North shore Lake Superior: [specimens] 40083-40095, 42013-42023. No. 338 1900

Van Hise, Charles Richard, 1857-1918
[s.l.]: [s.n.], 1900

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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 x 2½ x ¾ inches will be allowed, but in all other cases *large-sized specimens*, trimmed to a size of 3 x 4 x 1 inches, must be selected, in accordance with section 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. Specimens should not be placed together without protection in the collecting bag, as the fresh surfaces, important in determining the character of rocks, are thus destroyed. They should be damaged by no temporary mark, but the numbers should be at once marked in at least two places upon the inclosing paper or cloth bags. Specimens may be permanently marked in camp by painting the numbers upon them in white upon a black background, using Silver White and Ivory Black oil tubes for color, with turpentine as a diluent.

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

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

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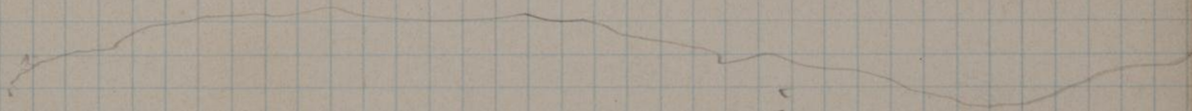


Beaver Bay [illegible] on
Containing anorthosite
including many fragments
great and small
finer grained below

Ash bed [illegible] from away
cut by gets steeper [illegible]

July 11, 1900.

In Haboro

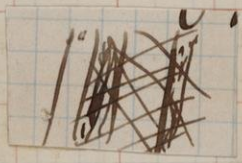
With Clements rowed from ~~Beaver Bay~~ to Split Rock; thence coasted to Beaver Bay. On the N. E. side of Split Rock is the typical Beaver Bay black diabase. This contains innumerable boulders of the anorthosite, varying in size from immense blocks 50 to 60 feet in greatest dimension to small cragments, many of which are no more than the single large feldspars of the anorthosite. In places the whole has the appearance of a stucco, the fragments and boulders of the anorthosite constituting the coarse pieces and the diabase the matrix.

The headland is composed of a mass of anorthosite, 163 ft. high and fully this at the top, but narrowing at the bottom. (See Fig.) To the S. W. the anorthosite mass is again bounded by the Beaver Bay diabase. The contact to the N. E. is very sharp; but that to the N. W. is not continuous. The Beaver Bay diabase, according to Clements, appears to grade into the amygdaloidal diabase to the N. W., but this relation is not clear.

Considering the fact that anorthosite fragments as large as a meeting house are found in the diabase, it appears probable that the point itself is merely a fragment in the Beaver Bay diabase.

(Photo 10 shows relations.)

S. T. R.



The anorthosite in places shows a beautiful sheeted structure with two sets of fractures cutting across same. (See fig.) The sheeted anorthosite is injected in a most complicated fashion a short distance around the point,- both parallel to sheeting and along the joints and in other directions. The rounded rhomboidal nature of the anorthosite blocks are believed to be explained by the fracturing and the following of same by the diabase. The diabase itself, where in considerable masses, has also a parallel fracturing or sheeting, in some places approaching a columnar structure

Two Harbors Bay between Split Rock point and the point east of Two Harbors Bay is occupied by a reddish fine grained amygdaloidal diabase. In detached exposure this amygdaloid passes nearly to the point, but is overlain and cut across at the point by the Beaver Bay diabase containing the fragments of anorthosite,- very numerous and great and small. The diabase is fine grained just above the amygdaloid, and grades through various phases to the coarser variety. (Specimens collected by Clements) Also the amygdaloid is cut by a dike of the diabase which appear to join the Beaver Bay diabase.

The end of the point is made by a great mass of anorthosite, the same as at Split Rock, only the mass is much larger. The point shows beautifully the sheeted struc-

ture, the alternate bands varying in composition,- some more of feldspar, some more of another mineral. Cutting the sheeting of the anorthosite is a multiple dike apparently of the same composition. Doubtless this came through at a later stage of the anorthosite eruption.

Rounding Split Rock point, the Beaver Bay diabase, the anorthosite blocks, and the amygdaloid cut by red rock, are here all exposed. In places the Beaver Bay diabase cuts across the amygdaloid: At various places it contains fragments of it. At places it follows along a very amygdaloidal surface,- below the Beaver Bay diabase. S. W. of point the Beaver Bay diabase is on top; at the S. E. it is below. Can be no doubt that the Beaver Bay diabase carrying abundant anorthosite masses, from minute to great, penetrated the amygdaloidal diabase; cut across it; included fragments of it; followed the bedding between the different lava flows. The amygdaloid just in the bay beyond the point is cut by red rock, same as at Beaver Bay.

It is certain therefore that the order of Split Rock and vicinity is (1) amygdaloidal diabase, (2) Beaver Bay diabase, carrying fragments of amygdaloidal red rock and anorthosite, (3) red rock. The relations of the anorthosite to the amygdaloid remain to be determined.

The entire series is much fractured. The openings are filled generally with amygdules. The earlier joints have quartz fillings along them.

The little bay next N. E. of Two Harbors Bay was filled with the amygdaloid. The salient making the point east of this bay had red rock on the west side and the Beaver Bay diabase on the east side, the latter making the larger part of the point. The contact between these two was found, but the relations were not perfectly clear, although Clements thought the red rock cut the Beaver Bay diabase. As we journeyed toward Beaver Bay the diabase which was fine grained in contact with the red rock became coarser and coarser, and finally became the very coarse, luster-mottled rock. This continued for a mile or more, and was replaced,- appeared to grade into the Black Gabbro of Irving. This gabbro continued almost to Beaver Bay, and then graded into the luster-mottled rock on the points just west of Beaver Bay. At Beaver Bay and in a little bay just west of same is the entire series seen at Split Rock and east of Two Harbors Bay; i.e., the fine grained amygdaloidal diabase, the Beaver Bay diabase, the anorthosite, and the red rock. However at these localities the areal relations are intricate; and the structural relations on certain points less clear, upon other points more clear than at Split Rock and vicinity.

(1) The anorthosite is genetically con-

nected in some way with the Beaver Bay diabase; i. e., wherever the anorthosite is found the Beaver Bay diabase is seen.

(2) The Beaver Bay diabase and anorthosite are very intricately related to the fine grained dense amygdaloidal diabase. If one had not the clue at Split Rock the relations would be difficult to make out. The Beaver Bay diabase penetrates the amygdaloid in the most intricate fashion. The Beaver Bay diabase retains its coarser texture even if in bands or films 1/4 inch or less across. If one did not examine the rocks closely the likeness in color of the Beaver Bay diabase and the earlier amygdaloid would be most confusing. However the two rocks weather very differently. The amygdaloid is always broken by regular sets of intersecting joints into small blocks, and the Beaver Bay diabase has a heavy irregular weathering.

July 12th.

Examined the crest of the point of Beaver Bay and also the Falls of the River At the former is the characteristic acid felsite or porphyry, well bedded, which makes the Palisades.

At the falls the relations of the "Post pile" amygdaloid, so-called on account of its weathering, to the Beaver Bay diabase is perfectly clear. The amygdaloid is cut across by a broad dike about four feet wide of the diabase. Included in the Beaver Bay diabase are long blocks of Post-pile stuff as represented by Irving (Mon. V, p. 308. Also blocks of clearcut anorthosite are included in the Beaver Bay diabase. The latter is here lustre mottled. Finally the whole is cut by the red rock, and whereit has produced its effect on the Beaver Bay diabase irregular areas of the red, or so-called orthoclase-gabbro, are found. It appears clear that t the latter rock is no more than the Beaver Bay diabase to which has been added some acid material by pegmatizing and from the red rock.In short, the orthoclase-gabbro is produced from the Beaver Bay diabase precisely as is the feldspathic quartzite from the quartzite at Rib Hill. As would be expected, the orthoclase-gabbro is most irregular in its distribution, and grades into the Beaver Bay diabase in the most irregular way.

Thus far it seems as if the Post-pile amygdaloid and the other intermediate and basic flows are the oldest rocks. In these the Beaver Bay diabase is apparently intruded as a great laccolith. The center of the laccolith runs from Beaver Bay to near Two Harbors Bay. Here neither the top nor the bottom are seen. Here also it is not lustre mottled, but is the coarse "black olivine-gabbro" of Irving. For this central part it is locally sheeted, and in general it has a coarse, imperfect columnar structure at right angles to the horizon or nearly so. At its borders its structure so nearly corresponds with the bedding of the amygdaloid, at least in a general way, that Irving thought it must be a bedded flow, although he clearly recognized that it cut the amygdaloid in a curious way in places.

This general correspondence is just what one would expect of a laccolite; but when the border relations are examined in detail there can be no question that it cuts the amygdaloid.

A most significant fact in this connection is the general appearance of the luster mottling where the other rocks are approached at Beaver Bay and Two Harbors Bay and Split Rock. Also in places in approaching contacts with the amygdaloid it becomes fine grained. (Clements specimen) Finally it cuts the amygdaloid in a most intricate fashion, following the joints in places, in places winding around the blocks, in places intruding itself as films; but always or nearly always a sharp contact. All the

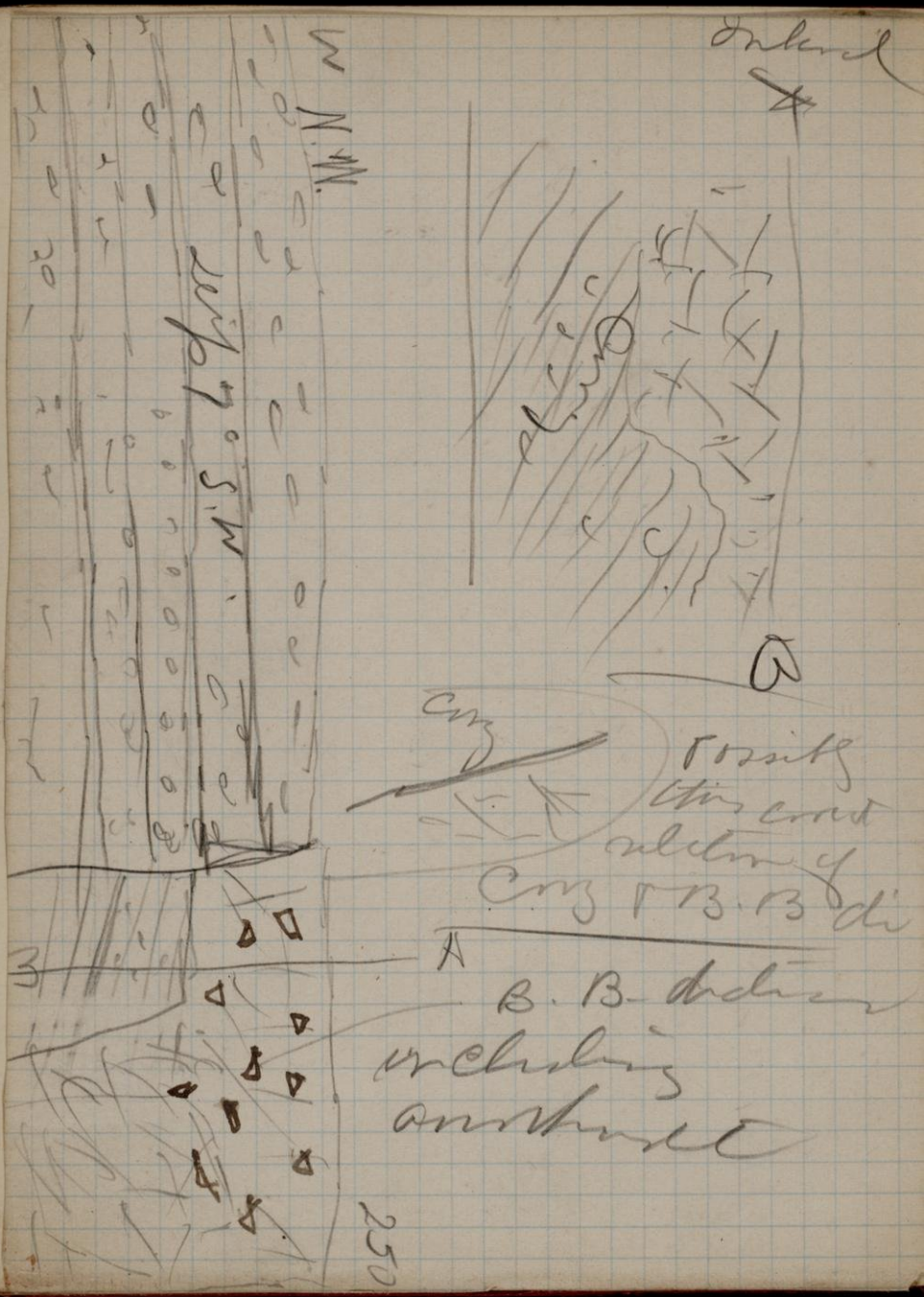
The fact the anorthosite fragments are wholly absent in the main mass of the Beaver Bay diabase and occur so abundantly along its borders where this rock has intrusive relations with the amygdaloid is most significant. If not a border seggregation, the mass must have cooled so slowly that they ~~kx~~ there had a chance to arrange themselves along the borders of the mass; and why they should do this is difficult to see if extraneous fragments.

The first two days' work is strongly suggestive that the Beaver Bay diabase is but a smaller laccolite correlative with the great Basal laccolith; and that from both the anorthosite seggregated by some differential process, although this apparently must have occurred to some extent, if not wholly, before the intrusive; for the contacts between the two are so sharp. Irving notes that the anorthosite particles are cut by the including diabase. The numberof fragments, great and small, included is certainly amazing, and they seem to increase in number as the amygdaloid is approached. Indeed there is but a small mass of the diabase in places,-but stringers between the anorthosite fragments. Is it possible that Lawson is right in thinking the anorthosite an older terrane upon which the amygdaloid rests or was poured out, and that the Beaver Bay diabase where intruded followed the contact, and thus picked up many anorthosites? But if this were so, one would expect more of the

amygdaloid to be included in the Beaver Bay diabase, it is so much more massive. But on the whole I incline the early differentiation theory. The reason the fragments occur along the sidemis that they have risen up from below, being lighter, but could rise no higher because of the amygdaloid. Thus their vast number. Many more may have risen in the central mass between Beaver Bay and Split Rock, but have been eroded.

According to Winchell, anorthosite also occurs along the borders, the reason being the same. However here, according to Winchell, the greater masses are in the center. Is this explained by supposing the same have here not been eroded away as at Beaver Bay?

(Sylvia Bolton?)


N.N.W.
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July 13.

Coasted from Bear Bay near to Petit Mer. After leaving Bear Bay the heavy lustre mottled drift ice came in. As becomes continuous did not hold any fragments of earth. Continued thro about 12 miles when great beds of anthracite appeared. Some of them hundred feet across. These are the great ones which gave Lawson his idea of a pre-historic ice creame. As soon as the ice appeared the Amyd and red rock was found, thus confining the anthracite to the border of the sea until it is out about 2

Section across
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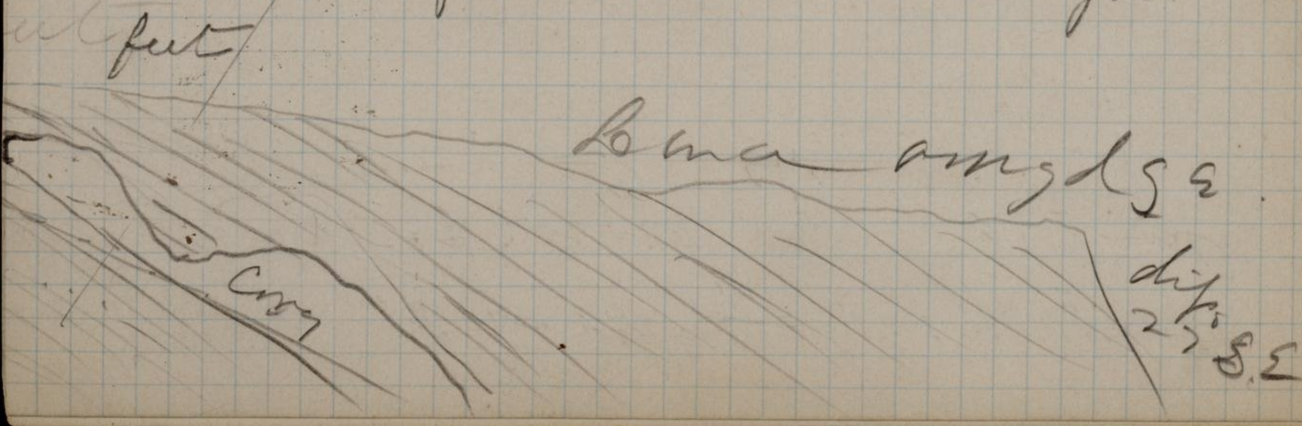

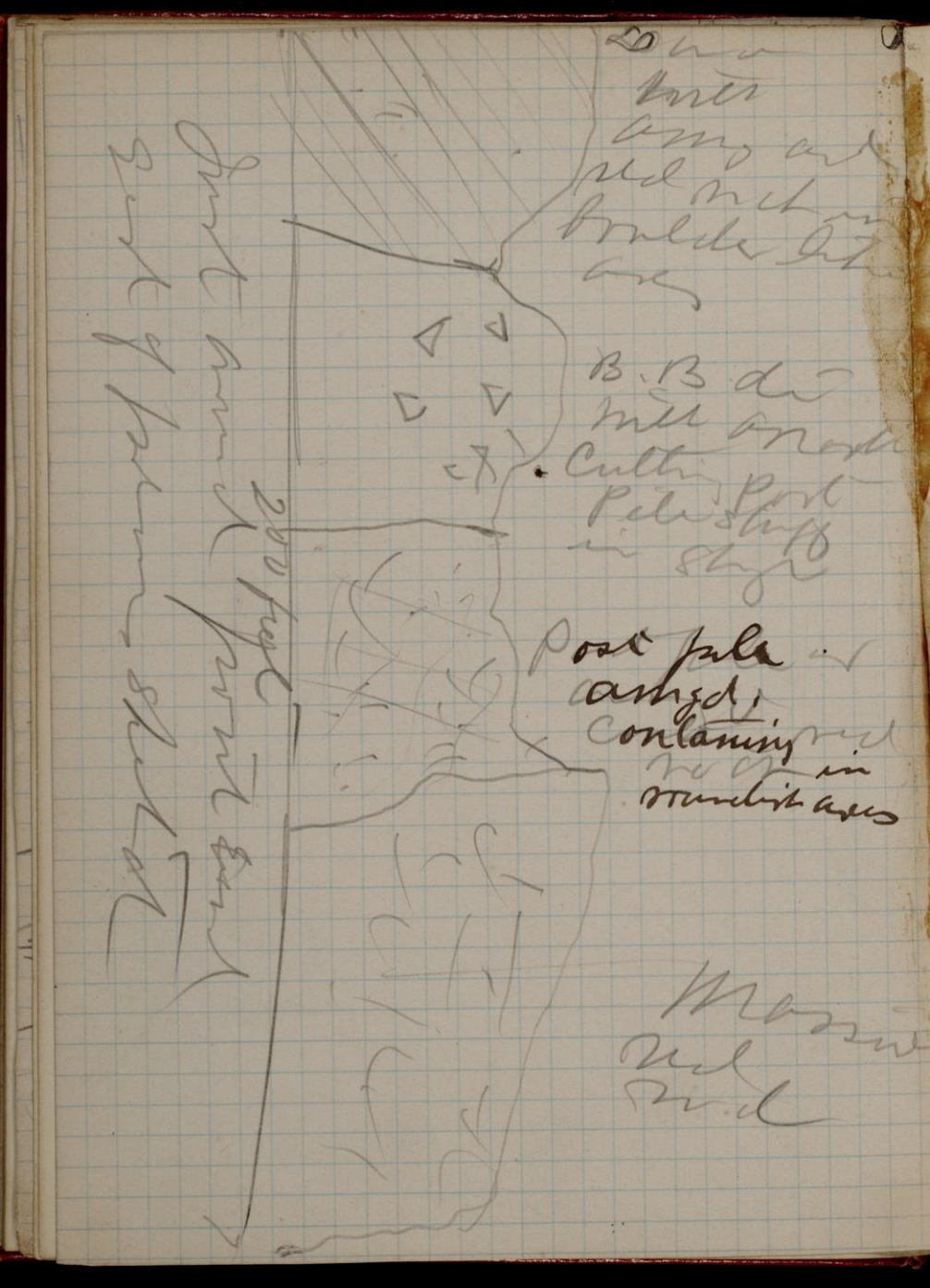

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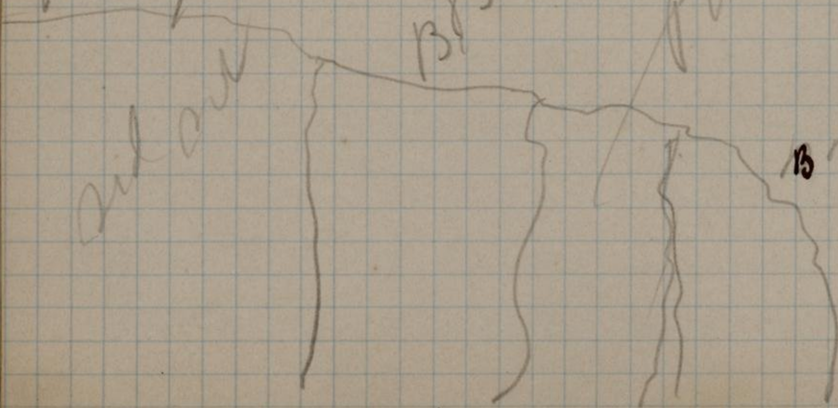

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July 13th.

Coasted from Beaver Bay nearly to Petit Marais. After leaving Beaver Bay the heavy luster mottled diabase came in. As became continuous it did not hold any fragmentsof anorthosite. Continued thus for about 1 1/2 miles, when great fragments of anorthosite appeared, some of them hundreds of feet across. These are the great areas which gave Lawson his idea of a pre-Keweenawan terrane. As soon as the anorthosite appeared, the amygdaloid and red rock were found, thus confining the anorthosite to the border of this area, which is only about one-third as broad as the one between Beaver Bay and Split Rock. The anorthosite is no more in"hummocky forms" than is the Beaver Bay diabase; only the latter in detail is rougher as a result of post-Glacial weathering. Many of the masses of anorthosite afe so large that it is hard to believe that they are fragments in the Beaver Bay diabase; but it is certain that on an island just off from shore the anorthosite is in the diabase in innumerable fragments, great and smal just as at Split Rock. If the Beaver Bay diabase can hold fragments as big as a meeting house, why cannot it hold fragments as big as a cathedral, is the question which continually recurs. Some of the larger of the anorthosites are cut in an intricate manner by the diabase (See Photo 1, film 1) As noted before, the contact between the anorthosite and diabase is perfectly sharp; no sign of a gradationor seggregation. In places adjacent to the anorthosite the diabase

base itself shows bedding and seggregation, but this does not affect the anorthosite.

The mixtures of diabase, anorthosite, amygdaloid, and red rock continued for some distance, the essential relations being the same as at Beaver Bay; then came the quartz porphyry of the Great Palisades. Immediately following same was again the coarse diabase making the bay of Baptism river (see Irving, p. 315) Just south of the Club House near Baptism the Beaver Bay diabase was found in a wide dike-like mass cutting the "orthoclase diabase" amd along the borders of the dike were immense numbers of small fragments of the anorthosite. This and other similar cases noted are perhaps more conclusive evidence of the genetic connection of the Beaver Bay diabase and anorthosite than the relations of the large masses.

We went up Baptism river for about 1/2 or 3/4 mile, and found the "Puckwunge" conglomerate of Winchell. Same as any other conglomerate of Keweenawan on south shore, containing both basic and acid fragments. The dip of the conglomerate seemed to be less steep than thak of the flows in the river below, but later rapid variations in dip were elsewhere noted. On the high hills across the river and a little way back from the shore, the heavy Beaver Bay diabase was seen containing large fragments of anorthosite. Still farther back higher bluffs were observed from the distance, and in these no white anorthosite was seen.

Just beyond Baptism two coarse diabase dikes were seen cutting the amygdaloid;

beyond this came a long area of quartz porphyry; and then again the diabase and amygdaloid with the usual relations of intrusion At the N. E. part of Sec. 11 (Irving, p. 315) the first conglomerate was found on the coast Here all the rocks yet noted were seen; the relations being roughly represented by the sketches, pp..... As usual the amygdaloid is cut in an intricate way by the red rocks. One belt of conglomerate in the amygdaloid narrows and widens and appears to run out. The Beaver Bay diabase, here distinctly amygdaloidal, containing anorthosite fragments along its border, intrudes the amygdaloid (post-pile rock) in the usual intricate manner, sending stringers small and great between the blocks. The Beaver Bay diabase appears to cut across and lap up over the conglomerate,, and the latter two are faulted down against the conglomerate (Irving noted this fault), the throw of which cannot be more than 10 or 15 feet. Passing north of this point the Beaver Bay diabase is seen to cut through the amygdaloid in dike form, and just a little farther on comes in the red rock.

Continuing to the northeast, the Beaver Bay diabase is the dominant rock for a large part of a mile. At the S. W. and N. E. parts of the section the intrusive relations of the diabase to the amygdaloid can be noted. The Beaver Bay diabase is here cut across by the great masses of the red rock and cut through by dikes of the red rock in the most intricate fashion.

In places, and especially where in cone tact with the large masses of red rock, the diabase appears amygdaloidal; but also amygdaloidal masses of it appear to be included in the red rock. But the most interesting of all is the wide area of diabase which is cut through and through by dikes of the red rock, great and small. Here the diabase seems altered throughout. It contains red feldspar; in a more acid aspect, assumes the "orthoclase gabbro" form. In fact, I have no doubt that the chemical composition of the diabase has been considerably affected by the minute penetration as magma and by water of the red rock material.

After the big display of Beaver Bay diabase there came in a long succession of bedded flows, a number of which have dips from 45° to 60° N.; and here the waves have cut out the softer parts and left the many caves. Going farther, the bedding flattens out somewh rapidly, and then we have a set of long square buttressed points dipping gently lakeward, and in which are small beltsof conglomerate.

Thus far the conglomerates of the Temperance river are subordinate, and I find but little essential difference but this between the Beaver Bay and the Temperance. Probably also the Beaver Bay diabase is not quite so dominant as in the "Beaver Bay group."

In closing the days notes it is noteable that the Beaver Bay diabase seems about as prevalent and important as in the Beaver Bay group itself.

July 15th.

Coasted from about 3 miles west of Little Marais to Temperance river. For this distance we found only the succession of bedded basic flows described by Irving. Interstratified with these diabases there may have been some conglomerates; but few were so thick as the two belts east of Baptism,- the first about 1/2 mile east, the second at the camping ground.

We went up Temperance river, and here saw the succession described by Irving. However, with the exception of the small lenses of sandstone at the mouth of the river, figured by Irving, we did not see any unmistakeable conglomerates, although very scoriaceous layers at various places closely resembled conglomerates. The narrow gorge and succession of gigantic pot holes are certainly very interesting, being very similar to those of the Witch Gulch, only the gorge is deeper, longer, and in much harded rocks.

The sandstone at the mouth of Temperance river may be a local stream deposit.

July 16th.

Visited Carlton's Peak. In our journey out our course was such as to bring us to the northwest flank of the Peak. Before reaching any of the four peaks which together make the higher part of Carlton's Peak, we crossed a ridge and found the rock to be the typical luster mottled Beaver Bay diabase. The Peaks themselves showed only the anorthosite, and certainly their joint area is large, being perhaps 1/3 of a mile in diameter. However it is wholly possible that the low ground which separates these different peaks, and from which they rise precipitously, are underlain by the Beaver Bay diabase. On our return trip we went straight lakeward to Tofti P. O. The anorthosite soon gave place to the typical luster mottled Beaver Bay diabase which continued from 1/4 to 1/3 of a mile in width. Then we came to the low ground which presumably is underlain by the amygdaloid, but of these there are no outcrops To the north of the Peak is a marked ridge composed of Bblack rock which is presumably the Beaver Bay diabase; since Irving maps the group as curving in here. I have doubt as to whether any of the lavas came in between this ridge and Carlton's Peak. Certainly there is not the shadow of a foundation for the relations represented by Lawson (Bull. No. 8, Minn. Surv p. 12),- no contacts, no amygdaloid. The anorthosite and associated with it as usual, the Beaver Bay diabase.

July 17th.

Coasted from Temperance river to Cascade river. For the entire distance the bedded basic lavas were seen, no cutting dikes of basic or acid rocks being noted. Some of the beds are heavier than others. Many are amygdaloidal, but in the degree of amygdaloidal character they vary greatly. Some of the beds are heavy and dense with little amygdaloidal character. Aside from the lavas the only rock noted is the conglomerate just back of Black Rock Point.

These beds must be later than the Beaver Bay diabase and the red rock, else they would be cut by them. The red rock pebbles in the conglomerates are positive evidence of this.

July 18th.

Coasted from Cascade river to Grand Marais Point. In general the same state of affairs existed as in the area studied the previous day. The beds for the first four miles are very amygdaloidal, although some black dense beds specimened by Clements. At Good Harbor Bay the sedimentary rock noted by Irving was examined. It is a shaly sandstone rather than a conglomerate. It has a dip conformable with the lavas above and below; and there is no reason for placing an unconformity below it. Below the sandstone at Good Harbor Bay is a very amygdaloidal lava at least at the top. (Specimens by Clements) This grades down into a more massive part of the flow. From this place nearly to Grand Marais the lavas are heavy and dense, with little amygdaloidal character. (Spec. by Clements) In the bay just west of Grand Marais the first red or acid rock is noted At the east this seems to be overlain by the lava conformably, but to the west seems to cut across it, as if it were an intrusive.

In general Irving is quite right in thinking the "Temperance River group" is different from and in part later than the Beaver Bay group, although to give a western boundary for the same is difficult At Baptism river and vicinity (Irving, p. 315) the Beaver Bay diabase and red rock seem to be higher up than the conglomerate 1/2 mile up Baptism river. However

this conglomerate containing red rock pebbles is more nearly horizontal than the lava beds, and may be faulted in just as the conglomerate in Sec. 11 is faulted against the diabase, as described on a previous page. In this case the Beaver Bay diabase and red rock may both wholly antedate this conglomerate and the higher beds.

July 19th.

~~River~~ In morning coasted to Devil's Track ~~Lake~~. In bay immediately east of Grand Marais theblack coarse diabase, very similar to the Beaver Bay luster mottled, only without mottling, comes in; and then beyond this at the head of the bay, red rock (Both specimened by Clements) At this dikes of red rock were seen in the diabase The red rock continued for about 150 steps along the beach, and then the black rock again came in. Here the red and black rocks interesected each other, but it was difficult to tell which was intrusive. The black rock certainly became more fine grained and also amygdaloidal in nearing the red rock, and this looks as if the latter were the later? At the next point, i.e., the first one east of Grand Marais, the black rock contains innumerable fragments of anorthosite, and also fragments of other rocks.

This rock, while having the coarse appearance of the Beaver Bay diabase, grades into fine material, and this into broken up rock which resembles the postpile stuff. It seems probable that the red rock is here a flow which by containing fragments of anorthosite is apparently connected with the intrusive Beaver Bay diabase.

At the next small point to the east the red rock and the black rock are again in contact. Here the diabase is finer grained at the contact, and unquestionably

grades into the coarse diabase. The contact is practically vertical, and the black rock is apparently intrusive.

Now coasting towards Devil's Track there is a succession of bedded flows, some of them being very openly amygdaloidal, and others being dense and varying in coarseness. These show a distanct tendency toward the post-pile rock; and in one place the black basalt is beautifully columnar, the columns being at right angles to the tilted beds of lava below.

At Devil's Track the red rock comes in.

In the afternoon coatsed to next small point east of Kadonce's Bay. However, first we went up Devil's Track river for about 1 1/2 miles, or at least 1 1/4 miles; perhaps 3/4 mile to a mile along the strike. Red rock was found all the way. As we got farther back from the shore the regular platy structure not plain. Impossible to determine the bedding. For some distance from the lake the red rock has a platy structure which dips lakeward, and the dip corresponds to the general dip of the layers. East of the river the red rock was the only rock along the shore,-(long beach re-entrants,- until the point west of Kadonce's Bay is reached. This point and both sides of the projection from the bay is composed of basic lavas, some black and dense, some the ash-bed diabase variety, and some amygdaloidal. Going to the bay the red rock is again found. It is perfectly clear that the

Devil's Track red rock continues along the strike, composing this bay and the country for some distance back. The red rock was seen to compose a ridge back of the water's edge, with a glass, shortly after leaving Grand Marais. It is therefore clear that the belt of red rock is at least 8 or 10 miles long, and how much longer is unknown to me.

Mr. Mayhen showed me a plat of strong magnetic attraction which continues for some distance, two or three miles. He says same is between red rock on the one side and a rock which he called quartzite. The specimen of same which he showed me is plainly olivine diabase. The section from the lake, according to him, is as follows:

Red rock.
Magnetic attraction.
Diabase.
Red Rock.
Diabase.
Lake.

The north red rock is along Devil's Track river. Between the red rock and the diabase in each case is a depression with no exposure. Looks as if basic seggregation had taken place in bas ic rock where same is intruded by or is in contact with red rock.

July 20th.

In morning coatsed from point east of Kadonce's Bay to point about 3 miles east of Chicago Bay in which is Farquhar's Peak.

For some distance the rock was a bedded rock of intermediate or basic character. The latter was the prevalent kind, and they seemed to be in flows. (Specimens Clements) The intermediate rock (Sp. Clements) had a peculiar spheroidal weathering, very similar to ellipsoids of the Ely greenstone only not so much marked. Seemed clearly to be spheroidal weathering, perhaps along cooling joints, but the material betwen sperhoids contained amygdules same as spheroids.

The bedded succession continued to ~~Big~~ Little Brule river. Between the exposures were long sand beaches without exposures. As seen as the Brule was passed we came to the black gabbro of Irving, which continued along the coast so far as the rocks were exposed to Where the rocks first came in they weathered out in a peculiar way and show a black lustrous material, which made me think of nepheline. (Specimen) This material continues a considerable distance, but finally grades into material nearer gabbro, but still having lath-shaped feldspars. (Sp. Clements) This again appears to grade into the rock still farther on having a true granitic structure, or something near the same. In the east part of Chicago Bay the rock is again the intermediate flow, but the big point east of the Bay is composed of the gabbro again.

gabbro again; but same here contains some red feldspar, and has the appearance somewhat of Irving's orthoclase-gabbro.

In the afternoon went on to the point where Irving's V and VI begins. The massive black gabbro continued to Red Rock Bay. (In places a gneissic gabbro, Clements Sp.; in places strong lister mottled) At no place were any intrusive rocks noted in it, either basic or acid. The relations of the fine grained intermediate rock occurring at two places were not asce rtainable along the shore. The diabse was coarse in texture (Sp. Clements) to the point where it last appears separated from the red rock by a short shingle beach. The red rock, where it first appears, is a typical quartz-porphyry. This rock is cut by diabase dikes, but whether off-shoots of the black gabbro it was impossible to determine.

After the red rock extended for 1/2 or 3/4 of a mile, the amygdaloid appeared, and this was cut by a great dike of fresh diabase or basalt having horizontal columnar structure or structures at right angles to its walls, and also much finer at the outside than the inside. Clements had the impression that this diabase or basalt is fresher than and later than the black gabbro of Irving.

The bedded lavas of basic character and varying coarseness continued to camp.

As far as gone, it appears that Elftman is nearly correct in his succession. The

main doubt is as to whether or not the black gabbro at one end continuous with that at the other. If the two were actually traced as mapped by him, this would be reasonably conclusive.

July 21st.

Held in camp by blow.

July 22nd.

Coasted to Pine River Bay. From point where the camp was, about 5 miles from Grand Portage Island, found only bedded lavas and intrusive dikes of diabase and gabbro. On the first point east of where we camped we saw three dikes cutting the amygdaloid, the dikes having general east and west trend parallel to the point of the shore, same as the dike in the red rock. These dikes have horizontal columnar structure, the same as the dikes cutting the amygdaloid on one side and red rock on the other, just east of Red Rock Point. One of these dikes is about 50 feet across; another about 15 feet; and the third about 2 feet. Coasting on toward Grand Portage the amygdaloid was seen to make the bays. On a point about 1 1/2 miles west of the point of Grand Portage Bay was found a mass of black rock, the center of which is coarse gabbro (Sp. Clements To the north this grades into fine material, and this into aphanitic rock which is in contact with and cuts the amygdaloid. The strike of the dike is nearly E.-W.

We next visited the Grand Portage Island conglomerate, described by Grant, and found his description accurate; i.e., conglomerate, then banded coarse grit, then fine black graywacke-slate, then black basalt, then light-colored even-textured sandstone, then overlying basalt. Whether the basalts are intrusive sills or flows was not determined.

The pebbles correspond to these described by Grant, except we did not find the

peculiar contact metamorphosed phases mentioned as occurring near Pigeon Point.

In the afternoon examined Pigeon Point. There saw manyof the phenomena described by Bayley. Shall not attempt to detail these, but will mention points which impressed me. (1) the difficulty of certainly discriminating between the gabbro and red rock, i.e., in placing a line where the contact is. The two seemed to grade into each other with an intermediate form, precisely as described by Bayley. In starting from the unmistakeable red rock one would not know at what place he passed upon the gabbro, and also the reverse. Going from the gabbro end, one would find red feldspars appear; then more and more until the rock contained much red feldspar, so as to have a distinct red appearance. Finally, quartz would be found, and we would have the red rock. While I can hardly doubt the relations described, it is still true that stringers of red rock cut through the gabbro. At one place there wasa band of rock, somewhat sharply separated from the red rock and equally clearly from the gabbro; but Clements and I could not agree as to whether it was the red rock or the gabbro.

Clements emphasized the point that in the red rock, where same was recognizable without question, were many fragments of Animikie; these however metamorphosed about their border. Clements says if the red rock is the result of fusion of the Animikie, why so many fragments in it; but this Bayley

explained by supposing same has acted as an independent intrusive.

At one place along the gabbro dikes, separate from the main dike, which intrude the Animikie there seemed to be coarse feldspars along the border, the same getting in appearance close to the smaller anorthosite fragments included in the Beaver Bay diabase.

It seems probable to me that some of the red rock, as held by Bayley, actually produced by the fusion of the Animikie. Certainly no place of xxx contact can be specified between the metamorphosed Animikie and the red rock at various places. However considering the great mass of red rock elsewhere in the Lake Superior basin, it is probable enough that some of the red rock is later.

If we accept this theory, then the order of events is: Animikie metamorphosed by gabbro, producing spotted rocks and some red rock. Independent intrusion of red rock along contacts producing further metamorphism in Animikie, altering gabbro and cutting previous rocks. I felt inclined to accept this theory or else alternative of independent intrusion of red rock as chief agent of metamorphism.

Monday, July 23rd.

From Pine River Bay to mouth of stream west of Pine Island. Splendid views at various places of the intrusive relations of the basic rocks to the Animikie strata. These vary from fine to coarse, many of them, and especially on the S. E. side of Victoria Island, being as coarse as the normal gabbro of Pigeon Point, and in every essential respect like it. The vertical columnar structure of the sheets, and the cross columnar structureof the dikes notable. The topographic relations of sills and Animikie beautifully seen. At various places the terraces and cliffs of the higher levels of Lake Superior evident. All along the exposures of the Animikie remarkably evenly bedded, and dipping with monoclinal dips lakeward.

It is notable that where the intrusives are there are marked local variations in the strike and dip, evidently due to the intrusions. On the outer and nearer island, about 3 miles S. W. of the S. W. point of Victoria Island, the red rock and gabbro were found. The former contained many inclusions of the Animikie. Between the two there is a broad gradation zone, the texture of most of which is similar to the gabbro, and a large part of which seemed to me to be the gabbro modified by the red rock intrusive. In the modified material were small stringers of red rock. The intermediate material is similar to that described by Bayley in a

similar position at Pigeon Point, and altogether similar to the modified Beaver Bay gabbro between Beaver Bay and Baptism River. Walking from the gabbro, one seemed on gabbro all the way until he had red rock containing Animikie fragments. Walking from the red rock, one found himself ultimately on gabbro. Both Clements and I were unable to tell where was the dividing line, if any; although of course there were later stringers of red rock easily discriminated, as already stated. A notable feature of the intermediate rock is its variability, and this rapidly in its nearness to gabbro and red rock. I am myself inclined to believe that the large mass of the red granular rock with gabbro texture is the gabbro modified by the red rock, and that the independent red rock was the part only which had the inclusions. If so, the altered zone is broad.

On the south side of Victoria we saw a red massive rock, with vertical columnar parting. Lawson's quartz-porphyry, but a peculiar rock, more acid than basic. Whether sheet or dike was not determined, but probably the former. (Sp. Clements) Appeared to continue, and near by the red rock appeared to grade down into a quartz-porphyry at the contact. No effect on the Animikie noted.

A little farther on a diabase-porphyry and the red rock were found in the most intricate relations, but not enough of the red rock to certainly determine the relations. Clements thought the diabase intrusive because fragments of red rock appeared to be included.

At the east end of Knob Island diabase porphyry with large crystals of feldspar cut in most intricate manner by red rock.

In the afternoon examined the relations of the sills to the Animikie slates. Found that, as described by Lawson and Ingalls, the slates are cut across by the sills at certain places. Saw dike running up toward the sills, but did not see any join on.

July 24th.

Sailed from point of camp of previous day to Port Arthur. Found the Animikie very flat-lying and with regular jointing at various places.

July 25th.

Visited the "Keewatin" rocks of the Canadian Survey back of Port Arthur. As had supposed, here found the typical rocks of the Archean of the Vermilion district. In places the mashing has gone to an extreme. Certain rocks which look as if they might have been quartz-porphyry are now finely fissile banded schists. The greenstones are rather massive in places; in places they take on a distinctly spheroidaly structure; in places are cut by much altered greenstones; but still showing plainly their dike characters. In one place there is a broad banding of a somewhat light colored rock which is taken to be the mashed porphyry, and the greenstone schist. There has been complicated intrusion of one into the other with subsequent mashings. The iron-bearing formation are the McKeller locations have the same complicated relations as in the Vermilion district, and especially in the vicinity of Tower. Indeed, the two are very similar; but there is less of jasper than about Tower. The jasper has some hematite, some magnetite, and some carbonate. Much of it is the black jasper, and some of it apparently grades into slate, or at least contains slaty phases.

In the top course found the belt which Ingalls has mapped as Laurentian was a relatively low one, which during the line of the wagon road showed no exposures. The drift is here very heavy, and appears to have been lodged between the resistent greenstone hill to the north and the Animikie with its sills to the south.

The sills of the Animikie must almost certainly have had an important protective effect upon the iron carbonate of the iron-bearing formation. These sills are everywhere interlocked. Their presence is the controlling feature of the peculiar topography about Thunder Bay. Thunder Cape, Pie Island, McKay's Mt., and practically all the high ridges and flat topped bluffs and mountains between Pigeon Point and Port Arthur are capped or composed of the intrusive greenstone. Where capped, the mountains are flat,- Thunder Cape, Pie Island, Mc Kay's Mt. Where the rocks are great dikes the elevations are linear. Mt. Josephine is the most conspicuous example, but the same thing is illustrated by many points. The Animikie is so flat laying here that the rule of Gunflint Lake and vicinity does not hold, i.e., vertical cliffs on one side and slopes on the other. Here are flat topped mts. with steep cliffs all about. In either case and in the intervening condition these thick sills must have greatly protected the iron carbonate of the Gunflint formation, and thus prevented the weathering process of the ore-formation. This doubtless is a more important factor than glacial erosion in the Animikie. The Animikie in

this respect contrats with the Mesabi which contains no intrusives. Also the intrusives here doubtless had a considerable effect in altering the carbonate, and thus we have the partial explanation at least of the magnetic character of the Gunflint formation in the Thunder Bay district. (Pumpelly especially spakes of the magnetic ore of the Animikie as general. See if the same is given in the Geol. Repts. Or the Ontario Bur. of Mines.)

The vast amount of intrusive material may also explain the apparently great preponderance of black magnetic jasper over that of red jasper in the Lower Huronian; although if this is the case the iron carbonate could not have been changed to ferruginous slate and chert in inter-Huronian time. The skim of this perhaps more largely removed by glacial erosion than on the south shore; especially as here are no Upper Huronian rocks to serve as protective covering as in the Marquette district. Thus the magnetic character of the Lower Huronian ores of the Thunder Bay district is explained by the alteration of the iron carbonate by the intrusives into magnetite, with the removal of the jaspery forms once at the surface.by glacial erosion, thus bringing the deeper products to the surface. These general statements fully explain the relations at Republic. There the lower part of the iron formation remained as iron carbonate in inter-Huronian time. It was changed to magnetite, etc. rock by the intrusives. But the weathered part altered to ferruginous

slates and cherts in inter-Huronian time, and covered by the Upper Huronian was by the intrusion and dynamic action combined changed to jasper.

The protective effect of the numerous intrusions in the Thunder Bay district may also partly explain the relative abundance of iron carbonate. The same explanation is applicable to the Vermilion district about Tower and Ely where are Upper Huronian slates or have recently been.

July 26th.

Visited McKay's Mt. Examined the Animikie slates and graywacke to see if they showed any metamorphic effect from the sills. Could not clearly discriminate any, although this would not prove that some effect was not produced in case of more delicate carbonate of iron formation. On the top of the terrace where is "Retreat" the top of an intermediate sill is exposed. It shows the peculiar irregular parting once before mentioned in an intrusive as similar to the ellipsoidal parting of the Vermilion. It may be that the more obscure of the spheroidal or ellipsoidal parting of the Ely greenstone formation, and especially where more massive, is intrusive.

On McKay's Mt. the system of terraces is beaufifully carved. Two lower with well marked beach lines, and with shingle beaches. One near base of delta ; the other considerably higher, half way up to the shrine. Then a broad wave-cut terrace on which the shrine is located perfectly. From a high point could see beautifully 5 major and 3 minor wave-cut terraces.on the end ofThunder Cape.

Also from the point could see finely the Kamanistiquia delta and valley filling which extends far inland. This great filled area is followed by the Canadian Pacific Ry. for 15 or 20 miles. Evidently a great bay filled by the Kamanistiquia. As the lake retreated the Kamanistiquia cut channels in the bars and barriers, has cut

built deltas at various places, and is now building a delta off Ft. William, having three mouths.

Back of Port Arthur the beaches and terraces are notable. One low terrace where the lower part of the town is located; then most beautiful higher terrace 5 or 6 blocks from the water, occupied by residences; then still higher terrace carved from shingle noted.

July 27th.

Visited the locality described by Bell as Wood's location, about 7 miles from the point of Thunder Cape, and on the northwest side. Also coasted from this point to the Thunder Cape. From Thunder Cape to point about 6 miles northwest the flat-lying Animikie slates, crowned as usual by the trap. While these slates look very flat from a distance, if one notes the beds as they came down to the water, he observes that they dip somewhat regularly to the N. E. The place on Irving's map (p. 328) where the Animikie and Keweenawan are marked as coming together is a place where a deep bay extends southeast. The continuation of this bay is marked by a depression southeast of which are the Animikie rocks, and northwest of which is the Keweenawan. This low-lying area beautifully shows a succession of old lake beaches, behind which were lagoons, as noted at one place on the north shore. Also from a high point, looked over one of the higher beaches and there saw small lake similar to that dammed by beches at place where we camped several days ago.

As one looks at the high Animikie hill to the S. E. of the valley, and the lower Keweenawan hills to the N. W., it seems impossible that the latter could rise over the latter; but when one gets down and sights along the contacts of the beds he finds that it rises high over the crowning overflow of the Animikie to the S. E., the horizontal distance between is so great.

Where the rocks of the two series approach near each other further up a cross valley, it is notable that the Animikie is not in the high bluffs. This cross valley evidently located at the point of weakness between the two series.

The succession described by Bell (Irving, p. 332) noted as far as (1) and (2) The conglomerate at the base was seen for a thickness of 20 feet. The pebbles of this conglomerate closely studied and carefully (Sp. Clements) specimened. Among the pebbles innumerable slate fragments were noted; but these less abundant than the cherty fragments, almost certainly from the iron-bearing member of the Animikie. The various

Few pebbles of granite found, also a very few of schist. One of the most interesting things was the pebbles containing greensand, noted by Clements, supposedly from the Animikie formation. In one of these I saw forms resembling foraminifera or other organic forms. Certainly hard to believe organic. (Sp. Clements).

Though carefully searched for, could not find any trap or quartz-porphyry fragments. The trap sills of the Animikie are so near by

, and this is the most resistant rock of the district, that the only possible meaning which can be given is that the sills were not there when the Kamanistiquia conglomerate was formed; hence of Keweenawan age. Also absence of quartz-

porphyry and basalt is strong evidence of the conglomerate antedating the acid and basic volcanics of the ~~Keewatin.~~ Keewanawan

The sandstones of the Keewatin ~~Keewanawan~~ above the conglomerate normally could not be discriminated from the Potsdam. (Sp. Clements) This is explained by the fact that here the lavas of the Keewatin ~~Keewanawan~~ had not begun to be poured out and the detrital rocks have the same characters in the series as in other regions of the world.

It is notable that the dike cuts diagonally through sediments of Keewatin. ~~Keewanawan~~ This or others doubtless the openings through which the flows and sills came.

Clements also found in slate fragments possible fossil corals,- hyolites or cone-in-cone. (Sp. Clements)

July 28th.

In camp most of the day at Thunder Cape. However in the afternoon ascended Thunder Rock to 1000-foot level. Took aneroid and measured heights of strongly marked terraces. They approximate 150 ft., 300 ft., and 500ft., from 15 to 50 feet. These are the strongly marked terraces noted at a distance; described by Lawson, but not discriminated from the less strongly marked terraces. Four are observed. I think that these

Probably mark much more definite stages of the development of the lake than the various beaches not discriminated from them. At each, the water was presumably long enough at approximately the same level to cut wide terraces in the rock; hence very definite stages. At first gulch east of Thunder Cape on the south side are said to be several small lakes. These no doubt were dammed by beaches as at other places.

July 29th.

Coasted in the forenoon from Thunder Cape to Silver Islet Bay. Found the Animikie rocks of Thunder Cape, as shown by the high cliffs, to dip 5° to the N. E. Found the point making T harbor about 3 miles east of the Cape to be composed of a great dolerite or gabbro dike. On the S. E. side of this point was found
42013 conglomerate (42013 and 42014), in-
42014 terlaminated with slaty quartzite
42015 This band is about 6 inches through, and intruded by the dolerite in the most intricate possible fashion.
42016 Dolerite at contact. (Photo 4 represents this conglomerate.)

The matrix of the conglomerate is much metamorphosed; so much so that it was impossible in places to tell whether the matrix is metamorphosed sediment or the gabbro including fragments of the conglomerate. In this respect it is very similar to the conglomerate at Mosinee Hills, which is cut by the syenite. The pebbles of 42013 and 42014 merge off into the matrix, showing the great amount of change. On the point making the east side of T Harbor, the dike again is found; and here it cuts the Animikie slates vertically. Here mantling over the slates on the top of the point, and coming down to the water's edge irregularly, but never interlaminated

with the slate, although at lower lev-
42017 els, is the conglomerate again.
At one place it is seen to run in and under and across the slates in a little cave, like this:

Taking this place alone, one might think that the slate was the newer formation; but the presence of slate fragments in the conglomerate controverts this; and taken in connection with the broader relation above, I have no doubt that the conglomerate was laid down along a cliff of slate, such as exists at the point at the present day; that the sill was intruded along and over the contact for some distance; that the resistant power of this sill has again stopped erosion, and thus make a new cliff at the same place as the basal Keweenawan cliff; for I take the conglomerate to mark the begin-
42018 ning of the Keweenawan. 42018 and
42019 42019 represent the Animikie slate at this point. In passing along toward Silver Islet, all the points were found to be composed of the dolerite or gabbro, each having the horizontal columnar structure,- in some cases with columns 6 or 8 feet in diameter,- and areally this marked a dike almost as clearly as by the manner in which they cut through the Animikie. One

of these dikes contains very numerous crystals of feldspar, some of them 6" or 8" in diameter, and also rounded boulders of anorthosite, one being seen 2 ft in diameter. From the
42020 rounded mass 42020 was taken.
This gabbro or dolerite is thus connected with the gabbro of Beaver Bay and Split Rock by these anorthosite fragments. A Mr. Cross of Silver Islet says this anorthosite-bearing dike continued for 4 miles to the east of Silver Islet.

Besides the main dike which makes the points as we passed along, the dikes were seen of various sizes cutting the Animikie slates. One of these, constituting a S. W. projecting wall from the slates with a hole through it was photoed (No. 5). When the bay just west of Silver Islet Point was reached, the topographic depression was seen as on the N. W. side of the cape.

On the east side of Silver Islet Point, south of an island, and on the S W. side of a bluff, a short distance north of the village, a section for about 100 feet is exposed. The bottom 50 or 60 ft. is typical Animikie
42021 slate (42021), but the upper because of weathering are green and
Directly upon these slates with an absolute contact seen for several hundred feet is a conglomerate about 5 to 6 feet in thickness, identical with that seen on Wood's location. Not specimened on that account. The con-

specimened on this account. This conglomerate contains large slate fragments, one of them 6 or 7 ft. long lying so flat as to appear like a sedimentary layer; but when followed out is cut square across by the conglomerate, and is in fact plainly a slate slab which has dropped from a cliff and laid down flat in the con-
42022 glomerate. From this 42022 was taken The break between the conglomerate and the slate is knife-like in its sharpness, is indeed absolute. In a number of places the conglomerate breaks across the slate, but this may possibly be due to very minor displacements; but it appears to be due to the breaking off of slate layers; i.e., like this:

The conglomerate when traced to the south point of the bluff thins to a layer only 2 or 3 inches in thickness, but still persists. This conglomerate
42023 is overlain by a quartzite (42023) with slaty layers. This is in all essential respects like the Keewatin sandstone above the conglomerate at Wood's location. I have no doubt that the conglomerate is basal, and marks the break between the Animikie and Keweenawan. The Animikie and cutting dike constituted the south side of the bluff. The slates are at the mouth of Silver creek; but back of the ?, immediately to the east is the Keweenawan.

immediately to the east is the Keweenawan.

In the afternoon coasted to first bay in straight to Black Bay, west of Edward's Island. Found the sandstone series of Bell all the way, but cutting same some dikes were seen. Indeed, cutting of dikes were noted cutting through both the Animikie and Keweenawan at Silver Islet Point.

July 30th.

Crossed Black Bay to west point of north part of Edward Island. Here found a conglomerate in general similar to the conglomerate at the base of the Keweenawan, but besides Animikie pebbles holding also pebbles of basic eruptives and of acid porphyries; showing that before its deposition the volcanic outflows of the Keweenawan had begun. On the north side of Edward Island found bedded amygdaloids and basic igneous rocks of more massive character which may or may not have been flows.

At Point Magnet and for some distance along the south side of same found dense coarse igneous rocks in general character the same as the Beaver Bay diabase. Here we took tow to the mouth of the strait into Nepigon Bay. The rocks were carefully watched with a glass. It was plain that the heavy black rock was dominant, and while we could not assert that it is not amygdaloidal, have little doubt that the greater part of it is similar to the Beaver Bay diabase; i. e., coarse dolerite or gabbro. Our course carried us through the channel of the Roche de Bout, and at one place to the left conglomerate and sandstone are seen; and it is probable that the amygdaloid also occurs here at various places.

July 31st.

Clements

(Cl.) 40092 Examined the rocks composing the N. W. side of Fluor Island, and found same to be coarse diabase (Beaver Bay diabase, 40092 Clements) as far as Bay about 2/3 of the way toward north end. Here in the bay on islands (Cl.) 40093 a dense fine grained rock (40093 Cl.) having the peculiar reddish spheroida weathering noted on Minnesota coast appeared. Found island west of Fluor Island to be composed of the gabbro; also mainland west of channel to point just south of little creek about 1 1/4 miles north of island. (Cl.) 40088 Here on a point was found a considerable mass of red rock (40088) in contact with the gabbro. Not perfectly clear as to relations. Looked as if the red rock was the intrusive, (Cl.) 40090 but the gabbro at this place (40090Cl 40088 is finer grained near the contact with the red rock which looks as if gabbro were the intrusive. On other side a perfectly well defined dike of red rock cuts the gabbro. In short, the relations are very similar to those found on the Minnesota coast bettwen Beaver Bay abd Baptism river, where the dike of red rock cuts the gabbro beyond question, and appears to modify it; and yet where the large masses come together at some places the gabbro is amygdaloidal at the contact. It appears that the red

rock must have intruded along the border of the gabbro or else that there are two red rocks. Believed the former is probable explanation; for while gabbro is intrusive, it was not all intruded at once, has a sheeted structure and varying texture. Also the red rock may have come along or near contact of the gabbro with prior amygdaloid. Clement however thinks two red rocks more probable. The gabbro is near here
(d) 40091 cut by big dolerite dike (40091). Is this of same composition? On the point immediately north of creek the gabbro is again found. But here
(d) 40085 this rock varies greatly in texture,
(d) 40086 varying from normal gabbro (40085)
(d) 40087 to porphyritic (40086), and to strong ly feldspathic and porphyritic.
(d) 40084 It also appears to grade into a red- dish porphyritic rock (40084), and is
(d) 40083 cut or at least has intimate relations with a reddish rock (40083) which Clements thought was an acid or intermediate intrusive, but which I was inclined to believe was a gradation from 40084. In this case there would be gradation between 40083 and 40087. It is notable that the latter, while not anorthosite, approaches near it; and indeed is like the seggregations of material in gabbro where anorthosite boulder or boulder-like areas were specimened two or three miles west of Silver

Islet. The gabbro is cut by a dolerite dike.

Have very strongly the impression that the set of intrusives here are identical with those of Irving's Beaver Bay group. Every essential the same. Not so much anorthosite noted, but red rock in both. In both, the rocks are resistant, and make up high peaks. Carlton Peak is one case; that of Fluor Island and the mainland to the west, another. Have little doubt that the porphyries S. E. of Black Bay which are the same heavy gabbro complex.

North of bay where the next little stream comes in to the west; i. e., opposite north point of Fluor Island, amygdaloid was found. From here amygdaloid was found all the way to Black Bay. At Point a la Gourgamme the amygdaloid is represented by (40095). Other phases of the amygdaloid noted. The belts of amygdaloid are seen to dip gently toward the channel, and to strike east of north, making the various points. Thus in passing up the strata we are passing to lower horizons; and this indeed corresponds with the mapping which brings the lower clastic member in at the west side of Nipigon Bay. As soon as the amygdaloid appears the topography changed from the bold round hills and even mountains on the south end

Cal. 40094

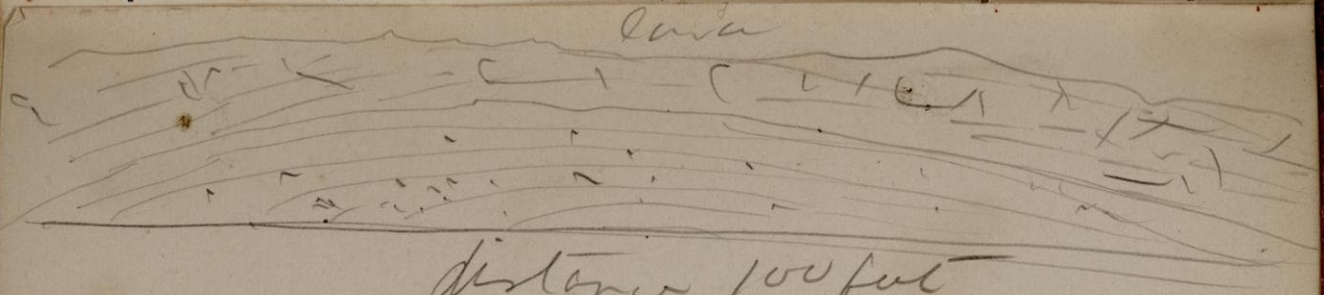
Cal. 4 0095

of the strait to gently rounded hills of moderate height. Appears from the distribution above given that the gabbro and other phases of the great intrusive in middle horizons of the Keweenawan. Whether the great connecting belt from the Gaps to the east end of St. Ignace is similar to the great belt made out in Minnesota was not determined, but the topography looks that way.

Aug. 1st:

On north side of Pt. a la Gour-
gamme found numerous dikes of a
red rock in the amygdaloid which at
first we took for intrusives. How-
ever stopping at one of the most
intricate and interesting to photo-
graph, we found them to be sandstone
dikes (Sp. Clements). Narrow and
wider; running out in stringers;
intersecting and anastomosing, just
like dike. (Photo Clements). On
reaching the N. W. side of point found
red sandstone (Sp. Cl.- dipping under
trap and basalt (Sp. Clements).
The sandstone first appears in a
little anticline which brings it a
few feet above the water, and then
plunges down on each side capped by
trap. (See sketch on. Page 53)
The strata of the axis of the anti-
cline is about N. 10 E., and the dip
of the layers to the east is about
20°, while those to the west dip
about 10°. Farther on, about 300
feet, the sandstone again appears at
the waters edge below the trap,
and still farther on again, although
the cliff is composed of trap.
Evidently the sandstone is the under-
lying formation. A little farther
to the west the land dips off to a
flat, and no exposures are found
until the point west of LeGrange is

reached. The shores of the west end of the bay are composed of blue clay, old lake beds which with beautiful even flat bedding are exposed at one place to the height of 30 feet. At the point west of La Grange the red sandstone (Sp. Cl.) appears. It is here contorted and broken. Dips of all angles are seen, and pseudo-conglomerate is found. That the rock is autoclastic is clearly shown by the fact that the pebbles and matrix alike are of red sandstone, although in places the matrix of the pseudo-conglomerate has a somewhat different appearance from the pebbles and boulders which it contains. Many of the fragments are well rounded by dynamic action, although many are angular.



distance 100 feet

Axis strike about N 10 E pitch at flat
angle to south

a
w