

On the way to the railroad we cross after descent from high hill a valley leading to the Carp River lake. Ascend a low ridge which is a continuation of the gorge hills and forms the divide between the waters of the gorge which flow towards the brickyard creek.

On hills west of kilns north of creek granite of red color forms dykes in a green dioritic rock and includes pieces of it all round besides many dividing veins running in all directions across it. Centre of Sec. 23, T. 43, R. 26. See specimens Dyke intersecting granite and diorite like rock both.

Diagram

Thursday Sept. 27. Road to Holyoke, from there southward for the corner of Sec. 6 and 1 of next township. From this 160 paces bring to top of plateau and by 464 steps we strike Holyoke Road.

A chain of knobs striking from southeast to northwest forms the edge of the plateau towards the Campo Creek valley. The rock is a laminated hornblende rock with many contortions and irregular bands or narrow dykes of granitic rock. The hornblende rock largely prevails and granite bands are very subordinate. 500 steps north of corner turned eastward and struck at 310 steps about the centre of the dioritic chain northwest and southeast extending from there 115 steps. Southwest is another small knob of same rock close to road.

The north line strikes an outlier of the before mentioned chain of rocks at 705 steps. There we are at the head of a slanting valley towards Campo Creek. At 320 we just pass a small granite knob which is a direct continuation of the before mentioned chain. The land towards the Campo Creek is a level terrace intersected by ravines.

We leave the north line, go 300 passes (paces) east over the plateau and 390 north from there when we have reached the edge of the plateau at the head of a creek or ravine. The edge of the plateau is lined east and westward with outcrops of granite and north northeast from us is a naked granite knob at a distance of about 250 to 300 steps.

We go on north, at 705 steps this hill is southeast from the line but touches it with the foot. It is close to the main stream of Campo Creek, consists of granite with a very large dioritic dyke or perhaps the granite breaks through the diorite. East southeast of our position on hill is the diorite hill near 6 kilns on which we were last on opposite side of creek is a wooded hill which is a foothill of Mt. Erygy.

I found out that the diorite is a large dyke cutting through granite and through the schistose dioritic rock similar to the schistose diorite of the chain seen this morning. The main creek runs where I supposed an arm of it and that arm is just a small branch coming out of the plateau. All granite outcrops on opposite side of creek.

Diagram

1200 paces in west northwest direction brings me to the foot of the last small granite knob on the left side. It stands on the river plateau which towards the south west slantingly ascends unto the margin of the high plateau.

A small creek runs in from southwest to northeast, enters the creek about 200 steps further on.

Diagram

Mt. Crispy is direct north from here and ascends immediately from the creek. 1400 steps to creek which seems to be the main creek. 200 steps north from here brings me to knob. Creek at bridge comes from southwest then bends east. Sighting from the hills at the camping place this upper form of creek is situated about northwest.

Saturday Sept. 29. This side of Schoolhouse $\frac{1}{4}$ mile. Sight from Bancroft road near Granite knob to gap through which the kiln road leads north northwest of our stand point. The west end of the largest hill of Granite range near the two lakes due north. Schoolhouse northwest of us.

From plateau first on road the east slope of the high plateau to our left is about running from south southwest to north northeast. The road passes the small knobs we noticed previously in front of the high knobs. One more is seen on the left of roadside which we did not observe before. We ascend the granite hill on left side of the road at gap. A sight to the edge of high plateau proves its margin to point at Bancrofts to correspond to a north and south direction. Northwest and southeast direction points from here straight unto the marginal laminated hornblende knobs seen yesterday.

Sighting at the high eastern chain the main bigger hill above small lake is east southeast and the end of the high range westward lies southeast from our standpoint. We see behind the large chain a row of lower knobs striking about in north and south direction and connecting with the eastern terminus of the west end of the eastern lake knob.

Diagram

The outer one marked with an "X" is about 35 degrees north of east seen from here. The central one is due east. A line 20 degrees north of east would strike the diorite hills near Campo Creek Kilns which we have examined a week ago. The distance from the point of observation to hill with "X" is not over 200 steps to the one due east $\frac{1}{4}$ of a mile.

From section corner are (to the) creek running into Harlows Lake 750 paces. Creek runs almost due north. From line to kilns, 425 steps south along creek. At the kilns the creek comes from southeast and is said to be not going further but $\frac{1}{2}$ of a mile. About 2 hundred steps westward at the kilns clearing, seems to indicate the centre line of the section running north and south.

From kilns return road almost south for about 400 steps then bending in southeast direction about $\frac{1}{4}$ of a mile further in that direction is the crossing of Campo Creek near the place where a small branch unites with it coming from the foot of Mt. Crispy. The road goes between rock outcrops on both sides. The creek has at the crossing a direction from the southwest and seems to pass the edge of the high plateau. At a distance $\frac{1}{4}$ of a mile upwards in that direction after the union with the Mt. Crispy branch the course of the creek is about south southeast to our yesterday's camping ground which is about 1400 steps on in that direction. Later it is fully southeast.

Line followed by Wagner east and west. Intersects road 46 steps west of corner. From there the little isolated knob near the bend of main creek. From corner to camping place 750 steps.

Diagram

Is situated 30 degrees north of west at a distance of about 250 or 300 steps. Southwest from there is the terminus of the large bulk of knobs extending from camping place on left side of road. Follow east and west line from corner. 558 steps from corner strike two trees with old blazes in north and south direction. At 682 steps strike a tree with a blaze east and west. At 1000 steps reach margin of plateau. At 1050 steps a big pine tree serving as my aim, the last green single pine tree of a cluster. Southward from it 78 steps northward is the edge of timberland joining the clearing and having an east and west direction.

400 steps north from east and west line leads along the upper declivity of plateau. Cross at that distance a ravine and wood road running down to creek with an east direction. At 550 steps north course which kept me always a little below the edge of the high plateau. I turn due east 500 steps in this direction, bring me over an undulating surface straight to the granite knobs at the foot of Mt. Crispy between which the coal kiln road passes near the bend of the creek. This creek does from here extend very little further because I had to come across it on my way. But the few ravines I passed are all dry and no sign of a continuation of the creek.

After union with the creek of camping place, Campo Creek has a northeast course. That first creek comes from the west and its sources are not much over $\frac{1}{2}$ of a mile distant, south of the knob in the angle of the creek. The margin of plateau is lined with numerous granite outcrops. On roadside to 6 kilns 700 steps due east of granite knob at camping place is a large diorite knob. See specimen.

All the knobs composed of it. Also on right side of road another smaller one projects due east of it. About 300 to 400 steps is another knob composed of same diorite and 600 steps further in same direction another large diorite hill is on right hand of road.

The road enters at this place the valley where it unites with the creek coming from section corner. The opposite side of creek is all lined with rock bluff of about 60 feet high in the east direction. Further on some little distance from the diorite hill to our right is another knob apparently composed of granite, but this granite hill is separate from the diorite chain which continues directly into the chain of the Bancroft lake range. The granite lies north of it separated by a ravine. The granite knob is about at the southwest corner of Ph. Kleins 40 acre lot.

I see subsequently that the described diorite chain does not unite with the main chain of Bancrofts knobs but forms a separate lower chain lining the valley of the Campo creek and is from the main chain about $\frac{1}{2}$ of a mile north. It connects however with the diorite hills formerly described, further east and wedged in between the high range and the granite range facing the creek $\frac{1}{2}$ mile below the kilns.

I see now also from the road that at this place the creek has rock bluffs on the northside which I did not observe before.

Diagram

Sec.

Monday Oct. 1. Starting from corner between 6 and 7 westward 700 steps we see on margin of high plateau 100 steps north of line an outcrop of granite. The line leads close along declivity of hill side. From this knob the kilns lie south southwest. At 795 steps the line has descended into a ravine with dioritic rock outcrops. (See specimens on west line between Sec. 1 and 12, 795 steps west of corner.) Diorite rock laminated.

From ravine we cross a small rock spur and descend at 867 steps into a creek running southeast. The west slope of the ridge we came over exhibits a band of granite intervening between the dioritic schist. We ascend now another hill but have to cross the circuitous creek three times in a very narrow space.

Diagram

The hill is quite steep and composed of similar dioritic schists. The quarter post is right on top of this hill. 100 steps further west we are on a broad shallow depression. At 200 over an undulating cone into a small shallow valley of a creek running from northwest to southeast. At 325 steps we are in another larger creek with steep valley running from northwest to southeast and course south southeast. At 415 paces at the foot of a rocky hill, dioritic, (see specimens), at $\frac{3}{4}$ of a mile nearly on its summit. Hill on north and south side apparently free unto 611 steps. From quarter post we continued slowly to ascend when we pass the head of a ravine running northeast. Further west still ascension. Hills decline northward and southward.

At 660 steps west of quarter post diorite rock intersected by a granite like quartzite band parallel. Still ascension. Ravines seen running northeast on righthand side. At 882 steps on summit right before us a ravine divides with one running south and the other north (300 paces centre of ravine). Rock specimen from there diorite rock mottled with granite seams.

At the corner which is on top of a little higher hill yet the hill seems to fall towards the west. We do not follow the line further but take the line southward. 137 steps northward from corner the rock ridge falls off to the northward. Also to the west and east the hill dips down and seems to be the highest point all round. 94 steps south brings us into a ravine descending westward. At 210 steps at the head of a ravine descending south. Dioritic rock on both sides of ravine which we descend. At 544 steps we came down a steep rocky hillside to the bed of a creek running from west southwest to east northeast. Ascend a diorite hill now. 600 steps from corner a specimen of dioritic schist on north and south line between Sec. 11 and 12, T. 43, R. 26.

At 635 on top of small ridge, thence descending into a ravine descending eastward. Then again ascending across another small ridge and down into a ravine. At 785 steps this ravine runs south southwest. 854 brings us over a slate knob into another ravine which unites with the other and comes from northwest. At 1132 steps we are at the creek. Slate rock on all our way. Direction of creek from south southwest to north northeast. The line would lead us a piece diagonally upwards across the valley but we ascend eastward a rounded hill the top of which belongs to the plateau.

We go about $\frac{1}{2}$ mile across this plateau in the direction of the kilns. We find there the main creek passing close by on the level of the plateau but from there rapidly descending into a deep ravine, some small ravines enter this valley from the southeast side.

Thursday Oct. 4. Followed line between 1 and 2 northward into T. 49 between 35 and 36. From corner of 1 and 2 to edge of plateau 1176 steps all level land and a good road all along the line. The edge of plateau is margined with granite outcrops. Kilns are seen in a northeast direction and a ridge of rocks strikes at the foot of the plateau east and west being situated between our standpoint and the kilns on the other side.

Diagram

Now follow the same line southward. 53 steps south of corner we cross Holyoke road. 570 steps to creek running southeast. At 638 we cross a small creek coming from southwest. At quarter post we have come over an elevation even with the plateau on other side of creek and descend now into a small ravine running southeast. Only a few steps further the line leads across a creek running northeast. Quartzite like specimen.

500 steps south of quarterpost at 535 we have to our left a ravine running northeast, the line continually runs ascending. We are near summit soon. At 734 specimens of aphanitic hard diorite, laminated. The line continually ascended to near corner post but that is situated already on the southern declivity. Ravines intersect the ridge. From corner go $\frac{1}{2}$ mile west. Pass over a ridge lower some than the corner and declining north and southward.

At 385 steps we are in a ravine on the divide, of it one end declining southwest, the other northeastward. At 459 steps at the edge of a very precipitous deep ravine with water flowing southward. Above it makes a curve towards the northeast. Cliffs of schistose diorite rock.

At 602 steps we have reached nearly to the top of an equally high hill. We descended (150 feet or more). Soon after the line follows a slowly descending ravine, continually descending unto the supposed place of quarterpost. We have reached another ravine with water running southwest. Crossing a small spur we are in another ravine entering the other in a south direction. Before us another hill ascends but we follow a northern course through the centre of section. This last ravine has flowing water and turns upwards more northwestward.

At 225 steps north we have ascended the top of a high hill with conglomeratic rock. Free view southwest and in part northward and brisk decline all round. At 300 a ravine to our left running southwest, From the flat into which we have descended. At 472 steps the drainage is northward. At 800 steps have descended into one of the ravines running northeast. We leave it and ascend a hill again. At 1178 cross a small watercourse running northeast, now dry.

Walking across a spur of dioritic rock like the other we soon descend into a wide flat valley which we have traversed at $\frac{3}{4}$ of a mile from our starting point. We are there on a flat low rock knob also dioritic. 50 steps further the rock briskly breaks off and 60 feet below us is a large swamp.

Friday Oct. 5. Follow east and west line from corner between 11, 12, 13 and 14 of T. 48, R. 26. A quarter of a mile west of crossing creek on high level land the knob over which we came is not higher than the plateau, but the hill we passed on the left of our way is considerably higher.

Behind it a ravine seems to be running towards Dead River and separated by a depression. Another high hill rises south southwest of our present position 600 steps from creek. The course of the supposed creek towards Dead River is about east. We have traveled now 1158 steps from creek over slowly rising plateau, ground all over drift covered and with ravines going to either side northeastward and southeastward. On the other left hand side we stand now on an elevated edge descending into a depression which seems to be running out into a valley with a nearly northerly direction. Right before us on line we see a hill higher than our present standpoint and with outcrops of rock. The rock is granite. In one place I notice a seam 5 inches thick running through it in west direction of which I took specimens. The seam is evidently injected into a crack of the granite.

On this granite hill is the section corner. Beyond the corner we would have to descend into a broad level terrace land expanding on the north side of Dead River. Dead River is scarcely 500 steps north of us. The rock ridge becoming lower extends westward until it strikes the river about $\frac{3}{4}$ of a mile west of us. The river plateau is on left side of line. See figure on other side.

Diagram of above.

Descending southward towards Dead River I cross a large dyke of dioritic rock 7 about 35 to 40 feet wide running about east and west. See specimens. From near corner descent unto plateau about 75 steps across plateau to edge 467 steps. There a descent of near 100 feet to River valley which is 710 paces from corner south. River coming at kilns established there, from west, briskly turns westward before it makes an abrupt bend to the east. The high granite hills on the other side are directly ascending first to the level of the large plateau, then the higher knobs, distance about $\frac{3}{4}$ of a mile.

Diagram

I mentioned before the west line strikes the main river but I found afterwards that to be a tributary entering the river. The river bends more southward.

Diagram

Terrace of river composed of drift. Terrace in two offsets. Creek running into dead river in southeast direction. It may be $\frac{1}{2}$ mile before the east and west line from corner would strike it or not much less. On south declivity of high hill north of the river about $\frac{1}{4}$ of a mile below kilns, granite bluffs. Sight from edge of plateau on road. High granite hills west northwest. Stone's Mill north northeast. Brickyard a few degrees east of northeast. Distance from diorite bluffs near lake on railroad $\frac{1}{4}$ of a mile.

German paragraph See Translation, page 1, Paragraph 4.

Sunday Cross creek on section line between 1, 2, 11 and 12. Creek runs east southeast. Comes from the west side of high quartzite knob which is crossed by the line. Followed east and west line to supposed corner between 1 and 2. From there 120 steps east the line crosses the creek. Going north line crosses same creek 100 steps from the east and west line. Creek runs southeast. At 223 steps from supposed corner we are on top of the granite range and at its eastern end. From there the high quartzite knob south of the marble quarries is situated east northeast.

The position of the granite range would accordingly be about 500 steps further south than I marked them on the map. From here we can see a ravine which runs southward. The hills which I had intended for granite hills may be left standing on the map but they consist of quartzite. Direction of granite range west southwest to east northeast. The granite is pervaded by a great many irregular bands of a granular quartzite with epidote and often a band of slate rock is connected with these seams. See specimen of quartzite and slate.

Small diagram

German paragraph. See translation page 1, paragraph 5

A small creek runs from the
Foot of quartzite hill to the larger creek the farm is near the quarter post.

6 pages of German. See translation page 1, paragraph 6

Two diagrams

Wednesday Oct. 10. On east and west section line of south line of section 2 from quarterpost to corner which is close to a creek running from northwest to southeast. The highest point of the ridge E. and W. over which we came is 750 steps west of $\frac{1}{4}$ post. 200 steps along the hill side north brings us into a ravine from N.E. to S.W. Then ascent again diagonally across the spur of a hill. At 376 steps again in a creek running to southwest. 450 steps from corner the line passes quartzite rocks on left hand side over this spur. At 500 we see below the roots of fallen trees the altered granitoid quartzite.

Diagram

At 621 steps we are at the head of a ravine running southeast. Water in the ravine. Rocks conglomeratic quartzite. See specimen. Line follows now this creek for awhile upward. At 828 steps we leave the creek bed to our left and ascent a small knob of slaty quartzose rocks, dark colored streaky slate striking east and west. Dip south. We can see now into the valley with the lake. The high quartzite hills on Carp river are now a little east of north from here. The high quartzite knob with granite at the base is seen in distance in an east northeast direction. At 890 steps the slate contains bands of marble. We descend now again into a valley or ravine over marble cliffs which runs northeast. We do not find the quarter post but about there we ascend from the ravine unto another marble and slate hill. See specimen. The rock has here only a gentle dip of about 30 degrees southward.

I went now on the marble hill about 100 steps eastward from the north and south line and had a fine (free) view over the country. The little lake is situated slightly north of east of the present standpoint about $\frac{1}{4}$ of a mile distant. The ravine from which I ascended flows toward it almost in the prolongation of the line striking across the little lake is a high knob of quartzite marked on the map with "X". The isolated knob of quartzite underlaid by granite is due east. The line crosses further on other marble and slate knobs but we turn now due east.

Supposing the quarterpost to be on the crest of the marble hill we follow from it the declining crest eastward and have descended into the bed of the creek at 220 steps. Creek flows almost due east. We follow it for awhile.

Diagram.

At 313 steps we leave the ravine to our left and cross the footspur of another marble hill and come into the same ravine again. We proceed in it unto 621 steps from our starting point and have ascended another footspur of a marble hill. All the way on both sides of the ravine particularly on left side are marble ridges running eastward. We are now due north of the quartzite hill marked with "2" and only separated from it by the valley of the creek. We pass now over another considerable marble and slate knob with the valley to our left. The top of the high hill seen from the farmhouse which I ascended some days before is seen in southwest direction from our present standpoint. At 622 steps we have from $\frac{1}{4}$ post

German paragraph.

60 feet above the bottom of valley the lake would be touched by our course on its southside. On the opposite side of the valley in front of quartzite range similar ridges of slate hills are noticeable parallel with ours. At 1000 steps we have descended close to the lake into the flats. The creek runs into it. To our right are very large perpendicular rock walls of the slate hills which continue in an uninterrupted chain to the slate and marble hill formerly described as being on the border of the lake.

Margin of knobs from farmhouse unto they meet with the big quartzite knob runs from northeast to southwest. The two knobs next to the farm are quartzite. The 3 others, very abrupt ones, are marble and slate. Below them diorite schists protrude and the slate is considerably metamorphosed. The foot of the quartzite hills near farm along the creek is granite and metamorphosed quartzite rock.

Diagram

The lake and its valley have to be much larger than on map. The outlet goes into Carp river passing the foot of the novaculite hill. 1246 steps to creek. At 1400 steps close to left hand a low outcrop of quartzite. At 1500 corrugated slate outcrops near top of quartzite hill beyond the bluff of diorite rock.

German Paragraph

Diagram

Thursday Oct. 11. From corner of Sec. 2 west 64 steps from corner crossing of the creek running south southeast. Ascending now to our left another branch of $\frac{1}{2}$ creek unites with this one only short distance below. That creek is larger than the other one.

Diagram

50 steps across a spur from one creek bed into the other. That one runs from northwest to southeast. The hill we ascend is granite. Likewise a seam of slate rock is close by on our line. See specimen. Strike westward. 164 steps bring us to cross the before mentioned creek. At 207 steps we are on top of a granite spur from which we immediately descend into the same creek as before mentioned. South of us is a large knob. At 230 steps we cross the same creek again but the line follows now the course of the creek which is to our left side.

At 325 steps we find two creeks uniting in a broad flat valley. One comes from southwest and runs northeast, the other comes from north and runs south into the other. At 566 steps we come again to the same creek which all the time runs to our left. The valley continues on. On our right we cross the creek and diagonally ascend along a hill side close by the creek which follows us on the right. At 734 steps, always along the declivity of the hill, we cross a ravine coming from southwest which enters the main creek close by us which diverges a little northward from the continuation of our course.

We ascend from the ravine a hill having generally been ascending all the while. At 875 steps we are nearly on top of hill. An outcrop of granite there and joining it a green dioritic rock which is probably a dyke. To our right we still see the creek in a deep ravine and the northside of the ravine is likewise a high hill like the one we are on. At 927 steps we have descended over a brisk declivity into the bed of same creek which now comes from the southwest. In its bed is a peculiar conglomeratic granitoid rock. See specimen.

We now cross the creek which still follows our course on the lefthand side and ascend a granite ridge of peculiarly conglomeratic rock character and find on its dorsum the quarter post. Direction of this ridge east and west. 125 steps from $\frac{1}{4}$ post over the crest we come to a depression with small creek running south at that spot, above coming from northwest. At 210 steps ascending, outcrop of quartzite-like rock. See specimen.

We travel as far as $\frac{1}{2}$ of a mile from corner continually slowly ascending over the back of an east and west ridge north. A ravine follows our course all the time of short distance. Also on the south side small ravines can be noticed. 593 steps from quarter post outcrop of granite with a two feet wide dyke of slaty structured rock. See specimen.

Apparently we have now reached the highest summit except left of us seem to be still higher portions of this height. To the right we still see the ravine running to the eastward. The line leads now on the north declivity of this hill gradually descending into the bottom of the before mentioned ravine. Red granite bluffs along our road projecting.

The ravine seems to be the watershed because before the water decidedly had an eastern direction while now an outlet appears to be to the westward. We will directly examine it. On the other side of the ravine 800 steps from quarterpost is likewise a high granite knob visible. At 836 we are at the entrance of a ravine descending westward at the point of division of the water courses. Right and left of us granite bluffs. Take dinner here.

The line crosses now the ravine but runs along side of it over a small bluff ridge. At 940 steps we have descended into a branch ravine which comes from north and enters the other. East and west ravine close to the left of us. Crossing now another small knob of red granite. South a still higher ridge. Across the ravine the section corner is right on top of this knob. From here we strike north.

82 steps from corner we have descended into a depression and commence to ascend a granite knob. At 140 steps we are across it (in) another small depression. Ascend again. At 233 steps we are in another ravine running northeast.

Go across it and traverse another hill spur descending at 422 steps into a ravine running east northeast which connects with the before mentioned one. Now go across another spur of granite. Descend a brisk declivity at 486 steps into a ravine running east northeast. Going along the slanting hill side across the ravine we pass at 706 steps to our left a granite bluff. Begin to descend. Further on at 805 steps in bottom of ravine running east northwest. Mounting now another spur and soon descend into a large broad valley in which we find the quarterpost before us, and to the right of the line a deep ravine commences with brisk descent east northeastward.

Wagner went 100 steps beyond quarterpost and then struck east. We follow now the large before mentioned ravine which we strike at 165 steps from line. High hill sides on both sides of us. No rock visible at the (this) place. We follow the ravine for 100 steps when it bends north northeast and we leave it crossing the spur of the hillside to our right. And after crossing it with 348 steps are in the bed of a creek coming from southeast and running northwest until it meets the other before mentioned creek of ravine. But this latter one is the larger creek. Ferruginous quartzites are in the bed of the creek and the surrounding hill sides are likewise composed of it.

A few steps east from where we crossed it the creek bends abruptly to the east, that will say flows from the east. We are on its bed now 418 steps due east of line. There is an outcrop of red marble (specimen). Strikes west, dip north. A road is here which has a southeast direction. The creek makes here another bend. Its direction being from south. We follow the road in southeast direction and along the roadside is a creek running northwest until it joins the other one at our starting point. The road is in a ravine between hills, on each side ascending. After 183 steps along creek the road turns east, on our left side level lands, on the right high bluffs of quartzite or marble ? .

363 steps from starting point on road we have still the creek on our side, have reached now a log house. The creek now from log house has a direction from east southeast. We follow the road on east southeastward, at 475 steps the road turns southeast. A marble outcrop here on our left hand formed by low hill bluffs.

804 steps from starting point we are still in the swampy valley of this creek. Hills on right hand, swampy ground to the left of us. The road continues on east southeast. An outcrop of granitic conglomerate rock at 880 paces on hills to our right.

At 964 steps on road in swampy valley rock knobs with perpendicular walls on both sides. The rock on left side is a mixed quartzose schistose rock, on right side it is granite. We go on between rock walls on the swampy valley ground due east. To the left a high hill of altered quartzite rises while close to the right the granite crops out. We ascend the quartzite ridge and follow it eastward until we are 1940 steps from our starting point at creek. On our way we find the quartzite and marble slates disappearing and altered quartzite and granite rock coming to the surface. Further on again the slates and quartzites come out.

We have gradually descended again in a valley where we meet with a trail which we follow. The quartzite range is very high and must be recognized from distance as we do not know exactly our whereabouts. At 2546 steps we are on the top of quartzite hill above the farm where we have our horse, about 40 acres from the north of south line of Sec. 2. Our general course therefore was east southeast.

TRANSLATION OF GERMAN PARAGRAPHS

OF

C. ROMINGER 1877

Paragraph 1. See page 4, German Paragraph 1

The northern abrupt descent or declivity of these knobs is 50 feet. In an east and west ravine the road runs. Farther on is (are) undulating east and west hills. Northward in a valley the descent is gradually wider (or broader).

Paragraph 2. See page 4, German paragraph 2.

So then we went east for more than 500 steps over a broken level high plateau that stretches further northward, about north of west. About 300 steps from the line are coal kilns. By 610 steps we are at the creek. The corner must also be further south than we thought it was, about by the blockhouse (log cabin). The creek which at the crossing runs east, after a few steps turns northward and holds that direction for a $\frac{1}{2}$ mile. At this place the creek is over 100 steps to the right of the line in a ravine running westerly, where it makes a sharp bend and flows faster to the east.

Paragraph 3. See page 5, German paragraph .

The section corner cannot be far from the bridge at the foot of the ridge. (Easterly). The southerly corner is in a swamp 300 steps from Camp River.

Paragraph 4. See page 13, German paragraph

According to L. Schweitzer he visited that land. The $\frac{1}{4}$ post lays 30 steps north from the bridge over the Dead River by the kilns.

Paragraph 5. See page 14, German paragraph.

Northeast from the farmhouse lays the large quartzite hill. The granite underlies the quartzite.

Paragraph 6. See page 14 - 6 pages of German

The foot of the granite hill in N.E. $\frac{1}{4}$ of Sec. 2, T. 47, R. 25 is intersected by large dykes of different kinds. specimens were gathered there. The large quartzite hill is a knob like a blister forming the cap, on all sides the schists fallen in. In the centre of the opening (crater) you can see schist rock, metamorphic quartzite and layers of slate rock. Through the turn over (revolution, evolution, or change) produced the granite of the knob. The granite rock of the hill east therefrom is the same metamorphic quartzite produced in ever so many irregular massive dyke-like bands (?) of sandstone and quartzite with slate rock layers intermingled.

Thursday. (Thurs.) Granite hills at Steinbruchs, the diorite laminated stone is in many regular massive bands, and striped granites intersecting.

C. Rominger August 21, 1977

Possibly
Waynes
ack

Starting from the old R.R. on Sec. line bet.
450 paces west of quarter post. For about 100 paces the
valley of the old R.R. bed. From here the land gently raised toward west.
At a point 200 paces west of quarter post I reached the plateau about 30 or 40 ft.
above the old R.R. bed. Trap rock cropping out in places. At 275 paces west of $\frac{1}{4}$
post I struck the R.R. valley and crossed the old R.R. at 350 paces west of quarter
post.

In looking southwest from this point at a distance of about 250 paces I saw the
trap chain of the Gorge (?) Hills, running about east and west along the south side
of the old R.R.

From the old R.R. I went west 100 paces and not being able to find the corner on
account of the burned timber and under brush, I turned north knowing at the time I
was exactly on the east and west line. From here I noticed a trap hill southwest of
me of about 75 or 80 feet high of which I took samples. 45 paces from corner I
struck a small creek running from southwest to northeast towards the old R.R. At
120 paces from corner I crossed another trap bluff of about 75 or 80 feet high of
the same kind of rock. At 350 paces north of corner I crossed the edge of a coarser
grained trap bluff of about 40 or 50 feet high of which I took samples. This bluff is
running northeast and southwest and a small ravine running on the east side of the
same.

From this hill I seen small trap knobs in most every direction and all the ra-
vines dipping northerly. At 450 paces I reached the No R.R. (may be N(ew) R.R.)
75 paces east of the 5 mile post. The line is visible here on Beach three (beech tree)
standing near to the top of the bank on the south side of the road.

On the north side of the road is a chain of small trap hills running parallel
with the road about northeast and southwest. The whole distance from the old R.R.
to the new one is very broken and small trap hills are visible in most all direction
until near the junction of the two roads at the Bruce (?).

Thursday Augst 23, 77. Starting at county road on Sec. line between Sec. 29 and
30. The road is running at this point about east and west. Going south 100 paces I
struck the edge of a big trap hill running east from the line. At 170 paces I reached
the top of the hill and at 200 paces I commenced rapidly descending towards the bed
of a creek which I reached at 350 paces from the road. This creek was running east
and west at the line and curving on east side of line towards the south.

At 445 paces I came to a high bluff without outcrops of rock. The line running on
the east slope of the bluff and never reached the top. The creek running close along
the foot of the hill on the east side in a southerly direction. At 600 paces I reach-
ed the corner post nearly at the top of the hill. Going south from corner the land
is gently rolling with small ravines running east towards the creek.

At a point 134 paces from corner I struck an old road running east and west and
at 268 paces I struck a large clearing on west side of line. At 500 paces I saw
a big chain of gravel hills 300 paces west of line running about north and south
and forming a kind of divide, water running east and west. At 1275 paces I came to a
creek running through a deep gully. The creek run from southwest to northeast.

C. Rominger August 21, 1877

Starting from the old R.R. on Sec. line between sections 19 and 30 at a point 404 paces west of quarter post. For about 100 paces the line runs through the level valley of the old R.R. bed. From here the land gently raised toward west and south. At a point 800 paces west of quarter post I reached the plateau about 30 or 40 ft. above the old R.R. bed. Trap rock cropping out in places. At 875 paces west of $\frac{1}{4}$ post I struck the R.R. valley and crossed the old R.R. at 950 paces west of quarter post.

In looking southwest from this point at a distance of about 250 paces I saw the trap chain of the Gorge (?) Hills, running about east and west along the south side of the old R.R.

From the old R.R. I went west 100 paces and not being able to find the corner on account of the burned timber and under brush, I turned north knowing at the time I was exactly on the east and west line. From here I noticed a trap hill southwest of me of about 75 or 80 feet high of which I took samples. 45 paces from corner I struck a small creek running from southwest to northeast towards the old R.R. At 120 paces from corner I crossed another trap bluff of about 75 or 80 feet high of the same kind of rock. At 350 paces north of corner I crossed the edge of a coarser grained trap bluff of about 40 or 50 feet high of which I took samples. This bluff is running northeast and southwest and a small ravine running on the east side of the same.

From this hill I seen small trap knobs in most every direction and all the ravines dipping northerly. At 450 paces I reached the No R.R. (may be N(ew) R.R.) 75 paces east of the 5 mile post. The line is visible here on Beach three (beech tree) standing near to the top of the bank on the south side of the road.

On the north side of the road is a chain of small trap hills running parallel with the road about northeast and southwest. The whole distance from the old R.R. to the new one is very broken and small trap hills are visible in most all direction until near the junction of the two roads at the Bruce (?).

Thursday Augst 23, 77. Starting at county road on Sec. line between Sec. 29 and 30. The road is running at this point about east and west. Going south 100 paces I struck the edge of a big trap hill running east from the line. At 170 paces I reached the top of the hill and at 200 paces I commenced rapidly descending towards the bed of a creek which I reached at 355 paces from the road. This creek was running east and west at the line and curving on east side of line towards the south.

At 445 paces I came to a high bluff without outcrops of rock. The line running on the east slope of the bluff and never reached the top. The creek running close along the foot of the hill on the east side in a southerly direction. At 600 paces I reached the corner post nearly at the top of the hill. Going south from corner the land is gently rolling with small ravines running east towards the creek.

At a point 134 paces from corner I struck an old road running east and west and at 268 paces I struck a large clearing on west side of line. At 500 paces I saw a big chain of gravel hills 300 paces west of line running about north and south and forming a kind of divide, water running east and west. At 1275 paces I came to a creek running through a deep gully. The creek run from southwest to northeast.

From this creek the line runs up a high gravel bluff about 200 feet high. No outcrops of rock to be seen. On account of the undercrush being too high I was unable to find the corner. I could not see any hills eastward from here except the high plateau southeast of corner. All the drainage was north towards the stream.

From here I turned westward and found the creek about 450 paces west of corner. The banks here were not quite as high as they were on N. and S. line. The land between the corner post and the creek is generally level, dipping near the creek towards the same. On east side of creek I found outcrops of quartzite of which I took a sample. At 1000 paces from corner I found a small quartzite hill of which I took a sample. One hundred paces S.E. of quarter post I found another quartzite hill of a larger dimension. From the quarter post the land rises slowly westward. From here I went northwest on an old kiln road towards the Morgen Furnace. About 300 paces from quarter post I found a small outcrop of slate in the road bed of which I brought samples.

Aug. 26, 1877 Starting at the township line going north at a point on the New R.R. 450 paces north of the corner. At 40 paces N. of R.R. I struck a creek running from N.W. to S.E. along the north side of R.R. At 100 paces north of R.R. I crossed a knobious trap range running about northwest and southeast. At 300 paces north of corner I passed through a gully between two trap knobs and at 355 paces I found the line placed on a cedar tree.

At 1000 paces from corner where the quarter post should be I found myself in a valley. Northwest of quarter post the land commenced to rise to a plateau, water running on north side in the river and on east side towards the creek. At a distance of 764 paces from quarter post I struck a road which I followed to the brickyard. From brickyard I went direct to the corner. 300 paces north of corner I found a small trap and granite knob of which I took samples. From here 100 paces north is the river. The banks on the south side of the river is about 20 feet high.

The land east of here is a level plateau and the land north of the river is a level valley. Hill commences to raise again $\frac{1}{4}$ of a mile from here.

4. Diagrams.

Aug. 31, 1877. Went with Mr. Wollner to the S.E. corner stake of the N.W. $\frac{1}{4}$ of the N.W. $\frac{1}{4}$ of Sec. 17. This stake sets in a little swamp running N.E. From here I went N. 500 paces to the East and west line, from which I struck east. North of this line for about 150 paces were outcrops of granite. At 200 paces from the above starting point I struck the Forestville road. At 375 paces I found myself yet about 200 paces south of Granite knob where we was on yesterday. This knob is in the S.E. $\frac{1}{4}$ of the S.W. $\frac{1}{4}$ of Sec. 3.

At 500 paces from where I started from on this line I looked for the quarter post but found no trace of the same. I then started on east again and came to the banks of the creek which are about 75 or 80 feet high. In this creek I found a line stake planted on east and west side. This stake is 360 paces from my supposed quarter post. A little stream coming from the east emptied in the creek at this point. From the banks on the east side of this creek I saw Dead River in a northerly direction about 200 paces off.

At 780 paces from quarter post I reached the Collinsville road. The land between the banks of the creek and the road is a level plateau. From this road I started for information about the corner to Collinsville. Mr. Mycoff told me where the corner was and I found the same on the road 206 paces east of where I came on to the same. In pacing 80 rods north of the southeast corner of northwest $\frac{1}{4}$ of the northwest $\frac{1}{4}$ and from thence eastward for $\frac{1}{4}$ of a mile I reached the corner only 20 paces out of the way.

From here I went north towards the river. The ground from the corner slopes down towards the east and northeast for about 150 paces when I reached the river bed. 525 paces brought me to the river. The river was here running northeast and close to the banks on north side which were about 50 feet high. 100 paces southwest I came to the mouth of Dutch Town Creek coming from the south. From here I followed the river up to the falls.

After examining the ravines and bank of the river I started to the east and west line and paced (or traced) the same through to the corner. The line passed close to the large granite bluff visible from the forestville road on the south side of the same which would place him (it) in the S.W. $\frac{1}{4}$ of Sec. 8. In the N.W. $\frac{1}{4}$ of the N.W. $\frac{1}{4}$ I noticed a small knob of about 100 feet long and about 25 feet high. This knob was about equally divided by two formations. The south half of the same being granite and the north half a coarse grained Ignite.

200 paces schoolhouse due west (about 250 paces). 300 paces on top of Dead River bank running about east and west. They are about 30 feet high. 500 paces in Dead River valley marked on a burned hemlock tree. Granite knobs about 150 paces east of here. In coming 250 paces west from there 250 paces I struck a creek.

September 5, 1877. Starting from the powder mill the river runs for about 150 paces due east from which it curves north about 75 paces. From here it runs east again for about 400 paces. Several small outcrops of granite are visible on south side of river. The banks on the north side of river are about 25 feet high. On the south side the banks are further off and forming a slow descent towards the river for about $\frac{1}{4}$ of a mile when the little creek comes close to the river again on the south side.

Here commences a group of several knobs composed of granite, trap and slate with iron and quartz veins running with the formation northeast and southwest through the same. One of these iron containing veins is about 3 feet thick and one of these quartz veins is heavily charged with chlorite. This group of knobs are all in S.E. of N.E. $\frac{1}{4}$ of Sec. 10, T. 48, R. 25. Close to the north of this knob is the 1/8 post. On section line the river runs east for about 100 paces and then bends towards the north into the Sloo. The banks on the south side continue at about 15 feet high till close to the Sloo.

In following the section line south to quarter post I struck another group of small knobs containing granite and quartzite. 70 paces from quarter post south the line crosses a west Sloo with a wide outlet running S.W. towards Dead River. From another (or quarter) post I went S.E. to Riedingers slaughter house 500 paces from $\frac{1}{4}$ post. Back of the building is a red granite knob with a dyke of trap 15 feet wide running through the same. From here I could not see any more knobs or hills of notice in any direction.

September 6, 1877. Starting in on east and west line between 3 and 10 I marked down the pond and swamp connected with the same and went west. At 500 paces I went to a small granite knob 225 paces north. This knob contained but narrow dykes of diorite and was about 20 feet high. Coming back to line I went south to some high bluffs. This bluffs contained Granite on the north and a belt of diorite of about 75 feet in thickness run through the same on the southern slope forming the highest knobs and running out on the west end to a sharp point.

West from this point I struck two small granite knobs and after this a larger one. Through all these knobs dykes of diorite were running with and across the formation. On this last knob I discovered thick seams of epidote in places charged with copper running through the dykes.

From here I took the north and south section line and went south. 325 paces from corner I passed a large level granite bluff on the east side of line. At 650 paces from corner I struck another small granite knob running from S.E. to N.W. and about 250 paces due west I was (on) another small granite knob. At 360 paces I reached one of the Powder Mill Bluffs which is about 50 feet high. The line which is well placed passes on the east side of bluff according to the government map. 175 paces E.S.E. from here I reached the highest Dead River Bluff which is about 75 or 80 feet high. The rock on the bluff is mostly a gray granite and on some places red with dykes running through the same.

477 paces from old R.R. to New R.R. on east and west line.

Diagram

Mounty Christy (Chrisby) is one of the largest hills in Marquette County.

September 22, 1877. Starting on N.E. corner of Sec.9. A small creek is running from this corner in a N.N.E. direction. From the corner about 200 paces north is a small granite knob and about 150 paces due west from this is another one of a larger size. From here I went north to the little lake. I found the lake considerable larger than I first anticipated. This lake is running about southeast forming a large basin on the east end of the same. 3 small granite knobs are visible from N.E. to east.

In turning back I struck a magnetic dyke about 10 feet wide running N.W. and S.E. Going west from corner post the land gently rises until 225 paces when I came to a high granite knob. The highest peak was on the north side of line. On account of the green timber I was not able to observe the neighboring hills. At 400 paces I found small granite knobs south of the line. These knobs were not of (off or over) 20 feet high from plateau.

Between here and 80 rod post I met a little swamp. South of 80 rods stake are some small granite knobs. 65 paces further I met another small granite knob. Looking from here south I saw a chain of small knobs running from S.E. to N.W. and are here about 400 paces off. This chain of knobs runs to the $\frac{1}{2}$ post which is about 500 paces south of Carl Bora's house. This chain continues in a N.W. direction from the $\frac{1}{2}$ post hill.

Another chain of knobs is about 700 paces S.W. from here running also in a N.W. direction toward the corner post hill. 450 paces due south I struck a diorite hill running east and west. A granite bed of about 20 feet thick running through the diorite. South from here the land is descending toward Dead River. Struck Morgan Road 525 paces from supposed $\frac{1}{2}$ post. Hill on north side of line running east and west.

September 29, 1877. The creek at Filas from south of small one runs east north-east. Near the corner of Sec. 5 and 6 is a quartz and chlorite vein of about 6 ft. thick overlaid by slate on both sides of the same. By turning west from corner 300 paces I struck a Granite hill about 75 paces north of the line. At 410 paces I found another granite knob close to line on south side, line running through a ravine coming from west to east.

At 700 paces I reached the top of hill. A still higher hill is visible from here in a N.W. direction about 200 paces off. From here westward the land forms a high plateau, slowly descending west at 1477 paces I struck a small granite knob on line close to the creek. At 1620 I reached the creek. At 1710 paces I came to a granite knob forming the bank of the creek on east side. At 246 paces I reached the road.

4 diagrams.

757 paces west of road reached the summit of hill. From here it descends rapidly towards the west.

(N.B. The preceding 4 pages are in very different handwriting and words misspelled are not the ones of Dr. Rominger. Under Date of Aug. 23, 1877 in Dr. Romingers notes I find this note (see German translation page) "Sent Wagner to examine the town line at Sec. 31. Received his report and will go tomorrow to examine it myself". Might this not be the report of Wagner in his own handwriting.)

Saturday Oct. 13. Examination of outcrops on northside of city. Well laminated schists separating in rhomboidal cleavage and at least 400 to 500 feet in thickness are interlaminated with bands of granite from a few inches to many feet in thickness. These bands are wedgelike and the acute ends are intercalated between the laminae of the schists. It is fully evident that the granite has entered between the strata by injection and is not a metamorphic condition of one of the sedimentary beds.

(N.B. The above paragraph is in Dr. Romingers handwriting as are also the following list of apparently specimen numbers and the location from which taken.)

- T. 49, R. 25 - No. 2
- T. 49, R. 33 - No. 156
- T. 47, R. 25 -
- T. 47, R. 29 - No. 25, 27, 28, 29, 157
- T. 47, R. 26 - No. 134, 153, 151, 150, 149, 40, 39, 18, 19, 8, 7, 5, 3.
- T. 47, R. 27 - No. 13, 21, 37, 148
- T. 47, R. 28 - No. 152, 35, 15, 6
- T. 47, R. 30 - No. 164, 165.
- T. 48, R. 25 - Thin sections No. 1, 4, 77, 16, 20, 23, 26, 742, 755, 143, 144, 146, 147
total 13
- T. 48, R. 26 - No. 140, 141, 138, 139, 42, 38, 22, 9
- T. 48, R. 27 - No. 41, 145
- T. 48, R. 29 - No. 30, 33, 158, 161, 163
- T. 48, R. 30 - No. 162, 159, 160, 158, 36, 34.
- T. 46, R. 29 Republic - No. 168, 167, 166, 32
- T. 46, R. 26 - No. 17, 18, 19

Paid for Dr. C. Rominger

Est.		.75
Sep. 1		.25
"		.25
3	Company	.25
		3.00
5		.25
6		.15
7		.10
8		.30
10	Hotops Mill	2.06
	For board	.35
	" nails	.10
	" bead (bed or bread)	.50
11	Paid Indian for test	.50
14	For bread	.10
15	Paid for huckleberries	3.00
		<u>11.92</u>

Received payment Sep. 15th.

A/C with Dr. Rominger

Sep. 18		.25
19		.25
20		.55
21		.30
22	Sunday	.65
24		.55
25	Fur .45 Prof. .25	.70
26	" "	.70
28		.25
29		.68
Oct 1		.25
4		.25
5		.25
7		.25
9		.20
10		.25
		<u>6.02</u>

John Baptice
A.W. Bernard
Jas. Boldic

Diagram

(K.B. The above account is in the same handwriting (Wagners ?)

May 3	To Detroit	1.15
	Baggage transportation to R.R. and boat	1.50
	Dinner	.75
	Return to Ann Arbor	1.15
	6 notebooks	2.00
	Steamboat to Marquette	16.00
12	Hotel bill at Marquette	1.50
	Transport of baggage to R.R.	.50
	R.R. fare to Negaunee	.55
	Over freight	.25
13	Negaunee, dinner	.50
	Dray for baggage	.25
	Room rented at 6 dollars per month	
	Post Office box to Jul. 1	1.15
	" " to Oct. 1.	
15	Blanket	2.50

E A Marsh July 1874 Salsberry mine.

Negaunee, Wednesday May 15. Went to N.W. corner of Sec. 31, T. 48, R. 26. About 75 steps north of corner. Descent to ravine from south of west to north of east. Hill of dioritic schist on this spot. Strike east and west almost perpendicular. 25 steps south of corner descent to a ravine. At 90 steps in bottom of ravine descending eastward. 150 steps south of corner on crest of another schistose east and west ridge. From there descent at 225 steps in ravine. About 60 steps to the south-east a higher ridge of diorite. Line goes over the lower portion west of the summit. At 500 steps still dioritic schists.

From here followed a road southeastward, leaving the line but bending westward, meet the line again in the bed of the creek. North of the valley dioritic schist. South side formed by a quartzite ridge which continues to the shore of the lake. Quartzite about 300 feet thick striking nearly east and west. Stratification in this spot indistinct.

A seam of novaculite-like slaterock 7 feet wide cuts across the quartzite striking from southwest to northeast and dipping northwestward or almost perpendicular. This slate vein is very much curved and distorted and the fissures filled with white quartz.

The eastern extension of this quartzite ridge is intersected by the outlet creek and ascends here on the east side into a high knob which is distinctly stratified and has a southern dip. On the 40 acres line east from the town line is a fence near east and west.

Diagram

400 steps to crossing foot of high diorite hill.

Afternoon followed town line south. Quarter post must be somewhere in the village near Jackson Hotel. The southwest corner of the section is on top of the hills marked by a thicket underbrush joining a clearing. The south line of the section is likewise joining the clearing by underbrush.

255 steps east from corner turned north and came at 150 steps to the edge of diorite hill. The diorite on the line goes 200 steps northward and between this space is a depression in which the heavy ferruginous strata extend half that distance southward.

Diagrams

From south corner mentioned 490 steps to edge of first iron mine at crossing of town line and not far from corner which is visible yet on a stump. The section corner is about 150 feet southwest of the ^{NE} corner of the mine. Strata dip south. In the mine strata much contorted, most southern dip, others north.

Diagrams

Paragraph in German

The east and west ore track is 400 steps north from Sec. corner German

Depot 360 steps north of road in south half of the section. Supposed to be the line $\frac{1}{4}$ mile from corner. 200 steps northwest from depot to crossing of town line.

Thursday May 16. To Teal Lake section corner on town line, thence west. The lake west of corner crosses the line only a few feet. Then bends its shore north of the line. The quarter west is in the declivity of the drift hill forming the foot of a diorite crest. Distance from shore about 200 steps, elevation about 50 feet.

3 pages German

200 steps from line on Jackson Hotel to first opening of Jackson mine at the south end of Breitung Street.

750 steps to entrance of railroad cut close to engine.

2 paragraph German

Return trip from point where the railroad strikes close to diorite hill with vertical walls which at the gravel pit joining it appears to be on the line between 1 and 2. 400 steps to last hoisting shaft of Jackson mine. Pioneer mine. 180 steps above the tunnel running under the road. From there 350 steps to telegraph post before mentioned. 1000 steps from Jackson house, Nagsunee.

Diagram

Friday May 17. R. R. track strikes $\frac{1}{4}$ post of Sec. 6 (centre of Sec.) at the spot where the state road and the road from the Pioneer furnace strike it. From corner near Catholic graveyard along line north 415 steps to foot of schist hills. 450 steps to top of ridge. Then brisk descent to quarter mile post which is at the foot of north side 500. From supposed quarter mile post to foot of quartzite hills 225 steps. Quartzite dip south.

2 Pages of German

Diagram

Saturday May 18. Followed line south passing the McOmber mine, the 40 acres stake in northwest quarter of Sec. 7. not far from summit of diorite ridge. Then above a swampy plateau with knobs of diorite and much slate ore and banded ferruginous silica slates in patches surrounding the diorite rocks. Also drift boulders on the northwest corner of the 40 acres lot belonging to Breitung a diorite knob and nearby at its base ferruginous silicious schists dipping south. From there line descends into a (gulch) and towards the corner between Sec. 7, 12, 13, 14 another diorite knob is situated declining from the corner south and westward into a valley.

Following now the line east between 5 and 10, I descend the diorite knob into a narrow swampy side ravine of the before mentioned valley and have at the east end of the 40 acres lot descended another diorite knob. Separated by a ravine I see to the east close by another dioritic knob whose slanting sides are surrounded by ferruginous silicious schists dipping southwest away from the diorite, forming the summit.

Diagram

2 pages of German.

Sunday 19. From quarter post to county road at street about depot 575 steps. To middle of street to depot from quarterpost 250 steps. 165 steps from supposed 40 acres line to mine railroad. From mine to railroad 250 (or 1250) steps. from R.R. at post 1 mile to Mineral branch at furnace 7 paces.

Tuesday 21. Followed road running north through the east half of Sec. 31, T. 45R. 26. About 40 acres from south line of Sec. Strike slate belt. 103 steps wide. Then flat to quartzite range. About 300 steps wide. Dip of strata south at an angle of 70 degrees. Balance in German.

Diagram

3 pages of German.

Friday May 24. From section line 170 steps to first knob of banded iron ore on side of road track and opposite the street to Breitung's house. (followed track of road west). Office of Jackson mine 1133 feet from line. From corner on McOmber to depot 2400 feet. Teal Lake 755, 5 feet above Lake Superior. Tunnel 1040 from west line of Jackson mine to east section line.

Diagram

Page in German

At mid-day to centre of Sec. 6, T. 47, R. 26. From there to small knob on left side of state road to Marquette. Knob about 30 feet high consisting of dark blackish creassee-ferruginous flagstones dipping under a high angle northward. Strike east and west.

On right hand side of road a higher and larger knob about 60 feet higher than the road consists of the same arenaceous-ferruginous flagstones. A portion of the knob has the strata dipping northward, in another spot they dip west and gradually bend round into a southern dip.

At the foot part of this hill in a few exploring ditches ferruginous flags richer in hematitic iron and identical with the ore beds of McOder mine or Seal Lake are uncovered. A third small hill only about 20 feet in elevation is situated near the quarter east on the line between Sec. 5 and 6. It consists of the arenaceous flagstones like the former. Dip north. A heap of rubbish from an exploring shaft is seen in the N.E. $\frac{1}{4}$ of N.E. $\frac{1}{2}$ of Sec. 6, T. 47, R. 26. The material thrown out is ferruginous-silicious flagstone and a schist which in part may be called a dioritic schist, in part a chloritic schist. No valuable ore found there.

From graveyard section corner east to quarter east all swamp short time after descending the hill side east of the corner. From quarterpost 440 steps across cedar swamp. Then strike gentle swell of highland. At 560 steps strike railroad. At this place a small knobby outcrop of schistose quartzose rock. See specimen No. 1. East 225 steps a knob 120 feet high consisting of the same rock. Dip north.

2 paragraphs of German

Sunday May 26. North line of Sec. 33, T. 46, R. 26.

Diagram

At old furnace near quarterpost conglomeratic quartzites dip south. Close joining slates talcose variegated, light colored. Then dark colored chloritic schists, several 100 feet, almost vertical. Sometimes dip south, other times north. The quartzites come close to river. On opposite side of river greenish schists. Found line close to station No. 4. High hill sandrock. Dip south.

3 pages of German.

Montag (Monday) afternoon. The line from Seal Lake to west end of Jackson property from the west on median line of section to high diorite hill 600 steps. At 350 to the right outcrops of diorite. 280 steps to left smaller diorite knob. Large knob continues to 460 steps. At the foot of the diorite hill are many boulders and jaspery veins of variegated quartzite. Further northwards is the foot of iron ore

Tuesday May 28. To Cascade Mines. Corner between 29, 30, 31 and 32, T. 47, R. 26 Paragraph in German.

Quartzite hills northwest of Cascade village dip north. Quarterpost of north line is close to road not far from village. 360 steps from quarterpost crossing of river. Now the road strikes northwest from the north line. Post center of Kegronee and Richmond Township 100 feet from the line.

Diagram

Wednesday. In Marquette where the section line a small valley (or ravine) a ridge of slate and sandstone 60 ft. high (sandrock and slate almost vertical). Generally strike east and west. Dip north nearly vertical. Slate and sandrock in continued alternation. Also ferruginous seams. Slates dip south on S.W. $\frac{1}{4}$ of S.E. $\frac{1}{4}$ of Sec. 5.

Started from $\frac{1}{2}$ post of south line of Sec. 4 northward. 200 steps came to a creek flowing east. At 424 steps strike a road, on left side ascending ground on east side also on the other side of a swampy flat a rounded hill. To 540 steps through swamp. Hills on left side slanting. At 540 steps on foot of rocky diorite knob.

Paragraph in German.

Diagram

Thursday. To Eagle Mill. Commenced on state road south of the mill about 250 steps. From there to Carp River bridge 750 steps. At 400 commences a small drift hill continues 200 feet. Then another similar hill strikes the river not over 100 steps northwest from bridge. Land perfectly level to river. From bridge road turns south-west. 250 steps from bridge strike foot of hill.

Strike line not far from edge of swamp after following its margin across a swell of the land, then descending close to it and rising again. From road to river along the line about 500 steps over a gently rounded drift ridge. The section corner is now about 40 steps south from the road.

From corner west along state road which runs parallel with it the west section line crossing it and running south of it 300 steps to a rocky knob on north side close to it. Continues to 600 steps where the summit is, but it continues in a declining height for several 100 steps further where its foot joins the large swamp bottom. Specimens of diorite knobs before mentioned N.E. $\frac{1}{4}$ of Sec. 4, T. 47, R. 26.

Paragraph in German.

Going out State road to the supposed quarterpost in swamp bottom thence south 370 steps through swamp until foot of hills where I strike other road. Follow road southeast and after little eastward bending, this is the same spot where I struck the road 2 days ago. 200 steps eastward on road opposite a slate and sandrock knob, strike east and west, dip north. A valley behind then the diorite knob No. 1 from 2 days ago ascends. At 360 strike a creek flowing north. At 380 go north 125 steps. Strike road coming down from knobs. At 300 steps on top, hill tops east and west of me. The one west is the before described diorite knob, 2 days before. (Is not. See now the knob farther southwest).

Paragraph in German.

Diagram.

Saturday. To north and south line between 8 and 9, T. 47, R. 26. On highest sandrock hill about 40 rods west of the line. The sandrock and slate intermingled in the most irregularly contorted and broken up manner so that no dip of the strata can be ascertained there. They are almost vertical and partly incline to this, partly to another direction.

The section line does not run over the hill but is extending in the valley. Went along section line about as far as to quarter post, then turned east and find myself at 400 steps on the brink of sandrock bluffs facing east, north and south. In the valley before is a watershed north and the other west.

Sunday June 2. From juncture of tracks in straight line 500 steps the railroad strikes the actual low river marsh. River little distance off, and rising ground on other side of river. 400 steps further is the sixty mile post from Escanaba and a creek crosses the road.

N.B. This creek is only a small side branch which unites again with the main creek 200 steps further on. The main creek runs for this distance close to the railroad track but then bends off towards the foot of a high hill. Here must also the section line cross the road.

Diagram.

At the railroad switch the creek passes the road, runs northeast. The high hill appears S.W. from the crossing of the road and creek. From crossing of creek to end of switch 500 steps. Line all this way from the junction of the ore tracks a perfectly straight line and continues so far about 1000 steps further, when it bends south. All land on both sides a dead swamp level. 200 steps east of 59 mile post the road makes its curve. Has rising hill on right hand.

Monday June 3. North and south line crosses road 110 steps this side of the 60 mile post from Escanaba. Corner of 15, 16, 9 and 10 is close by the railroad mile post 59 miles from Escanaba.

Diagram

2 pages of German.

Wednesday June 5. To Teal Lake mines. $\frac{1}{4}$ of a mile west of section corner left the mines which are in the ferrugineo-jaspery horizon and almost invariably dip south towards the hill range. Went through fine sugar bush ascending a smoothly rounded hill side and struck the line on top of hill 230 steps north of the southern declivity margined by diorite knobs behind which northward is a broad level dorsal plain extending westward into the next corner.

Diagram

From corner and end of Teal Lake in swamp to the road 100 steps to the foot of knob 300 steps. Knob diorite-like the entire chain. The ores extend close to its foot from the north side. With the southern foot the knob strikes a swampy plain with a small lake in the centre. Ishpeming is right in full view on west side of the line.

3 pages of German.

Diagram Lake Superior mine

3 pages of German.

Iron ores dip south. Surround the base of diorite knob on southwest corner of Sec. 2 in close proximity to the south.

- New York Mine. Section in northerly pit.
- No. 1. Quartzite, dip south.
 2. Chlorite and
2 Chloritic ore
 3. Schists, an ore bed banded jaspery
 3. Silky schists.

Paragraph in German.

Diagram. Hill side N. Y. mine.

Cleveland mine. a conglomerate ferruginous sandrock 50 feet thick. Immediately under it a fine granular ore occurs. Under this various talcose chloritic schist amounting to about 50 or 60 feet. Under it massive jaspery ores, the same which form the large knobs in the vicinity.

Sunday June 9. To Ishpeming. Close to railroad track not far from west section line a protrusion of reddish white sandrock (quartzite). Dip apparently south.

On the north descent (decline) the dioritic rocks near Lake Bancroft are well laminated ferruginous flags of sandy nature with many contortions. Dip of the diorite (south).

Diagram

Monday June 10. To southeast corner of Sec. 12, T. 47, R. 27. Following line to S.W. corner of same section and propose to go a mile further west to L. Angeline.

2 pages of German

Tuesday. To corner between 11 and 12, 13 and 14, T. 47, R. 27. 170 steps south to road.

Wednesday. To south line of Sec. 11, T. 47, R. 27. Going west from road through a valley for about 300 steps when meet with a swampy flat and lake across which the line leads. On both sides of the valley hills the swampy flat extends northwest.

4 pages of German.

Thursday. To section corner, N.E. corner of Sec. 15. Goose Lake. Could not find corner but line well marked unto the vicinity of corner. Then walked along the brow of hills in sect. 10, a valley to the right and struck after some time a line east and west, median line of section, which I followed west over a very high diorite hill, the highest point being to the right of the line which runs over a saddle. Then continually descending over rolling descent to a creek and then slowly ascending came to the quarter post. Decline of the entire region south from the line. Found in all the lower hills the quartzose flags and slates.

From quarter post down into swamp then to creek and then leaving the line over rolling slowly ascending ground everywhere quartzose flags, where drift allows the rock to come to the surface.

3 pages of German

Tuesday June 18. Examination of Section lines of Sec. 1, 2, T. 47, R. 26 which I could not establish to satisfaction on yesterday's trip to the same place. Near line and in south half of section between 11 and 12, meet a large creek flowing from west to east. Lost line. Return.

Wednesday June 19. Excelsior mine. Diorite hill in S.W. $\frac{1}{4}$ of S.W. $\frac{1}{4}$ of Sec. 5, T. 47, R. 27. Top of hill regular massive diorite. Surrounding it dioritic schists. Dip of schists north. In immediate contact with it is the brecciated ore. Dip south.

Diagram

Lake Corning near Excelsior. Lake Cooper east of north corner between sections 5 and 6

Page of German.

From south section corner between 25 and 26 south, went westward ascended a low dioritic schist hill the top of which leads into a swampy place which terminates into a ravine running to the left side of the line toward the lake. The line now ascends obliquely over the declivity of a diorite hill. Then descends into another swamp valley which has a north and south direction and seems to unite with the former ravine. Southwest I observe across the valley high hills which seem to be bordering the lake.

Sunday June 23. Near Teal Lake, $\frac{1}{2}$ mile east of outlet, ridge of slate rock. Dip south. Supposed thickness about 100 feet. Then ridge of sandrock and slate again. Sandrock not over 20 or 30 feet thick in that place. The slate behind it more micaceous than the other. Several other seams of sandrock interlaminated between. The gap between the slates and the massive quartzites amounts to several hundred feet which to all appearances is filled also with slaty softer rock. Some slate seams are also found in places interlaminated with the quartzites.

Monday.

To Eagle Mills from Southeast corner of Sec. 27, T. 48, R. 26. Followed line westward to Carp River. Southwest corner of the section not preserved. All cleared and covered with underbrush. To the south of the line near Carp River is a quartzite ridge with southern dip. A creek runs at its northern edge which separates it from steeply ascending and higher hills of dioritic and partly chloritic schist, likewise with southern dip. Schists very thick.

Further north the nucleus of the hill range is composed of compact massive diorites. A vein of quartz pervades in the southeast quarter of Sec. 26. The schists which contains a little copper pyrites and has caused a very expensive mining operation which was a total failure.

Further north the diorite disappears under the drift and a widely spreading high plateau occupies almost the entire area from here to the Dead River valley which is again margined with dioritic and partly granitic hills.

Tuesday. June 25. Foster mine. Jaspery ores dip north. South wall dioritic schist in(?)conformable with the ore beds. Apparently very poor location but of great thickness.

On Southeast corner of Sec. 13, T. 47, R. 27 are the ferruginous flags in immediate contact with the diorite.

Diagram

Paragraph in German.

Thursday. June 27. Town line from Wegaunee south. Near Breitungs lot. Arrangement of knobs.

Diagram of above.

From northwest corner of Sec. 13 southward descended the little knob from corner. Came to a flat wet space extending from southeast to northwest. After 3 to 400 steps had crossed it and began to rise over the foot of a diorite hill.

Diagram

Paragraph in German.

Friday. Same trip as yesterday Followed creek south. Passed along a sort of a lake about 40 acres length at the foot of the hill which extends south from the corner post. Dioritic to the foot of it. A small creek comes down eastward from the line which is here about - steps from the bed of swamp lake. Another rounded ridge continues southward along the valley.

Diagram

Saturday June 29. Followed Railroad to Foster Mine. From first bridge to the second 340 steps. To creek 400 steps. 550 to foot of bluffs and end of bridge. From there to line 600 steps.

Diagram

From corner which is in a little swamp northward 200 steps over a diorite knoll then descent 90 steps. line is in a swamp valley at 108 steps. Line crosses a good sized creek. By 234 steps across swamp at the foot of the hill. Total from corner 434 steps.

Diagram

Paragraph in German.

Monday. Came out on new made Cascade road straight up from the creek. Went 400 steps south until we are at the crossing of the creek we left. From section corner on road to crossing of creek 300 steps. Thence ascent over a rounded hill.

Wednesday July 3. At the corner on road side, S.E. corner of Sec. 7, T. 47, R. 26 the compass declines 45 degrees eastward from south (true). At quarterpost of same line the compass points to east instead of south. The median line runs straight through the saddle of the two knobs (centre line).

Friday July 5. To southeast corner of Sec. 13, T. 47, R. 27. Followed the line west from the swamp where the corner is situated.

The line runs over a low rounded elevation, sinks down into another swampy place then rises again slowly to north and south side of it. Decline on the north to the valley passing the railroad bridge. On the south side the water flows towards the low land surrounding Tilden Lake. No outcrops but in the drift many ferruginous slabs and the first elevation next to the corner from which I started consists of diorite.

The hill on which the quarterpost is situated (destroyed) is higher than any other on that same section line eastward but no outcrops of rock. The next joining knob on the northside of it is diorite. At Tilden mine the ferruginous flags are disclosed in regularly stratified order to a thickness of 50 to 60 feet. The beds dip towards the mountain under an angle of 40 degrees. They are unusually rich in iron but not as much so to make them useful for the miner. Large outcrops are at the northwestern side of the first openings which have partly an almost horizontal position in flat arches forming promontorial hills.

Wednesday July 10. Excursion with assistant to north tier of T. 47, R. 25. Provisions 3.50. Sent for supply 2.80. Crossed Carp River in the centreline of Sec. 6 and ascend a hill side on which the slaty banded strata of the quartzite group are seen in extensive outcrops. See specimen.

Now the east and west subdivision line which we followed leads to the river which forms here rapids, and high perpendicular walls form its southern embankment. The north shore is next to the river flattish. The perpendicular walls are quartzite but with it are also the slaty strata of the marble series level. Go south over the top of this hill. Descend to the creek marked on the map. Then cross another quartzite ridge. Come to a swampy depression and ascend another quartzite ridge. The line not yet found.

Diagram.

Thursday. From supposed quarterpost (going west) of the east and west line between Sec. 7 and 6 across a rounded hill consisting of slaty rock. Descended to a swampy creek at 210 steps. 240 steps to the main stream of creek. At 500 steps across the swamp. Leave swamp left side. Begin slowly on higher ground. 60 steps further in another little swamp.

Sunday July 7. From creek to east and west line 273 steps on top of ridge. Went from there to corner.

Monday. To Lake Hall. On return followed a road which comes out near iron hill over which the line runs (Cleveland mines). Follow Megaunee road. First hill on road side all dioritic schist. Second hill diorite schist surrounded by massive ores. 53 steps further across the swamp entering higher ground slanting towards the right. On right side followed by a depression. At 340 after the first 500 steps we are at the corner which is on a rolling little elevated spot. At 106 from corner in swampy place. Again the swamp seems to join the former followed depression.

At 180 steps leave swamp which seems here to open into a southward descending valley. Follow a slowly slanting hill side through hard woods. Incline of hill southward. At 500 steps on tolerably level ground, rolling. At 300 steps we begin to descend. At 400 on the descent enter swamp.

At 300 in swamp. 300 more through swamp without finding sign of quarter post. Return leaving swamp. Direction north of east over moderate hill range. At 160 outcrop of sandy slate rock. At 400 towards top the slates of marble series. On top at 450 quartzite. We travel on our course over high ground. At 1057 steps meet a creek running down north. At 1125 we strike the north and south line on the edge of a clearing, a tree marked on 4 sides.

Thursday. N E $\frac{1}{4}$ of N E $\frac{1}{4}$ of Sec. 1. On hill west of section line of the chain ending at Eagle Mills, slates of the marble series exposed. Hunted north line of Section. Went west to quarterpost. Started south from line near quarterpost to river. 160 steps south from line have descended to the edge of a marsh meadow. Go a few 100 steps east to end of marsh across a spur coming from northeast and descend to same marsh again at 400 steps from line. At 500 steps we strike the river running there northeast. Opposite shore likewise low. A small creek entering river at this place on our side.

100 steps along river it takes an eastern course. A small creek enters here again from west, little to the north. 43 steps further river 10 degrees north of east. 73 steps from small creek we strike a little valley running from north of west and the river bends due east. A spur of high land strikes here the river from the north. Opposite a valley seems to extend southeast. From there 83 steps over the foot of hills the river bends now north of east. We descend now in a depression which descends from the north.

On the opposite side a creek seems to enter which is the outlet of the before mentioned valley in the direction west of south. The river at 92 steps from the 33 bends north of east. On the opposite side the east side of the mentioned valley seems to be bordered by high land on our side. The high ground is further north away from the river. At 150 steps from last counting we see high lands on our side approaching the river and a small creek entering. On the opposite sides high land close to river.

At 80 steps the river bends due east. High lands to that place on our side and also on other side, high land near by. At 56 steps river bends south of east. 137 (or 37) steps farther, here rapids. Slaty rock in river bed. Here is also the line. It comes down through a hollow and there we met further back also the creek flowing westward. The river bends from the section line eastward. Rapids. Rock specimen. High land on our side rising. River somewhat south of east.

We now leave the river along a hollow running 10 degrees east of north. Very short distance we come to the clearing and big drift hill over which the line runs.

Thursday. Afternoon follow river downward the crossing of section line and corner (S.E. corner of Sec. 6), to perpendicular quartzite bluffs on river 30 feet high. In river bed all to there slate rocks. Dip westerly. On opposite side low land but at the end of the bluffs on opposite side likewise a steep hill. The slate rock is evidently below the quartzites. It crops out at the east end of bluffs, from direction under the quartzite. Dip southwest.

Passed the corner without noticing it. Followed on east and west line eastward still on level high land. Then across a sort of a creek valley. Then again mounted a high knob of marble from which we descended into a swampy broad depression. Then ascended another steep marble knob. North and south side declivity as well as the side we ascended just as steep and almost perpendicular is the eastern descent.

Rock more slaty, calcareous. We find the corner right after the descent from the precipice. Flat level. Where quartzite crops out the line to Little Lake makes another brisk descent of about 75 feet. Lake all surrounded by bluffs. We return to corner and go north, line which directly ascends another knob. The marble hill is isolated all round by a deep valley which on the side of the corner seems to open into the little lake.

Diagram.

The north line ascends another isolated slate knob which is crossed at 200 steps when we are in a level that connects with the one on which the corner stands and seems to incline north. At 300 steps we have marked (walked) on this plain and have to our right another slate knob which is a continuation of the slate ridge over which the line led.

Diagram.

At 400 steps we descend into a ravine directed and descending west. We immediately have crossed and walk on a comparative level. The compass indicates 22 degrees variation east to the direction of the line. At 500 steps we see to our right a rapid descent southeastward. To the left begins a ravine bordered by rock exposure marble.

At 500 steps we followed a wrong line to far east. The line is supposed to lead directly over that marble hill. We are on a declivity eastward which descends north to the Carp at a distance where we can hear the falls north of us. At the falls we find the line again. We have been much too far east. From falls follow course of river upstream. Descend across a ravine. Opposite shore a high ridge. Soon after we ascended another rounded knoll, we descend in another ravine. On our south side a high ridge, at short distance. At about a quarter of a mile walk on moderately inclined hill side we strike close to river and steep declivities composed of marble border is ascending into high hill sides.

On the other side the hill chain seems to have an interruption. Little further on a good creek seems to enter the river on the other side and a distinct gap is visible. On our side steep hill side. We walk at waters edge. Soon we come to a good sized creek entering the river on our side.

Friday. Exploration of north half of Sec. 6. Starting from quartzite knob on quarterpost we see south of it another quartzite crest extending to the creek. Its foot is surrounded by slaty outcrops. We cross the creek and ascend a steadily rising slope on top of which a large flat space extends unto near where we strike the section line. There quartzite ridges running about north and south extend along which we go southward but lost the true line. The general slope seems to be always towards the course of that creek and the surface remains tolerably on the same level.

Saturday. To falls of Carp River. Ascertained the configuration of the high spur bordering the river below the falls. Base of it and river valley composed of slates of the marble series very silky smooth. Dip north 80 degrees. A short distance further down the slates disappear and drift masses form high bluffs on the north side of the river.

The base of the drift is a coarse conglomerate red, and resembles much the conglomerates of the Potsdam sandstone. Similar conglomerates were observed by me last year farther down the river and in close proximity with Potsdam sandstone.

German paragraph.

T. 47, R. 25

Follow north and south line between Sec. 9 and 10, to east end of the lake over a granitoid bluff. Descend it and mount another one. Then a third one which is the largest. Descend an almost perpendicular rock bluff into a valley which seems to open eastward and seems to connect westward with the kettle of the lake as we see through a gap into it. All the rocks of the granitoid character.

From brink of last rock bluffs to the foot of the next hill across the valley 250 steps we find the corner on top of the granitoid knob. Now turn west.

Sunday. Followed section line to corner between 3 and 10. Thence north line to corner between 3, 4, 33, 34, T. 48 and T. 47, R. 25. Granitoid rocks outcropping to about the middle of the section along line. From there high steep bluffs but apparently drift on surface and no outcrops except where the line crosses the creek near the corner where I notice reddish slates in the bed of the creek.

Monday. Start from section corner of 4,5,8,9 south. We proceed on plateau about 200 steps. Descend to a small creek which opens towards the lake and ascend the side of a quartzite hill. Leave the highest part to the left. On our right we are followed by the ravine with the creek. We almost come to descend into it after while. Thence we ascend again, a continuation of the former quartzite ridge. We ascend a very high knob which at the lower part has quartzite outcrops. The crest is granitoid rock almost vertical. See specimen.

We descend and mount a still higher granite ridge with steep rock walls, after ascension of which we find the quarterpost right at the edge of a precipice. Go now across a broad undulating surface still rising to the south, all underlain by granitoid. Then we descend across 3 or 4 rocky spurs of the mountain all directed westward and find the corner in the side of a ravine all yet granite.

Diagram

From here we go west on the low ridge enter pine (pine) plains which continue to the next corner interrupted by some hardwood and mixed timber lands. From that corner we turn north towards the Carp River. The first $\frac{1}{4}$ of a mile leads us over a quartzite and marble knob on the other side of which we find a fine creek where we take dinner.

From the creek we immediately go over another small ridge. Descend again into a ravine having the same direction with the creek and ascend another ridge on which we must find the quarterpost now soon. Descent into another little creek over marble rock bluffs.

Tuesday To north and south line between 7 and 12. Find corner just at the south edge of a swamp valley. Quarterpost on a marble hill. Next south of it another ridge of marble and connected rock beds. Swamp valley north of corner about 150 steps wide.

Went to corner south of Eagle Mills between 8, 9, 10 and 11. Followed the line west. The line is on that portion not in swamp as I supposed and runs over the north margin of a diorite hill and then follows the southern foot of another diorite hill. The diorite ridge extends farther to the northwest. Paid up Sperry to Monday July 28, including Monday.

Monday, July 28. Excursion to Sec. 11, 12, 13, 14, T. 47, R. 26. Provisions 2.61 Railroad fare to Goose Lake .40 cts. Follow the north line of Sec. 24 to northeast corner which we did not find in the burnt flats with pine at the supposed vicinity of corner. Went north 350 steps which bring me to the foot of a long marble ridge terminating at the Goose Lake. With the silicious marble are connected dark purple slates and similarly colored quartzites partly brecciated. Visible thickness of strata over 60 feet.

The ridge is quite broad and continues some distance eastward. Ridge forms an arched dome. Strata partly dip south, partly north and the marble on top is nearly horizontal. We return to the line and succeed in finding the corner of the section but further to the west than we first supposed. The line leads over several lower knobs consisting of slaty or quartzose members of the marble series. Then after crossing the creek we ascend the higher range which is crowned by very thick masses of marble and in almost horizontal position over the top part.

Under the marble the slaty rocks crop out. The quartzite bands are mostly of reddish color and inclose some streaks of iron ore of peculiar splendor. Sometimes also a brecciated structure is observed. The slates, quartzites and marbles must have an aggregate thickness of at least 200 feet, if not more.

5 pages of German.

From quarter post we go north. Ascend a high hill close by 116 steps to its summit. Summit level. A few outcrops of marble. At 300 steps all told we are in a sort of depression which descends northeast. Marble outcrops at the foot. I am not certain whether the decline of this valley is to the northeast or comes from the northeast. It seems now to be as if it descended to southwest.

25 steps west we are on a hill sides with marble outcrops. on the plateau, at 500 steps in all, Descent into deep valley begins, descent gradual. At 360 steps we have descended, then move over a flat unto 500 steps, the supposed centre of the section. All round us low but dry land. Soon however swamp seems to commence. 327 steps we move on north through swamp. All round us also swamp. Ascend there a high tree to look out. Swamp continues in broad belt southwest and northeast also due east. Swamp nearly half a mile wide. Westward we take now our course where we can see a high hill at some distance.

About 200 steps we go to its foot and proceed along it directly westward. Wet ground passed but no actual running creek. We passed along the southern declivity of marble and slate hills until we struck the north and south line between section 11 and 12. Followed it across a swamp, mounted a narrow hill in our way. On the edge of its southern brisk declivity is the quarterpost. The declivity exposes marble beds and at the foot we find a swamp and creek flowing southwest. From there a ridge is ascended consisting of the marble series to the left of the line (east is a higher portion of the same ridge), then we descend some into the valley of a small creek and ascend a knob again likewise composed of marble. Descend again and mount another similar one on the southside of which we find the corner. Below it is a swampy creek valley and beyond it high marble ridges extending towards Goose Lake.

We follow now the line east to the same quarterpost which we passed this morning. It is situated at the edge of a swampy valley which is a continuation of the valley near the corner we came from. Now we go south again through the centre of the section over various hills and ravines all with marble outcrops and vertical bluffs of these rock. They continue without intervention of any other kind of rock unto we arrive at our camp.

The marble series is principally made up of dark purple or blackish clay slates of fine grained silicious rocks of reddish colored partly brecciated quartzite and of mighty layers of marble. The marbles lie often almost horizontal on the top of the hills and are less twisted and contorted than in other localities. The thickness of the entire series is very considerable and amounts to several hundred feet.

Wednesday. On hills on southwest side of Goose Lake. Foot composed of dark grey slaterock mingled with bands of reddish variegated quartz. Dip towards the lake in places, other times from the lake. The top part of the hill is very massive quartzite, highly ferruginous and with plenty of bicaceous iron oxyd sprinkled in. Some portions are brecciated and seams of slaterock sometimes alternating with the quartz. The hills are not less than 300 feet higher than the lake. Some nests of good iron ore are found in the quartzite. See specimens.

6 pages of German.

Thursday Aug. 1. To Washington Mine. Ore formation leaning against the foot of a diorite ridge uppermost under heavy drift masses a light colored compact quartzite thickness not ascertained. Under it a series of talcose slates and schists amounting to 100 feet is penetrated by a tunnel. Then again from 40 to 50 feet quartzite of more ferruginous character with intermediete chloritic beds and gradually assuming the character of a mixed ore. At this horizon and close to the ore beds is a peculiar diorite like rock partly coarsely crystalline, partly fine grained slatelike and more or less interspersed with magnetite granules. Some beds make transition into talcose schists with red garnets inclosed. All the numerous variations of rock have a talcose character in common. Their position is evidently above the ore beds. The foot wall of the ore beds is not uncovered.

In one place a dyke about 3 or 4 feet thick intersects the quartzite and ore beds. The twisted and dislocated condition of the strata makes the mining very irregular and some faults cut off the order of things in a very abrupt manner.

There are vertically erected beds of talcose schists and of quartzite which inclose between a rich mass of not only specular slaty ores but east and west this ore seam is briskly cut off, but also in vertical direction. It terminates at once and is underlaid by quartzite which is persected by a tunnel right under the ore deposit above which at present is mined out.

Diagram

Friday afternoon.

to Negaunee. Railroad fare 40 cts.

Friday Aug. 2. To Republic. Republic mine. Strata dipping under a steep incline away from hill range. First I notice reddish quartzites of about 50 feet thickness. Under it is a belt of magnetic ore of silicious quality about 8 or 10 feet in thickness. Then follows a narrow seam of talcose slates. Next to this is magnetic ore banded with jasper including beds of pure ore, ^{thickness considerable} amounting to not less than 200 feet

Behind the escarpment rises a diorite ridge. See specimen. Further south ferruginous flags over 100 feet in thickness form a knob and close behind it is a gneissoid rock full of garnets. The ferruginous flags stand almost vertical. Strike and dip conformable with the ore beds in front of hill.

German paragraph

Diagram

4 pages of German.

Sunday afternoon. Aug. 4. Along quartzite range eastward, Sec. 32 and 33, T.48 R. 26. South portion of range contains thick belts of clay slate and belts of brecciated reddish and white mottled ferruginous quartzites. In the centre of the chain another heavy slate belt is found intercalated. The quartzite contains in places considerable veins of micaceous iron ore and some slates are filled with nodular quartz pebbles. The chain is composed of 3 or 4 separate parallel ridges, each one representing a certain series of strata.

The slate belts alternating with the quartzites are many and of great thickness, generally of dark bluish purple color often conglomeratic. In the drift are boulders of marble in great abundance but no trace of a marble outcrop or of the connected slaty rocks could be discovered.

Monday Aug. 5. Camped on side of railroad track $\frac{1}{2}$ mile east of Cascade location. Went in the evening along R.R. branch leading into the mines south of section corner. Ore beds dipping north exposed on road in the hill side. North of the road is another range of hills composed of ores, dip likewise north.

Further west along the side branch after entering a cut in the drift I came to a diorite protrusion which was cut through by the road. On the diorite westwards followed the ore beds and on the ore beds laid a sandrock of light color and partly variegated with iron. In its upper portion was a very coarse conglomerate composed of iron ore fragments, slate, quartz and dioritic pebbles with chloritic masses interspersed. The conglomerate and sandrock exposed are at least 50 feet thick. In the mine close by this locality the direct conformable superposition of the sandrock on the ore beds is well uncovered for observation. Dip of all the beds northward away from the higher portion of the ridge.

4 pages German.

Wednesday Aug. 7. To Home Mine location. East of houses a low ridge at foot of high hills which consists of slate conglomerate. Dip north (see specimen) the same as the little hill in the swamp near left side of road. Close south of it are flag ores with jasper leads. Very thick series but no good ore. They differ in appearance from the Cascade mine strata. The high hill is composed of such and similar jaspery ore. On north side of road across the swamp is another low ridge which at the foot has outcrops of a peculiar jaspery ore different from all seen before and on it are mighty quartzites of whitish and red color, besides a very coarse quartzite conglomerate in all probability the same as the high ridge south of it and separated from it by a swamp.

Farther west at the centre line of the section the railroad makes a cut through the same jaspery ore strata and schistose beds which composed the last mentioned hill. Across the swamp we followed the R. R. track to Cricken Mine.

5 pages of German.

Friday Aug. 9. To Cascade location west along R.R. to first little ridge along track. Decidedly granitic. Specimen No. 1. Then to higher hill north of granitic likewise. Specimen No. 2 and 3. From there it is direct continuation of the granites. Near the corner of section we descend, cross little creek and come to quartzite ridge. The granites as far as can be ascertained seem to dip north or are vertical. The quartzite contains jasper and ferruginous jasper fragments and is decidedly identical with the quartzite, above the ore beds. Specimens labeled No. 4. Dip north.

We go from here north to the high rock cliffs. Find the base formed by a ferruginous quartzose rock. The top cliffs formed of a singular form of granite. The ferruginous rock at base seems to dip north, granite parallel with east (or it). The contact of the strata is plainly seen and granitic seems inclosing fragments of somewhat altered ferruginous rock have irregularly mingled with the ferruginous rock. The granite forms a solid mass of over 100 feet thickness. Granite specimen marked 6, ferruginous specimen 5.

North of the granite after a short descent a conglomeratic sandrock similar to the upper quartzite conglomerate No. 4, lies on the granite rock with a northern dip and forms the declivity of the hillside all round. Specimen No. 7. Following the granite ridge we meet with a layer of coarse schistose conglomerate different from the quartz conglomerate and probably of older age, and closely connected with the granite. Specimen No. 8.

The creek coming down into the outlet of Palmer Lake divides the hill range more than I have represented it on the map. There is quite a gap between the granite ridge and the knob above Palmer Lake. From east end of Palmer Lake we followed a trail along the side of steep hills crossed a creek and continually rising got about as far west as the west end of Palmer Lake. No outcrops here but many boulders particularly of flag iron lean as near Republic or Washington Mine.

From there we followed a subdivision line of the section north and south which brought us to the top of a high granite ridge which falls off very precipitously towards the lake. See specimens No. 9. Descended the precipice and followed the margin of the precipitous ridge through a level valley for $\frac{1}{2}$ mile. Then ascended the hill again which was still the same granitic and slaty rock. At the edge further back is all covered by drift. Struck now for the trail we had left and went along a depression behind the ridge back again to Lake Palmer and to camp. No outcrops but plenty of angular slabs of the iron flags in the drift.

Followed creek south to sawmill. Examined the diorite dyke and ascertained the direct contiguity of the iron ore beds with the granitic series. Granite fine grained, poor in mica or hornblende, interstratified with schists. Dip apparently north like the general dip of the ore which forms a bubble like convex arch dipping generally north but with the curved flanks more or less west and eastward. All the hills across the sawmill branch of the creek are granitic. The shore of the creek is bounded by steep bluffs, partly drift, partly granite on the south side.

Saturday . Along railroad to Goose Lake. In several places along road outcrops of ferruginous slates and greenish quartzites. Further along in the middle of swamp land a knob bulges out with ferruginous quartzites, chlorites and bands of excellent iron ore. Brooks Mine. Specimens of various rocks from there. Dip of strata north. The formation is very thick and largely exposed by the mine. There are chloritic well stratified beds and laminated quartzose ferruginous beds in connection with the ore. The lower strata are a greenish sandrock weathering white on exposure. This sandrock is the same as has been exposed all along the road.

The hill with the mine joins a small valley and makes natural rock escarpments. Towards it on the other side of the valley close by the iron ore comes out. The granitic formation with banded structure, bands of chloritic dioritic schists alternating irregularly and wedgelike with granite bands being frequently much twisted. This locality forms the foot of the higher quartzite range delineated on the map on the previous trip to Goose Lake. The mine cannot be far off from the crossing of the railroad by the section line between $\S, 25$ and 26 , perhaps an eighth of a mile further west than the section line.

Tuesday Aug. 13. Along Escanaba road to cut through hematitic ores. In the mine west from the road the jaspery hematites surround the dioritic schist knob whose strata are nearly vertical. They dip generally westward and away from the diorite. Dykes of slate like the slate dyke in the railroad cut continue through the mines in a northwest direction. The slate stands between the ore vertical. Examining the cut towards the sand and slate rock forming the top of the ridge I have fully convinced myself that the sand and slate rock lies on top of the Iron Ores. It dip is variant but the main mass nearest to the ore protrusion dips northeast in a manner which would bring the ores in conformable contact with them.

Diagram

on

We follow from corner and the road the line between 15 and 16 southwards into (or through) a low swamp with water. Then rising the side of a diorite hill about 80 feet high which extends short distance west and terminates eastward near the railroad. Then descent into swamp of considerable extent. Quarterpost in swamp. From there ascent over a low ridge of hardwood behind which a creek is found flowing east. Ascend again and higher crossing of another branch of the creek. And still ascending a higher hillside on which quartzite blocks lay in great quantity but no regular outcrop. Found finally the corner on the slope of the hill before reaching its highest top. Close by is a sugar camp and road leading to the Goose Lake.

6 pages of German

Wednesday. To southwest quarter of Sec. 20, along Cascade Road. Thence east until strike north and south section line between Sec. 20 and 21 on high quartzite hill. From there north. While going from road east I passed all along footspurs of hills to the north, none very high except the continuation of the diorite ridge running along the centre of Sec. 17 and part of 20. The foothills consist of the ferruginous slates with sandrock. Frequent small knobs passed.

From centre of north line of the southeast $\frac{1}{4}$ of Sec. 20, T. 47, R. 26, go northwest at random. To the right I see the margin of an extensive swamp about $\frac{1}{2}$ mile north-east from starting point. Strike a creek flowing south which is not marked on the map. Ferruginous flags in the hills but not well exposed.

After having crossed several spurs from the higher ridges on left side of me I came out on the clearing of Sec. 17, about $\frac{1}{2}$ mile from the southeast corner of Sec. Crossed the clearing. The creek marked there is only a dry ravine, beyond it are several small domelike rock protrusions of a diorite like rock closely adjacent ferrugineo-silicious flags. The flags are sometimes entangled between the mass of the diorite-like rock. From here crossed over to the foot of high diorite knobs. Followed awhile the ravine of Partridge Creek and then after crossing it struck a road which leads at the declivity of a higher hill terrace eastward to Goose Lake.

Followed it about $\frac{1}{4}$ of a mile and struck northwest crossing a swamp valley which partly connects with the Partridge Creek low lands. Eastward seems to unite with the swamp creek opening into Goose Lake near the railroad bridge. Across this swamp I found a long but moderately low drift (?) ridge extending from east to west, which I crossed and struck again a narrow strip of swamp land before I came to the railroad $\frac{1}{2}$ of a mile east of the Partridge Creek Crossing.

Thursday Aug. 15. To Teal Lake mines.

4 pages of German.

Friday Aug. 16. From west to east through the centre part of Sec. 4, 3, T. 47, R. 26 About $\frac{1}{3}$ of a mile west of section line between 2 and 3 the road leads on an east and west ridge of banded slaterock. Dip north. All the hills of this part strike from east to west and form parallel rows lower than the more southerly situated knobs of diorite. Examined the summit part of the hill over which the line between Sec. 2 and 3 runs and found it composed of the ferruginous banded slate rock with sandstone layers. From here went into the valley behind the quartzite knobs of Sec. 11 and 12. From the edge of hill in southeast $\frac{1}{4}$ of N E. $\frac{1}{4}$ of Sec. 11, T. 47 R. 26, free view of Goose Lake.

Returning the way I came I studied the topography of the hills and delineated it in a rough way on the map. The valleys between the different small ridges are generally broader than I represented them and have swampy bottoms or meadow ground.

Diagram in back.

Note on cover. St. Chas. Hotel, Milwaukee

First page in German

Saturday Aug. 24. Excursion of A. A. S. to Pilot Knob and Iron Mountain. Passing at first for 10 or 12 miles down along the Mississippi we saw many extensive outcrops of the St. Louis limestone. Afterwards we observed sections through the calciferous sandrock of prevalently calcareous or dolomitic nature full of irregular vermicular cavities. The surface of the calcareous beds is covered with disintegrated and fragmented rock full of flint and chert and of dark red color by intermixture of ferruginous clay. This limestone region extends to the immediate vicinity of the Iron Mountain which is composed of a porphyritic rock with interlaminated beds of compact iron ore.

The iron ore is in part totally pervaded by crystals of apatite and at the Iron Mountain exhibits a high degree of weathering and decomposition into a soft fragile rock with abundance of Kaolin like portions and in many places of an obviously brecciated character.

At the mine of Iron Mountain a reddish coarse grained sandrock containing a large proportion of weathered clay-like feldspar crystals lays horizontally or nearly so on the porphyry. The dip of the sandrock seems to be not caused by the uplift but an original obliquity in the deposition of the layers caused by adaptation to the undose irregularities of the subjacent surface.

The structure of the Pilot Knob seems to indicate an identity of the formation with the Iron Mountain but there is a considerable lithological difference. The strata are less weathered and the ore beds of Pilot Knob are very different in aspect from the Iron Mountain ore. We find at the foot of the hill mighty layers of a light reddish colored porphyry partly compact, partly weathered and porous absorbing water higher up and evidently regularly superimposed in a fine grained dull gray iron ore with distinct laminar striation; and in places pure, in other seams silicious and even brecciated by intermixture of quartz and other rock fragments.

The thickness of this ore seam may be from 20 to 25 feet and very regularly superimposed on it are about 30 feet of ferruginous porphyritic rock of dark blackish color by an intermixture of a large but variable proportion of iron ore granules. This porphyry is to a great extent likewise a breccia composed of a porphyritic cement or ground mass in which feldspathic and quartzose rock fragments are abundantly dispersed.

I notice also specks of heavy spar in them and talcose or Kaolin-like white and soft rock pieces, no apatite occurs in this ore. But it seems to be not such high-graded in iron as the Iron Mountain ore. The dislocation or uplift of the beds is not near so great as the uplifts in Lake Superior country and the sequence of the layers is left for the whole extent of the mine perfectly regular with an incline of the beds not much exceeding 30 or 40 degrees.

From Pilot Knob we returned near dark and arrived at St. Louis again about 11 at night. The citizens of St. Louis and the R.R. Co. made every effort to make the trip for the participants as pleasant as possible. Beer, lemonade, ice cream and cakes were in abundance served round the cars and a few miles beyond the Pilot Knob we stopped at a large country mansion with garden where a sumptuous dinner was served.

Sunday afternoon accepted an invitation to Doctor Hambach which acted during the past few days as a faithful cicerone to me and Prof. Safford in which latter acquaintance I rejoice considerably, not only from the standpoint as a scientist but for his pleasant social qualifications.

2 pages of German

To Pueblo. Dinner excellent. A.H. & Geo. E. Worthen, Warsaw, Ill.

Sept. 11, 1878. Sent reports postage paid to Prof. Jas. M. Safford, Nashville. Dr. G. Hambach, St. Louis, Mr. J. Alden Smith, Boulder City, Colo. (not yet sent the last full set).

Friday Sept. 13. 11 A.M. Left home for Negaunee. Arrived at Negaunee Saturday 3 o'clock Sept. 14.

Monday Sept. 16. 3:50 to Ishpeming. 2:44 from Ishpeming to Michigamme.

Diagram

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Diagram: Spur mine.

Interstratified with anthoph chlorite with garnets. Jasper ore about 400 feet. Anthoph ores also about 400 feet.

Spur mine. Compact conglomeratic quartzite 12 to 15 feet. Banded ore beds with pure ore on top about 30 or 40 feet chloritic rock.

Michigamme mine. Actinolite rock bent in synclinals and anticlinals about 100 feet, below quartzite, lower ore, still lower mixed ore.

Diagram

At the foot of the granite hills near R.R. track large quantities of white quartzite boulders. South side of Lake Michigamme micaceous schists with quartzose micaceous beds, seams of the schists filled with garnets and staurolith.

Wednesday Sept. 18. Returned to Negaunee.

Thursday Sept. 19. To Ishpeming and to Friederick's

5 pages of German

3 Diagrams

Sunday Sept. 22. Went along a wood road diagonally through Sec. 26, T. 47, R. 27. Road leads over a high plateau. To the north a rounded ridge extends westward which consists of the ferruginous siltstones and jasper ores. South of the road is an outcrop of quartzite. Strata dip south at the west line of Sec. 6. A small knob consisting of the jasper beds stands at the margin of a swamp situated in Sec. 1, T. 47, R. 28. The road leads now curving northwards not far from the section line to the 1/16 post of the northwest quarter of Sec. 6 then crosses the line and strikes the east and westline between Sec. 1 and 26. T. 48, R. 28 and T. 47, R. 28

About $1/3$ of a mile west from the corner there is a swampy depression which descends southward and extends also northward dividing the waters. The northern continuation flowing into the Deer Lake branch of Carp River. The road goes now northwestward through the centre of Sec. 36 to the quarterpost between Sec. 36 and 25. Along it are many outcrops and knobs of serpentine rock but about $1/4$ of a mile south of the quarterpost the serpentine disappears and the rock bluffs opposite the last serpentine bluff consist of dioritic and chloritic schists connected with compact fine grained diorites.

At this place a ravine goes off westward through which a road leads in the direction of Greenwood furnace. On the east side of the road there is constantly a strip of swamp land. The dioritic schist and diorites continue now through Sec. 25, T. 42, R. 23. The road leads to coal kilns which are situated in the N.E. $1/4$ of the S.W. $1/4$ of Sec. 25 and from there bends northwest striking the northwest corner of the section.

Monday 23. John $1/2$ day. To Sec. 4, T. 47, R. 27. From the ferruginous talcose slate hill a high plateau extends east and within the limits of Sec. 5 another ridge of the same ferruginous talcose rock in vertical position extends eastward into Sec. 4.

South of the eastern portion of this ridge is a low ridge of mighty quartzites. Dip south. I do not know whether this quartzite is the upper quartzite or identical with the Teal Lake quartzite. About $1/5$ of a mile south of it are in a parallel ridge the banded quartzose ferruginous slates exposed also with southern dip. Further south the land declines into the swamp of Carp River.

Going east and somewhat north over the dorsum of elevated land I struck several large exposures of the jasper ores. Dip south. Surface finely drift polished striae from northeast to southwest. The highlands extend close to the river. But about $1/8$ mile south of the section line east and west a border of swampland intervenes. The line runs through swamp westward $1/3$ of a mile. Thence we crossed a crossbar of highland and on the other side of the quarter post descended again into swamp which continues up to the section corner and adjoining small lake. North of the swamp a high vertical bluff of dioritic schists rises about 120 (?) feet above the valley and on the south side of the western portion of this wall lay talcose-quartzose schists of a light yellowish color. These are immediately overlaid by a compact quartzite of dark reddish color and very mighty. Dip of strata distinctly south. The quartzite forms separate knolls in front of the dioritic schists and the talcose schists generally occupy the intermediate gap. Bluffs very prominent and abrupt.

From the section corner we follow the line southward for short while and then bend west. Descend after some distance into a swampy slough extending from Lake Cooper and emerge from it into the highlands which we follow in southwest direction to the house of Excelsior mine. At the north declivity of these highlands are several outcrops of the banded slaterocks encountered all with southern dip. The rest of the surface is covered by drift and numerous boulders of quartzites, banded ferruginous slates ectr.

Tuesday Sept. 24. Went to kilns on Lake Cooper. Followed the coal road to Deer Lake in northeast direction passing up a ravine after crossing a narrow swamp extending from the little lake westward down to Carp. On the southside of ravine knobs of dioritic conglomeratic slate, on north side of the high schistose ridge adjacent brecciated (?) beds of the talcose slates belonging next under the quartzite. From there across the summit saddle all dioritic conglomeratic schists.

Descending again another ravine we strike a creek coming from the righthand side and crossing our way which flows to Carp River entering it about $\frac{1}{4}$ of a mile west from the lake. Our road leads then to Deer Lake on the foot of high conglomeratic schist knobs. To the north of us is likewise a series of knobs running parallel with our road and separating us from the Carp River valley.

At Deer Lake furnace we turn south across a depression from which a large spring emanates and ascend a ridge which consists of the talcose schists below the quartzites. Part of them is a true breccia and the strata in other places are considerably bent and contorted inclosing quartz beds. Another parallel ridge consists of the same schists and then follows the compact red quartzite in another ridge which is a continuation of the quartzite range seen yesterday.

We return now to the furnace, follow the road along Carp River which leads along the foot of conglomeratic schists. Then we strike across the small creek which we passed previously coming down from the Lake Cooper. To our righthand is swamp and further off a ridge of conglomeratic schists north of which the Carp river flows. We strike the north side of this ridge and after crossing its foot descend into the swampy valley of a large creek coming from Sec 32.

The road leads us now through swamp to near the section line which it crosses a little west of the 1/16 post. Here we have close to the road on our lefthand a high conglomeratic schist knob with a basaltic dyke visible on the top part. A chain of knobs extends from here to the west. The section corner is situated to the left of the road but nothing can be found of it.

Entering Sec. 29, we soon strike close to the river and at the point where we are close to its big bend is a high dioritic schist bluff. A small creek comes down on its east side and a high bridge crosses this ravine. Then the road descends into the swamp valley where a large creek enters the river coming from the southwest.

We go on through a swamp for about $\frac{1}{4}$ of a mile when we see to our left high bluffs of serpentine. A road leads up to them and an abandoned farmhouse is found at the foot of these very extensive bluffs which form a large semi-circle. The land below the bluffs is rolling highland descending to the deep creek valley with very steep bluffs.

2 Diagrams

These serpentine knobs extend in a westerly direction forming 3 or 4 separate ridges. They inclose belts of limestone mixed with talcose and asbestine material. A belt of limestone more considerable than the others observed runs through the southwest $\frac{1}{4}$ of the northwest quarter of Sec. 29, T. 48, R. 27 separated from the other serpentine ridges by a broad swamp valley.

On the north side of the limestone compact serpentine masses form the higher part of the ridge which is on its northwest side truncated by vertical rock bluffs over 100 feet in high. About $\frac{1}{4}$ of a mile north of these bluffs is a small lake. Returning we passed the serpentine bluffs again with the quartzites adjacent to them in a belt not less than 75 feet thick and $\frac{1}{3}$ of a mile long.

The bluffs we descended to the creek are drift. The valley there is narrow and the opposite side ascends likewise in a drift covered rolling plateau. To our right we see knobs of dioritic schists and also on the left of us as long as we are in Sec. 29 we see the western terminations of dioritic schists knobs which **extend** from the Carp River valley westward, on the limestone and serpentine bluff.

In the northwest $\frac{1}{4}$ of Sec. 29 it is worthy of notice the frequent occurrence of quartzite and of the banded ferruginous slates below the jasper ores in boulders. There must be north of that place this part of the Huronian deposits represented.

Wednesday Sept. 25. Heavy rain. Went to Negaunee, got letters. H.B. (?)

T. 47, R. 29

Thursday Rainy. Went to N.E. $\frac{1}{4}$ of N.E. $\frac{1}{4}$ of Sec. 7 to hill of drift on whose south-ern declivity a considerable outcrop of a dark talcoso-argillaceous slate in vertical position is seen. The outcrop is too extensive as to be taken for a loose mass. All the land seen from this point is a rolling drift covered high plateau.

Breitungs knob (near $\frac{1}{4}$ post of east line of Sec. 12, T. 47, R. 28) of banded fer-ruginous schist very much contorted. Dip south. In N.E. $\frac{1}{4}$ of N.W. $\frac{1}{4}$ Sec. 13, quartz-ite with dark slate in east and west ridge. Dip south. Railroad and Carp River only about $\frac{1}{6}$ of a mile south of us a hill south from quartzite between our standpoint and the railroad. For $\frac{1}{2}$ day.

In the afternoon followed the road leading through the north half of Sec. 7. to-wards the $\frac{1}{4}$ post on Sec. 12 of the next township to the right of our way, after having passed along the hight of a rolling plateau we see a knob situated directly west of the knob in the northeast corner of the section. This one is in the N.W. $\frac{1}{4}$ of the N.E. $\frac{1}{4}$ of Sec. 7, T. 47, R. 27 and consists of almost vertical schistose beds uniformly composing the whole width of the knob. The rock is the same as the rock composing part of the knob in the corner of the section. It is a very peculiar rock unlike any I have noticed before.

At the northside of the last mentioned knob a swamp belt commences which contin-ues west, arching round to close proximity of the quarterpost in Sec. 12. Beyond the swamp north is a similar rounded hill range with plateau surface as the one we are on. It consists of the jasper ore series with a belt of quartzites south of the jas-pers. Beds apparently all dip south.

Following the road further west we have to our left a ridge of higher ground com-posed on the surface of drift with great abundance of quartzite ferruginous slate and iron ore boulders. Near the section line between 7 and 12 in the N W $\frac{1}{4}$ of the S W $\frac{1}{4}$ of Sec. 7 a knot of black ferruginous schists is noticed and in its direction another similar knob is found across the line in Sec. 12 on Breitungs land.

West from the latter knob and also on the northside of it the before mentioned swamp continues and taking a more southerly direction connects with the Carp river valley. We go now southwest over drift covered land with undulating surface and reach its summit about where the section line between 12 and 13 intersects it. This round-ed ridge is in the vicinity of the eastern corners of the two sections, covered only by a thin crust of soil and close under it mighty quartzite rocks are uncovered by an exploring ditch recently made.

The quartzite is dark grey very compact and seems to be a link of the slate series with quartzite beds following next above the Teal lake quartzites and below the jasper ores. From this ridge a gradual regular descent is made into the Carp River valley, **However** with intervention of several undulating east and west ridges composed partly of drift, partly exhibiting quartzites and slate (ferruginous) in outcrops. Dip south.

Separated from these undose hillsides by a strip of swamp are a string of knobs composed of dioritic schists and of compact diorite and south of them the Carp River flows with the railroad track close by crossing road and re-crossing it. On the south side of the river similar diorite knobs exist, one of them about 100 steps west from a railroad bridge across the Carp, consists of vertical ferruginous schists directly joining the railroad track, and behind them an apparently dioritic schist joins them. At all events a ~~knob~~ few steps further west is composed of genuine dioritic schists with compact diorite. (See the specimens collected from these localities).

N.B. From road on Carp River 150 steps northeast crossing of creek 180 steps further crossing of other creek.

Friday Sept. 27. With John Went with Frederick and Mr. Cummings to N W. corner of Sec. 5, T. 47, R. 27. Crossed over several parallel knobs of conglomerate-dioritic schists which amount to an aggregate thickness of near 1000 feet perhaps over. The highest part of the knob is west of the line. The ridges east of the line constitute a lower terrace of land and are partly drift covered while to the west the bare rocks prevail. In the fork between the two creeks crossed by the line is a high dioritic schist ridge touching the line with the foot of the higher rock knobs.

Further on across the creek a steep ridge of schistose dioritic rocks is ascended then descent and ascent of another similar ridge. The ridges are divided into numerous isolated knobs strung together by lower undulating portions. About 1/8 of a mile from the corner of Sec. 30 and 29 the line crosses two knobs of serpentine in succession before a steep descent is made into the valley of another creek. The hill marked to the east of these knobs is of chloritic or dioritic schistose nature.

After crossing the narrow valley of the creek we stand before a brisk wall of quartzites dipping south in almost vertical position. The thickness of the quartzite is not less than 80 feet perhaps over the range extends from here at least 1/4 mile further southwestward. Near the line is a gap in the range through which we enter into a longitudinal depression which separates the quartzites from the high steep serpentine ridges.

The first row of serpentine hills is the highest of the entire group of parallel chains of which we have 4 or 5 in succession to transgress before we come to the swamp valley in the north half of the section. Between the parallel knobby ridges smaller swamp expansions are very abundant but the knobs are so numerous and the surface **is** densely covered by timber that it is **impossible** to give a topographically correct representation of all the surface details.

Be it remarked that the entire range of bulk of hills from the quartzite to the centre of the north half of the section consists of serpentines with subordinate limestone seams.

But west of the line before descending to the creek passing the coal kilns the front range of hills is of dioritic schistose composition. The eastern knobs are serpentine. Crossing the creek and ascending to the kilns we find all the outcrops to be dioritic schist. On the road east at its intersection with the line is a belt of granitic rock between the schists. The high knob in the N.E. $\frac{1}{4}$ of the N.W. $\frac{1}{4}$ of Sec. 29 are already described before.

We follow the section line between 20 and 29. First through ugly swamp passing the little lake, then ascending a steep high hill range consisting there of limerock in a very rotten condition. The line descends again into swamp land, then rises into another steep and very high ridge consisting of serpentine. The corner of the section is on half the height of the summit. Near the corner the serpentine contains large masses of asbestos with calcareous intermixture.

We go about $\frac{1}{8}$ of a mile east from the corner on a spur extending more southward than the main ridge and descend by a road into Carp River valley all swamp. Thence strike the Deer Lake coal road which we cross and take our way home over the hills in southwest direction. The knobs seen on the way are all of dioritic schist, some of them conglomerate.

On the knob in S.W. $\frac{1}{4}$ of S.E. $\frac{1}{4}$ of Sec. 29 a dyke of dark basaltic rock 2 feet wide crosses the schists and in the drift covering the plateaulike surface we transgress are very numerous large boulders of quartzite of ferruginous banded schists and partly also of serpentine.

In the knob west of the one crossed by basaltic dyke I notice from distance several bands of reddish granite and other bands of dark green slaty rock which alternate with the main body of light green colored chloritic or dioritic schist.

Saturday Sept. 28. With John. From quarter post of Sec. 25 and 36 eastward on line 151 steps across swamp, then ascent on diorite hill.

3 pages in German

Diagram

Sunday Sept. 29. Examined the surface of Sec. 8 and part of 7. T. 47, R. 27. In the afternoon went to Negaunee for camp equipment.

Monday Sept. 30 Forenoon rainy. Went to Parsons mine where large masses of the jaspery hard ores occupy the surface with various dip conformably overlaid by massive quartzites. Further south much drift covers the ground but at Whintrop location a range of diorite hills strike east and west and leaning against their base are mighty layers of jaspery haematite ores.

Further south on the south side of the same diorite knobs the ore beds are more approaching to the hard ore of the Jackson. At the railroad bridge across the Escanaba are talcose dioritic schists and close to them on the south side well stratified quartzose rocks of grey color but weathering reddish white.

In the Parsons mine are many fissures filled with quartz, micaceous iron and finely crystallized heavy spar. Afternoon packed specimens and procured provisions.

Tuesday 10. Went to Kilns in Sec. 21 in N.W. $\frac{1}{4}$ of S.W. $\frac{1}{4}$ of T. 48, R. 27

Diagram

Wednesday Oct. 2. From N W. corner of Sec. 21 north 175 steps on high land to the right a ridge . We descended now to swamp. 811 steps hill land rises again. 170 steps further over hill, see on left side descent to swamp. From corner 570 steps to where we cross road on high land drift plateau. At 879 steps a descent commences. At 982 steps in the depression we find the quarter post. From there the plateau seems to extend north in undulations unto the swamp which surrounds the branch of Dead River. We go now due east $\frac{1}{2}$ of a mile east over the plateau. We strike a wood road leading east to the kilns.

We go on east. At about $\frac{1}{4}$ of a mile west from the quarterpost between 16 and 15 we cross a rounded knob of dark ferruginous slates. (See specimen) And the same rock has been seen in boulders in the drift all the way we were coming over the plateau. The ferruginous slates continue in a ridge to our right side unto the line. The quarter post is at the north slope of the ridge.

We now go south 240 steps from quarter post. We have reached summit of the before mentioned ridge. Descend now a gentle depression. At 321 we are in a small swamp and directly ascend another hill composed of the ferruginous slates. The swamp runs east and west. At 500 we have reached the summit of a quartzite knob. Descend and mount another knob at 777 when descent to the swamp land begins corner in swamp. The second small knob at 777 steps is dioritic schist. The quartzite dips north, as also the ferruginous slates did. Dioritic schists almost vertical.

We find the corner in the swamp. A creek runs close by it in east direction. We ascend across the swamp a rolling elevation. To our east we see a continuation of the creek and an expansion into a little lake . Further on at 740 steps we descended into a depression which continues eastward into a rapidly descending ravine, ascending now a steep knob of dioritic schist we are about at the quarterpost.

A descent to the creek north of it is very rapid over perpendicular bluffs. Then we enter a broad swamp expansion in which on the east side of the line rises a low ridge of dioritic schists only about 20 feet high but extending east about $\frac{1}{2}$ of a mile. We are at 280 steps south of $\frac{1}{4}$ post. Due west of it and due west from our standpoint we see at about $\frac{1}{3}$ of a mile distance a high hill which seems to belong to the same chain the quarter post is on.

Wednesday Oct. 2. Went along a road north from our camp until we struck the north line of Sec 21 about $\frac{1}{4}$ of a mile from N W corner. Found the line in swamp extending partly to the creek which flows into Carp River through the little lake near quarterpost between Sec. 20 and 29. Partly connects with the creeks which connect with the Carp in Sec. 22.

From the aforesaid swamp we ascended high lands and descended then to the creek which passes not far South of the N.W. corner of Sec 21. Ascended a ridge on which we find the corner on the northwestern slope. We then follow the line north between the edge of Sec 17 and 16 descending it to (into) a swamp which extends south through the centre of Sec. 20. Ascend unto a high plateau mostly drift covered but in places full of large angular boulders of the ferruginous slates.

Above the quartzite formation at the quarterpost which is in a depression we strike west continually on the high plateau which gradually sinks northward to the tributary of the Dead River.

About $\frac{1}{4}$ of a mile west from quarter post between 15 and 16 the median line of the section crosses a knob of ferruginous slates dipping north and a ridge of similar rock continues to the right of our course all the way along until we strike the line between 15 and 16. We find the quarter post on the northern declivity of this ridge and the land falls northward as far as we can see.

We now follow the line south. Ascend the ridge which here has no good outcrops. At 240 steps we are on its summit and descend into a narrow swamp valley running East and west (320 steps to $\frac{1}{4}$ post). Ascend directly another hill composed of the ferruginous slates. 500 steps from quarterpost we are on the summit of a quartzite knob, descend and are at 777 steps on a hill of dioritic schists with steep perpendicular rock walls on the south side which joins a swamp in which the corner stands. A creek passes close to the corner and flows S E. forming about $\frac{1}{8}$ of a mile from there a small pond surrounded by meadow.

Across the swamp we ascend rolling plateau land. At 740 steps from corner we have descended into a depression which sinks to our left into a ravine. Thence we ascend a steep dioritic schist ridge with perpendicular rock walls towards the south side. We descend it and are in a broad swampy valley of a creek running to the east. About 60 steps east from the line and $\frac{1}{8}$ of a mile south from the quarterpost is a low rounded knob of dioritic schists protruding above the swamp, and about 100 steps west from the line in the continuation of the strike of this low knob is another similar ridge in the swamp but mostly drift covered.

Going further west in the same direction we strike the high dioritic schist ridge which continues from the quarter post between Sec. 21 and 22. The highest summit of this ridge is regular dioritic schist. On its lower more southern portion are the talcose quartzose slates underlying the quartzite formation in a thickness of several 100 feet, close adjacent to the diorite schists and in part closely resembling them. On the southside of these and still composing a portion of the same ridge are bright green chloritic schists with much of magnetic iron granules.

Descending into the valley of the creek and going southward across it we find the bluffs of the opposite side likewise composed of the talcose quartzose slates of partial resemblance with the dioritic schists and full of quartzose talcose veins with black graphite-like mineral and with chlorite and novaculite-like talcose seams. 73 steps from corner to foot of hill. 172 to top of dioritic schist hill thence decline to the valley.

Thursday Oct. 3. To little lake on line between 21 and 28. Hill N.W. of lake serpentine. Hill - large* east of lake serpentine and likewise the hill on south side. Further on hills on south side of line all serpentine unto short distance from the corner of Sec 22 where the hill ranges are composed of dioritic schists. Went north from corner to a small dioritic schist knob. Then followed the line south over a much higher hill range of diorite schists. Then after descent of vertical declivity of schists we find forming the foot of the range a belt of lower rock knobs which are composed of serpentine and form the slope of the valley for quite a distance up and down the river.

Crossing now the river which is in a broad swamp valley and very tortuous we ascend the hill knobs on the opposite side and a little east from the line. We find there at least 4 or 5 parallel ridges in the space between the river and Deer Lake.

The first or most northerly knob consists of a soft talcose rock partly massive partly schistose. The next following knobs southward are all dioritic schists, partly very silicious, partly conglomeratic and of lighter and darker greenish color. West from them is a gap which leads into a small east and west valley between this group of knobs which on the southside towards the outlet of Deer Lake compose one connected high rock chain facing the river.

Diagram

Friday Oct. 4. To kilns in Sec. 30, T. 48 R. 27. Here to northeast corner of Sec. 30 which is not preserved. From here we see northward rolling drift hills. Westward we follow the line for $\frac{1}{2}$ of a mile when we are at the descent to swamp. We follow now the edge of the hills due northward and have to make a descent towards the swamp after 500 steps. At 562 we have descended to the swamp land and take now our course eastward unto the margin of the hill tops is reached again, which distance is 250 steps. We then go further east yet for 250 steps more which brings us to the section line between 19 and 20.

Here to our right about $\frac{1}{8}$ of a mile south of the centre line of section we find a ridge of quartzite extending in the direction from S.W. to N.E. and with northward dip. This quartzite is partly conglomeratic of grey or red color and very little altered. It appears to me the sandrock imbedded in the slates or a sandrock higher than the Teal Lake quartzite.

We now follow the line north over a rolling drift plateau declining on all sides towards swamp lands and descend into the swamp near $\frac{1}{2}$ post. Find corner of Sec. 20 & 19 on a road leading through swamp up to Sec. 8. The line leads now over an isolated ridge of ferruginous slates with imbedded quartzites and descending over its north side we see a lake with an outlet stream running into Dead River. For a long distance north a broad swamp belt extends.

We strike now east towards the high lands which are about $\frac{1}{2}$ of a mile distant from the road. The hill land in this place extends much further west in a spur than is indicated on the government maps. The hill sides are steep. No outcrops but I suppose them to consist of the ferruginous clay slate formation. On top is a high plateau undulated with several parallel east and west valleys which on this side all decline towards the western swamp and project the intermediate spurs or ridges into it.

We see also a wide swampy indentation to our righthand side which is the valley coming down from our camping place. After about $\frac{3}{4}$ of a mile travel eastward we descend into that valley and pass through considerable swamp over numerous spurs running out from the hill lands and finally ascend a very steep ridge in the north west quarter of Sec. 21 which consists of ferruginous clay slates. Dip northwest

Arrive in camp at 5. Inspect the country along the north line of Sec. 21 which declines in a watershed partly west, partly eastward. North of the line not far from the $\frac{1}{4}$ post between Sec. 16 and 21 a quartzite ridge strikes N.E. in continuation of the quartzite knob situated in the S.E. corner of the N.W. $\frac{1}{2}$ of N.W. $\frac{1}{2}$ of Sec. 21, T. 48, R. 27.

The hill east of that knob consists of dark and light colored much contorted novaculite like slates of several 100 feet thickness and adjacent to them on the east side are dioritic and chloritic schists which across the valley running down to the kilns form a much larger body in a high east and west ridge. But on their south side the novaculite like strata are also adjacent to them and further south again a belt of chloritic schistose rock lays close against the novaculite.

Diagram

Saturday Oct 5. Went to rock spur in the bend of Carp River. Nearly all the knobs composing it are dioritic schists, some of them conglomeratic. Many boulders of iron ore in the drift.

Diagram

The broader part towards Deer Lake is intersected by a swampy valley which opens on one side towards Carp River. The other end extends across the section line to the outlet of the lake. Two ranges of knobs on the side of the Deer Lake and 4 ranges towards Carp River. Of the latter the most northern one is a talcose serpentine with bands of limestone. The knobs on the opposite side of the gap are all dioritic schists which continue in several ranges to the east end of Deer Lake.

They connect there near the north and south section line with the hills north of Teal Lake by a sort of high plateau. The knobs at the east end of Deer Lake are all schistose diorites. On the south side of Deer Lake the knobs nearest to the lake are likewise dioritic schists. Next to them south are dark talcose schists belonging to the novaculite series which is in contiguity with those on the southside. Then follow the quartzites all dipping south

Diagram

Sunday Mc Omer mine.

Diagram

Diagram (formerly New England ?)

Monday Oct. 7. To sec. 36, T. 47 R. 28, passing Saginaw mine ectr. We see the quartzite which covers the ore beds of Parson mine extending west over a large area. The road to Saginaw mine leads over this ground. Ascending the first hill, soon after leaving the upper quartzite I found some outcrops of the jasper ores and further south on or near the summit of the ridge are the dark ferruginous slates largely exposed. From the top of the ridge a high plateau extends which is mostly drift covered with abundance of large boulders.

Near the new Burt mine the upper quartzites make their appearance again and under them large masses of conglomeratic jaspery ore follow which inclose seams of good slate. Granular and specular ore below are in the shafts of Saginaw mine. Various talcose and argillaceous schists with admixture of more or less iron ore granules are penetrated on the surface. No outcrops of such rocks are seen. Further south the haematitic jasper ores are disclosed in great thickness and under them the well stratified ferruginous slates form large knobs. These ferruginous slates are very rich in iron and resemble the Tilden mine ores.

This order in the disposition of the rocks is everywhere westward from the Saginaw mine to the Whintrop and to the Parsons mine in a similar distinctness, observable particularly at the New England mine. The contact of Haematite ores several 100 feet thick with the diorite is plainly seen. The ores dip away from the diorite. Above them are more lean jaspery ore strata with beautifully banded structure and exhibiting remarkably fine flexions and contortions. North of these jasper beds is adjacent and incumbent on them a fine bed of slate ores and above these conglomeratic ore beds which finally merge into the upper quartzite which is there of great thickness.

The same structure is seen in the Parsons mine. The total thickness of the iron bearing strata of this district is not less than from 500 to 800 feet, perhaps much more. At the Parsons mine the fissures in the ore are filled with splendid crystals of heavy spar and of quartz with silky shining talcose scales in the interstices between the crystals.

2 pages of German

Thursday Oct 10. Went to corner between Sec. 25, 36, 31, 30 behind east end of Teal Lake. Descended from corner to valley of a creek. Struck 250 paces from corner the foot of another diorite schist hill. The valley extends in an east and westerly direction. The hills on which the corner is extends in a somewhat lower elevation along this valley to the west and apparently also somewhat north. At 370 we strike the swamp. 488 from corner we strike the creek. At 140 passes across creek, strike foot of hill. We pass along its south slope and descend at 278 into a depression, ascending from there another knob of diorite schist.

Friday Oct. 11. To line on east end of Teal Lake. Thence north $\frac{1}{4}$ of a mile from $\frac{1}{4}$ post accurately 700 steps north. Thence due west along valley. On both sides continued ridges unto 500 steps west. At 585 steps the road turns northwest and the hill on our right hand terminates. Water runs to the east. A watershed is here and 76 steps further in the northwest direction, we come to a descent of the valley in western direction. 44 steps further the road turns again northwest. At about 30 steps more the road turns due north and at this bend the lower termination of the ridge is crossed in a low depression but continues westward and another valley comes from the east on the other side of the ridge.

Diagram

We go 80 steps north and ascend an east and west dioritic ridge. A plateau extends at 200 steps. We are on it. Follow line northward between 25 and 26, T. 48, R. 27. Go from corner through swamp unto the 1/16 post. Pass near lake and across creek flowing into it from 1/16 post to top of dioritic schist hill 121 steps. Down to valley 241 steps, thence up to top of next ridge 310 steps in all. Thence we mount another ridge after crossing a small depression with swamp and find the quarter post not far from summit on northern declivity. Thence we go west along brow of hill. Ascend 30 steps southward from the centre line to reach the summit crest. On this we find a descent into a saddle at the distance of 200 steps from $\frac{1}{4}$ post.

56 steps further we are in bottom of depression and thence ascend a steep bluff of diorite schists. A good road is crossing there over the hills southward. We cross this knob and descended to another depression at 400 steps. At 500 we are on top of another knob which seems to be the highest of all.

I went 120 steps south from our course on the highest summit and could see from there a deep valley apparently extending all the way up to the Deer Lake. Opposite this valley is a long high ridge extending east and west. The decline of this valley is eastward.

We go now through a depression unto another knob of dioritic schist from which I have a specimen. At 810 steps we are at the brink of a declivity. A hill lower than ours is to our right hand side and west of us our course passes the northside of another knob. The course to the centreline of the section led us through an east and west valley between the before mentioned hills. We are now about 20 steps south from the centre of section.

This valley is here obstructed by a higher bar of land. It seems behind us to decline with its outlet to the northeast. Before us on the other side of the bar it declines northwest. The hill to our right terminates here. We go further west 400 steps. Passes across knobs which extend diagonally across our way towards the river. The high ridge is still to our left but the hills we are crossing are separate from them.

We go as far as 500 steps west from centre. See to the north the hills extend and slope to the river west west. Before us is a high knob separated from us by a depression and southwest from our standpoint a swampy valley extends apparently to the section line west of us and intersects it south of the quarterpost. We strike south now across the foot of east and west ridges and through spurs of swamp uniting with the swamp on the west section line. At 260 steps we are at the descent into a big swamp valley, apparently the same valley which I have seen from the high ridge $\frac{1}{2}$ mile east from here.

Monday 14. With Frederick to Sec. 29,20,17 of T. 48, R. 26. Return by tram road to Eagle Mills. Railroad fare for John .20. Ascended from Carp River the diorite bluffs Found the creek noted on government map entirely misplaced. Went due north 500 steps east of Section line. Struck the creek about $\frac{1}{4}$ of a mile south of the north line. Swamp valley. Crossed a spur of dioritic schists. Descended again in a swamp valley water flowing east. Ascended another dioritic hill and found the north line near the swamp bottom of the creek which flows west.

Then ascended another diorite ridge from which we descended in a large swamp valley. Diorite knobs to our right and left. Creek running west. Traversed another diorite spur. Descended again in swamp valley creek flowing east. Then crossed 3 dioritic schist knobs with intermediate small creeks. The last knob has a large dyke of augitic rock. After crossing the creek we ascended the forehills of a very high ridge which is at the foot dioritic, top granite. We find the line on its north slope and come to the corner $\frac{1}{2}$ of a mile west from there. The corner is in a depression between much lower hills close to a road leading to the kilns in Sec. 17. We follow that road eastward over the higher part of the granite ridge and descend to the kilns.

Tuesday Oct. 15. From Eagle miles. R.R. fare 40 cts. At the tram road leading from the kilns quartzites dipping north are opened in the railroad cut in great thickness and above them slaty ferruginous beds resembling somewhat the jasper beds are resting on them. The road then crosses a creek before it makes another cut through granites near the northwest corner of Sec. 21. The creek flows southwest.

Tuesday to Eagle Mills. Followed the line up to Schweitzers mill. Found no corner preserved but identified the spot where it must be on the top of a high dioritic knob. Thence descended on the north and south line to the creek in Sec. 23 which leads to the kilns on the plateau north of Bruce Station. The creek is falsely marked on the government map. We ascended the high granite ridge on which the corner is but also destroyed, and thence west over the ridge west to the next corner. From there south over various granite knobs and finally to the next corner which is in the high plateau about 350 steps north of the tram road.

Thence Frederick followed tram road to Eagle Mills and I went on a road north of tram road which passes over the plateau between some smaller knobs and on the left hand side about $\frac{1}{2}$ mile east of the corner, I notice at no great distance a lake which seems to be the head waters of the creek at Schweitzers mill.

Wednesday 16. Went to corner of Sec. 32, crossed Carp River on line between 27 and 28 and found corner on the plateau close to the road to Baldwin kilns. Returned on account of rain.

Wednesday Abend (evening) Oct. 16. With Sperly
Board bill paid including Wednesday fir mich und Friederich (for myself and Fredk)
18 dollars.

Thursday Oct. 17. Went to S.W. corner of Sec. 21, T. 48, R. 26. Thence east 400 steps over plateau inclining to the north of us somewhat. At 400 steps we are at the foot of a high dioritic knob which the line crosses. At 607 steps we are on the pointed east end of the bluff briskly falling off into a plateau. Near the quarter post we cross a creek surrounded by swamp and thence go over the plateau to the corner between 22, 23, 26 and 27.

Thence we struck south for the tram road and followed it to the northwest corner of Sec. 21 which is on the granite hill to the left of the great bridge on the declivity of the granite hills. Have at their foot smaller knobs which consist of dioritic schists and all the hills on the south side of the tram road are dioritic. We followed from the corner the line southward over various diorite ridges and came some distance beyond the quarter post, again down on the plateau which brought us again to the southwest corner of Sec. 21.

The last diorite hills we descended are facing with their east end the depression in which the Baldwin kilns are situated. Near a lake low land connects the plateau with this depression but the water from there flows in an opposite direction westward.

Friday Oct. 18. Snow. Quit work. Packed boxes and prepare for departure. Afternoon to Ishpeming where the Barnum mine Co. bored through the upper quartzite in the village for ore. At 550 feet most all through quartzite and slaty rocks in the lower part. Found 18 feet of iron ore at a depth of 600 feet below surface.

Sunday Oct. 20. Left Negaunee for home. Paid \$15.60 railroad fare. 6 dollars board bill.

Dr. S S Garrigues

Sir:

4 or 5 years ago you sneaked yourself into my friendship and loaned 300 dollars of my hard earned savings from me at a time when your income was fully one third larger than mine.

Yielding to the wishes of Governor Bagley and contrary to my own inclination I agreed to let you work out the economical part of the geological report on salt production in Michigan. And after having done it you handed over to me a bill for your work and for 6 dollars additional expenditures for a photographic plate of the Buffalo Salt Works, saying that I should give you credit on the note you owe me and you would pay the remainder of the debt as soon as possible.

I handed these bills over to the Geol. board and was told they would pay the six dollars but not your other bill as that work done was a part of your official duties. So I gave you credit for the six dollars and informed you of the fact, besides the refusal of the board to pay the other bill.

Meanwhile I learned (heard) that you was such a bad householder that you was utterly unable to pay your honest debts and intended to sustain the loss silently and say no more about it, supposing that the adversity of circumstances forced you to such an inpromptness in your promises.

But a few days ago receiving a letter from Mr. Angel in East Saginaw by which I was informed that you made him believe as if I had received the 6 dollars illegitimately instead of paying it to him I fully perceive the situation and believe that you borrowed the money from me with the original intention to swindle me out of it or else you would not for the trifling sum of 6 dollars throw such a mean suspicion unto me. No man with a particle of sense for honor would have acted in this case as you have done.

This opinion of your character I will hold so long until you have paid your debt as a man and a copy of this letter to you I will send to Mr. Angel and to the Governor of the state in order to justify myself before them.

With expression of regret ever to have met you

I sign my name

Chs. Rominger.

C. Rominger Diary 1879

Tuesday May 13. Went to Parsons Mine. Knob east side of road in N.W Part of the S.E. $\frac{1}{4}$ of the section. Dioritic on its southern declivity. Recently good iron ore has been uncovered. The knobs in the east half of this $\frac{1}{4}$ section are all dioritic.

In the S.W. $\frac{1}{4}$ of the S.E. $\frac{1}{4}$ the road crosses smaller knobs which on the west side of road consist of thick beds of the upper quartzite dipping nearly due west. The top layers are a light colored quartzite with distinct stratification. In places false bedding is noticed. Beneath them the layers of quartzite are dark purplish black by admixture of considerable quantities of iron. On the east side of the road heavy layers of conglomeratic iron ore crop out with a conformable dip, and beneath them the ore beds of the Parsons mine are opened. A small separate knob connected with this group and forming the eastern end consists of dioritic schists dipping in the same direction with the other strata.

Wednesday May 14. Examined the hills in the west half of Sec. 16. They consist of the upper quartzites of great thickness, partly thinly bedded and sandrock like with mica, partly heavy bedded compact quartzites. Beneath the quartzites a ferrugineo-arenaceous or sometimes a dark ferruginous slaty rock is often seen denuded which resembles the arenaceous slate beds beneath the iron ore deposits, but I consider them in these localities as being a part of the upper quartzite. The summit of these hills is generally deeply covered by boulder drift with many quartzite and iron ore boulders.

Thursday May 15. To Saginaw mines along railroad. Near the quarter post between Sec. 16 and 17 the road cuts through a thick series of the upper quartzites with southern dip. Lowest beds heavy light colored quartzites, upper strata micaceo-arenaceous flags. Further on all the surface is drift. The first rock outcrop is met with near the N.W. corner of Sec. 20, T. 47, R. 27. A knob of conglomeratic iron ore south of the wagon road to the Saginaw mines where it crosses the railroad track which leads to the mines opened on this knob. Further west another iron ore knob joins the first and on it the Saginaw mines are opened. On the north side of the ore Hills outcrops of the upper quartzites are seen in several places. The strata dip north.

Friday May 16. Followed H. & Ont. R.R. to about the centre of Sec. 14, T. 47, R. 28. No outcrops unto the S.E. $\frac{1}{4}$ of the N.W. $\frac{1}{4}$ of Sec. 13 where a small knob is partly cut by the read bed which consists of dark black ferruginous slates. Dip? A few hundred steps further another small knob is touched by the road which consists of schistose diorite. From the west line of Sec. 13 I followed the line to the N.W. corner of the section which is on a high knob denuded of all its timber and not preserved, but some marked trees are found yet indicating the north line of the section.

This hill and all the others over which the line runs to the N.W. corner of Sec. 18 consist of quartzites and ferruginous slates of dark color in almost vertical position but apparently dipping north. (Strata below the iron ore horizon). Denudations of the rock are seen along the whole line and near the corner of Sec. 18, test pits are opened by Mr. Breitung which uncovered the quartzites of a light color and of vitreous compactness.

Going south from the corner of Sec. 18 at the first 16($\frac{1}{4}$) post a knob rises, consisting of ferrugineo-arenaceous beds with a large proportion of carbonate of lime and iron.

By weathering the hard rock of bluish grey color is converted into a porous yellow ochreous mass friable with the fingers. Further south the hills forming the border of Carp River valley are chloritic and micaceous quartz schists, often of conglomeratic structure. All the strata seem to dip north but I have to examine the dip yet more accurately.

Saturday 17. To Parsons mine. Topographical examinations.

Sunday 18. At noon with Mr. Frederick to Whintrop (Winthrop) and New England mine. All the high hills in the central portion of the N.W. $\frac{1}{4}$ of Sec. 21 and in the N.E. $\frac{1}{4}$ of Sec. 20 are composed of jaspery iron ore with interstratified good slate ores and below with large deposits of haematite ores. All dip north.

Monday May 19. To corner between 15, 16 21, 22, corner at the foot of a diorite hill. From there south to $\frac{1}{4}$ post. Diorite knobs on east side of line. Thence followed road to Foster mine.

Tuesday 20 To Parsons mine following railroad to the branching off of the Saginaw mine road. Ore beds of Shenango mine, Whintrop and New England dip north.

Wednesday 21. To corner between 21, 22, 27 and 28. Follow line south 350 steps south of $\frac{1}{4}$ post. Granitic outcrops. From there south all granite, gneissoid hornblende rock. The granite encloses fragments of the hornblende rock.

Thursday 22. To Parsons mine. Quartzites above ore, above white, below dark and next below underlaid by conglomeratic jasper ore. Dip of strata about north, north-west. Hill south of Shenango mine jasper, dip north. Ore pit newly opened near the centre of Sec. 16. Dip north towards the diorite.

Friday May 23. On wagon road to Saginaw mine. Quartzites in N.E. $\frac{1}{4}$ of S.W. $\frac{1}{4}$, dip N.N.W. Light colored, below, ferruginous flaggy, above very thick, still lower are dark slaty beds which resemble form 8 of Brooks but seem to belong to the upper quartzite. Top of plateau covered by boulder drift. Large hills south of Saginaw locations and extending to the Goodrich location. All jasper conglomerates with inclined ore belts. Above quartzites and quartzite conglomerates. Dip little east of north.

Saturday May 24. To Saginaw mine along R.R. near quarter post between 16 and 17. Quartzites dip south, light colored, below ferruginous, flaggy above, large thickness. Outcrop of upper quartzite $\frac{1}{4}$ mile east from S.W. corner of Sec. 17, dip north.

Sunday 25. To Cleveland mine. Strata much folded. Dip partly north, partly south.

Monday 26. The Saginaw mine. High hill south of the mine consists of the banded ferrugineo-arenaceous beds rich in iron granules and very thick. Dip north under the ore beds. $\frac{1}{4}$ mile south of these knobs, granitic outcrops on the east slope of the undulating ridges of the plateau land. Followed the town line south to the corner of 30 and 31, and 25 and 26 of the next township. All granite in this portion of the country.

Tuesday 27. To N.W. corner of Sec. 18, T. 47, R. 27.

Saturday May 31. Two pages in German

Diagram

Sunday June 1. To line between Sec. 4 and 5, T. 47, R. 27. High hill in north east $\frac{1}{4}$ of S.E. $\frac{1}{4}$ of Sec. 5 consists of schistose partly quite massive rocks of chloritic composition with magnetic ore granules more or less impregnated also calcareous spar crystals abundantly intermingled. The rock seems to be identical with the schists above the diorite on Excelsior mine. At the same time some similarity exists between it and the dark calcareous-arenaceous schists in the knob near the northeast corner of sec. 7 with the schists of the first mentioned knob, also diorites mingled with epidotes occur.

South and some distance west(east) of this knob is a large outcrop of light colored massive quartzites dipping south and little to the west. Their thickness is not less than 300 feet. A diamond drill is at present boring through it and has reached a depth of 60 feet.

Not quite $\frac{1}{4}$ of a mile south of this quartzite is a low ridge composed of the arenaceous slates of Form 8 of Brooks and $\frac{1}{4}$ of a mile east of the quartzite a low knob of diorite comes to the surface. $\frac{1}{6}$ of a mile north of this diorite the red jaspery ore beds beautifully polished by drift action are seen on the surface in almost a vertical position or other times with southern dip.

North of them the brown jaspery ore strata with fine bunches of grape ore are largely exposed. Strike east and west. They can be followed for the distance of $\frac{1}{4}$ of a mile westward and form a considerable vertical bluff in the north slope of the hill in N.W. $\frac{1}{4}$ of the S.W. $\frac{1}{4}$ of Sec. 4 just at the edge of the large swamp. The generality of the surface is covered by boulder drift with large blocks of quartzite jasper ore slaty arenaceous banded rock of Form 8.

The reasonable explanation of the arrangement of these different rock outcrops is a matter of great perplexity and I am for the present not settled in my opinion as to the age of the quartzite, whether it is the upper or the lower quartzite. The diamond drill will solve this problem in a short time.

Monday June 2. To centre of Sec. 12, T. 47, R. 28. From there over drift plateau to line between 11 and 12. From here north to corner all on a low level drift plateau corner not preserved. Thence on line west. Strike swamp after 400 steps. Swamp extends about to the quarter post. Thence slow ascent to a rounded drift hill on which the corner is located but not preserved. From there north and eastward all a sub-swampy level for quite a distance. From corner south across undulations to a hill on which a farmhouse is located, the line runs between the house and the stable and the house is close to the $\frac{1}{4}$ mile post. Strike county road going east alongside of ferruginous slate hills.

Slates vertical or inclined partly to the north, partly to the south. Behind these hills $\frac{1}{4}$ of a mile east of the westline of Sec. 11 and not far from its north line a higher knob with considerable rock bluffs rises. A small swamp lies between the two ranges of hills. The high knob consists of rather massive but well stratified arenaceous black slates mottled with whitish quartzose streaks and partly brecciated and considerably corrugated. It appears to dip south but the distorted condition of the mass allows no accurate determination. The slate rock of the more southern hills is very fine grained, black, not arenaceous, cleavage oblique to the stratification. The more eastern portions of these hill ranges are drift covered and present no outcrops.

From here I followed the line between 11 and 12 southward . The knob west of the line in the S E $\frac{1}{4}$ of the S.E. $\frac{1}{4}$ of Sec. 11 consists of the black slate rock banded with greyish streaks oblique to the cleavage. The thickness of the slates is apparently more than 300 feet.

Went then across the creek to the north portion of Sec. 13. The hills on the north line are all slates and quartz rocks interstratified and closely related to the slates of the other knob in Sec. 11. Went southeast across a depression to knob in S W. $\frac{1}{4}$ of N.E. $\frac{1}{4}$ of Sec. 13 which consists of a very thick series of micaceous schists in part massive scaly, in part fine grained and banded of distinctly stratified structure but stratification oblique to the cleavage. The fine grained rock lies on the south slope. There also an amygdaloid schist occurs with nodules of spar which is sometimes carbonate of iron. Also the micaceous schists not amygdaloid contain a great proportion of calc spar and nodular calcareous and cherty concretions from the size of a pea to a mans fist which give it the aspect of a conglomerate but it's actually concretionary structure of a highly altered but yet distinctly sedimentary rock.

The knobs in the south part of the N W. $\frac{1}{4}$ of Sec. 18 which I considered formerly to be dioritic are of the same structure and of micaceous nature. I am inclined to identify these micaceous rocks with the rocks of the knobs in the N.E. $\frac{1}{4}$ of the S.E. $\frac{1}{4}$ of Sec. 5, and with the schists leaning on the south slope of the dioritic knobs at the Excelsior mining location. Returned to Ishpeming with railroad from Saginaw Station.

Tuesday June 3. Remained home waiting for Wagner but he failed to come. Wagner arrived during that day

Wednesday June 4. To Sec. 36 in T. 48, R. 28. Commenced to follow the north line of Sec. 36 beginning at the quarter post near the road to Sec. 25. The line leads first along the brow of diorite(schistose) beds. Then follows the swampy valley of a creek. Ascends again a dioritic hill. Near the corner which is on the east slope of the elevation large outcrops of diorite. From here follow(ed) the line south. Not much seen unto near the quarter post. After crossing a small creek high rock bluffs are on the line which consist of dioritic massive rocks protruding below incumbent serpentine rocks which form four separate east and west ranges with deep valleys between each range.

Proceeding further south the hills are all the same . Various serpentine rocks with veins of asbestos and in several of the hills dioritic rock are found again in close contact with the incumbent serpentine. But there is an abrupt change between the two rock kinds and no gradual transition. In the diorites close to the serpentine are sometimes veins of quartz, red feldspar and of epidote.

The serpentine has in frequent instances the plain marks of former sedimentary origin but generally is a highly metamorphosed sub-crystalline rock with no stratification. In the neighborhood of the diorite the serpentine seems to be much more crowded with a network of asbestine seams than further away from the contact.

Thursday June 5. To Sec. 29, T. 47 R. 27. Ascend from Saginaw mine R.R. a high granite knob. Line passes its eastern slope. Descends into a lower sloping undulating high plain. Corner only approximately determined. From there on southline of section over granitic knobs and intermediate valleys to centre of section line.

Quarterpost not found. Situated in a swamp which extends westward to the west corner. From quarterpost north ascended a high dioritic bluff close by. After crossing its high descent into a ravine sloping northwest. From ravine went northeast to high hill partly covered with boulder drift. On north slope outcrops of diorite. All the other hills east of it are granites with gneissoid hornblende rock. The gneissoid hornblende rock evidently intruded by the granites and fragments of it inclosed within the granite mass.

Friday June 6. To Foster mine. All the hills on south side of road jasper ores and flag ores. Dip north or almost vertical. Went to corner (N.E.) of S. 27. From there 300 steps south and then west. All over jasper ore hills to middle of Sec. Thence south. West of our line the hill range in the south half of the N.W. $\frac{1}{4}$ of Sec. 27 are diorites. South over a low land forming the divide between 2 creeks flowing west the hills west of our course situated in the central portion of the section are all granites. $\frac{1}{2}$ mile from northline strike on a high granite bluff with gneissoid hornblende rock and after crossing it descend into a depression which slopes eastward and opens on the cascade road near the east line of the section. Before us another large granite knob with gneissoid hornblende rock. From its high then a brisk descent to the Cascade Railroad.

Saturday June 7. To Foster mine by way of Cascade Railroad. Hunted for S. E. corner of Sec. 27, T. 47, R. 27. Could not find it. All hills here granitic. From supposed corner went east but did not find a line. Followed the east direction to the supposed $\frac{1}{4}$ post which must be at the edge of the swamp where the railroad crosses the line. Went from here north. Ascended a small granite knob close by the road. Then crossed a creek and narrow swamp. Ascended a low plateau and came $\frac{1}{4}$ of a mile north of the $\frac{1}{4}$ post to the foot of a granite knob. Crossed it. Descended to a small branch of the main creek we had crossed previously. Then crossed a few undulations of spurs of a granite knob situated to our right. At a short distance to our left small knobs of granite bordering the valley.

About the centre of the section on our line we struck a high ridge composed of granite at the slope. Ascending we find a highly altered hydro-micaceous quartzite of whitish color resting immediately on the granite. Dip north. On this white quartzite which is about 25 feet thick a belt of a black colored hydro-micaceous quartzite follows likewise about 20 or 25 feet thick. On this regularly follows a belt of a finer grained partly ferruginous and hydro-micaceous quartzite 20 feet and on it about 50 feet of green micaceous-dioritic schists repose forming a precipitous bluff after ascension of which we find again heavy masses of granite forming the crest of the hill.

Diagram.

Our line leads now down the opposite slope on granite. Crossing a ravine we ascend again a steep ridge consisting all together of micaceous-dioritic schists well banded and stratified with frequent corrugations and plications of the masses. Crossing this ridge we descend again into a sloping depression forming the basal portion of higher hills east of the line. Several small knobs a little west of our course consist of dioritic rocks. We leave now the strict compass direction and wind our way westward towards the slope of the high crest of the Tilden mine location and find in the south slope of those hills mighty thick deposits of flag ores and Haematitic jasper ores.

But the small knobs north of the coalkilns in the N E. $\frac{1}{4}$ of Sec. 27 are dioritic flag ores. Dip north. The diorites likewise and apparently situated below the flag ores.

Diagram

Monday June 9.

Tuesday July 29. To Deer Lake hill on east end of lake over which the section line runs, a coarse grained diorite with various dioritic dykes 5 or 6 feet wide, likewise the hill on which corner stands. The knobs north of the line are a conglomeratic schist, pebbles very abundant of stratified rock fragments partly angular, partly rounded. The pebbles are not of very different chemical composition from the schistose mass, siliceo-feldspathic.

On the north side of these conglomeratic schist knobs is a drift plateau declining to the creek directly over margined by other knobs near the centre of the section (27). The most eastern is a dioritic schistose rock with rhomboidal cleavage, containing much of red feldspar crystals, and sometimes of granitoid aspect. Next to it on the west side is a knob of black magnesian rock identical with the serpentine rock of Presque Isle. It forms a uniform bulky mass 80 feet high and with almost vertical sides. West of this two other knobs are in the same strike which consist again of siliceo-dioritic schists with rhomboidal cleavage and not essentially differing from the conglomeratic schists so largely developed in the more southern range of knobs. These also exhibit usually rhomboidal cleavage.

Wednesday July 30. To Eagle Mill with P. Gier. From $\frac{1}{4}$ post on west line of Sec. 34, 375 steps to its crossing of county road 160 feet from $\frac{1}{4}$ post to crossing of R.R. All swamp. The line southward runs over a hill of the slaty sandrock. See specimen. From supposed corner 329 steps to road in ravine going to the coal kilns. Find centre line of Sec. near $\frac{1}{4}$ post. From there north 370 steps to intersection of tram road. From tram road 872 steps north on plains. From there 380 steps east to a pond at the foot of the diorite ridge. Our course leads below pond and the foot of the ridge.

Thursday 31. To Eagle Mills and Sec. 22, T. 48, R. 26, with Gier and Mary.

Friday Aug. 1. To N.W. Corner of Sec. 23 T. 48, R. 27 on high undulating plateau in a swampy depression. From there west 214 steps in swamp. Then rise unto small knob of quartzite. On left hand side a high ridge but without outcrops we descend into a depression now, which slopes into a ravine running west. We move with the line on the base of the north slope of the high ridge, now 410 steps from corner. At 600 steps large outcrop of quartzite to our left, At the base of the high ridge partly conglomeratic. Ravine continues to the right. Dip apparently to the north. At quarter post we are at the foot of the ridge almost in ravine. Slaty sandrock outcrops nearly vertical. Now south over the west and (end) of the quartzite ridge. Descend into valley to our left, The end of the next southern ridge which consists of diorite schists vertical or dip south. The valley opens here to the west.

Saturday Aug 2. Office work at home

Sunday Aug. 3. For victualien (meals) 3.50
To east line of Sec. 21 in valley. Thence south 186 steps to creek. From here over a hill spur of arenaceous schists 200 steps to the second creek.

From east line of Sec. 21, west 1400 steps to our camping house.

Monday Aug. 4. To N.E. corner of Sec. 21, T. 48, R. 27. Thence west from corner $\frac{1}{4}$ of a mile all in swamp. Thence north 200 steps to base of hill spur. Thence return to corner and south to $\frac{1}{4}$ post. All rock outcrops seen belong to the black banded ferruginous slates. Afternoon followed north line of Sec. 21. Hills west from $\frac{1}{4}$ post Quartzites. To the south of $\frac{1}{4}$ post to kilns, schists inferior to the quartzites, sometimes more diorite like, other times approaching novaculites. Quite ferruginous in some strata and often pervaded by quartz veins and chloritic masses sometimes also of brecciated character and much corrugated but always well laminated. South part of the hills quartzite with northwestern dip.

The hills in the northeast $\frac{1}{4}$ of the section are dioritic schists with adjacent schists of the quartzitic association. Some augitic dykes pervade them. In the north part of the N.E. $\frac{1}{4}$ quartzites and dioritic schists likewise with augitic dykes. It is not always easy to determine whether the quartzite masses on the surface might not be huge boulders. The dioritic schists are nearly (or clearly) in place. Went about $\frac{1}{4}$ mile east of N.E. corner to a clearing in Sec. 22 on a high plateau covered with drift. The slope of hills dioritic schistose rocks of peculiar kind with augitic dykes and in places large quartzite blocks strewn over the surface.

Tuesday Aug. 5. To N.E. corner of Sec. 21. Thence follow north line of Sec. 22. Immediately rising from the meadow to the slope of high dioritic schistose bluffs line gradually ascends to top of these hills. Reaches it at about 550 steps east of corner. There large rock bluffs at the edge of the hills. See specimens. Some dioritic, often stratified arenaceous and ferruginous rocks. From here which is the highest point in the country one can see far to the south. Northward extend plateau lands, undulating, full of blocks of the stratified ferruginous-arenaceous rock, above the quartzite.

The line while it descends to the creek runs slowly down into a broad swampy valley which extends north and east to the quarterposts. From $\frac{1}{4}$ post we go due north 220 steps through this swampy flat. There we are at foot of high hill. 350 steps to top of hill, 400 in all to edge of northern declivity from which I can overlook the Dead(?) river valley.

We descend a deep declivity into a ravine extending to the west. Ascend then a spur of slate rock which extends from a more easterly situated higher knob at 850 steps. We have crossed this steep sided spur and are at a creek coming from the west and flowing northeast. We cross now another rounded hill spur coming from the west and find on the other side of it the large creek flowing N.W. 1100 steps north of $\frac{1}{4}$ post, further on undulating east and west ridges of lower height. From the creek we take a due east course, cross the creek and follow continually the slope of a hill range, the valley of the creek following us to the right.

Several ravines running south into the creek are crossed at 500 steps and we are at the foot of a high hill on our left hand side, consisting of the slate rock. We pass on in east direction and ascend a steep hill range which extends eastward for $\frac{1}{4}$ of a mile where we strike the quarter post between Sec. 14 and 15 at the edge of a ravine running south into the creek. This ridge of rocks with precipitous slope towards the creek consists of a crystalline massive and very tough rock resembling the augitic dykerock of other localities but forms nearly all of the hill range with exception of some schistose belts.

On the east line of Sec. 15 we went from the $\frac{1}{4}$ post north for $\frac{1}{4}$ mile. The land slopes gently towards the north at intervals undulating and interrupted by knobs of rock one of which we strike on the line at about 400 steps distance from $\frac{1}{4}$ post. The rock is of dioritic schistose nature. Looking further north from this knob the surface generally slopes towards the Dead river valley, but we see at the distance of $\frac{1}{4}$ mile little east of north a similarly high knob projecting like the one we stand on.

We return now to the $\frac{1}{4}$ post, descend the very steep hillside on the section line to the creek which is dammed by a large beaver dam and converted into a pond. On the opposite side the line ascends a steep high hillside composed of the ferruginous slate formation, then descend into a deep east and west ravine, ascent on another slate hill descend again and ascent of a very steep third slate hill from the top of which we slowly descend to the swamp valley in which the S.E. corner of Sec. 15 is situated.

All the slate hills are composed of nearly vertical strata sometimes plainly with northern dip. Near the last mentioned corner the quartzite comes to the surface and on the opposite southern ridge of the valley the north slope consists all of quartzite and slate rock, but the summit of the ridges and the south side of them consists of schistose dioritic rocks.

Wednesday Aug. 6. Start from S.E. corner of Sec. 15, T. 48, R. 27. Go east in a valley. A rounded low ridge to our right. At 130 steps we pass over its top, at 176 we are in the valley again. A ravine enters it from the south. We descend now in the valley for 200 steps, at the north slope of a good sized hill. The line runs now in the middle of the somewhat swampy valley. The hills on the right draw back southward from the line. On the left we are likewise at the east end of a hill spur and a ravine opens into the valley which comes from the north. We go with the line in the valley close to the foot of a hill range. On our left at 155 steps a creek flows in the valley with the line. The valley is several hundred steps wide, the hills of south side further off from the line. 180 steps further continuing with the creek the valley is now narrow, hills on both sides, we are on foot of hills on the south now. Hill on north side is quartzite. See specimen.

Went south from line 100 steps where on a hill spur arenaceous slate rock crops out in vertical position. 100 steps further south is on the higher ridge a bluff of dioritic schists. The line goes along these southern hills and soon I find the $\frac{1}{4}$ post on their slope not far from the creek. Dioritic schists close to the $\frac{1}{4}$ post. Line after crossing a small depression ascends now a moderately high rounded hill with a plateau on top which extends to about 200 steps west of the S.E. corner of Sec. 14. A settlers shanty is on a clearing of the S.E. $\frac{1}{4}$ of the S.E. $\frac{1}{4}$ of the section

The corner is in a large swamp. A road leads east along the section line. We strike from the corner the southline between 23 and 24. The high land begins about 100 steps from corner. With gentle ascent we cross an east and west dioritic schist ridge. The line passes between two knobs and descends at 400 steps from corner to a creek running little south of east. There are large outcrops of augitic dyke rock connected with the schists.

Across the creek we ascend another ridge which we have crossed. At 680 steps from corner a ravine goes from there in southwest direction. We ascend another hill spur the ravine following the line at near distance. We cross the hill, transgress a swampy east and west valley which connects with the aforesaid ravine, (swamp valley about 150 steps wide) and find the $\frac{1}{4}$ post right across it at the base of another ridge.

From $\frac{1}{4}$ sec. corner on clearing on Carp, N.W. course 230 steps, have descended into valley with small creek flowing west. 36 steps farther another creek comes down from rock bluffs, From west of north. We ascend hill now. About 25 steps to top, then plateau for 200 steps. We ascend now the higher ridge with 100 steps, on top near its edge southward level ground or rather slow gradual ascent over rocky dioritic undulations for 451 steps.

Ravines visible western direction descending to our left. With 90 steps further have descended into the said ravine. Ascent again 125 steps, then descent and lower ground visible in that direction. With 85 steps have descended a steep bluff of dioritic rocks. The ravine is swampy, runs east and west, a creek in it flowing west. Now take western direction. Creek soon bends into a southwest direction. After 118 steps of our west course strike on a north and south line blazed. 96 steps further over a rock spur. There a few steps further south we take up the due west course again. High hills on our right side, our course on undulating flats, slowly descending into a creek valley which we strike after 174 steps. Small creek running west. Follow creek for 361 steps. Our course is now little to the right of creek on foot of high hills. Also high hill range on the south side of the creek.

This course along the base of high dioritic hills we continue for 500 steps to our left. A broad flat valley follows us which slowly declines westward. We go now over a spur plateau like on top and descend into a ravine which comes from little west of north at 294 steps progress. 187 steps further after summounting another spur, we are in a spruce swamp. High bluffs to our right close by, swamp extending plateau like to the south and west. Follow the edge of this swamp for 400 steps, thence ascend along slope of high hills, swamp below extends further. We go off from the swamp for 220 steps further on the slope of hills and see to our right above us the clearing from where a trail leads to the location. We go there. The creek we had passed before without knowing in a ravine where it runs under ground.

Thursday Aug. 17. To N.E. corner of Sec. 21, thence north across a dioritic schist hill. Descent into an east and west valley. Ascent with the line on a quartzite ridge which extends about 175 steps east of the line. There a decline into a valley which is in connection with the before mentioned valley and likewise connects with a yet broader east and west valley situated north of the quartzite ridge.

Eastward no other quartzite hill is noticeable. The said valley continues east where the quartzite hills should be expected. But the northern limits of this valley are formed by a high range of hills which uninterruptedly extends west and eastward and consist of the banded arenaceous slaterock. Dip north. This is the summit ridge and from its hight we see northward a rapid precipitous decline to the tributary of Dead River. No high ridges in sight in this direction. Rather a low sinus towards the ridge.

Friday Aug. 8. To line between 16 and 21. Started from line about $\frac{1}{4}$ of a mile east of S W corner of 21. Went due north 560 steps across swamps to foot of hills. From here west 280 steps until we strike road. The road from here goes almost due north for 200 steps. Makes then a bend to northeast, then bend to north and northwest. At 424 steps from starting point on road $\frac{1}{2}$ mile north of line a due north course strikes the road again.

Returned to Ishpeming Friday evening. Hired wagon for going and returning from camping place, 2 trips 5 dollars. 8 days work paid to Peter Krier 16 dollars.