

Notebook No. 179 - Leverett

COUNTY

Cheboygan: 1, 2, 3-8, 9-29, 34, 35-38

Emmet: 1-2, 28, 29-34, 35

Mackinaw City: 2

Fresque Isle: 8

I N D E X

N O T E B O O K   N O .   1 7 9

Donated by \_\_\_\_\_

(September 24 to October 2, 1902)

- September 24. Rail Petoskey to Mackinaw. Walk Mackinaw to Freedom.  
Rail to Cheboygan. Drive northwest from Cheboygan.
- September 25. Drive southeast from Cheboygan to Black Lake, Phillipps'  
and back by Duncan City.
- September 26. Features around Cheboygan and a drive southwest into  
Munro Township and back. Deep wells.
- September 27. Drive south on east side of Mullett Lake past drumlins.
- September 28. Notes around Cheboygan.
- September 29. Drive Cheboygan to Burt Lake, Douglas Lake, and  
Topinabee.
- September 30. Topinabee past Burt Lake to Pellston, Levering, Barrow  
Cliffs, Cheboygan. Rail Cheboygan to Levering.
- October 1. Drive with Taylor from Levering to Bliss, Round Lake,  
Ely and back.
- October 2. Drive Alanson to Indian River. Hill north of Indian  
River. Drive to Legrand and back.

September 24, 1902. 5:40 a.m.

Located by \_\_\_\_\_

Aneroid 29.450 at G. R. and I. railroad station in Petoskey, 661 feet. This is 32 feet below the Algonquin beach (693 feet). I go north on G. R. and I. railroad. Aneroid 29.510 at Bayview about 611 feet A.T.; 29.540 at tannery east of Bayview where Harbor Springs branch leaves main line. Kegonic Station -- this is about 10 feet above Lake Michigan. Aneroid 29.550 at a brewery at level of a gravelly beach covered by dunes at east end of Little Traverse Bay. There is a lake north of the railroad east of here that is but 5 feet lower.

Aneroid 29.537 $\frac{1}{2}$  at Conway - 605 feet; the same at Oden - 611 feet. High beach a mile northeast of Oden around which the railroad runs at base. Aneroid 29.540 at Alanson - 613 feet. Sand plain back of Alanson at or near Lake Algonquin level. Moraine a mile northwest, and another tract 1/2 mile east of Alanson. From Alanson north, the railroad rises to the plain just inside the Algonquin beach a few feet. This beach is along the base of a morainic tract about 1/4 mile west of the railroad for 2 $\frac{1}{2}$  miles south of Brutus. Aneroid 29.480 at Brutus, 681 feet; 29.450 on sand ridges about midway between Brutus and Pellston. The moraine is over a mile west from these ridges = 705-710 feet. Aneroid 29.470 at Pellston, 691 feet. The moraine is fully two miles west of here. There is another east of here about two miles, on east side of outlet of Douglas Lake. It seems to extend from Douglas to Burt Lake.

Aneroid 29.430 at flag station = 725 feet  $\pm$ . A mile south of here I saw a cut bank 1/2 mile or more west of the railroad, 30-40 feet high. Aneroid 29.420 at water tank south of Van, 735-740 feet  $\pm$ ; 29.410 on knolls south of Van that rise 20 feet above track; 29.420 at Van Station, 740 feet  $\pm$ ; 29.410 at Levering, 747 feet  $\pm$ . There are morainic knolls, 20-40 feet higher here, and just west of the village. The drift in cuts here is full

of limestone cobble and boulderets. There seems to be a gravelly, cobbly beach in north part of village. The aneroid reads 29.410 at its base. It rises 15-20 feet above this level, or to about 770 feet. Within a mile north, the railroad cuts the ridge and it runs northwest from there. Aneroid 29.410 at base. The ridge is fully 20 feet higher. Top of ridge 770 feet  $\pm$ . Aneroid 29.450 at Carp Lake = 735 feet  $\pm$ ; 29.440 at a beach line  $1\frac{1}{2}$ -2 miles northeast of Carp Lake Station, sandy gravel, = 735 feet  $\pm$ . Mostly swampy south from here. Ridges where aneroid reads 29.525 = 645-650 feet A.T.

Aneroid 29.590 at Mackinaw City, 590 feet; 29.610 at 8:30 a.m. where it read 29.590  $1\frac{1}{2}$  hours ago. There is limestone at, or a little above, level of Lake Michigan, in a well being made about a block north of post office. The rock is struck at 4 feet. There is a large boulder of red jasper conglomerate at a hotel west of post office that was dug out of a cellar near there. The gravel and cobble ridges in Mackinaw City reach a height of 15-16 feet above lake level.

I follow the M.C.R.R. southeast from Mackinaw City, and am on a sandy, swampy tract for  $1\frac{1}{2}$  miles. But in west part of Section 19, T.39N., R.3W., I enter a bouldery till plain that lies between the Nipissing beach and Lake Michigan. It has a slightly uneven surface in Section 20. The till is of a reddish color. The Nipissing beach is back from the lake here near corner of Sections 19, 20, 29 and 30, and trends south of east. I think it runs northwest across Section 19 about to its northwest corner before turning west. I could see it plainly about a mile south of Mackinaw City, there being a sharp bank 40-50 feet high back of it. There is a similar steep bank where a road runs south, about two miles southeast of Mackinaw City, probably on line of Sections 19 and 20, 29 and 30.

Aneroid 29.550 on a till swell in Section 20, north of the beach.

This extends nearly a mile along the railroad. There is then a descent of 20-25 feet to a flatter tract. There is, however, a low ridge or bank south of railroad at about 20-25 feet above track and back of this, a cut bank that stands 50 feet higher. I go south onto the high bank. Aneroid 29.490 at top; 29.540 at base = 630 feet  $\pm$ ; 29.550 at top of sand or lower bank - 620 feet; 29.560 at base, 610 feet. Both banks have a stiff, clayey till. Aneroid 29.590 at the lake north of this place, 581 feet.

Aneroid 29.525 at outcrop of rock on west side of a ravine about  $1\frac{1}{2}$  miles west of Freedom, 640 feet. The surface is striated and bearing is S30<sup>o</sup>W magnetic. The magnetic variation seems to be several degrees from true north-south. Aneroid 29.510 on bluff back of the quarry. The wagon road rises to this bluff east of here, near a school house. I am told by a man living in Section 5, T.38N., R.3W., that a gravel ridge runs across the south part of Sections 5 and 4, and touches the northeast corner of Section 8. South of it is an extensive marsh, running nearly to Carp Lake. The marsh has gravelly bottom in places. He also says that limestone occurs on the bluff west from this quarry at several places in ravines. Aneroid 29.530 at Freedom Station. The upper ridge of the Nipissing beach has been excavated just east of here, and is about 5 feet higher than the station. There are two small ridges north of the station, at about the level of the station. South of the station, 10-15 rods is a cut bank, 8-10 feet high, whose base is at the level of the station.

I take train to Cheboygan. There is a cut bank at the Nipissing shore east from here close by the railroad for 3 miles or more, to where a wagon road leads south. But from this road east, there are sandy bars for 2 or 3 miles. I then catch glimpses of a cut bank  $1/4$  mile or more south of the railroad. There is so much underbrush in this interval that I can see

scarcely anything. From here southeast to Cheboygan, I get a better view and see the cut bank back  $1/4$  to  $1/2$  mile. It is about  $1/2$  mile back to it (southwest) in Section 23, and from there, it bears through the west edge of Cheboygan,  $3/4$  mile  $\pm$  west of the station. Aneroid 29.565 at Cheboygan Station at 11:45 a.m. = 598 feet; 29.570 on flat tract 40 rods northwest of station = 593 feet  $\pm$ ; 29.590 at Cheboygan River, 581 feet  $\pm$ . I level up to the court house and find it 604-605 feet. This is on the low bank or beach on which the station stands, for that runs east from the station to the river and crosses the river directly east of the court house. It evidently marks an old lake level at about 600-605 feet A.T. Aneroid 29.560 in business part of Cheboygan, 590-595 feet  $\pm$ .

Aneroid 29.495 at beach west of Cheboygan, 650 feet  $\pm$ , near line of Sections 25 and 26, where it crosses a creek. There is a delta here of sandy gravel, covering 10 acres or more, on which there are low ridges. North and south 40 rods from the creek, a cut bank occurs, 10-25 feet high. I find till swells on the bluff back of the Nipissing beach, 5-15 feet high that are bouldery, and seem to mark a moraine line. There is a chain of swells along the narrow strip in Sections 22 and 15, between a creek and the beach that has these swells. There is a tamarack swamp along the creek. The strip is only about  $1/4$  mile wide that has the till swells.

I turn west on line of Sections 9 and 16, Beaugrand Township, and continue to the west line of the township through a swampy tract with a few small raises of ground 3-5 feet high and a few square rods in extent. Boulders are numerous all the way, and on the raises of ground, form a literal pavement. There seems to be till under all this tract, though in places a coating of sand, a few feet deep, occurs. The bouldery tract extends from the shore of Lake Huron past the Nipissing beach to the first ridges of the Algonquin series of beaches, and boulders occur in places

between these ridges. There is usually, however, so much sand and gravel in these ridges and between them, that boulders are covered. The supervisor of Hebron Township, William Peake, in Section 13, says boulders are numerous in that township only in Sections 1, 2, east part of Section 3, east part of Sections 11, 12, 13, and northeast corner of Section 24. The southwest edge of the bouldery tract marks beginning of Algonquin beaches.

Thomas Lewis, in southeast part of Section 23, Hebron Township, has a well 90 feet deep. This is on a moraine at altitude 300  $\pm$ . Aneroid 29.330 at corner Sections 10, 11, 14 and 15, Hebron Township, on a beach, 700 feet  $\pm$ . There is another, 100 rods west. Each bears slightly east of south for 1/2 mile, both north and south of these corners. Aneroid 29.315 on the west one, 3/4 mile south of corners. It seems to be 10-12 feet higher than the east one. I passed a sand ridge at corner of Sections 11, 12, 13 and 14 that is a few feet lower, the aneroid reading 29.345 on it. There is more or less gravel in the ridges near line of Sections 14 and 15 and in west half of Section 14. There are gravelly ridges on line of Sections 22 and 23 running east-west across it, on which the aneroid reads 29.300 = 730-750 feet  $\pm$ . These run past the north side of a moraine that sets in in the south part of Section 23. This moraine is a sharp range of hills, about 1/2 mile wide, running from the south part of Section 23 in an east-southeast course to Section 31, Beaugrand Township, a distance of 3 1/2 miles. Its highest points are about 900 feet A.T., or 125-150 feet above the Algonquin shore. It is highest near line of Sections 25 and 36. The drift in it is more sandy and gravelly than on the flat, bouldery tracts to the northeast.

Aneroid 29.210 on hill in Section 26. The road I take through Sections 26 and 36 follows the south edge of the moraine. There is a swamp south of it a mile or more wide, and a range of hills south of the swamp. I cross

the moraine near town line in a low sag 50 feet above the Algonquin beach. Boulders are very numerous on its north side in Section 31, and are said to be numerous from there north to the Straits. In Section 32, there is sand along the east-west road which runs along an Algonquin beach in a course south of east. At the northeast corner of Section 32, I enter boulders and they are numerous from there east to Cheboygan. This road, like Sections 28 and 33, 27 and 34, 26 and 35, 25 and 36, is on a till tract with nearly plane surface. A few low swells occur in Sections 26, 27, 34 and 35. The Nipissing beach crosses the line of Sections 25 and 36 about 1/4 mile from its west end, and here bears east of south. It is a steep bank, 30 feet  $\pm$  high, of clayey till. There are boulders east of this beach, as well as on and west of it, there being very little sand and gravel here on the Nipissing beach. Aneroid 29.450 at Cheboygan, 590 feet  $\pm$ .

September 25, 1902. 6:15 a.m.

Aneroid 29.370 at Cheboygan, 590  $\pm$ ; 29.360 at 7:00 a.m. I go south on west side of river to within 1/3 mile of town line, then east across river to a low sandy ridge. Aneroid 29.330 on ridge = 625 feet. From here I go south to the main Nipissing beach. Aneroid 29.320 = 635 feet A.T. at the township line. There is sand on top of the bank back of the tract but it is only a thin coating, there being till within 1-3 feet of top. Aneroid 29.305 on plain south of beach = 645-650 feet.

Aneroid 29.270 at summit south of center of Section 5 = 675-680 feet. There is a weak moraine running east-southeast here with ridging with that trend. The ridged tract is 1/2-3/4 mile wide here. The road runs east on the south edge of it, or partly down the slope toward the Nipissing beach of Mulletts Lake. The outlet of the Mullett-Lake-Nipissing into the Lake Huron-Nipissing is about 1/2 mile wide where this ridged tract is cut

through in Sections 5 and 6, T.37N., R.1W. I go eastward on the old road that leads through Sections 5, 9 and 10. It skirts along the south slope in Sections 5 and 9, of the ridged tract, but, on turning southeast in Section 10, it rises to a tableland or flat tract on which the aneroid reads 29.200, or 730-740 feet A.T. This is gravelly, and probably was made flat by Lake Algonquin. This high tract does not extend to south side of Section 15, but there is an abrupt descent to where aneroid reads 29.270 near south side of Section 10. The top of bluff here reads 29.225 and it is cobbly and has boulderets. Looking from Section 10 southwest to a school house at corner Sections 16, 17, 20 and 21, I see a bluff trending northwest-southeast on southwest side of Black River, that is nearly as high as the one in Section 10, and there is a flat tableland back of it. Lake Nipissing seems not to have had a wide channel into Black Lake. The valley is terraced at a level 40 feet  $\pm$  lower than the bluff on which the school house stands.

After crossing a ravine on a high bridge, the road rises to a bouldery tract. Aneroid 29.230. South of this, at Peter Chimbley's blacksmith shop, it drops to 29.270 on a terrace of Black River. I go east, rising again to 29.230. There is a wide plain each side of Black River at about this height. Aneroid 29.225 at Catholic Church at corner Sections 25, 26, 35 and 36, T.37N., R.1W. Alverno Post Office is here, in southwest corner Section 25. Aneroid 29.285 at bluff or bank of Black River on line of Sections 35 and 36; 29.325 = 640 feet  $\pm$  at Black River, south of middle of line of Sections 35 and 36. The bank here is a reddish till. This 40-foot bank has a terrace, giving the valley a width of fully 1/2 mile at this point. I go southeast to corner of Townships 36N and 37N, Ranges 1E and 1W on this terrace. There is a clayey till here and a few low swells on it.

The bluff east of this has a looser textured material at top with boulders and cobblestones, and is uneven in Section 31, T.37N., R.1E., suggesting a moraine. There is a wide extent of plain west from here between Long Lake and Mullett Lake.

Henry Leonard has a flowing well in northeast corner, Section 8. James McKervy, in southeast part of Section 4, also has one. Aneroid 29.230 at well. There is a sandy ridge here. Kenneth McLeod outlined for me the extent of the high hills northeast of Black Lake (see county map). Aneroid 29.215 at sand ridge running northwest-southeast from Section 3 across northeast part of Section 10. From here, there is a gradual ascent eastward to the base of the high range of hills lying in Sections 1, 2, 11, 12 and 13, T.36N., R.1E., and Sections 7, 16, 17, 18, 19 and 20, T.36N., R.2E. Aneroid 29.170 at 11:00 a.m. at west base of hills, at forks of road south of Twin Lake in southwest part of Section 2, T.36N., R.1E. Mr. McLeod says the hilly tract runs to the lake in Section 16, T.36N., R.2E., and there is a tableland farther southeast. He also says there is a rather smooth slope from the hills down to Black Lake, covering a space nearly a mile in width. Aneroid 28.960 on highest point in the range, near line of Sections 11 and 12 = 900 feet  $\pm$ . Points in south part of Section 12 are equally as high, and there is a high tract south from there into T.36N., R.2E. The crest of the highest hills and ridges comes up nearly to 900 feet. There are some basins shut in among winding ridges at the north end of this range. Twin Lakes and other small lakes occupy these basins. The ridges are very steep sided and are a gravel and cobble with some sand. There are a few boulders on the slopes.

Aneroid 29.170 at 11:45 a.m. at base of hills; same as it was at 11:00 a.m.; 29.160 at 12:15 p.m. I go east through Section 1, crossing a low

ridge, aneroid 29.110 at summit. There are higher points north of the road (20-30 feet or more higher). The east slope of this range has a clayey till with smooth surface, that slopes rapidly toward Lake Huron. Aneroid 29.140 at Mr. Phillips' in east part of Section 1, T.36N., R.1E., 80 rods from east line. There is a swamp setting in near the northeast corner of Section 1 at which aneroid reads 29.155, and sand sets in at Phillips' in low ridges. There is an error in the map as to roads. The angling road passes just west of the corner of Sections 25, 26, 35 and 36, and there is a steep bank here, 35 feet high. Aneroid 29.160 at base = 740 feet  $\pm$ ; 29.130 on top. Albert Rabideau lives here in northeast part of Section 35. He says Section 35 is nearly all gravelly and slightly ridged lake beaches. His lawn is on a beach on top of the bank that is 6-7 feet high and several rods wide. This is probably Algonquin, while the bank below is not so clear to interpret. This bank runs along or near the angling road to the lake in Section 16, T.37N., R.1E., and on northwest as far as the hardwood timber goes, or about to the line of Sections 16 and 17, T.37N., R.1E. The bank is usually 15-20 feet, but in places is less. The surface is flat south of it, and not very stony. There are cobblestones, but very few boulders.

Aneroid 29.140 on plain back of the beach where I enter the pine stump land near the meridian. I find it a sandy land with flat surface. A little over a mile west, I come to the forks of roads and leave the state road, taking one northwest toward Duncan. There is a low bank here on the sand, 4 feet  $\pm$  high, facing north. I presume all this sandy plain was covered by Lake Algonquin. About  $3/4$  mile from the forks, a descent of 8-10 feet is made. There is a low ridge north of here, 4-5 feet high, and north of that, a marsh, covering perhaps 100 acres -- nearly circular; and 8-10 feet below the sandy plain north of that, there is hardwood timber, and also west. I go through that in the west and find the soil sandy. There may be more

gravel in it. Within a mile from here, or about 3 miles southeast of Dundan, boulders of small size -- a foot or less in diameter -- become rather numerous. My guide, Mr. Hudson, says they run east from here through the hardwood timber, north of the marsh above noted. The surface is level and altitude about as high as the plain farther southeast though at the north edge, a mile from Duncan, the aneroid reads 29.160; 29.195-29.200 at base of bluff, at border of sand plain; 29.220 at south edge of a swamp; 29.235 at creek at north edge. There is a sandy ridge 15 feet  $\pm$  higher than the creek along its north side, and north of this, a lower swamp. Aneroid 29.250; 29.260 at Duncan, on a flat till tract with boulders of large size, as well as small ones.

September 26, 1902. 9:00 a.m.

Aneroid 29.190 at New Cheboygan Hotel, 592 feet  $\pm$  A.T. I go east and south across a plain with stiff, clayey till to corner of sections, middle of south side of Section 32. A beach crosses the road 50-60 rods west of this corner and bears east-southeast, crossing 30-40 rods south of the corner. It there comes around to the south, toward a higher beach that runs east near center of Section 5 and to Section 4 near middle of west line. I go east 1/2 mile and there turn south to the middle of line of Sections 4 and 5. There are low ridges winding around in northwest part of Section 4 and northeast of Section 5, that stand only 600-615 feet A.T. that have till on them and boulders on the surface. They are north of a prominent shore line or cut bank that runs east-northeast across Section 4 near middle, being south of the east-west quarter line, or about near west side to about 60 rods east of west line where it passes to the north side. Aneroid 29.160 at base of cut bank = 625 feet, 60 rods from west line of

Section 4 at L. Tole's barn. Robert Coleman's barn is up on the top of a bank south of here. Aneroid 29.140 on top = 640 feet  $\pm$ ; 29.130 on bouldery knoll about 40 rods farther east. There is a large limestone block in field south of road, 60-80 rods northeast of center, 15 feet high and 16-18 feet in diameter, a white limestone similar to the purest carbonate of lime at the Alpena quarry. Aneroid 29.125 at the limestone boulder = 650 feet  $\pm$  A.T. There are a great many limestone blocks in the same field, from a few inches up to 3 feet in diameter.

Robert Coleman has a well 95 feet, that has 25-30 feet of water. A well is being made for Frank Jewell in west part of Section 3 that is now down 60 feet, and is in a fine sand. There is some water here. Aneroid 29.120 at the well. Several wells in Emery's Addition, in west part of Cheboygan, northwest from the railroad station, have struck a hard material at about 30 feet that never has been punctured far enough to know what it is.

I go east to line of Sections 3 and 4 to a north-south road, and find the ground literally covered with boulders. It has an uneven surface and seems to be a moraine. It extends north 80 rods beyond center of Section 3 to the steep cut bank. There is a recess in the old lake in Section 3, so it extended nearly to south line 80-160 rods east of southwest corner. There are many boulders along its south edge to where it begins to swing northeast near middle of south part of Section 3. There, a sudden change to sand is made, and a sandy plain in the southeast part of Section 3 and east half of Section 10 stands above this bouldery tract. I skirt along its west edge to line of Sections 10 and 15 where the Rogers City road leaves the Black Lake road, and am here at the general level of the sand plain. Aneroid 29.040 on sand plain (700 feet  $\pm$ ), line of Sections 10 and 15, at 10:40 a.m.

I return to Cheboygan on the line I came out on yesterday. A descent of 20-25 feet is soon made in northwest part of Section 10 to a cobbly flat, aneroid 29.070; 29.090 at sag at line of Sections 9 and 10, near middle. There are bouldery knolls here, 10-15 feet higher. The knolls are rather sandy in Section 9, and extend but little south of the north tier of 40's, there being a swamp just south of the wagon road. There is a reddish till and undulating tract along line of Sections 8 and 9 for 100 rods south of the place where this east-west road cuts it. I go south on this line 1/2 mile to a plain that borders Black River. Aneroid 29.130 on the plain at south edge of the till knolls; 29.100 on bouldery till ridge in Section 8, about 30 rods and 80 rods south of middle of north line; same at cemetery on same ridge west of north-south road, near the line of Sections 5 and 8; 29.140 at top of bank of Nipissing beach in Section 5; 29.155 at base of bank at center of Section 5; 29.155 on a small ridge with till nucleus but capped by gravel that crosses this quarter line 40-60 rods south of the north end; 29.170 on plain (till), 20 rods south of this ridge and beach. The till ridge, as well as the plain north of it, is bouldery. There are low swells south of this, between it and the cut banks that have till on them. Aneroid 29.170 on plain at bridge at township line in south part of Cheboygan; 29.155 at base of bank where Michigan Central Railroad crosses town line, 1/2 mile south of station; 29.140 at top of bank at general level of the till plain. It is very smooth west and south from here for 1/2 mile or more. Farther west, there are swells in view. Aneroid 29.155 on beach, about a block southwest of Cheboygan Station = 608 feet  $\pm$ ; 29.165 at station at 11:45 a.m. = 598 feet; 29.170 at New Cheboygan Hotel at noon = 592 feet  $\pm$ .

I return to township corners in southwest part of city and take road west. Aneroid 29.150 at base of cut banks of Nipissing beach at 1:00 p.m.

Aneroid 29.120 1/2 mile west on till plain east of a ravine. The till has a decidedly red tinge. There are few boulders here. West of this ravine are sandy ridges with a few pebbles. Aneroid 29.100 on highest one = 650 feet  $\pm$ , 100-120 rods from west end of line of Sections 36 and 1. There are ravines west of here that drain northeast across Section 36.

Boulders set in in great numbers on the line of Sections 2 and 35, and the surface is undulating. Aneroid 29.070, 665 feet  $\pm$  at a school house at middle of line, Sections 2 and 35; 29.050, 675 feet  $\pm$  at corner Sections 3, 4, 33 and 34. These four sections, as well as Sections 2 and 35, are very bouldery. I come to a bouldery beach near the west end of line of Sections 4 and 33, aneroid 29.010 = 710 feet. It runs north-northwest - south-southeast. The wagon road runs northward along it for 1/2 mile. I go west in Section 32 and soon leave the boulders, but near line of Sections 32 and 31, the road enters the bouldery tract again at a small ravine where aneroid reads 29.030. The sandy beach seems to take a southwestward course from near middle of Section 32 to the border of the moraine in Section 31. Aneroid 29.010 at Algonquin beach at base of moraine in northwest part of Section 31 = 715 feet  $\pm$ ; 28.970 at line of Sections 31 and 36, at summit on road, in a low place in the moraine. On the south border of the moraine, in Section 36, there are cobbly, narrow ridges, apparently beaches, nearly up to the level of this low gap. Aneroid 28.980 on the highest one. There is another, 8 or 10 feet lower. Aneroid 29.000 in swamp on southwest side of the moraine, in Section 36 = 725 feet  $\pm$ . On the southwest border of the swamp is a cobbly beach, 15 feet  $\pm$  above it. Aneroid 28.980, 740 feet  $\pm$ . The swamp here is scarcely 1/2 mile wide, but to the west, it soon widens to about 2 miles. There is a moraine in the west part of Section 1, Munro Township (T.37N., R.3W.), that extends west a long distance. I could see

it from the moraine north of the swamp, September 24th. I rise into it on line of Sections 1 and 2, Munro Township. Aneroid 28,900 = 800 feet ± on crest.

Anthony Striebich, in southeast corner of Section 2, has well 84 feet that has 30 feet of water. It has 30 feet of till at top. The rest is sand. Aneroid 28,930 at well. At school house, 1/2 mile west, is a well 90 feet, and Herbert Baker, across road, has one of similar depth. This is at Weadock Post Office. The deepest wells in this vicinity are only 90 feet, but about 3 miles southeast, at Eugene Vallett's, is a well about 135 feet. It is in northeast part Section 24.

Aneroid 28,940 at corner Sections 11, 12, 13 and 14 on edge of a swamp that widens out to the southwest. Its east end is drained north through Section 12 and its west end southwest to Douglas Lake. It covers the northwest part of Section 13 and southeast part of Section 14, perhaps 1/3 of each section. The rest of the sections is high rolling land. Aneroid 28,870 on high point at town line of Munro and Inverness, corner of Sections 12 and 13, 7 and 18, 825 feet. The moraine extends north on this line nearly to corner of Sections 1 and 12, 6 and 7, but it extends east only 1/2 mile on line of Sections 7 and 18. The moraine has a clay loam soil and is very productive land, much of which is cleared already. I go south on town line, rising to an altitude of over 900 feet near south end of line of Sections 13 and 18. Aneroid 28,800. There is a point 20-25 feet higher, 80 rods southeast, in northwest part of Section 19, Inverness Township. There is a high tract a mile east from here near corner Sections 17, 18, 19 and 20, Inverness Township, but to the west, much lower land is reached at corner of Sections 13, 14, 23 and 24.

J. J. McCallum has a well 240 feet, in southwest part of Section 30,

Inverness Township. It was largely clay. The school house well in Section 25, Munro Township, east side, is 178 feet deep. Frederic G. Carlson, in Section 24, southeast part, has one 107 feet that has 25-30 feet of water. Aneroid 28.910 at the well. Henry T. Myers, in Section 19, southwest part, has one 98 feet. It is about 10 feet lower ground than Carlson's. A dug well at John A. Carlson's, near center of Section 19, on a hill, is only 30 feet. It is a dug well. Aneroid 28.880 at well. One at Polish school house, in northwest corner of Section 32, Inverness Township, is 105 feet.

Aneroid 28.865 at corner Sections 24, 25, 19 and 30, on a hill. The land is lower a mile south, but is rolling. I take the angling road east-northeast across Sections 19 and 20. Aneroid 28.900 at line of Sections 19 and 20 in a sag 30-40 feet below neighboring hills; 28.870, 825 feet, at summit in Section 20. The north line of Section 20 crosses a hill in east part that is fully 50 feet higher than this. Aneroid 28.900 at place where state road crosses line of Sections 18 and 21, 80 rods from west end. This is in a shallow ravine. Aneroid 28.870 on brow of hill overlooking the low country, near center of Section 16 = 825 feet; 28.970, 735-740 feet, at foot of steep hill; 28.985 at edge of swamp = 725 feet. The highest level of Lake Algonquin was probably near base of steep part. The steep bluff runs southeast from here at corner of Section 16 about to corner of Sections 15, 16, 21 and 22. It runs northward nearly to north line of Section 16 and there turns west along or near line of Sections 9 and 16, 8 and 17, then runs northwest past north end of a pond in Section 7, striking near the corner of Sections 1, 6, 7 and 12; then west nearly 1/2 mile and north-northwest to where I find it at north end of line of Sections land 2. It is said to keep just south of the line of Munro and Hebron Townships, west from there, for  $2\frac{1}{2}$  miles. Aneroid 29.030 at about the line of Sections 15 and 16. There are boulders in a sandy tract each side of this

creek, but not very numerous. I have noted large limestone blocks both on the moraine and on this plain. Aneroid 29.020 on a sand ridge running northwest-southeast which the state road crosses 100 rods  $\pm$  northeast of the creek in Section 15 = 700 feet  $\pm$ . East from this ridge, boulders are very numerous. There is considerable sand so that I see few places where till exposures are seen until I cross to the north side of a small creek in Section 11. From there west, a stiff clay forms the subsoil in many places. Aneroid 29.090 at creek in Section 11; 29.075 on plain north of the creek, at a yellow school house by cross roads, where a road runs north-south between Sections 11 and 12. I go east through center of Section 12. The surface is more undulating and more bouldery in Section 11 than in Section 12, and higher.

It seems as if a till plain is entered near ~~east~~ side of Section 11 whose border runs north-south. I crossed it on line of Sections land 36 going west. Aneroid 29.070 on plain at M.C.R.R. in east part of Section 12; 29.090 at top of bank back of Nipissing beach at town corners; 29.110 at Nipissing beach near town corners in southwest part of city of Cheboygan; 29.140 at New Cheboygan Hotel, 592 feet. The red clay which underlies the plain in southwest part of Cheboygan and that back of the beach in Sections 1 and 6 and 36 has only a few pebbles, some exposures showing scarcely any. Boulders are not rare on the surface, and it is probable that some of them have been gathered up to use for foundations, etcetera, so they may once have been numerous.

September 27, 1902. 6:45 a.m.

Aneroid 29.050 at New Cheboygan Hotel, 592 feet A.T. I drive south on west side of river. At the place where the bluff of the Nipissing lake

comes to the river on the west, a sandy gravel or pebbly sand is built out along the river, and it runs south past a valley that looks as if it once had continued northeast into the river, but now the stream turns south about 30-40 rods and breaks through a narrow gorge only 30 feet wide, or scarcely one-third the width of the southwest-northeast valley. The interesting and rather puzzling part of this feature is the low altitude of the old or broad part. It is as low as the present stream. This rather throws doubt on its being a blocked up valley, and I am inclined to think the variations in breadth may be due to the difference in resistance, the wide part being in sand and at a sharp curve that has eaten back. The bank on west side of the river, south of the place where the Nipissing came to the river, is lower than the undulating tract east of the river, the level being but 10-15 feet above the Nipissing beach, or about 60 feet above Lake Huron.

Aneroid 29.100 on the northwest bluff of Mullett Lake outlet. An undulating till tract with large boulders in moderate number is entered on line of Sections 19 and 20, near middle, and I see its continuation to the west on the west side of Mullett Lake outlet. The outlet cuts through it immediately after leaving Mullett Lake. It stands 20-40 feet above the till plain north of it at the borders of Mullett Lake outlet and still higher to the east. Boulders are very numerous at corner of Sections 20, 21, 28 and 29 at an altitude of nearly 700 feet A.T., aneroid 28.940. I go south on line of Sections 28 and 29 and soon leave them, entering a sandy plain or sandy loam. Boulders are said to be numerous at corner of Sections 21, 22, 27 and 28, and they are scattered over much of Section 28 and all of Section 33. Aneroid 28.930 at corner of Sections 28, 29, 32 and 33. There are low swells, 3-5 feet high, in west part of Section 33, and boulders are very numerous on them. Section 33, where boulders abound, has hardwood and

there is some hardwood and a few boulders in east part of Section 32, north and south of quarter post. Aneroid 28.925 at Methodist Church in southwest part of Section 33; 28.956-29.000 on bottom of a valley in south part of Sections 32 and 33. A small part of Section 32 is south of it. The north-east bluff runs near middle of line of Sections 4 and 33 and from there to southeast corner of Section 4. The width of valley here is nearly 1/2 mile but it narrows rapidly to the southeast. I find there are drumlins south of it in Section 4 and west part of Section 5. They are separated by swampy depressions of different depths. This valley just noted is connected in origin with the drumlins. The trend of drumlins is west-northwest - east-southeast, and they are 20-40 feet higher than the swamps. They are comprised of a compact, reddish till, and the surface is thickly strewn with boulders. I find much of Section 5 is a low swamp where aneroid reads 28.990. The highest drumlins read 28.950 in west part of Section 4.

John Thompson, on north side of Section 9, has a well 106 feet. It has 66 feet of water. Aneroid 28.930 at well = 700 feet  $\pm$ . It had 85 feet of red till. There was then a streak of sand and below this, blue clay. The water was in coarse sand under blue clay.

I return to corner of Sections 4, 5, 8 and 9 and find reading of 28.930 just north of corner on a drumlin where it read 28.950 1/2 hour ago; 28.985 at creek at corner of Sections 8, 9, 16 and 17. There is a flat here about 1/2 mile wide, trending west-northwest-east-southeast. There is a smooth slope on its northeast border like a drumlin, and a rise of 25-30 feet, but I am told there is no drop to the east to this low level. Aneroid 28.930 on bluff south. There is a sandy tract here full of boulders. It rises to the south quite rapidly, though the surface looks level. Aneroid 28.890 at school house at cross roads at corner Sections 16, 17, 20 and 21. Boulders

of small size are very numerous here and there are a few large ones. They extend west from here to the border of Mullett Lake. This level is maintained for 1/2-3/4 mile west of the school house before the descent toward Mullett Lake begins. Boulders continue across Section 20.

Aneroid 28.870 at line of Sections 28 and 29 on a plain. There is a lake in Section 29 that has a westward outlet -- Devereaux Lake. Aneroid 28.900 at lake. The plain east of this lake is gravel, rather than sand. It was timbered with mixed white and Norway pine. My driver, Mr. Hudson, says there are boulders west from the lake along its outlet. Aneroid 28.860 at base of hills about a mile south of this lake, probably in Section 32. They rise 50-75 feet quite abruptly. After skirting the northwest end in a southwest course for 1/2 mile or so, a beach ridge. Aneroid 28.840 on the beach. I turn back northeast on a road that crosses the moraine. Aneroid 28.770 at summit; 28.840-28.850 at east base of the hills. There is not a distinct beach here. We go southward and come near the township line to where the hills run off east. We stop for dinner here on the north slope of the moraine. Aneroid 28.780 on a tract of jack pine. There was pine from here west to Mullett Lake, both on ridges and plain. There is perhaps 80 acres of hardwood timber at the north end of the point of moraine that I crossed. The pine land on the moraine is gently undulating sandy drift with a few boulders. In the hardwood, I find no place where the aneroid reads less than 28.700. It is very gently undulating. Aneroid 28.800 at a sandy ridge near base of moraine; 28.810 on a beach 1/2 mile west of moraine. It runs west of north and east of south. The moraine border trends north-northwest - south-southeast here. I go back around west end of the hills.

Aneroid 28.850 on swampy hardwood tract west of Duncan; 28.860 at line of Sections 20 and 29. Boulders are very numerous in northwest part of Section 21 and north part of Section 20. Mr. Hudson says they run west-southwest from

there to a hardwood tract on the bank of Mullett Lake at Red Pine point, opposite Topinabee. Aneroid 28.870 at Ball school house, corner Sections 16, 17, 20 and 21. A well here is 109 feet, and has 40 feet of water.

I go east on line of Sections 16 and 21, and come to drumlins on east part of section line. One sets in in the southeast part of Section 16 and runs east-southeast for fully a mile past the center of Section 22. It stands about 30 feet above a swamp on its northeast side and 10-15 feet above one on its southwest side. The swamp on southwest side is 40 rods wide and runs east-southeast into Section 26. The one on the northeast side is over 80 rods wide at line of Sections 15 and 22, but it is narrow southeast of here. Aneroid 28.900 on drumlin at Mr. John St. Peter's in northeast part of Section 21; 28.940 in swamp on line of Sections 15 and 22. East from here at Mr. Dietz, and just east and just west, there are three very narrow drumlins, the western one being the highest. Aneroid 28.885 on summit. The low ones are as narrow as bench lines, but the high one is 30-40 rods. Aneroid 28.910 in swamp east of the high ridge. This is only 20 rods  $\pm$  wide. The swamp and the drumlins have the west-northwest - east-southeast trend. The drift becomes sandy here and though there is some tendency to a west-northwest - east-southeast ridging, it is rather vague and the ridges wind, more or less. The swamps between them are more regular. Aneroid 28.870 on sandy ridge near corner Sections 14, 15, 22 and 23. The drumlins are very thickly set with boulders, but on the higher sandy tract east, in Sections 14 and 23, there are few, if any. This holds a general altitude with aneroid 28.870. In the east part of the sections, the road comes into an undulating tract (till), a little higher than the sand plain. Aneroid 28.850. It is thickly set with boulders. This seems to run northwest-southeast, and extends to Long Lake on its northeast border. The banks of Long Lake are about 25 feet high. Aneroid 28.890 at Long Lake. The boulders are very numerous on the ridge

between Long Lake and Black River. Aneroid 28.860 on the ridge. The outlet of Long Lake is not operative now because blocked up by logs. It was to the southeast. Aneroid 28.890 at a sandy terrace a few rods wide on the slope toward Black River, east of Long Lake; 28.960 at Black River east of Long Lake, about opposite south end of Lake; 28.915 on main terrace of Black River, opposite north end of Long Lake.

There is a flat tract extending from the river back to the swamp at north end of Long Lake, but it does not drain the swamp. In this flat tract, Mr. Jeremiah Jones, in southeast corner of Section 35, T.37N., R.1W., has a well 70 feet deep. It has 40 feet of water. It penetrated red clay, 12 feet; then dry sand, 15 feet, and then quicksand to coarse sand at bottom. Aneroid 28.910. At school house, in northeast part of Section 2, the well is 137 feet. It has about 80 feet of water. Aneroid 28.880. It is on upland plain south of sag. George Wheeler, in east part of Section 35, has a well over 100 feet. It is on upland north of sag. Aneroid 28.880. Boulders are very numerous on this upland plain. Aneroid 28.850 at bend in road where a road runs north across river on north-south quarter line of Section 35 or 26. This high plain is flat-topped and very bouldery. Toward the northwest end, it assumes a drumlin shape, with a swamp west of it.

After crossing a small creek in west part of Section 27, I rise to a cobbly tract with basins that extends a little into Section 22 and merges into a very bouldery tract with nearly plane surface. Aneroid 28.870 on bouldery tract; 28.875 at log school house in Section 21. The boulders are numerous for only a short distance from there west from here, the north part of the section being nearly free from them. It has gravel and cobble in places at surface at about the height of the bouldery till to the south. Boulders cover the south half of Section 20.

Aneroid 28.900 west of school house on a plain near corner of Sections 16, 17, 20 and 21. This is 10-15 feet lower than it is 80 rods east or south, and this flat runs west  $3/4$  mile and another drop is made to the clay plain that borders the river back of the Nipissing beach. Aneroid 28.915; 28.930 at terrace representing Nipissing beach on north side of Mullett Lake outlet = 635 feet  $\pm$ ; 28.980 at New Cheboygan Hotel, 592 feet A.T.

September 28, 1902.

I level up to the court house and find it 27 feet above Cheboygan River, or 607-608 feet. The railway station is about same altitude as court house, 598 feet. The dam on Cheboygan River holds the water about 13 feet above Lake Huron at present stage of river. There are times when the river is  $1/4$  inches higher than now, the present stage being a low one, so that at ordinary stage, the water above the dam is about 594 feet A.T.

I am told by Mr. Watson, of Cheboygan, that the high tract of hardwood that I was on in Sections 5 and 6, T.35N., R.1W., extends as far southeast as the north part of Section 23, and covers nearly all of Sections 3, 4, 5, 8, 9, 10, 11, 14 and 15. It has a gently undulating surface and is not very bouldery. It will make excellent farming land. He says the clay tract with boulders that I found northwest of this high tract covers much of Sections 24, 25, 26 and 27, T.36N., R.2W., and is bouldery throughout. South of it, in Sections 34, 35 and 36, T.36N., R.2W., and Sections 1, 2, 3, 10, 11 and 12, T.35N., R.2W., is a sandy plain with low ridges, probably beaches such as I noted in Sections 1 and 12, R.2W., and in Sections 6 and 7, T.35N., R.1W.

East of the high tract of hardwood is a swamp covering much of Sections 1 and 2, T.35N., R.1W.; Sections 24, 25, 26, 27, 34, 35 and 36, T.36N., R.1W.,

and Sections 29, 30, 31 and 32, T.36N., R.1E. The north parts of Sections 29 and 30, R.1E., however, have clay under the swamp, and the clay extends north from there to Black River. In Sections 17 and 18, and north part of Sections 19 and 20, it is not swampy, but is like what I saw at the southeast end of Long Lake. There is also clay on east side of Black River in Sections 4, 5, 6, 7, 8, 9, 16 and 17, T.36N., R.1E., but from there east to the knobs that I visited September 25, is a sandy plain with low ridges, probably beaches. Mr. Watson thinks drumlins extend no farther southeast than Section 23, T.36N., R.1W., for there is a sandy tract both east and south from that section.

September 29, 1902. 8:00 a.m.

Aneroid 29.280 at court house, 607 feet A.T.; 29.250 on clay plain at corner Sections 12, 13, 7 and 18; 29.290 at delta of a small creek at corner Sections 13 and 24, 18 and 19. It has a sandy gravel. Southwest of here about 80 rods is a cut bank at east end of a knoll, aneroid 29.260; 29.230 at top of knoll at Mr. Lapres' farmhouse. This is a continuation of the tract across the outlet of Mullett Lake where boulders set in, as noted September 27. The well here is only 9 feet deep. The knoll is 10-15 feet higher 40-60 rods west. It is elliptical, with west-northwest - east-southeast trend, and has the smooth surface of a drumlin, but there is sand on the surface. South and west from this knoll, there are lower ones that are somewhat bouldery when composed of till, but when composed of sand and gravel, are nearly free from large stones. Aneroid 29.215 at middle of line of Sections 23 and 24 at cross roads just east of a sandy knoll 10-12 feet higher. In the southwest part of Section 24, there are several sharp sandy knolls on west side of railroad track. They extend southwest across the southeast corner of Section 23 into Section 26. Lake Nipissing extended into the northeast part of Section 26 to the railroad for 80-100 rods south of corner and the sandy knolls lie just west of it.

Aneroid 29.290 at Mullett Lake. The Nipissing beach runs south as a cut bank about 40 rods west of line of Sections 25 and 26 in southeast quarter of Section 26. I level up from Mullett Lake and find the beach is 23 feet above it, or about 37 feet above Lake Huron, and 617 feet A.T. There is an island knoll of sandy drift in southeast part of Section 26, and back of this, as swamp that was covered by Lake Nipissing. It rises to about 650 feet. The swamp extends a little west of the railroad 40 rods or so in south part of Section 26. The southwest corner of the section is up on a bluff and back of this, to the west, is a sandy plain. Aneroid 29.190 on east side of plain about 20 rods west of corner of Sections 26, 27, 34 and 35. It rises westward. In about 1/2 mile I cross a beach ridge, aneroid 29.155; 29.140 at highest Algonquin beach, where a road turns south, probably on line of Sections 33 and 34. A strong gravel ridge runs north from here 120 rods to a morainic knoll starting from a knoll here at road intersection. The altitude seems to be 730 feet.

I take a road that runs south of west from near middle of east side of Section 33, striking line of Sections 32 and 33, about 100 rods north of the town line. The moraine lies about 1/4 mile north of this road, and covers nearly the north half of Sections 32 and 33. The road is along or near one of the Algonquin beaches in both these sections. There is a strong ridge of sandy gravel here, 5-6 feet above the swamp back of it. The main ridge is 30-60 rods  $\pm$  from the base of the moraine. The aneroid reads 29.130 on it in east part of Section 31. The moraine covers the north half of Section 31 and NE $\frac{1}{4}$  of Section 36. The border runs northwest from near the center of Section 36, and is said to cross the state road near center of Section 26. I go west across Section 36 and drop below the Algonquin beach about 80 rods west of center of section. Aneroid 29.175 on a clay loam plain. From there

I go southwest and cross a low sandy swampy tract with a stream going east. Aneroid 29.230 at stream. I then go south to a school house at middle of line of Sections 1 and 2, T.36N., R.3W. Aneroid 29.190. A morainic tract sets in about 1/2 mile south from here. Its border bears west-northwest - east-southeast. I go west through Section 2, rising over a strong clay loam slope for 1/2 mile and then a sandy gravel to the Algonquin shore. Aneroid 29.120 just east of line of Sections 2 and 3. There is another just west of line, of same altitude that runs from a morainic hill southeast of here to one north of here in northeast part of Section 3.

I level up from Burt Lake and find that 25 sights passes less than 1 foot above the crest of Algonquin beach:  $25 \times 5\frac{2}{3} = 16\frac{2}{3} \times 125 = 141\frac{2}{3}$  feet above Burt Lake. Burt Lake is about 15 or 16 feet above Lake Huron, so the beach is about 156-157 feet above Lake Huron, or 736 or 737 feet. A well here, in east part of Section 3, at D. D. Goodrich's, is 100 feet deep and has 40 feet of water. There was a weak vein 60 feet below surface that probably holds it up. I find red till outcropping on the slope toward the lake at 60 feet below the level of the well. Above this, the drift is sandy and has a few boulders. Aneroid 29.060 = 736 feet on Algonquin beach at D. D. Goodrich's at 1:10 p.m.

I go northwest to the state road, keeping just west of the ridge that the Algonquin beach follows, and come to a flat tract, aneroid 29.000, that is about 40 rods wide that forms the summit between Douglas and Burt Lakes in Sections 34 and 33, T.37N., R.3W. The state road crosses it where I come to it and there it is only 15-20 rods wide, but west from there, it is wider. The road runs along the base of a bank 35 feet lower than this sandy tableland. Aneroid 29.040 at base; 29.050 at Douglas Lake at 2:30 p.m. at the resort at west end; 28.985 on tableland south; 29.010 in sag that leads northwest-southeast. It is 10-15 rods wide and about 20-25 feet

deep. Aneroid 29.050 where sag crosses the state road; 29.030 on old lake plain at state road; 29.020 at base of bluff of Lake Algonquin in Section 34; 29.000 at west summit on state road in Section 34; 28.970 on tableland east from there on southeast border of a bay of Douglas Lake. This extends 100 rods or more. There is then a slightly lower, somewhat uneven sandy tract, aneroid 29.000-29.020 much of it, up to where aneroid reads 29.000. This continues for 1/2 mile or so. I then rise again to the sandy tableland, aneroid 28.970. This extends east to the hardwood timber with a gradual ascent but smooth slope. Aneroid 28.950 at edge of hardwood in Section 26. The surface is plane and free from boulders and drift sandy for 1/2 mile farther east. The road then enters a bouldery, morainic tract of till in the northwest part of Section 25. From there to the corner of Sections 24, 25, 19 and 30, there is a rise of 50 feet. Aneroid 28.880 = 835 feet; 28.930 at corner of Sections 25 and 36, 30 and 31, on the moraine.

Aneroid 28.990 at Algonquin shore at corner of Sections <sup>31</sup>25 and 36 = 735 feet. Boulders are very numerous for 1/2 mile south. I then enter a sandy tract, aneroid 29.030 = 700 feet. It runs east a short distance and extends west only about 40 rods into Section 1 to a swamp that is much lower. To the east, bouldery land occurs in northwest part of Section 6 at a level but little higher than this sandy strip. I descend to the swamp just north of cross roads at middle of line of Sections 1 and 6. Aneroid 29.110 = 635 feet. The swamp is 1/3 mile  $\pm$  in width here. I find, upon continuing south, that there is a low till island 5-15 feet above the swamp, covering about 40 acres and south of this, another swamp about 60 rods wide that cuts across the northeast part of Section 12. South of this I rise to a sandy plain that stands 690-700 feet. Aneroid 29.040 at its north edge. It is only 40 rods to where I begin an ascent to the beach.

Aneroid 29.000 at Algonquin beach (lower member); 28.985 at upper member. This is about 80 rods north of corner of Sections 12, 13, 7 and 18. Aneroid 28.985 on another ridge of the Algonquin at the section corners. From here I can look west over Burt Lake as this is the summit. Aneroid 29.000 at corner of Sections 7, 8, 17 and 18. Boulders are very numerous in the east part of Sections 7 and 18 and in Sections 8 and 17 to where the descent is made to a lower tract that is near middle of section line, Sections 8 and 17. A sharp moraine sets in in south part of Section 18, west of this wagon road and extends to within a mile of Topinabee, and the beach that runs along its east side continues nearly to Topinabee along this road. There is a basin back of it that holds a small lake. There seems to be another beach west of the lake, probably formed by wave action from the Burt Lake side. Aneroid 29.090 at Topinabee, at 6:15 p.m. I take train into Cheboygan and back in evening.

September 30, 1902. 6:00 a.m.

Topinabee, Michigan. Aneroid 28.975 at Mullett Lake = 593 feet; 28.860 = 670 feet on first sand plain back of Topinabee. This runs back  $1/4$  mile  $\pm$ . Aneroid 28.825 = 700 feet at top of bank northwest of sand plain; 28.800 at beach on east side of the basin with small lake  $1/2$ - $3/4$  mile north of Topinabee. The basin is fully  $1/3$  of a mile wide east-west and nearly as wide north-south, so it covers 60 acres or more. The beaches are sandy with a few pebbles and cobblestones scattered through the sand. Aneroid 28.950 at Topinabee Station at 7:15 a.m., 609 feet.

I take road northwest from the village, and when I reach the summit at about the level of the Algonquin beach, I find a reddish till exposed. Aneroid 28.815 at summit. The road then crosses a sag, aneroid 28.850. There are a few boulders on the slopes of the ridge east of this sag. There

are hills near middle of line of Sections 19 and 24 that rise 20-30 feet above the Algonquin beach. They seem to be an isolated group. West of them there is a rapid descent down to about 700 feet A.T., or 30 feet  $\pm$  below the Algonquin beach. I am told that there is a basin tract in Section 19 and southwest part of Section 18 between the hills just noted and those seen last night. Much of Section 13 is bouldery and has till, the north edge of the sandy tract being in the south part of the section. This section scarcely reaches the level of the Algonquin beach except in its northeast corner and perhaps on its east line. The highest point on the north-south center road is 20 feet or more below it. Aneroid 28.840 at the highest place about 100 rods from north line. There is a low ridge running west-northwest from here. It stands 25-30 feet higher than low ground north of it at middle of line of Sections 12 and 13. Aneroid 28.870.

I go west through a bouldery tract to Burt Lake, then north to Mr. Goodrich's at east side of Section 3 where I took dinner yesterday, and find boulders numerous along the way. The plain below the Nipissing beach is  $1/4$ - $1/2$  mile wide from the little bay in Section 14 north. Aneroid 28.810 at Mr. Goodrich's, 736 feet A.T. I go west on the Indian trail which follows a sand ridge standing 30 feet  $\pm$  below the highest Algonquin beach. Aneroid 28.850  $\pm$  on ridge. Its crest varies 10-20 feet in height. There is an abrupt descent of 50-60 feet on its south border and 20-30 feet on its north. It is probably a dune beach of the lowest stage of Lake Algonquin.

In Section 4 I cross a stream which is 10-15 feet wide and carries as much water as ordinarily drains several square miles, yet it heads in springs just north of this trail. It is perhaps an underground outlet of Douglas Lake. Its surface outlet is west in Maple River Township. These springs head in a steep bank just south of the state road. The distance through the sand plain from Douglas Lake to there is probably  $3/4$  mile or



more. Aneroid 28,880 on sand plain west of the spring brook in Section 7. From here there is a gradual rise southwest to the base of a morainic tract. Aneroid 28,810. I leave the Indian trail road here and go northwest 80 rods to another road that heads southwest into the moraine. Aneroid 28,730 = 800 feet at first summit. This is sandy, but the slope below it to the northeast is bouldery and has some till in it. The moraine extends south to within 100-120 rods of south side of Section 7. The shore of Lake Algonquin there runs westward into Emmet County. There are boulders and till over a great part of Sections 17 and 18. I am told that they abound in Section 17 to the edge of Burt Lake, and there is some bouldery land in Section 8 below the level of Lake Algonquin.

I go south to a school house in southeast part of Section 18, and this takes me into the edge of the sandy land. I am told that there is sand plain and cedar swamp from there south to the west bay of Burt Lake. South of this bay, as noted by Taylor, there is a morainic tract. I return through Section 18 to a road that runs northward near line of Sections 7 and 8, 5 and 6, over the moraine. Aneroid 28,660 at township corners and county line east of Pellston at crest of moraine. The moraine is less bouldery here than in Sections 6 and 7. Aneroid 28,700 on hill 1/4 mile west overlooking the Lake Algonquin plain; 28,810 at foot of hill probably near level of Lake Algonquin. The plain has a sandy soil. Aneroid 28,840 at a sharp sand ridge 1/2-3/4 mile west of border of Lake Algonquin. It is 1/3 of a mile  $\pm$  east of Maple River. Aneroid 28,875 at river; 28,850 on plain (sandy) west of river. Some till occurs about 1/2-3/4 mile east of Pellston but it seems to be a local deposit, for there is sand both east and west. Aneroid 28,840 at Pellston at noon = 691 feet. The moraine east of Pellston is more or less hummocky on its east face. Its crest is more smooth. It is very bouldery on the east slope. It extends north to Maple R. at west end of Douglas Lake.

Aneroid 28,870 at Pellston at 1:00 p.m. = 691 feet. There is a morainic tract setting in on west side of the G. R. and I. railroad about 2 miles north of Pellston and 1/2-3/4 mile west of the railroad. It rises 40-50 feet above the plain east of it. There is a very sandy strip from Pellston to Van Every. Aneroid 28,820 at Van Every Station; 28,780 on beach at Levering, 15 feet  $\pm$  above station, or 765 feet. There is a moraine west of Levering Station. The village site east of the railroad, and for 1/2 mile east-southeast from there, is built up with gravel and cobble that is slightly ridged east-west on its south border. Probably it is a glacial deposit worked over by Lake Algonquin. I take the road east-southeast across Sections 3, 2 and 1 (the Cheboygan road). It is on this high gravelly tract for much of the way to the line of Sections 3 and 2. A swampy tract is then crossed for 1/4 mile  $\pm$ , then the road follows a low ridge or strip of sandy gravel 20-30 rods wide for about a mile. Aneroid 28,810 on this gravelly strip. It is 6-8 feet above the bordering swamp. The road then runs north of west for 80 rods  $\pm$  across a flat swampy tract and comes to a ridge 6-8 feet high and runs along it east-southeast for about 1/2 mile, or to near center of Section 1. The ridge there runs south of the road and seems to die out.

Upon entering Cheboygan County at the first residence there is a gravelly tract of 15-20 acres standing south of road where it leads to the northeast that is 8-10 feet above bordering swamp. It is covered with cobblestones. After crossing a swamp 60-80 rods wide, the road runs over another low swell of cobbly land. From there, a tract runs eastward along or near the line of Sections 6 and 7. There is a sharp knoll in the northwest corner of Section 8, called "Mary's Nipple" that has been cut by the lake on its north side. Lancaster Lake lies just east of it. There is a

strong moraine between Lancaster and Monroe Lakes covering east side of Section 8 and west of Section 9, and running southward to Douglas Lake, covering much of Section 16. Aneroid 28,800 at beach near corner of Sections 5, 6, 7 and 8. There is a hill about the middle of line of Sections 5 and 6, 30-40 feet high. This is said to be the last prominent hill of this range, there being a swamp north and west from there.

Taylor, however, found a range of hills 1 to 3 miles northwest from here in Sections 36, 26, etcetera, in Emmet County, running west nearly to Walker siding, two miles north of Levering. The moraine extends north a little into Sections 34 and 35, T.38N., R.3W.

Aneroid 28,780 at Barrowcliff's store in Section 34, on slope of moraine; 28,810 at Algonquin shore a mile east; 28,860 at sand ridge in Section 32; 28,890 at corner Sections 28, 29, 32 and 33, where boulders become very numerous; 29,000 at Cheboygan Station. There is a bank that suggests a beach running across the northeast part of Section 34 and north part of Section 35, T.38N., R.2W., and curving around to the south through Section 36 and running out in the low sandy ridges noted on line of Sections 36 and 1. It stands about 650 feet A.T. This seems to be continued on the rise or bank in east part of Sections 2 and 11.

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Aneroid 29,100 at Levering Station; 29,060 at a ridge near south end of line of Sections 28 and 27. There are two ridges here 20-30 rods wide with a depression between them 10-15 feet lower. Both north and south of the two ridges are swamps 25-30 feet below them. The south ridge has cobble on its slopes but is capped by till. They trend west-northwest - east-southeast and are about 1/2 mile long. There is a hummocky moraine to the west in southwest part of Section 33 and west part of Section 28.

I see no more to the north or south of these two drumlin-like ridges. There is a nearly plane tract (till) of same altitude as the drumlins, covering much of Section 23 and west part of Section 27.

We come to the Algonquin beach near corner of Sections 21, 22, 27 and 28. It runs east-southeast past Walker's siding and connects with a morainic knoll in Section 26. The Algonquin shore runs east-southeast on north side of that ridge and built a bar across to one in northeast part of Section 36. Aneroid 29.085 at Algonquin beach near Walker's siding. We go west between Sections 21 and 28, reaching 29.020. We descend to a swamp at corner of Sections 22 and 21, 28 and 29, aneroid 29.090. The Algonquin runs west through south part of Section 21, and from there north-west across Section 20. There is a high tract each side of the swamp in Section 28. Taylor thinks the swamp runs southeast across Section 28 at the Lake Algonquin level. We go west on line of Sections 20 and 29, rising to a high tract, aneroid 28.970. This is elongated, west-northwest - east-southeast, and suggests a drumlin, though the slopes are not so regular. There is a more regular one north, running from west part of Section 19 east-southeast into Section 20 to about 80 rods south of center. It laps past northwest end of the high one. There is a still higher ridge running west-northwest - east-southeast from north side of Section 30 to center of Section 29. Aneroid 28.890 at its northwest end on line of Sections 19 and 30 = 925 feet  $\pm$ . West from here, there are sharp knolls and the altitude reaches about 950 feet just east of line and corner of Sections 24 and 25, aneroid 28.860. It is equally high 40 rods north of same corner and a few feet higher on east-west road in central part of Section 24, aneroid 28.850. A point south of center of Section 24 is nearly 975 feet. West from here we descend to a gravel plain that heads in morainic hills. Aneroid 28.990 on upper plain; 29.020 on lower one.

Aneroid 29.100 at Bliss Post Office at middle of line of Sections 14 and 23, T.37N., R.5W. The hills each side of the valley in which this post office stands are 150 feet higher. Those east, in Sections 13, 14 and 24 are very sharp and gravelly. Those on the west, in Sections 15 and 23, are also very high and sharp. The Algonquin beach is at this level, but is built as a barrier across the valley in which Bliss stands  $3/4$  mile  $\pm$  north of there. It hits about the corner of Sections 10, 11, 14 and 15, (Aneroid 29.110 = 750 feet  $\pm$ .) and runs slightly north of west. Aneroid 29.110 on it 80 rods south of center of Section 10. The moraine covers the southeast part of Section 9 and nearly all of Sections 16 and 21. Aneroid 29.150 at noon at northeast corner of Section 8 at Mr. Morrowhill's, 20 feet below Algonquin beach; 29.320 at shore of Lake Michigan at west end of Section 8. This gives the Algonquin beach an altitude 170 feet above Lake Michigan, or 750 feet A.T. We follow the west edge of the moraine south past Canby to north edge of Round Lake. It is very prominent in Section 21, rising over 100 feet above the Algonquin beach quite abruptly. In Section 16 it is low and gently undulating. There is a prominent range running northwest-southeast from north of Round Lake to Ely -- from Section 9 to Section 24, T.36N., R.5W. It reaches an altitude of over 900 feet A.T. in Sections 14 and 15, and has sharp knolls of gravel and sand. In Sections 22 and 23, there is a gently undulating bouldery till south of this high range that stands about 800 feet A.T. From accounts of residents, it appears that there is a great moraine covering the southeast part of T.37N., R.5W., the southwest part of T.37N., R.4W., the northwest part of T.36N., R.4W., and the northeast part of T.36N., R.5W., an area of 40-45 square miles. We are just south of it in driving from Ely east to the G. R. and I. railroad. There is a recess in it west of Van Every that we do not get the full extent of, but it seems likely to cover the swampy tract in Sections 6, 7, 8, 9, 16

and 15, T.36N., R.4W. Taylor will work out this region.

Aneroid 29.195 at Levering, 9:40 p.m., 749 feet. I take train to Alanson. Aneroid 29.235 at Pellston = 691; 29.250 at Brutus, 681; 29.340 at Alanson, 613.

October 2, 1902. 7:30 a.m.

Aneroid 29.475 at railroad station at Alanson = 613 feet A.T.; 29.380 on Algonquin beach east. It is sandy here and stands 10-15 feet above a sag back of it. Aneroid 29.380 on gravelly beach east of center of Section 7, T.35N., R.3W. There are morainic knolls south of the road in Sections 11, 13, 14 and 24, T.35N., R.4W., and Section 7, R.3W. This is a bouldery, gently undulating tract 50-75 feet above the Algonquin beach, or 750-775 feet A.T. It covers Section 18 except in northwest part and in Section 17 except the northeast part. It also covers much of Sections 19, 20 and part of Sections 29 and 30. There is a bouldery slope north of this below the level of the Algonquin beach in Sections 1, 2, 11, 12 and 13, T.35N., R.4W., and in Sections 5, 6, 7 and 8, T.35N., R.3W., extending to a swamp in the north, and to Burt Lake in the northeast. I am told that bouldery land occurs on Indian Point in Sections 20, 21, 28 and 29, T.36N., R.3W. It is on ground 50 feet  $\pm$  above the lake. This bouldery strip runs north along west side of Burt Lake to the moraine in Sections 7 and 8.

I go south at center of Section 8, T.35N., R.3W., and rise into the moraine near line of Sections 8 and 17. There is a gradual southward ascent across Section 29. Aneroid 29.250 at south part = 800-825 feet; 29.330 on a low tract south of here; 29.400 at school house 80 rods east of center of Section 29. The south border of the hilly land runs west near center east-west road in Section 30. It bears northwest from there

toward Alanson. The high land runs north of east through north part of Section 29 into Section 21. I go south on line of Sections 28 and 29 across a sandy swamp and find that the morainic upland covers part of the south half of Section 32 and a little of the NE $\frac{1}{4}$ . So the valley-like tract here is only  $1\frac{1}{4}$  miles wide. It is much wider both east and west from here. Aneroid 29.420 on the sand plain at northeast corner Section 32. The swamps on this plain are narrow and 10-15 feet lower. Aneroid 29.410 on this sand plain at south end of Burt Lake. There are dry ravines running into the lake here. Aneroid 29.430 at bluff of Sturgeon River on the sand plain; 29.505 at Sturgeon River at the place where it has been cut through the Nipissing beach,  $1/2$  mile south of Indian River. The gravelly beach here is about 20 feet above the river. Aneroid 29.490 at Indian River Station at 10:30 a.m. This is 18-20 feet above station and 611 feet A.T.

Charles Cableman, who lives about 3 miles north and two miles  $\pm$  west of Brutus, on the highest hill in that part of the county, dug a well 404 feet. It was through various kinds of drift but did not strike rock. He drew water from it with a windlass for a while with hose attached, but now has a windmill. (Information given by H. C. McPhee of Alanson).

North of Indian River is a tract on which till and boulders occur at 30-50 feet  $\pm$  above the stream, but north from there, up a slope, I find it sandy to the level of the Algonquin beach. Aneroid 29.370 = 715-720 feet A.T.; 29.190 = 870 feet on highest point of hill near south side of Section 12, T.35N., R.3W. It has a sandy drift with a few boulders. There is a gradual west slope down to Burt Lake. On the northeast face, there is a very steep descent down to the Algonquin level, aneroid 29.370. There are numerous large boulders on the plain northeast of this steep bluff. They cover the north half of Section 12 and extend east into Section 7 to brow of bluff, back of the Nipissing beach. They occur, to some extent, below

the beach. I can hardly decide yet whether this is a continuation of the moraine that comes to Burt Lake on Indian Point or of the one west of the south end of the lake, though the former seems rather more probable. This would be the case if the one at south end of lake continues south-southeast across the narrow plain noted in Sections 25 and 32, T.35N., R.3W.

I return to Indian River for driver. Aneroid 29.475 at 12:20; same at 1:20 p.m. I go east across a sandy swamp through middle of Section 19, T.35N., R.2W. This section and Section 18 are nearly all swamp. I rise near line of Sections 19 and 20 to a jack pine plain. Aneroid 29.400 at brow of bluff in west part of Section 20; 29.360 at line of Sections 20 and 21 on the sand plain near level of Algonquin beach. There are cobblestones and boulders for 30 rods west of here that may have been worked over by the lake. There is a sweep of hills on the north edge of Section 20 that rise 75 feet  $\pm$  above the Algonquin level. I turn north on east side of NE $\frac{1}{4}$  of Section 20 and pass along the east base of the hills. Aneroid 29.350 on sand plain east of the morainic hills. The moraine runs across the east part of Section 17 and touches the west edge of Section 16. The high part is in Sections 17 and 20.

There is a strip of hardwood land west of Pigeon River along line of Sections 8 and 9 nearly to north side of the sections. Aneroid 29.485 at Pigeon River. East of Pigeon River, south of the bridge in Section 9, there is a sand plain. Aneroid 29.400 on it at brow of Pigeon River bluff. There is some till east of mouth of Pigeon River near corner of Sections 3, 4, 9 and 10 at an altitude 20-50 feet  $\pm$  above Mullett Lake. The surface is gently undulating here. I am told that there is very little clay and but few boulders for two miles north from here on east side of Mullett Lake. Farther north, beginning near Red Pine Point, boulders are numerous, as noted a few days ago. There is a more elevated tract there than at the

head of Mullett Lake. It looks to be 30-100 feet or more above the lake. There are a few boulders and a little till at the west edge of the pine plain a mile farther east on line of Sections 2 and 11. I go east-southeast across the pine plains in Sections 11 and 12 and 13 to west end of Silver Lake. Aneroid 29,360 at east edge of the plain next to the moraine. I cross the edge of the moraine south of Silver Lake in Section 18, T.35N., R.1W., and am near its edge from there to Legrand in southwest part of Section 21. The moraine is prominent in Sections 16, 17 and 18, northeast part of Section 20 and north part of Sections 21 and 22. I am told by Mr. Morrow who lives at center of Section 19 that the moraine runs east-southeast through Sections 23, 24, 26 and 25, T.35N., R.1W., along north side of a tributary of Black River. There is a swamp and narrow strip of sandy land south of it from the Pigeon eastward to the Black River drainage. It is scarcely 1/2 mile wide in Sections 27, 28, 21, 20, 19 and 18. The plains cover much of Sections 1, 2, 10, 11 and 12, 13, 14 and 15, T.35N., R.2W., east of Pigeon River, but south from there, a morainic tract lies east of the river. It is very prominent in the south part of Section 23, reaching an altitude 100 feet or more above border tracts. There is a nearly plane till tract east of it to Legrand.

There is a high tract south of Legrand near the state road in south part of Sections 32, 33 and 34, T.35N., R.1W., and the sections to the south. The aneroid indicated an altitude of 730 feet at Legrand in the swampy valley while the high land two miles south is 825 to 850 feet where state road runs through it. This seems to have a limestone nucleus, for I hear of two school house wells that reach limestone at about 6 feet. One in center of Section 29, T.35N., R.1W., 3/4 mile southwest of Legrand is 40 feet in rock, entering it at about 5 feet. Another, in southeast part of Section 6, T.34N., R.1W.,

is 60 feet and also entered rock at 5 feet. A well being made in south part of Section 36, T.35N., R.2W., is down 30 feet and not into rock. It is mainly till. The altitude is 825 feet  $\pm$ . The school house in Section 6 is 800 feet or more, and that near Legrand may be 800 feet, as it is said to be on a hill. Pigeon River seems to be about 700 feet A.T. at crossing of the state road on line of Townships 34N., and 35N., R.2W. I am told that the bed is on limestone above this state road for about two miles.

Mr. Andrew Hudson of Cheboygan had a well at the point between Black River and Mullett Lake outlet on ground 12 feet  $\pm$  above the river that penetrated 80 feet of red clay and there struck water in gravel that rose to the surface. But the head has since fallen to 5 or 6 feet below. It was made 23 years ago.