut by gabbro

44

or else I have taken a facies
lower facies of galbrs for sedimentary
rock.

After getting well into
galbrs turned east and
followed in as indicated on
plat. Exposures chiefly of
main galbrs. Near end
of run get far enough
N. to again touch the
narrow clastic belt which
lies between the galbrs and
dolerite in this vicinity.

More detailed work should
be done here to determine
accurately limits and
relations of dolerite. Especially
at W. & E. end of the dolerite
ridge.!!

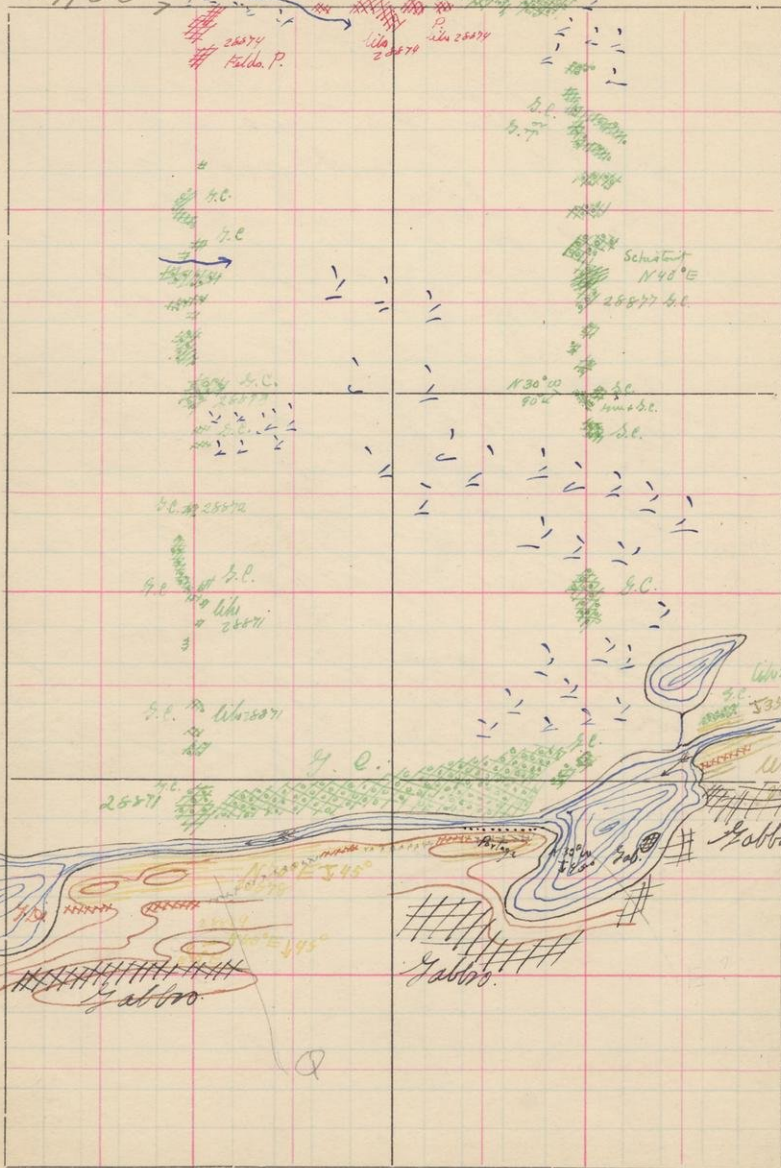
S. 27/26
34/35

T.

65

R.

5



C
28871 N1880 W 0 Sec. 34-65-5-

On north bank of river there rises a hill of rock which weathers with rough pebbly surface and is represented by 28871. This shows fresh surface. This is a much metamorphosed greenstone conglomerate or tuff similar to that seen south of Kingfisher Lake.

Pass over exposures of this same tuff as I go north. Upon many of these the conglomeratic character is even plainer than on those nearer river. Rounded character of pebbles is well shown. Pebbles resemble the hornblende matrix but are evidently not same as they are more resistant and project on the weathered surface. Can not determine lithological character of the pebbles.

C
28872 N720 W 0 Sec. 27-65-5-

Ledge of very distinct greenstone conglomerate. Conglomeratic character is plain on weathered surface

it is practically impossible to get hand specimen showing the elastic character. Pebbles all of greenstone with ^{secondary (?)} new? hornblende crystals as a prominent constituent. Does not differ materially from 28871

fb.
C
sd. for Cpl.

28873

N 1975-W 1950 Sec. 26-65-5-

Chips of pebbles in greenstone conglomerate. Large piece shows part of pebble with some matrix. In some dense greenstone pebbles here hornblende phenocrysts 1" long were seen.

F.P.

28874

N 1975-W 0 Sec. 27-65-5-

Top of hill occupied by exposures of a fairly fresh feldspar porphyry. Compare with 28869

b1

28875

N 0 W 1350 Sec. 26-65-5-

Here and there associated with the feldspar porphyry 28874 but not in such position that relations can be determined. I find a dense green rock 28876.

C
28876

N10 W 1280 Sec. 26-65-5-

Here I come to exposure on which I can see that debris rock 28875 is but a facies of the much metamorphosed greenstone fragmental series. 28876 is a specimen.

C
tuff ore
28877

N1250 W 1000 Sec. 26-65-5-

Specimen shows fine tuff and a small pebble looking like a purple quartzite. Purple fragments quite common in the tuff at this place.

am. g.
#0.
28878

N1800 W 0 Sec. 34-65-5-

On south bank of river just across from the greenstone conglomerate I find a very different rock exposed. The ridge is composed of a banded coarse + fine quartzite which is quite strongly impregnated with magnetite. In fact some thin bands consist almost wholly of magnetite. Although this is such a distinct banding to the rock it nevertheless does not look exactly like a true quartzite but more like

sed. met. by
gold ore or det.

vein quartz. Possibly it may be quartzite recrystallized by gabbro contact.

South of the quartzite there is exposed a mass of dolomite. Strike of quartzite is $N 70^{\circ} E$, dip $45^{\circ} S$. No dolomite seems to be interbedded with the quartzite. If so then the thickness is not 50 fathoms as that is surface exposure.

To south of the quartzite and dolomite a high ridge of coarse gabbro is found.

From section line on river run west to where quartzite is cut off by water then S. across quartzite and dolomite to gabbro. Now run east along gabbro to section line and then N.

am.
Olivine rock

28879

N 1645 W 0 sec. 34-65-5-

At this place then crops out banded green quartzite and magmatic. This quartz has also been deposited here in band parallel to the quartzite bands. Strike of beds varies on account of plications in them.

It looks as though we

are here near the W. end of
a syncline plunging D S of E.
and overlain by gabbro - or
cut through by gabbro.

This structure is shown on
flat by variation in strike
from $\text{N } 40^{\circ} \text{ E}$ on west end of
outcrop to $\text{N } 80^{\circ} \text{ E}$ dip 45° S on
N. side of exposure = N. limb
of syncline.

This North limb of syncline
is traced to E. for long distance
and overlies the gneiss
conglomerates to N.

Just N. of 28879 on section line
between 34/35 there occurs an
exposure of dolomite ^(sp. 28879) followed to
N. by quartzite, both with dip
of about 45° S.

Am

28880-1-2

Several miles east in Sec. 28-65-4
(cf. Gith's notes for exact location),
a mine has been opened, Paulsons
Mines, in this banded ore and
quartzite. 28880 is a specimen
of the ore. It is reported to contain
a high percentage of nickel.

2

Spec. 28881 is of ore and quartzite.
 Its Spec. 28882 is a part of a
^{rock} gneiss from mine. It is
 found in fragments as described.
 To judge from appearance of these
 fragments it is interbedded with
 quartzite & occurs also in the vein
 quartz.

28883

Muscovado.

N 1400 W 0 Sec. 29-65-4.

Alley lake is incorrectly located
 on land office plat. Known
 as Club lake by homesteaders.

On north side of road flanking
 this lake there occur exposures of
 a micaceous dolomite. Shows no
 structure or relations. As we go
 north this rock appears to continue.

Here and there it is coarser and
 in places rock looks like hornblende
 schists.

M.

28884

N 1250 W 500 Sec. 20-65-4

Grey granite (weather pink)
 succeeds the hornblende rocks.

This granite is same as that on
 W. Bull & Sea Bull lakes. Relations of

S. 29

T.

65

R.

4

Wesley Lake
Iron Rocks.

Robust

29

Gabbro

Gabbro

28

a

Seph. L.
of the m.

28

Gabbro
a

granite and hornblende schist
not exposed here.

N 1500 W 1200 Sec. 20-65-4

Here green hornblende schist is
cut by granite. Strike schistosity
N 70° W dip 90°.

N 1075 W 1500 Sec. 29-65-4.

North side of ferruginous sediments.
like 28878-9. Strike N 70° W, dip 45°.

28885-67 N 1250 W 520 Sec. 29-65-4

West end of railroad from
Port Arthur. Here in the
cut the rock of ridge north
of Akaby Lake is well exposed
28885.

28885-67 N 1250 W 520 Sec. 29-65-4

Here there is an old shaft
just N. of an exposure of the
Akaby iron bearing rocks. This
shaft is said to have been
run to depth of 75 feet
and to have bottomed in ore.
There is no ore ore dump, but
get specimens of banded fer-

an.

surface
of N. W. My note

det.

condition
a way east

S. 28

T.

65—

R.

4

Con

Con

28

21

28

Golden 5.7 26658-9

to Humphreys & Post Astor

 $N 50^{\circ} W$ $T 40^{\circ}$

Gabbro.

Cor.

6—747

Con.

Taken in Contact product of 256.

ruginous slate 28885 and also of an actinolite magnetite quartzite (prominent magnetite schist?). This is also a fresh dolomite 28887 on dump. This probably comes from an interbedded sheet such as are known to occur in these iron bearing rocks.

28888-9

Unexposed!

N 1380 W 1550 Sec. 28-65-4

West end of the railroad from Port Arthur. Here there is an extensive cut and in it the rock forming the ridge north of Akely Lake is well exposed. 28888 is a fresh specimen.

At one place in the cut there were counted within a few paces ten small approximately parallel sheets of basalt which had been injected in 28885. Appears to have followed schistosity but 28888 appears quite fresh and massive here. These sheets trend E-W and stand vertical. They vary from $2\frac{1}{2}$ " in width down.

Some of the schists have been stripped
by glacial operations and then
a hexagonal parting perpendicular
to face of sheet is very apparent.

Was instructed by Dr. Bayley
to see if I could find
jasper which is reported to
occur on shore of High
lake near E-W section line
between secs. $\frac{33}{4}$ T $\frac{24}{63}$ R. 12.
Ran west from Macander corner
for 450 paces then N. 250 paces
and back to shore. On this
run I passed over hornblende
schist cut by red granite dykes.
In places the schist is very
much contorted. At others it
is even broken into small
pieces which are cemented
by the granite forming an
enfranchised breccia. The schist
is pretty ferruginous and in
places is coated with a
ferruginous crust. This may
have given rise to the report

of the occurrence of gneiss here.
 Also went in along shore
 south of M.C. but found
 some schist and granite
 showing same relations as have
 been described. Could not
 find any gneiss here where
 I was told to hunt for it.

Canved around East and
 part of NE shore of point,
 known on Hunters Island
 sheet, Canadian Survey as
 United States Point on Winchell
 map as North East Cape, which
 projects N.E. through T65R10.
 Found granite near base of
 point followed to N. by
 strip of hornblende schist.
 This is cut by numerous
 granite dykes. This schist
 is then followed by gneisses
 which form extreme N + NE
 parts of point.

In the course of this seasons field work the only place where I was able to get any good relations between the various members of the Vermilion Horizon was on west shore of West Gull lake.

There a green schist series was found to be the oldest rock series. This was cut by Saginawa granite. These two were then overlaid by the Knife Lake sedimentary series which is also unfolded in the granite.

The presumption is that this green schist series here on East end of range is to be correlated with the green schist around Tower and Sky and to be placed at base of geological series. The Knife Lake sediments would then be paralleled with the Stuntz conglomerate.

and overlying slates.

Before reaching Gun
Thint Lake a new series of
rocks comes in and must
be accounted for. This overlies
the green schists. Lies in a
Synclinorium plunging
to E of S. Dip is flat
about 60° as maximum
at west and flattening
to 20° & less as it is followed
to east. It is ferruginous.

This series is younger than
anything thus far men-
tioned to judge by its
low dip there where it is
nearest to the Knife Lake
sediments which all have a
high dip of 80° or thereabouts.

It is also far less metamorphosed in appearance. It is known to overlie the green schists.

Does it not correspond to the Animikie and should it not be connected around to the south of the Giant Range with the iron bearing rocks of the Mesabi? Now, of course, these two areas are separated by the great gabbro mass which overlies the intervening Animikie or else has intruded and displaced it.

