

Notebook No. 120 - Leverett

COUNTY

Alpena: 23, 25-31

Cheboygan: 1-3, 10

Emmet: 2

Montmorency: 16-25

Otsego: 8-16, 17, 18

I N D E X

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N O T E B O O K 1 8 0

- October 2. Indian River flowing wells.
- October 3. Indian River to Wildwood, Wolverine, and return.
- October 4. Wolverine west and south to Vanderbilt, and return.
- October 5. Vanderbilt west and wouth to Gaylord and back.
- October 6. Vanderbilt to Hetherton and Big Rock.
- October 7. Big Rock, Valentine Lake, Atlanta, Gilchrist Creek.
- October 8. Gilchrist Creek to Hillman and Flanders.
- October 9. Flanders to Alpena, and drive north to Long Lake and back. Striae.

October 2, 1902, Indian River, Michigan.

Donated by _____

There are 6 flowing wells on east side of river in this village and about a dozen on west side. They range from 90 to 140 feet deep. Henry Lauterman's is the deepest. There is considerable clay on the east side at surface, but on the west side, surface sand is deep. Those with the best head will rise about 25 feet above the level of the railroad station, or to about 635 feet A.T. The first one was made about 5 years ago. A deep well, 300 feet or more, was made at the resort on Indian Point, on west side of Burt Lake. (See Bert Clemens.) There is a well on low bottoms in Indian River at a mill, that is only 10 feet deep and water comes to the surface. It is, however, about like a spring.

October 3, 1902, 7:30 a.m.

Aneroid 29.650 at Indian River, 611 feet. Aneroid 29.600 on sand plain 1-1/2 miles south at west bank of Sturgeon River = 655 feet. Aneroid 29.590 2 miles farther south at the state road in Section 2, T.34N., R.3W., = 660-665. On the east side of Sturgeon River, prominent hills set in in Section 12. They rise 100 - 150 feet above this plain at their front in Section 12, and appear to become higher to the southeast. On the west side of Sturgeon River, the sandy plain extends up nearly to Rondo.

I take the state road westward. The plain seems to be a few feet higher a mile west than at bluff of Sturgeon River. Aneroid 29.580 in east part of Section 3 where road turns southwest. It reads 29.570 in southwest part of Section 3 where road turns west. A moraine sets in about 1/2 mile west and southwest from here and the soil is more stony from this bend to the moraine than it is northeast from here, and the sand is only a thin coating, for up-turned stumps show till. A small stream running northwest through Section 10 and corner of Section 3 into Section 4 seems to be at the border of the deep sand.

Aneroid 29.450 on morainic knoll near middle of line of Sections 4 and 9. Aneroid 29.370 = 850 feet at summit on line of Sections 5 and 8. There is another still higher near west end of section line. Aneroid 29.350 = 865 - 870 feet. Aneroid 29.520, 710 - 720, at Wildwood crossroads in a valley that heads within a mile south in prominent hills. There is a prominent range west of this valley on edge of Emmet County that extends a mile, more or less, north from the state road and rises above 800 feet.

W. H. Webb, 1/2 mile south of Wildwood, has well 75 feet deep. Aneroid 29.440 at well = 790 feet. Aneroid 29.350 on hill 3/4 mile south of Wildwood, 865, more or less. A hill 100 rods southeast is 75 feet higher, and the road crosses one 1/2 mile farther south 40 - 50 feet higher. Aneroid 29.300 = 910 feet, more or less.

Aneroid 29.340 at school house and crossroads 2 miles south of Wildwood in a valley or sag, 875 feet. In the next mile are gentle undulations of 10 - 25 feet and a gradual southward ascent. Aneroid 29.290 at corner of Sections 19, 20, 29 and 30, Mentor Township, = 920. The drift on this moraine is loose textured till, so the roads are sandy. Boulders are not very numerous. I seldom see any piled in fields or along farm lines. The topography is variable -- in places hummocky and greatly broken up; in places gently undulating; and in places with large knolls. Aneroid 29.320, 890 feet, at school house at corner Sections 29, 30, 31 and 32. Aneroid 29.235 on upland 1/2 mile farther east = 975 feet, more or less.

E. Atherden has a well here, 118 feet, in Section 29. C. H. Giles, across road in Section 32, in northeast corner, has one of same depth. It was clay loam 10 feet, then a few feet of sand; then a little red clay. From about 30 feet down, it was all sand to a coarse sand at bottom. It has only 4 feet of water.

Warner Vromm, on south side of Section 32, has a well about 140 feet deep. It is thought to have 15 feet of water. Aneroid 29.220 at well. Mr. B. Dewick has one on south side of road, in Section 5, that is about 200 feet. Aneroid 29.300 at corner of Sections 3 and 4, 33 and 34. Aneroid 29.250 on general level of upland 1/2 mile east.

W. E. Munson has a well in southwest of Section 35, 135 feet. Aneroid 29.260 at well. Mr. Robick, about 40 rods west, has one about 125 feet. It is 10 - 15 feet higher ground.

South from here 1/2 mile is one of the most prominent knolls in this region. Aneroid 29.200 = 1,007 feet, at top where road bears east into Section 2. A boring was attempted here by David Oliver, 132 feet, but no well obtained. Its lower 85 feet was a gray clay.

I go east and descend just east of center of Section 2 to a sandy plain. Aneroid 29.350 = 875 feet. Aneroid 27.330 on a curving ridge 1/2 - 3/4 mile northwest of Wolverine - 890 feet, more or less. It is about 40 rods wide and 20 feet high and has cobble and boulders. It is on the north, west and south sides of a basin 50 - 60 feet deep, that opens eastward into Sturgeon valley. Its length or the circuit of the basin on 3 sides is 1/2 mile or more.

Aneroid 29.350 on sand plain in west part of Wolverine = 875 feet, more or less, at 12:20. There is some till on the slope between the gravel and sand, setting in 10 - 20 feet below top of plain.

Looking south, morainic knolls set in within 1/2 mile between the two branches of Sturgeon River. Aneroid 29.460 = 773 feet at Wolverine Station at 12:30. Aneroid 29.450 at 2:00 p.m. The citizens of Wolverine are boring for oil and are now down 281 feet and have not reached rock. It is nearly all through sand and fine gravel. Altitude 835 feet. There was 65 feet of yellowish clay, 45 - 70 feet. The well at Hillier home is 41 feet through a reddish clay to gravel and water.

Mr. Molineaux, in northwest corner Section 9, on high hill, has well only 49 feet. Aneroid 29.240 = 960 feet, more or less. Points southeast are 975 feet, more or less. Mr. Jacob Shook, in north part of Section 4, has a well 80 feet on a ridge. It was through drift all the way. Frank Ford has one 30 feet on low ground, in southeast part of Section 32. Aneroid 29.300, 900 feet, more or less, at well. Shook's is about 50 feet higher.

There are a large number of limestone blocks in the drift here and possibly rock is near surface. I am not able, however, to learn of more than a remnant of an outcrop in Section 33. James Betcone, in southwest corner of Section 33, says there are places on borders of cedar swamps in this section where the stone almost forms a pavement, but he doesn't think it is a limestone. There is a large amount of cedar swamp in this section and Section 32 on which the aneroid reads 29.320, or about 810 feet. There is a northward slope and drainage from here. Aneroid 29.330 on low ground at corner Sections 20, 21, 28 and 29. The road bears east here past knolls 50 - 60 feet high, to the Little Sturgeon. Aneroid 29.380. About a mile farther east, the road reaches a plain that has hardwood timber on its west edge but this soon gives place to pine -- largely jack pine. Aneroid 29.300 on west edge of plain = 885 feet, more or less. Aneroid 29.320, 870, on edge of jack pine belt in Section 22, on a road running southwest - northeast.

James Betcone in southwest of Section 33, has well only 16 feet. He knows of no outcrop in Section 33.

The road turns east after traversing the plain about a mile northeast and crosses a dry valley. Aneroid 29.380 = 800 feet, more or less. Aneroid 29.390 in a swampy valley in southwest corner of Section 14 and southeast of Section 15. There is hardwood timber east from this will till and boulders standing only 8 - 10 feet above the swamp. I come to a shale outcrop just east of center of Section 14. Aneroid 29.400 = 780 feet, more or less. There are masses of dark colored oily limestone imbedded in it. It seems to be the same

shale that outcrops west of Adam on shore of Pine Lake, and contains concretions.

In the east part of the section, by a brown school house, is a limestone ridge 25 - 30 feet higher than the shale. Aneroid 29.370 on top, 800 - 810 feet A.T. I am told that it runs past the southeast corner of Section 14 as a prominent ridge.

I find outcrops on the bluffs of a small ravine on line of Sections 13 and 14, north of the school house. The top is 10 feet lower than at school house. The ridges here trend north-northwest - south-southeast, and the drift in them has a smooth surface, so there is a suggestion of drumlins, especially in some that are shaped like covers. The limestone is dark colored and oily. Near middle of line of Sections 11 and 12, a few rods south of place where road bears northwest, I drop down over a limestone bluff, 20 feet, more or less. Aneroid 29.380 at top. Aneroid 29.400 at base. The limestone shows for some distance farther -- 40 rods, more or less, on the low plain.

Aneroid 29.400 at bouldery west bluff of Pigeon River, south of state road, = 780 feet. Aneroid 29.460 at intersection with state road, near corner of Sections 2 and 3, 34 and 35, 730 feet. Aneroid 29.480 about 1/2 mile west on the flat sand plain, 710 feet. Aneroid 29.545 at creek valley on line of Sections 4 and 33, = 655 feet, more or less. Aneroid 29.490, 700 feet, more or less, on west bluff on sand plain. Aneroid 29.560 at Little Sturgeon River, = 640 feet, more or less. Aneroid 29.500 on west bluff, = 690 feet, more or less.

I follow this bluff northward $1\frac{1}{2}$ - 2 miles, before descending into valley. Aneroid 29.530 at brow of bluff at level of sand plain where I

descend = 665 feet. Aneroid 29.580 at foot of bluff on a sandy plain. Aneroid 29.590 at Indian River Station, 611 feet A.T. I am told that the deep well on Indian Point made by Colonial Resort Company, is 476 feet deep and entered rock at 30 feet from surface. The head is 4 feet above surface, or about 20 feet above Burt Lake.

The moraine which I crossed east of Wolverine is sharply ridged and hummocky, with frequent oscillations of 50 feet or more in level. It has a clay loam soil, to a large extent, that is being developed into a farming district. There are numerous boulders on it, rather more than I saw on the moraine between Wildwood and Wolverine, although they are not scarce there. The moraine, or rather the till tract, along the west side of Pigeon River where I find limestone so near surface, has a liberal supply of boulders and a surface with smooth slopes. The unevenness is due, in part, to underlying rock, but not wholly so -- this till tract seems to be contemporaneous with the sand plain west of it, that being an outwash from the ice margin that stood on the east edge of the plain. This gives the ice margin a trend more nearly north to south than I had anticipated. The position and extent of this sand plain was outlined for me by George D. Richards, a land broker at Wolverine, and I have simply tested the north end of the tract he mapped. It seems very accurate. I take train from Indian River at 6:05 p.m. to Wolverine.

Aneroid 29.440 at Wolverine, = 773 feet. The Sturgeon Valley is between high morainic tracts at Rondo and for about a mile north. Farther north, the sand plain occurs on west bluff and extends to the Maple River drainage, as noted this morning. On the east bluff, the moraine extends north into Section 12, as noted this morning. On my return to Indian River, I noted that it is about a mile south of the state road between Little Sturgeon and Sturgeon rivers, and it rises rather abruptly 100 feet, more or less, above the sand plain at its north end.

October 4, 1902, 8:30 a.m.

Aneroid 29.330 at Wolverine = 773 feet. Aneroid 29.220 on upland plain in west part of Wolverine = 875 feet. Aneroid 29.190 = 900 feet on sand plain at cemetery near corner Sections 1, 2, 11 and 12. The plain has deep basins here, one of which, on line of Sections 11 and 12, has a lake covering 80 acres, more or less. Aneroid 29.240 at lake. Aneroid 29.175 at middle of line, Sections 2 and 11, on plain. The moraine sets in about 120 rods northwest from here.

I go south to center of Section 11 and turn west through the plain. It has deep basins in Section 10, one of which, south of the road, contains a lake. Aneroid 29.225 at basin by lake in Section 10. The drift is sandy, with a few cobblestones. There is hardwood timber all over this pitted plain. I enter the moraine in Section 9. It has numerous small boulders. Its altitude reaches nearly 1,000 feet. Aneroid 29.080 = 970 feet, more or less. Aneroid 29.160 at foot of moraine in Section 8 = 900 - 910 feet.

Aneroid 29.180 - 29.185 at swamp = 880 feet, more or less. There are high morainic hills on southwest side of this swamp. The valley is only 1/2 mile wide here between the morainic hills. I follow the valley east along the new line of railroad to an old camp. Aneroid 29.200 at camp = 860 feet, more or less. I then go about due north to the quarter line road through the forest. Aneroid 29.150 where I come out near the edge of the pitted plain. The valley is, therefore, about 50 feet lower than the plain.

Aneroid 29.160, 900 feet, more or less, on plain in Section 11, near center where it read 29.175 1-1/2 hours ago. I go south across a basin. The plain seems to descend southward or southwestward. Aneroid 29.180 in north part of Section 14 on the general level of the plain. Aneroid 29.240 at west branch of Sturgeon River in Section 14 = 825 feet. There is a swampy plain here, nearly 1/2 mile wide. South of it is a narrow remnant of the gravel

plain 1/2 mile, more or less, in width. I go southwest on this for about two miles. It does not have basins and is a little lower than on the north side, 860 - 875 feet. Aneroid 29.180 - 29.200 on it. It has a sandy gravel.

I take road south into the moraine near center of Wilmot Township. It soon reaches the crest of a hill. Aneroid 29.005 = 1,030 feet, more or less. From here, the road drops 30 feet or more into a ravine and follows it south-southwest, rising quite rapidly. Aneroid 28.950 at intersection with a north-south road. This road here turns south and rises more rapidly. Aneroid 28.850, or 1,120 feet, more or less, at top of grade. There are then low swells over which the road passes and gradually rising through a gently undulating tract for 1/2 mile to a summit. Aneroid 28.810. The hills are sharper south from here.

Aneroid 28.750 = 1,240 feet at first dwelling at top of a grade. Aneroid 28.740, 1/2 mile farther, where a road leads east between Sections 27 and 34 = 1,220 feet, more or less. Aneroid 28.790 at county line at 12:30 at Mr. Artcliff's, = 1,170 feet. Elliott Webb, on south side of Section 34, has a well 180 feet. It has 16 feet of water. F. Buhl, 1/2 mile farther east, has one of similar depth. At the school house on east side of Section 34, a well is also about 180 feet. It has 12 feet of water. Peter Delaney, in southeast corner, Section 27, has one of similar depth. It was dug, but the others were driven. There is a little surface till, but below this, the drift is mainly sand. The till has a few boulders. Aneroid 28.780 at Mr. Artcliff's, 1:30 p.m., = 1,170 feet, more or less.

I go south between Sections 3 and 4, descending from the moraine to a gravel plain about 60 rods north of corners of Sections 3, 4, 9 and 10. Its border trends west-northwest - east-southeast. The northeast part of Section

10 is morainic, but the southwest part is on the plain. Aneroid 28.900, 1,040, at the north border of the plain. Sections 9 and 8 and 7 are level and the south edge of Sections 4, 5 and 6 and the north part of Sections 16 and 17, and nearly all of Sections 15, 14 and 13.

Aneroid 28.890 at corner Sections 9, 10, 16 and 15. There is a large swamp southeast of here, as indicated on map. Southwest of it is a moraine that has a bluff-like relief on its northeast edge of 30 feet, more or less. From there, the moraine rises toward the southwest to a high altitude within two miles. Aneroid 28.815 at summit on road, near corners of Sections 15, 16, 21 and 22.

Aneroid 28.820 at corner Sections 21, 22, 27 and 28. Wells here are about 40 feet, but get into water at 30 feet. It is a gravelly plain and Vanderbilt stands on it. Aneroid 28.835 at Vanderbilt = 1,090 feet. This flat tract extends south a mile or so but low undulations there set in. East of Vanderbilt, 1/2 mile, is a higher gravel plain. Aneroid 28.810. I see nothing higher than this to the south for two miles or more, and the plain descends eastward. There are a few small boulders on it in Sections 24 and 25, but no till, and the surface is level. The gullies show deep sand.

I cross a swamp in east part of Sections 24 and 25. Aneroid 28.930 = 1,000 feet. There are morainic hills southeast of here in Sections 36 and 31, along east side of Sturgeon River that rise 250 feet, more or less, above this sandy plain. To the east, the country seems to be as low as on this plain. The swamps are 20 - 30 feet, more or less, below the plain.

I go east to corner of Sections 1, 20, 29 and 30, T.32N., R.2W. Aneroid 28.940 = 990 feet, more or less. I here turn north through a tract with a few small knolls. Aneroid 28.930 at clubhouse on gravel plain near north

edge on south side of a creek in west part of Section 17, = 1,000 feet. The north part of Section 17 has high hills, and they run northeast from there toward Sturgeon River a mile or more. The road skirts along their west face to about middle of line of Sections 7 and 8, and there enters the moraine. Its sputh border bears westward from there to the M. C. railroad in Section 12, T.32N., R.3W. It seems to be a continuation of the high tract that I left on line of Sections 3 and 4 of that township. It is more bouldery than I found that to be and seems to have more till. The surface is quite hummocky. On several points near the county line, aneroid 28.750, or fully 1,125 feet A.T. The moraine is strong on the slope down to Sturgeon River. The structure is variable, some till, much sand. Aneroid 29.100 at Sturgeon River, 1/4 mile south of Trowbridge = 815 feet, more or less. The station is only 5 or 6 feet above river, or about 814 feet. Aneroid 29.095 = 814 feet.

Aneroid 29.150 at Wolverine, 773 feet. I level up to the deep well and find it 62 feet above the station, or 835 feet. Aneroid 29.150 at Wolverine, 6:45 p.m.

I take train to Vanderbilt. The West Branch of Sturgeon River enters just south of station through a valley that is only 50 rods wide, or about 1/3 of its width 2 miles upstream where it is on the sand plain. It is here between till bluffs, but the north bluff is capped by gravel. Sturgeon valley is about 1/4 mile wide near Wolverine, but is 3/4 mile just north of Trowbridge Station, where an eastern tributary comes in. It seems to be scarcely 1/2 mile wide above Trowbridge as far as I can get a view from the railroad. The tributary up which the railroad passes from Trowbridge nearly to Vanderbilt has till bluffs and hills of mien height as far as the swamp in Section 1. From there to Vanderbilt, the railroad is either in swamp or sand plain. Aneroid 28.810 at Vanderbilt, 1,090 feet.

October 5, 1902, 8:15 a.m.

Aneroid 28.660 at Vanderbilt, 1,090 feet. I take road west, entering the moraine in east part of Sections 21 and 28. Aneroid 28.560 at quarter post, Sections 21 and 28. Aneroid 28.550 at corner Sections 20 and 21. Aneroid 28.829 at east base of a high range of hills that covers Sections 20 and 29. Aneroid 28.400 = 1,330 feet about 80 rods west of corners of Sections 20, 21, 28 and 29, at crest of hill.

John Warner, in SW $\frac{1}{4}$ of Section 20, has a well 275 feet. Aneroid 28.370 = 1,355 feet at well. Water rises 30 feet in it. There was red till, 20'; (2) Gravel, 20'; (3) Red clay, 10 - 12'; (4) Gravel with streaks of sand to bottom of well. There was a cemented crust at bottom that the water bubbles up through.

There are sharp hummocks strewn thickly with boulders on this elevated tract. The highest crest is just west of corners of Sections 19, 20, 29 and 30. Aneroid 28.290 = 1,430 feet. Aneroid 28.600 at west base of moraine in west part of Sections 19 and 30 = 1,135 feet. The plain extends 80 - 100 rods east of the county line here. Aneroid 28.610 at county line at corner Sections 19 and 30, 25 and 36, at crossroads. Aneroid 28.615 at West Branch Sturgeon River = 1,120 feet, more or less. There is a plain about a mile wide on this stream, with low bottom, 80 - 150 rods wide, and terrace 15 - 20 feet above low bottom.

The west tier of 40's in Section 24 and northwest corner of Section 25 are on the slope of the moraine west of the valley. The moraine covers only the north part of Sections 26 and 27, there being a flat tract as far west as Hoffman Lake in Sections 27 and 35, as noted in August. It seems probable that the moraine west of this valley (West Branch of Sturgeon River) is a continuation of the one west of Elmira, there being a basin tract from Hoffman

Lake through to Elmira. The drainage from Elmira was southwest, but from Hoffman Lake, it seems to have been along the line of this valley northeast to Section 8, T.32N., R.3W., and then east through the valley crossed yesterday north of Vanderbilt.

I go north on quarter line of Section 24, entering the edge of the moraine. It covers the northwest half of NE $\frac{1}{4}$ of Section 24, but the knolls are low, compared with those in Sections 13, 14 and 23. There is a very high tract in Section 14, probably reaching 1,300 feet or more, and it extends north into Section 11. Its east edge touches Section 13. I go east to county line at corner Sections 13 and 24, 18 and 19, and then turn south. This takes through the valley to within 1/2 - 3/4 mile of town corners on line of Sections 31 and 36. There are places where the valley is bouldery and has a terrace above the level of the one noted on line of Sections 24 and 25. I am on one of these bouldery flats at post office. Aneroid 28.570.

The range line road reaches a morainic summit near corner of Sections 1 and 12, 6 and 7, though for 1/2 mile north the knolls reach about the same altitude, aneroid 28.250 = 1,410 feet, more or less. There are numerous sharp hummocks here and boulders abound. Near the corner of Sections 1, 12, 6 and 7, I enter a high plain with shallow basins. Aneroid 28.280 = 1,380 feet, more or less, on plain. It has a gravelly soil and subsoil, and is free from boulders. The contrast both in topography and structure between this and the moraine is very marked. The basins are shallow saucer-like depressions, 10 - 15 feet deep, covering usually several acres each. Wells are, in several instances, 175 feet or more in depth, and are largely through gravel and sand, the gravelly part being near the surface. The moraine has a relief of fully 50 feet above this plain in southwest part of Section 1 and southeast of Section 2 and can be distinctly seen from corners of Sections 11, 12, 13 and 14.

Ora Ball's well, on south side Section 11, is 164. It passed through a foot or so of dark, mucky stuff at 80 feet, more or less. Aside from that, it was gravel and sand. It has 20 feet of water. H. J. Dixon has one 180 feet, on east side of SE $\frac{1}{4}$ of Section 11. Mrs. Bell's in SW $\frac{1}{4}$ of Section 12, is 164 feet, and has about 20 feet of water.

Boulders cover a large part of Section 11 and the northwest part of Section 14, and extend across the center of Section 15. They extend west from there across Sections 10 and 16, 9 and 17. The surface is hummocky where they occur. The highest points are 20 feet, more or less, above the gravel plain, but much of it is lower than the plain. Aneroid 28.250 on hill on line of Sections 14 and 15, near middle of line. Aneroid 28.310 at A. Kelso's at 12:30. Mr. Kelso's well is 104 feet. It has 14 feet of water. C. L. Hatch, across road in Section 15, has a well 118 feet. B. H. Hallock, in northeast corner Section 22, has a well dug 40 feet that supplied water for a time, but now has a pipe driven a few feet farther. Aneroid 28.340 at well = 1,325 feet.

A valley-like sag sets in 1/2 mile north of here and runs south through east edge of Section 22 and west of Section 23. Its north end is in the bouldery moraine. It seems to be free from boulders and so do the slopes either side. It narrows down to a ravine in southeast part of Section 22. Aneroid 28.260 on tableland in Section 26. This is gravelly, and seems to be free from boulders.

Aneroid 28.270 at town line at corner Sections 25 and 36, 30 and 31, on plain. I see a sharp knoll 1-1/4 miles north of here on line of Sections 24 and 19. It is 30 - 40 feet high and only covers a few acres. This is the only knoll I have seen on this gravel plain. Basins are conspicuous near

corner of Sections 25, 26, 35 and 36, T.31N., R.4W. In Sections 29, 30, 31 and 32, T.31N., R.3W., basins occur with lakes in them. There are also several basin lakes in T.31N., R.4W., as indicated on map. The basins are from 30 - 50 feet or more below the plain. Aneroid 28.290 at town corners 3 miles west of Gaylord. The tubular wells in this vicinity are only 45 - 50 feet. Aneroid 28.315 in sag near middle of south side Section 31, T.31N., R.3W. Aneroid 28.290 at Gaylord= 1,343 feet, at 3:00 p.m. Aneroid 28.250 1 mile north of Gaylord at border of moraine on gravel plain. Aneroid 28.230 at crest of moraine about two miles north of Gaylord. There is a point 1/2 mile east-southeast from there that is 25 - 30 feet higher.

There is considerable till in this first mile into the moraine, especially in the sags. The knolls contain gravel and cobble, as well as till. Boulders are numerous. Aneroid 28.350 at red school house 3 miles north of Gaylord. There is a very clayey red till near here. This outer part of the moraine has sharp hummocks and occasional large knolls. Aneroid 28.440 at corner Sections 14, 15, 22 and 23. The drift here is more sandy than on the high part of the moraine southwest of here. There is a flat swampy tract fully 1/2 mile wide on the Sturgeon River east of here. The road crosses an arm of it on line of Sections 14 and 15. Aneroid 28.520.

I enter a plain on line of Sections 10 and 11, that stands at about the line that the swamp is 1-1/2 miles south. Aneroid 28.520 near middle of line of Sections 10 and 11 on plain. This has till at slight depth but is coated with a sandy material carrying cobble and a few small boulders. Aneroid 28.550 at ravine near north end of section line of 10 and 11. Aneroid 28.520, 1,100, on plain north of ravine. The plain extends less than a mile west, the western part of Section 3 being morainic.

Aneroid 28.530 on plain at town line, 2 miles south of Vanderbilt, 1,090 feet. Aneroid 28.530 at Vanderbilt, 1,090 feet. The rise of ground east of Vanderbilt has a knoll northeast of the station 50 feet, more or less, above station, but most of this higher tract is about 25 feet above station, or 1,115 feet. It extends nearly $3/4$ mile north from road running east from Vanderbilt.

October 6, 1902, 6:30 a.m.

Aneroid 28.440 = 1,090 feet at Vanderbilt. Aneroid 28.490 at Vanderbilt, 8:30 a.m. Aneroid 28.580 at north-south road $3-1/2$ miles east of Vanderbilt = 1,000 feet. Aneroid 28.660 at Sturgeon River in Section 29, T.32N., R.2W., = 930 feet. There is a strip of moraine east of river here about 100 feet above river, 1,030 feet. Aneroid 28.550 on summit about 40 rods from east end of line of Sections 29 and 32. There is a gently undulating surface.

Aneroid 28.580, 1,000, at edge of plain near corner of Sections 27, 28, 33 and 34. There are a few low knolls in Sections 27 and 26, but most of the surface is plane, and so are the sections north.

There is a prominent moraine in Sections 11, 12, 13, 14, 24 and 25, T.32N., R.2W., rising 50 - 100 feet or more above the plain. Aneroid 28.630 at Pigeon River = 950, in Section 36. The river enters the moraine at north edge of this section. The moraine extends south about to the township corners and east from there to the bend of Black River. In Sections 5 and 6, T.31N., R.1W., there is a swamp that runs across from Pigeon to Black River that was probably a line of glacial drainage eastward. There is a low tract plainly visible from hills in Section 36, T.32N., R.2W., running up Black River with a range of morainic hills on each side of it. The hills on the west side set in about 2 miles south of here, probably in Sections 7 and 12. The gap is $1 - 1\frac{1}{2}$ miles wide between this range and one on the northeast side of the

northwest flowing part of Black River. Pigeon River also has a low tract a mile or so wide, up which I can look from Section 36 for several miles. The high moraine is separated by a wider gap, but low hills are visible within 1/2 mile or so of Pigeon River in T.31N., R.2W., on each side.

We drive eastward along line of Sections 31 and 6, then turn northeast through Sections 32 and 29, T.32N., R.1W., keeping on a sandy moraine that was timbered with pine. It has only a few boulders. The knolls are 20 - 50 feet high. Pigeon River, in Sections 25 and 36, T.31N., R.2W., and Section 30, R.1W., is in a narrower valley than south from there -- a swampy tract 1/4 mile or less in width with morainic hills each side.

We stop for lunch by a small lake, probably in Section 28.. Aneroid 28.620 at lake. The bordering knolls are 30 - 50 feet higher. We take an eastward course from here, passing through a tract of standing pine, probably in Section 27. Aneroid 28.590 at summit on road in pine timber. As I go on east, hardwood timber sets in, and there is a reddish till in spots. There are sharp hummocks 15 - 30 feet high here. Boulders are more numerous than on the sandy tracts to the west. This tract extends eastward to the bend of Black River in Section 26. There is then a range of high hills along the northeast bluff of river, in Section 36, T.32N., R.1W., and probably reaching into Sections 31, 6 and 1, in the oxbow of the river. There is a low flat sandy tract, fully a mile in average width, above here. Aneroid 28.630 at Beulah River in Section 36 = 930 feet, more or less.

Aneroid 28.460 on hill in Section 36 = 1,080 feet. Aneroid 28.670 at oxbow bend in Section 6, T.31N., R.1E., = 900 feet, more or less. Aneroid 28.630 on plain bordering Black River here. Aneroid 28.650 at swamp north of Hodkiss Saloon. Aneroid 28.550 at school house. Aneroid 28.530 on knoll

back of school house at Mr. Gibb's residence in west part of Section 19. Aneroid 28.510 at corner Sections 19 and 30, 24 and 25. Aneroid 28.540 in swamp on line of Sections 25 and 30, 1,000 feet, more or less. This drains east from here to Little Black River, but there is a westward drainage from it. The swamp is $3/4$ mile, more or less, wide here, but becomes about 1- $1/2$ miles wide farther west a couple of miles, and continues wide to where I saw it this morning in Sections 5, 6, 7 and 8 (see map) for its extent is outlined by Mr. Myers, a trespass agent. There is a very high range of hills south of it, but to the north, the height is much less. The county map shows the area of morainic land, as outlined by Mr. Myers. Mr. G. M. Rouse, another trespass agent, outlined the extent of the morainic tracts in the townships east -- T.31N., and T.32N., R.1E. Aneroid 28.230 at top of hill, 1 mile north of Hetherton.

Aneroid 28.180 on hill $1/2$ mile north. Aneroid 28.180 on hill at Hetherton. This, by aneroid, from Gaylord a few weeks ago, I made 1,330 feet. Aneroid 28.200 $1/2$ mile south. We here go east through Section 7. Aneroid 28.220 at line of Sections 7 and 8 on upland. Aneroid 28.260 in ravine 80 rods east. This high range of morainic hills has considerable till in Sections 6 and 7, 1 and 12, and sections farther south. Boulders are numerous. The surface is hummocky. Aneroid 28.250 = 1,250 feet at line of Sections 8 and 9.

Aneroid 28.500 at a ravine at a farm house on north side of road, about 3 miles east of county line, = 1,025 feet. Aneroid 28.400 on hill in west part of section. Aneroid 28.550 on hill near center of Section 10. Aneroid 28.240 in east part of Section 10, on crest of high ridge. Aneroid 28.310 in ravine in Section 11. Aneroid 29.260 on hill east of ravine.

Aneroid 28.560 at Mr. Remington's at 6:15 p.m., at center of Section 7, T.30N., R.1E., = 975 feet, more or less, A.T. This is on a knoll 40 feet, more or less, above a lake and swamp southwest of his house. There is considerable till in the moraine from Hetherton to here. Charles Hildebrand, in Section 5, made a boring 156 feet, without reaching a water vein. Wells in this vicinity are generally 30 feet or less. There is considerable clay.

The northwest township of Montmorency County, as I observed from hill in Section 36, T.32N., R.1W., is nearly all a sand plain. I was told by Mr. Rouse that the hardwood and undulating land in the west side of the township covers only the west edge of Sections 18, 19 and 30. The high range of morainic hills in the east part has its west border in the east part of Sections 14, 23, 25 and 36, T.32N., R.1E. He could not outline its border north of Section 14. The morainic tract in northwest part of T.31N., R.1E., covers the south part of Sections 5 and 6, and southwest of Section 4; east 1/2 of Section 7; all of Section 8, and much of Section 9; northeast of Section 18; north 1/2 of Section 17 and northwest of Section 16.

Much of Sections 10, 11, 14, 15 and 22 are in a swamp. There is a nearly plane or gently undulating till in Section 16, and much of the same sort of land in Sections 18, 19, 20 and 21. It extends west over Sections 24, 23 and 22 in T.31N., R.1W., as stated by Mr. Myers, the trespass agent.

October 7, 1902, 6:00 a.m.

Aneroid 28.690 at center Section 7, T.30N., R.2E., at Mr. William Remington's, 975. Aneroid 28.740 at 7:00 a.m. = 975. Aneroid 28.570 at Dr. Valentine's, in southeast part Section 31, T.31N., R.2E., = 1,125. Aneroid 28.590 at 8:40 a.m. = 1,125. Aneroid 28.530 on hill near center of Section 31 on north-south road = 1,175. Aneroid 28.830 at swamp in north

part Section 30 = 925, more or less. It leads through from east fork of Black River to Valentine Lake. It is narrow here, being but 40 - 50 rods wide and has morainic hills each side. Those on the northwest side are very bouldery. It extends but little west of this road. Northwest of it is a broader swamp. Aneroid 28.840 on the broad swamp in Section 19, T.31N., R.1E., = 915 feet, more or less. Aneroid 28.840 at railroad at line of Sections 18 and 19, about 80 rods east of township line.

Looking south, I see a very bold front to the hills that stand in Sections 30 and 25. The rise to it is about 300 feet in 1/4 mile. There is a prominent ridge in Sections 24 and 23 running east-northeast - west-southwest for a mile. There is also an isolated high hill on line of Sections 27 and 34, with a plain on its northwest side 1/2 mile, more or less, wide, separating it from the moraine in that direction, and a swamp of similar width separates it from the moraine south of East Black River. There is high rolling land with hardwood timber (in part) in Sections 20, 21, 22 and north edge of Sections 27 and 28, T.31N., R.1E.

From a hill in Section 18, T.31N., R.2E., I have a view to the north across a swamp and low sandy tract to low hills in south half of Section 1, T.31N., R.1E., that have hardwood timber. North from there, just north of the town corners, a very prominent moraine sets in that covers the northeast of Section 36 and west side of Section 31, and all of Sections 25, 24, 13, 12 and 1, and east part of Sections 14, 23 and 26, T.32N., R.1E., and Sections 6, 7, 18, 19, 30 and west part of Sections 17, 20 and 29, T.32N., R.2E. It rises in places 150 - 200 feet above the plains each side of it. It is largely timbered with hardwood and has a productive soil. I am told by Dr. Valentine the county surveyor (address, Big Rock), that west of this high range in Sections 11, 14,

23 and 26, there is a red clay subsoil, and stony tract that has a level surface. It is timbered largely with jack pine.

We drive northeast through a sand plain to Valentine Lake. Aneroid 28.900 at outlet of Valentine Lake at 10:45 a.m. There is a low but very bouldery moraine on the east side of this lake that runs north past the east side of Clear Lake in Sections 3, 34, 27 and 22. There is a break in it east of south end of Valentine Lake a mile wide, separating this range of moraine from a morainic tract south of the lake (see map). I go southeast across it to near corner of Sections 7, 18, 12 and 13. Aneroid 28.860 on the plain in Sections 10 and 11, and in Section 13. The southeast part of Section 13 only is on the moraine, and nearly all of Section 13 is sand plain. In Section 18, I go onto the moraine and find it has a few small boulders. It is very sandy and gravelly. Aneroid 28.800 on one of its knolls in northwest part of Section 18 that is about the height that neighboring knolls reach, or 50 feet, more or less, above the sand plain.

Aneroid 28.880 at a beaver dam on a small stream tributary to Thunder Bay river, near middle of line of Sections 19 and 20, T.31N., R.3E. The dam is as good as I ever saw, about 12 rods long, 3 feet high, and 4 - 6 feet wide. There is a beaver marsh of 100 acres or more west of it, from which most grass is cut.

Aneroid 28.840 on nearly plane sandy tract in south part of Sections 19 and 20. Aneroid 28.865 at a saw mill in southwest part of Section 20 where we stop for dinner. This is on a sandy plain and the mill proprietor says it runs east almost to Hillman on each side of Brisby Creek -- the creek on which I found the beaver dam. There are knolls north of where we crossed in Sections 6, 7, and 18, T.31N., R.3E. All of Sections 19 and 20 are plane, but west from here in Section 24, and north part of Section 25, there are hills, and a low undulating tract extends northwest across Section 14 to Valentine Lake.

From accounts, I judge that T.31N., R.3E., is all a sand plain, except on its west edge in Sections 6, 7, 18 and possibly 31. There is much sand plain also in T.32N., R.3E. The mill owner knows of one group of knolls in Sections 26 and 27, west of a lake. There are also some on the north edge of that township. There is a morainic tract on the northeast side of the southeast flowing part of Thunder Bay River east and southeast from Atlanta in T.30N., R.3E.

Aneroid 28.880 at lumber mill in southwest of Section 20, T.31N., R.2E., at 1:00 p.m. There is considerable till near surface in Sections 19, 30, 29, 31 and 32, but it is nearly plane and was largely timbered with pine. There are very prominent hills in Sections 36 and 35, T.31N., R.2E., and Section 1, T.30N., R.2E., standing 150 feet, more or less, above the level land to the east. South and east of these is a plain on which till is near the surface, about as it is in the southwest part of T.31N., R.3E.

There is a high range of morainic hills east and south of Atlanta, trending north-northeast - south-southwest. It runs north into the east part of T.31N., R.3E., about to a creek in Section 24, covering part of Sections 23 and 24 and much of Sections 25, 26, 34, 35 and 36. It touches Sections 6 and 7, T.30N., R.4E. In T.30N., R.3E., its southeast border is at the bluff of Thunder Bay River and its northwest border is in Sections 3, 4, 9, 16, 17, 20 and 19. Thunder Bay River enters it in Section 20 and winds around among its hills to the bend in Section 34 in a narrow valley. The moraine continues southwest between Crooked Lake Creek and Hunt Creek to the great moraine that runs from Vienna southeast. It is apparently a great spur from that moraine. Aneroid 28.980 at Atlanta at 3:00 p.m. Aneroid 28.760 on hill about 4 miles south, near range line in Section 36. There are hardwood tracts 1-1/2 miles east and 1 mile southeast from here, but thus far, the moraine is timbered with pine.

The high tract between the Thunder Bay River and Crooked Lake Creek, a tributary east of it, has pine fully as far south. Hardwood then sets in. There is hardwood west of the river down to within 2-1/2 miles of Atlanta. Aneroid 29.000 at Sage Creek, near line of Sections 17 and 18, T.29N., R.3E.

There is a plane tract for 1/2 mile, more or less, back from Sage and Hunt Creeks on northwest side covering Sections 17, 18 and 19, and continuing, I am told, to the mouth of Hunts Creek. This plain covers the tract between Sage and Hunt Creeks about to the range line. I can see higher land in Sections 24 and 25, T.29N., R.2E. There is an elevated tract of hardwood east of Hunt Creek from about Sections 20 and 21, T.29N., R.3E., south into Oscoda County, covering the interval between Hunt and Gilchrist Creeks, but it does not extend farther north, there being a plain to the north between these creeks. This plain has numerous small basins of a few square rods, each 10 feet, more or less, in depth. It is underlaid at slight depth by till and in many places till is at the surface.

Aneroid 29.100 at east line of Section 14, T.29N., R.3E., at Mr. Robert Widdis at 6:00 p.m. I think this plain and the ranges of hills each side indicate that a tongue of ice laid on the plain between morainic spurs. Possibly a lake occupied it later to give the coating of sand. This digitate border of the moraine seems to characterize the Thunder Bay drainage basin on its west and south borders, but not to extend in so pronounced a form into the drainage basin of Black River, Pigeon River, and Sturgeon River. The range that runs up to Valentine Lake from the southwest is perhaps a spur from the great northwest-southeast trending moraine southwest of it. The high knolls north of Atlanta lie on the line of continuation of the spur that is between Thunder Bay River and Crooked Lake Creek, but the gap is fully three miles.

October 8, 1902, 7:00 a.m.

Aneroid 29.050 at Mr. Widdis in Section 14, T.29N., R.3E. The hills set in 1/2 mile east and 1/2 mile south, and are 100 - 175 feet above this plain. We go into them in east part of Section 13 on a road leading past south end of Lakewood Lake. There are a good many boulders here and some till occurs that is clayey, but as a rule, the moraine is a loosely textured drift.

Aneroid 29.020 at Lockwood Lake. This is surrounded by sharp morainic hills, 75 - 100 feet or more in height, except at the northwest border at the outlet. We continue east 2 or 3 miles beyond Lockwood Lake through a gently undulating tract of loose textured, rather sandy drift with a few boulders. It stands, much of it, on a level 50 feet higher than Lockwood Lake. Cole Creek, on its east flowing part, is bordered by these rather low morainic hills and ridges on each side. We have in plain view, to the east and southeast, a high range of hills that lies east of Turtle Lake. The prominent hill in the northwest township of Alcona County that I went to last year, is at the south end of this high range. The range runs a long distance into Alpena County.

We take a road that leads west of north through the northwest part of T.29N., R.4E. It rises through a bouldery moraine with some clayey till, to a high range on which the aneroid reads 28.780 - 28.800. From this range, Turtle Lake is visible. This high tract has some till of clayey constitution, but is largely loose textured and is timbered with pine. We come to the Lewiston-Hillman road about 1/2 mile south of the edge of the hardwood timber. Aneroid 28.830 at the intersection. This is at about the line of the high part of the hardwood north of here. It has an undulating surface with variations of 30 - 50 feet in altitude.

Charles Klein, in southeast part of Section 29, has a well 68 feet deep, mainly through red till. It had 2 feet of water when completed. Aneroid 28.880 at well in a sag, 1,000 feet, more or less. Peaches grow here successfully.

Aneroid 28.900 at northeast corner of Section 20, where a road turns east. Aneroid 28.950 at middle of north side Section 21, in a sag. I am told that the moraine covers only the southeast of Section 19 and its west border runs south from there near the line of Sections 30 and 31, and on to the west side of Lockwood Lake near west line of Section 7. Aneroid 28.980 at south line of Section 16 where road turns east.

Aneroid 29.020 at a swamp at town hall near corner of Sections 15, 16, 21 and 22 from which there is both southward drainage to the upper South Branch Thunder Bay River, and westward to the main stream. The sag is less than 1/2 mile wide south from here, but it opens out to the northwest into a broad sandy and swampy plain along Thunder Bay River. Aneroid 28.900 at east line of Section 16 at intersection with north-south road. I turn north and in about 1/3 mile, reach a summit. Aneroid 28.850. Aneroid 28.920 at center of Section 10 at a school house.

The moraine extends 1/2 mile west from here, or nearly to Thunder Bay River. Its border lies near the river from here to Hillman. There is a gently undulating surface in Sections 25, 26, 34, 35 and 36, T.31N., R.4E., and Section 3, T.30N., R.4E. Sections 1, 2, 11, 14, 15, 22 and 23 have a strong moraine with some knolls 50 feet or more in height. East of this is a swamp extending to upper South Branch of Thunder Bay River, covering much of Sections 12, 13, 24, 25, 36, and Sections east of this, and parts of Sections 23 and 26.

Aneroid 29.060, 752 feet, at Hillman at 11:30. Aneroid 29.080 at river

= 730 - 735 feet. Aneroid 29.000 on hill south of village, at church where road turns east to Alpena = 810 - 815 feet. I take road east and find a till tract with boulders for about a mile, on which there are knolls 20 - 30 feet, more or less, high. Farther east, there are small hummocks of clay that are, in places at least, nearly free from pebbles.

Aneroid 29.090 in swamp on line of Sections 19 and 30. The southeast part of Section 30 is not swampy. The northwest corner only of Section 27 is swampy. Aneroid 29.060 on edge of hardwood timber near corner Sections 20, 21, 28 and 29. This extends north nearly to Thunder Bay River, and trends southwest - northeast. East of it is a swampy tract. Aneroid 29.090 at its outlet near corner Sections 21, 22, 27 and 28. Aneroid 29.070 on bouldery knoll 40 rods east. Aneroid 29.125 at small creek, on line of Sections 22 and 27. This has a swampy plain $1/4$ - $1/2$ mile wide, underlaid by till, with numerous boulders. Aneroid 29.070 on sharp till ridge east of creek, near east end of line of Sections 22 and 27. This runs less than $1/2$ mile north, there being a swampy tract along Thunder Bay River.

There is a very sharp knoll near center of Section 23, about 60 feet high and northeast of this, probably in northeast of Section 23 and edge of Section 24, is a larger knoll, fully as high -- both timbered with pine. The tracts to the west have had hardwood. Aneroid 29.160 at upper South Branch of Thunder Bay River.

Aneroid 29.090 on drumlin that crosses township line and runs south-southeast. Aneroid 29.140 at Mr. Flanders at post office, near base of east side of drumlin. Mr. Kimball's well, at top of drumlin, on east-west road, 40 rods west of here, is 85 feet. Mr. Flanders' well is 60 feet deep. It has 30 feet of water. It was largely gravelly material, but Mr. Chas.

Kimball's well was largely through clay. Water only rises 12 feet.

There is a large drumlin in Section 24, just south of center. It is 60 feet or more above the plain along the stream west of it. It is oval and about 1/2 mile north-south, and 120 rods east-west. On its east side is a sink hole, but I am not able to learn of limestone being struck. A well on its south slope is thought to be 50 feet deep and, after passing through 12 - 15 feet of till, it was in gravel and sand.

The drumlin-like ridge just west of Flanders post office, is about 40 feet high and 3/4 mile long and 1/3 mile wide. It has till at surface and only a few boulders. There is a very large hill east of here, in south part of Section 20 and north part of Section 29, T.31N., R.6E., over 100 feet high, and others farther south and east. To the north from these hills, both east and west of Flanders, there is a low plain.

The upper South Branch of Thunder Bay River has no swamp where it crosses the line of Sections 26 and 23, T.31N., R.5E., but has a plain 1/2 mile, more or less, wide that is underlaid by till. It rises toward the bordering hills or swells on each side the river. Above Section 26, it seems to have considerable swamp on its borders.

October 9, 1902, 6:00 a.m.

Aneroid 29.520 at Flanders post office, 760 feet, more or less. George Waring, on slope of hill on south side Section 20, has well 80 feet:

1. Clay loam	14 feet
2. Sand and gravel mixed	54 feet
3. Gravel	<u>12 feet</u>

Total - 80 feet

The water rises 20 feet. Aneroid 29.475 at well = 800 feet, more or less.

Aneroid 28.370 on hill near north side of Section 29 = 940 feet, more or less. Probably 910 - 915 feet. There is a sink hole on north slope of

the hill in southeast part of Section 20, 30 feet deep and about 8 rods across. Aneroid 29.350. A well 30 rods north, on Sheriff Jones land, is 80 feet deep and is said to have struck coal at bottom, probably in shale. Aneroid 29.565 at well = 760 feet. Shale at 680 feet. Aneroid 29.580 on plain east of the quarter line of Section 21 where road turns northeast.

Aneroid 29.620 at Bean Creek. East of this is a gently undulating, bouldery till tract -- swells 10 - 15 feet high. In east part of Section 23 is an esker, 15 - 30 feet high, about 10 - 20 rods wide, running slightly west of south, and winding a little. Aneroid 29.600 at base of esker. It is composed of cobble and gravel. It runs south into Section 2.

I cross a shale ridge about 60 - 100 rods west of corners of Sections 19, 20, 29 and 30, T.31N., R.7E. Aneroid 29.615 on ridge = 720 feet. Aneroid 29.650 at corners of Sections 19 and 20.

A. B. Green, on north slope of west drumlin, near center of Section 24, T.31N., R.5E., has a well 65 feet. It was largely a bluish till. There was red till at surface, 4 - 5 feet, then 6 - 8 feet of sand and under this, blue till. Water rises considerably -- 20 feet, more or less.

Till and boulders continue east to lower South Branch of Thunder Bay River, but east from there is sand. Aneroid 29.665, 673 feet, at stream (Lower Branch). About a mile east is a gravel ridge on which a pit is opened. It is only 6 feet deep and stands but 2 - 4 feet above the border tracts. Aneroid 29.650 at pit. It is 60 - 80 rods west from where a road leads south -- probably at quarter line of Section 27.

Aneroid 29.690 at school house, probably near corner Sections 23, 24, 25 and 26, T.31N., R.7E. Aneroid 29.705 at range line on a swampy flat. Aneroid 29.730 at Devil Creek. The limestone sets in on east side of this creek and is within reach of the place except where sand ridges cover it.

NOTES ON STRIAE

There are striae, bearing $N41^{\circ}W - S41^{\circ}E$, on ledges on north side of road about 100 rods east of creek and about same altitude. Farther east 1/2 mile is a rock ridge where aneroid reads 29,700. Aneroid 29,735 at cemetery near west limits of city of Alpena. Aneroid 29,770 in business part of Alpena at 9:00 a.m. = 592 feet, more or less, A.T. Aneroid 29,840 at noon. Aneroid 29,820 at 1:25 p.m. = 592 feet. I drive north on road to Long Lake. About a mile north of the railway junction in a ditch on east side of road, I find striae, bearing $N41^{\circ}W - S41^{\circ}E$. Magnetic. Aneroid 28,780 at the ledge = 625 - 630 feet. Less than 1/4 mile farther north, in a ditch on west side, about 40 rods south of a yellowish-brown house, is a better exposure with the same bearing. These are both south of quarter post of Sections 10 and 11.

Aneroid 29,740 at corner Sections 2, 3, 10 and 11 = 640 feet, more or less. (In 1924 aneroid made it 648?). A few rods north, on west side of road, is a fine striated ledge with similar bearing. Another about 80 rods north less perfect, on west side of road -- similar bearing. It is a little north and on opposite side of road from Orchard Hill dairy farm. Aneroid 28,720 at exposure.

There is a fine exposure in ditch on east side in front of a brown house (C. B. Walker's) north of middle of line of Sections 2 and 3. Bearing the same -- $S41^{\circ}E, N41^{\circ}W$. They show also on west side here. Aneroid 29,715 at exposure. Aneroid 29,700 at township line at corner Sections 2, 3, 34 and 35, 673 feet. There are good exposures of striae here both sides of road with bearing about $N41^{\circ}W - S41^{\circ}E$. About 60 rods from north end of line of Sections 34 and 35, on east side of road, is a fine exposure with bearing



S41°E, with knob and trail features well displayed. The rock is planed smooth up to the cherty prominences on the northwest side of them, but a low, tapering ridge runs out to the southeast, as shown in diagram. The northwest, seems therefore, to be the stoss side. Bearing N41°W - S41°E. Aneroid 29.685 at exposure, 2:40 p.m.

There is a school house less than 80 rods north of line on east side of road, southwest corner of Section 26, near a gravelly beach. The beach or bar runs west-northwest - east-southeast along the top of a limestone ridge. Aneroid 29.675 at cobble ridge. It is well-rounded cobble. I have seen nothing but boulders well-rounded south from here, the limestone blocks being angular. There is a ridge 120 rods, more or less, west on line of Sections 27 and 34. Aneroid 29.675, (685 feet (barometric) in 1924) on low limestone escarpment facing north-northeast about 1/4 mile south from north end of line Sections 26 and 27, = 710 feet. Aneroid 29.690, 670 feet, on flat tract north of it = 700 feet (Grobain). Aneroid 29.700 at forks of road on line of Sections 22 and 23 = 705 feet (665 feet in 1924). Aneroid 29.720 at swamp bordering Long Lake = 690 (640 barometric in 1924). I have seen no cobble ridges since passing the one at the school house.

Aneroid 29.690 = 715 feet, more or less (665 feet in 1924) at forks of road south of Summerville. I take road west. There is very little rise for a mile. I then rise into a cobbly tract that is ridged in a northwest-southeast direction. Aneroid 29.640, (705 feet barometric in 1924) on first ridge, probably the lowest Algonquin, (altitude 725 feet, more or less) for 1/2 mile west I come to a bar 35 feet higher. Aneroid 29.600, or 760 feet. (732 - 734 feet barometric in 1924.) It is a sharp ridge, 4 - 8 rods wide, standing 3 - 6 feet above the tract back of it on the southwest side, and

having a rapid slope on its northeast side to a level 18 - 20 feet lower. The altitude remains high to the south. This high beach crosses line of Sections 16 and 21 about 80 rods from west end, but curves and crosses back to the line near the corner of Sections 16, 17, 20 and 21. The lower Algonquin crosses the line of Sections 16 and 17 about 120 rods north of section corners. It then turns north near the line.

There is a high tract near middle of line of Sections 20 and 21, aneroid 29.590, that is strewn with limestone blocks, and seems to have rock near the surface. Altitude 775 feet (730 feet in 1924). I find a striated exposure just south of middle, on east side of road, with a bearing $N41^{\circ}W - S41^{\circ}E$. It shows a fine case of a grooving around a cherty place. The prominence is 2-1/2 inches wide, and the groove around it is fully 1/4 inch. It closes in slightly upon passing the chert, as indicated in diagram. There are also the knob and trail features in more pronounced form than south of school house on line of Sections 24 and 35. Aneroid 29.600 (730 feet barometric in 1924) at the exposure at 3:45 p.m., = 770 feet, more or less, A.T.

Aneroid 29.615 in sag south of here. There is another limestone ridge south of corner Sections 20, 21, 28 and 29, 20 - 40 rods. Aneroid 28.605. It has striae exposed on east side of road 40 rods south of corner. Just north of school house, perhaps 130 rods from north end of this section line, is a faint ridge with some gravel and cobble. Aneroid 29.625 at the ridge. About 60 rods farther south, striae appear each side of the road about 20 rods north of F. N. Richelle and Leon Manville. Aneroid 29.635 at exposure.

Aneroid 29.650 at the residence south on edge of a swamp. About 80 rods south of corner Sections 28, 29, 32 and 33, is a strong beach or bar 10 feet, more

or less, high, and 20 - 30 rods wide. Aneroid 29.665 on its crest = 715 feet, more or less. Aneroid 29.680 at base on south, 700 feet, at residence of John Gavreau and Adolphus Vassor. It bears east-northeast - west-southwest here, and is visible for 1/4 mile, more or less, each side of section line of 32 and 33.

Aneroid 29.700 (670 feet in 1924) at township line, corner Sections 4, 5, 32 and 33. About 1/2 mile south of township line and 120 rods, more or less, north of railroad crossing, is a wide sand ridge. Aneroid 29.710 at sand ridge, 600. Aneroid 29.730 at railroad crossing. I follow the railroad southeast and in about 1/2 mile come to a sandy ridge 10 - 12 feet higher. Aneroid 29.720 at base. The sandy ridges run southeast from here past a school house at center of Section 9. Among them, south of the school house, till and boulders are exposed in the ditches at the side of the pike. Boulders are numerous also in Section 16 among the sand ridges. There is a large gravel pit in Section 16. Aneroid 29.760 at top. It is 15 feet deep. It is about 80 rods north of the cross roads in southeast part of Section 16 at poor house. It is probably the Nipissing delta of Thunder Bay River. Aneroid 29.775 at river = 591 feet above dam. Aneroid 29.795 at business part of Alpena, 592 feet, more or less.

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