

Notebook No. 181 - Leverett

COUNTY

Alcona: 11

Alpena: 1-5, 6-10, 11-14, 16, 27

Cheboygan: 27-28

Emmet: 8

Montmorency: 5-6

Presque Isle: 14-26, 28, 29

I N D E X

N O T E B O O K   N O .   1 8 1

October 10 - October 20, 1902

- October 10. Work over area southwest of Alpena -- beaches, drumlins, etcetera.
- October 11. Flanders to Hillman, Hubert's, Long Rapids and Alpena.
- October 14. Alpena to Ossineke by rail. Drive west to Hubbard Lake and back.
- October 15. Ossineke - Alpena - Posen by rail. Drive Posen to Long Rapids past Sunken Lake and return.
- October 16. Drive Posen to Hagensville, Nagels Corners, Metz, and back to Posen.
- October 17. Posen to Millersburg by rail. Drive northeast from Millersburg nearly to Rogers City and west from there to Ocqueoc River and south to post office.
- October 18. Ocqueoc to Onaway and Millersburg. By rail, Millersburg to Laroque and Alpena.
- October 19. Beach level in Alpena.
- October 20. By rail, Alpena to Onaway. Drive west from Onaway.

October 10, 1902. Alpena, Michigan

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

Aneroid 29.730 in business part of city about 592 feet A.T., 8:00 a.m.; 29.725 at 8:30; 29.735 at Thunder Bay, 580 feet. I drive southwest, crossing the D. & M. railroad in Section 33, T.31N., R.8E, aneroid 29.685; 29.680 at Devil's Creek, northwest part of Section 4. There is a swamp here bordered each side by sandy ridges. There is a flat, swampy tract in Section 5 with peaty muck, underlaid by sand, that lies south of a sand ridge that runs west-southwest - east-northeast, on north side of the road -- aneroid 29.665 in the swamp. There is no limestone on this route. I am told that the limestone extends only  $3/4$  mile south of the corners of Sections 19, 20, 29 and 30, T.31N., R.8E.

Near the line of Sections 5 and 6, a system of sand ridges is entered that run north-south. The ridges are 12-18 feet high. Aneroid 29.630 on the highest ridges; 29.630 at middle of line, Sections 18 and 13; 28.580 on Algonquin beach in northwest part of Section 24 (40 rods northwest of center at gravel pit in road). The beach runs west of north, crossing the line of Sections 13 and 14 not far from middle, and continuing parallel with the South Branch of Thunder Bay River to where I crossed it yesterday in Sections 22 and 27, T.31N., R.7E. To the south it runs to the moraine in south part of Section 24. Aneroid 29.515 at school house on edge of moraine, corner Sections 23, 24, 25 and 26, T.30N., R.7E; 29.540 at top of upper or outer Algonquin beach, 80 rods north, = 705 feet (1924); 29.550 on plain, at base of beach, on line of Sections 23 and 24. This level fills interval between the outer shore and the gravel ridge that has a pit in it about 40 rods northeast of center of Section 24. Aneroid 29.540 at the pit at 11:00 a.m., where it read 29.580 about 40 minutes ago. The moraine that lies southwest of this beach comes only into the south edge of Sections 23 and 24 on this side of lower South Branch of Thunder Bay

River. It is thickly set with boulders and has small hummocks. Aneroid 29.525 = 675 feet  $\pm$  in delta of river in Section 23; 29.560 at Lower South Branch of Thunder Bay River in Section 22 at 11:20 a.m. = 677.5 feet; 29.500 at place where I get dinner, on west bluff of river, near east line Section 22 at 11:40 a.m. The delta is entirely on the east side of river here. It is ridged in a west-northwest - east-southeast direction, and covers probably  $1/4$  of a square mile. There are many boulders on its north edge and some between its ridges. The ridges are a fine gravel.

Aneroid 29.460 at place where it read 29.500 an hour ago. (735 feet in 1924). I continue west through Section 22, and find that the drift in this section and bordering ones on the north and west has a ridging in a west-northwest - east-southeast direction, with sags and swampy tracts separating the ridges. In some cases, the ridges arch up into drumlin forms, but usually, they are flatter than the typical drumlins. They are composed of a stiff, clayey till, and are strewn with boulders. The longest ones, as indicated on the map, are nearly a mile. I take a zigzag course through this drumlin district and find that they cover, or occur in, Sections 3, 4, 5, 6, 8, 9, 10, 15, 16, 17, 19, 20, 21, 22, 27, 28, 29 and 30, T.30N., R.7E., and in Sections 29, 30, 31, 32 and 33, T.31N., R.7E. The highest ones are 35-40 feet above the sags, but the usual height is about 15-20 feet. They are more prominent in southwest part of T.31N., and northwest part of T.30N., R.7E., than farther south. These prominent ones trend north-northwest - south-southeast.

Some of these are rather irregular, especially one at a church near corner of Sections 4, 5, 8 and 9, and one east of there, on line of Sections 4 and 9. The latter extends into the edge of Sections 3 and 10, and has a narrow, sharp, esker-like ridge only 20-25 feet wide, and 6-8 feet high, along its east edge. This ridge, however, is composed of a

stiff, clayey till. The drumlins occupy less than half the surface of the sections named above in Townships 30N., and 31N., R.7E. Among them are flat till tracts, also strewn with boulders.

There is a nearly plane till tract north and west of the drumlin tract in Sections 19, 20, 21, 29, 30 and 31, T.31N., R.7E., and Sections 24, 25, 26 and east part of Sections 26 and 35, T.31N., R.6E., and in Sections 1, 12, 13 and 14, T.30N., R.6E., and Sections 6, 7 and 18, T.30N., R.7E. In a few places in these sections the drift is slightly ridged in a northwest-southeast direction, suggesting drumlins, but usually the low swells are irregular in shape. It is all thickly strewn with boulders.

West of this plane till tract is a ridged belt, partly till and partly sandy gravel. Where composed of sand and gravel, it is generally in form of sharp, esker-like ridges, but when of till, is broadly ridged. The sharp, esker-like parts reach heights ranging from 25 feet up to fully 75 feet. The highest noted are in Section 2 and south part of Section 10, T.30N., R.6E., but there may be ridges farther south that are as high, for the belt continues, I am told, to the south, along line of Sections 15 and 16, 21 and 22.

In Sections 2 and 11, the gravelly ridges form a plexus that wind and interlock. This range runs from Section 23, T.31N., R.6E., in a course west of south, through Section 26 and along line of Sections 34 and 35 and on through Sections 2 and 11. It there turns westward nearly a mile, and is very prominent in south part of Section 10. From there, it runs south at least two miles, as noted above. West of it, there is a gently undulating till tract with an occasional drumlin-like ridging, covering much of Sections 3, 4, 10, 16, 20 and 21, T.30N., R.6E., but west of there, for several miles, is a flat till tract, as indicated on the map. The south part of T.31N., R.6E., has a morainic topography from this ridge west (as

noted October 9) to Flanders. There are drumlins near Flanders (see map).

I am not quite clear as to interpretation, but the features suggest that the ice laid on the east side of the sharply ridged tract in Sections 2, 11, 10, 15, 16, 22 and 23, T.30N., R.6E., covering the till plain. Perhaps the border ran east through the southeast part of this township and south part of T.30N., R.7E., past the south side of the drumlin tract. Further study down there may clear it up.

I stop for the night with Mr. Green, the Supervisor in Section 24, T.31N., R.5E., and he gave me much information noted above. The sink hole in Section 24, southeast of center, on slope of a drumlin, covers about 7 or 8 acres, and is said to have water over 100 feet deep. The water surface is 20 feet below lowest part of river.

October 11, 1902.

Aneroid 29.040 at Mr. Lon Green's at 7:00 a.m. in Section 24 = 825 feet  $\pm$ ; 29.100 at Upper South Branch Thunder Bay River, in Section 24 = 720 feet  $\pm$  (1924). There are large limestone blocks on private road near line of Sections 23 and 24, on hill facing southwest, that suggest an outcrop. Aneroid 29.060 at outcrop.

Aneroid 29.020 on sharp hill near center of Section 23. This is sandy drift with a few boulders. The sand ridges east of it are sandy drift, but the large hill on line of Sections 23 and 24 has considerable till and many boulders. There is not the continuous ridging in the sandy drift that would characterize an esker, but instead, a chain of knolls, somewhat disjointed -- even in the main chain.

I come out to the Hillman and Alpena road near corner Sections 22,

23, 26 and 27 and go west. Aneroid 29.020 on a smooth hill, east of middle of line of Sections 22 and 27, that suggests a drumlin in smoothness, but is nearly as broad east-west as it is long north-south. The knolls west and south from here have a more wavy surface. Aneroid 29.070 at creek on line of Sections 22 and 27. In south part of Section 27 and Section 34, there are high hills, 100 feet  $\pm$ .

Mr. Green, the Supervisor, informed me that morainic topography extends to the bluff of South Branch of Thunder Bay River in Sections 2, 11 and 10, T.30N., R.5E. In Section 9, there are knolls and swamps, but Section 8 and north part of 17 and the bordering parts of 7 and 18 are sharply undulating till with hardwood timber. There is a great swamp in Sections 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 28, 29, 30, 31 and 32, T.30N., R.5E., as indicated on map, and a wet till plain in Sections 6, 7 and 18. Southeast of the great swamp there is a strong moraine in Sections 27, 28, 34, 35 and 36, T.30N., R.5E. In Sections 22, 23 and 26, there is a nearly plane tract with a sandy loam soil. In Sections 1, 12, 13 and 14 and 24, there is flat clay land. The northwest part of Section 25 is also clay. There is a sandy plain in the southeast part of Section 25, east part of Section 36 and in much of Sections 30 and 31 east of there. The southwest part of Section 19 also is on this plain, but the rest has a clay soil. There is some sandy land in southwest part of Section 18, but the rest is clay. I made notes last night on the rest of the township.

Aneroid 29.070 in swamp in Sections 19 and 30, T.31N., R.5E.; 29.000 on hill in south part of Hillman (810 feet in 1924); 29.070, 750 feet, at Hillman House, 15 feet  $\pm$  above Thunder Bay River at 8:30 a.m.; 29.000 on knoll 1 mile north of Hillman = 810 feet. There are only low swells south

from here for two miles except a knoll 25 feet  $\pm$  high in northwest part of Section 12. The drift is clayey and has few pebbles in Sections 11, 12, 13 and 14. Aneroid 28.930 on high point 1/2 mile east of Brush Lake on line of Sections 3 and 10, T.31N., R.4E. This range leads northwest to Lucy Lake and North Branch of Thunder Bay River, coming to the river in Sections 19 and 20. It has a loose-textured drift with a few boulders. Southwest of it is a sand plain. Aneroid 29.030 at small creek flowing southeast across line of Sections 2 and 11, T.31N., R.4E. In Sections 1 and 2, there is a clayey tract with many little hummocks 5-10 feet high, and an acre or less in area. Much of these sections is flat and swampy. The east half of Section 1 has swells 20 feet  $\pm$  in height and larger in area. This tract of larger swells runs north in a strip about 3/4 mile wide in Sections 26, 25 and 24, T.32N., R.4E. It has a few boulders and probably marks an ice margin, the ice being on the east side of it.

Aneroid 29.000 at corner Sections 1, 2, 35 and 36; 29.040 on plain at county line, corner Sections 36, 31, 1 and 6. Mr. J. D. Hubert, Supervisor of the north tier of townships in Montmorency County, outlined for me the extent of clay land of T.32N., R.4E. It covers much of the east half of the township. There are hills in Sections 5, 6, 7, 8, 17, 18, 19, 20, 29, 30, 31, 32 and 33. East of the hills in Sections 4, 9, 16, 20 and 21 there is a strip of rather light, sandy soil, nearly plane. There are tamarack swamps among the hills in Sections 5, 6, 7 and 8, 17 and 18. He says there are hills around the great swamp in T.32N., R.3E. There are also hills around Grass Lake in the southeast part of the township, and there is considerable undulating land west from Grass Lake to Rush Lake on the south side of North Branch of Thunder Bay River.

I go east on line of Sections 31 and 32, through R.5E. The surface is

flat except a few sandy ridges. The sand sets in within two miles east of the county line. Aneroid 29.070 where it begins. This reading continues for 3 miles or more east, to where the road turns north. I there come to a moraine that is hummocky and bouldery and rise to where aneroid reads 29.000 on high points in Section 36, T.32N., R.5E. The moraine extends into the northeast part of Section 35, and its west edge seems to bear north-northwest from there. I am on the moraine all the way east to Long Rapids village and can see it for at least a mile farther east. It is very bouldery and full of little waves and hummocks. Aneroid 29.020 on hill west of Long Rapids; 29.075 at small stream, west part of village, 10-15 feet lower than the post office and store; 29.060 at Long Rapids at noon.

Limestone is struck at slight depth in Section 25 and north part of Section 36, and there is rock at slight depth in much of T.32N., R.6E. There are sink holes in Sections 16, 15 and 9, T.32N., R.6E. The largest and deepest in this region are in Section 16. Sunken Lake is in Section 32, T.33N., R.6E. The north fork of Thunder Bay River formerly ran into the sink but is now turned away by a dam.

Aneroid 29.080, 717 feet, at Long Rapids at 1:30 p.m. There are gravelly ridges and knolls on south side of Thunder Bay River below Long Rapids in Section 3, T.31N., R.6E., and perhaps on east edge of Section 4, and the district east of Bear Creek has knolls and ridges, I am told by Mr. Martindale, former Supervisor, and now the postmaster at Long Rapids. He thinks they extend into Section 12 and run south from near line of Sections 11 and 12 to where I saw the ridge in Section 23. They are quite sharp, gravelly ridges. There are knolls on the north side of Thunder Bay River in Sections 2 and 3. Some are sandy, but others contain till. Some gravel is obtained in Section 33 in banks or bluff of a small north tributary of the river.

I take a road that leads down to river at a mill  $1\frac{1}{2}$  miles below Long Rapids, and go northeast from there to the main road in Section 35. Aneroid 29.035 on bouldery knoll, near line of Sections 35 and 36, T.32N., R.6E; 29.080 on river flood plain, 15 feet above stream, in Section 31, west part. There is a limestone ridge north of road, in east part of Section 36 and across Section 31, but looking north on line of Sections 31 and 32, the road does not seem to touch it. Probably Lake Algonquin did not extend farther up the Thunder Bay River than here. Aneroid 29.060 on river flood plain in Section 32. Probably this is lower than where it read 29.080 in Section 31. Aneroid 29.070 on bridge of north fork Thunder Bay River, 15 feet  $\pm$ . There is a changeable soil on the plain east of this tributary, sandy in places; bouldery till in others.

I am told that limestone sets in  $1\frac{1}{2}$  miles south of Bolton, on east side of North Branch, and that it is near the surface around Bolton and Cathro. The main river comes into a shaley limestone about 2-3 miles below the mouth of North Branch. The road is in it from there to the mouth of Falls Creek. There is a small gravel pit on north side of road, near the place where I first noted the shaley outcrops. Aneroid 29.070 at pit. This is nearly opposite the mouth of Lower South Branch, and may mark the lower Algonquin. Aneroid 29.110 at river at mouth of Falls Creek. There is a rapid fall for about 2 miles below here, probably 20 feet to the mile, for the aneroid reads 29.140 on the plain 15-20 feet above river two miles below mouth of Falls Creek. Aneroid 29.150 on Nipissing delta at county farm; 29.170 at Thunder Bay River above the 11-foot dam, or 591-592 feet.

James Bradley, in Redwood Township, section 29 (T.37N., R.6W., Emmet County) has a well 325 feet that is flowing. It will lift an inch board, 1 by 3 feet, up an inch or more when there is strong northwest wind.

I learn from Mr. Morse, the Supervisor of the southwest township of Alpena County, that is all rolling country except a strip of flat, nearly swampy, clay loam land  $3/4-1\frac{1}{2}$  miles wide, leading south from Beaver Lake, covering parts of Sections 10, 11, 14, 15, 22, 23, 26, 27, 34, 35 and 36. There is also, on the west border of the township, a narrow strip of swampy land, north of Turtle Lake, in parts of Sections 6, 7 and 18, and south of lake for  $1/2$  mile, or to middle of line of Sections 30 and 25. The range in the west half of the township is a sandy loam that had large pine timber; that in the east half has a heavier soil. It extends into a hardwood tract on its east side in west part of the adjacent township, T.29N., R.6E.

Mr. Morse also states that there is a rolling tract in the east part of T.29N., R.4E., between Turtle Lake and upper South Branch of Thunder Bay River. The knolls are not so high as in the range east of the lake. Mr. Morse says that T.29N., R.6E., has a large, flat, rather swampy tract in its central portion and extending from southwest to northeast across the township.

On the border of the township, in Sections 6, 7, 18, 19, 20, 29, 30 and 31, there is an undulating to rolling hardwood tract. There are also hilly tracts in the north, in Sections 2 and 3, and on the south in Sections 28, 32, 33 and 34. On the east, there is a moraine that covers the south edge of Sections 11 and 12, and nearly all of Sections 14, 23, 26 and 35, and all of Sections 13, 24, 25 and 36. It extends east into T.29N., R.7E.

October 14, 1902. 6:30 a.m.

Aneroid 29.390 at Alpena, about 590 feet. I take train on D. & M. railroad to Ossineke. Aneroid 29.370 at the junction and roundhouse, a mile north. This is about 605 feet, for the track is 14 feet  $\pm$  above the river above dam, and that is 591 feet. Aneroid 29.350 at crossing of wagon road in Section 32 or 33, T.31N., R.8E., = 625 feet  $\pm$ . This is probably the sand of the Nipissing that is piled up 5-10 feet above the level of that lake, making the level of Lake Nipissing 615-620 feet here. In sags south from here a mile or so, the aneroid reads 29.360. There is jack pine here with some scrub oak. Aneroid 29.380 at Ossineke at 7:00 a.m. = 604 feet  $\pm$ .

Aneroid 29.300 on Algonquin beach in Section 23, T.29N., R.8E., = 670 feet  $\pm$ . There is a dam on south fork of Devil's River, near line of Sections 23 and 26, and I am told that there is a 72-foot fall from top of dam to Lake Huron. The dam is perhaps 15 feet below the crest of the Algonquin beach.

I go southward into the moraine, and find it thickly set with boulders, though very sandy. Aneroid 29.160 on crest of a morainic ridge just west of county line, in Section 35 = 800 feet  $\pm$ ; 29.180 at Adolph Hubert's on till plain southwest of the ridge. The ridge trends southeast-northwest across the northeast part of Section 35. The till plain west of it descends to the west. Aneroid 29.210 on it at James Eaton's, south side of Section 34; 29.240 near corner of Sections 33, 34, 3 and 4 = 710 feet  $\pm$ ; 29.230 a mile west at a road leading south between Sections 4 and 5. There is a rise from here west. Aneroid 29.150 at place where road runs south through a plain to a swamp (see Alcona County map); 29.150 at edge of swamp  $\frac{1}{2}$  mile west. The road here leaves the county line.

I cross a high range of hills that lies east of outlet of Hubbard Lake. Aneroid 29.010 on crest in road, 900 feet. Points south  $\frac{1}{4}$ - $\frac{1}{2}$  mile near the county line, are about 40 feet higher, or 940 feet. This was timbered with pine, but has a loamy soil suitable for agriculture. It is quite bouldery, and so is the till plain east of here. Aneroid 29.120 at brow of bluff east of Hubbard Lake outlet; 29.215 at Hubbard Lake Station. There is a till plain for  $1/2$ - $3/4$  mile east, and about as far west from here, making a valley  $1\frac{1}{4}$  miles wide  $\pm$ . Aneroid 29.260 at outlet of Hubbard Lake, 675 feet  $\pm$ . This is in a narrow channel 25-30 feet deep and 20-30 rods wide. Aneroid 29.140 at corner Sections 28, 29, 32 and 33 = 775 feet; 29.100 = 810 feet at George Stovell's in Section 32, north side; 29.050 on hills in northwest part of Section 29 = 855 feet  $\pm$ .

Aneroid 29.120 at the Mulvaney farm in Section 17, west side, T.29N., R.7E., = 790 feet, on a flat tract surrounded by higher land. This range west of the South Branch has a large amount of till. There are more swamps among the knolls here than on the range east of the South Branch. The well here is only 58 feet, but one 80 rods north, in southwest part of Section 8, at Bromley's, is 115 feet. One at Haberlieg's, in Section 7, east side, was sunk 120 feet without getting water. They all have till much of their depth. It is of blue color in lower part. There is a lighter soil, I am told, on the west side of this morainic tract, in T.29N, R.6E., than in T.29N., R.7E., much of it being too light for agriculture and not settled. It is called a "briar hill region". Aneroid 29.130 at Mulvaney farm at 12:30 = 790 feet; 29.095 at Bromley's well, southwest part of Section 8 = 820 feet.

Aneroid 29.080, 830 feet, on hill on line of Sections 7 and 8, near south end. This commands a view of about 3 townships, T.29N., R.6E., and much of T.30N., Ranges 6E and 7E. Aneroid 29.200 at swamp on line of

Sections 5 and 8, 4 and 9 = 720 feet  $\pm$ . From the corner of Sections 5, 6, 7 and 8, I had a fine view to the north to where I was driving a few days ago, across a flat country. There is a rolling country to the northwest with a border trending northeast-southwest, as shown on map. Aneroid 29.220 at corner Sections 3, 4, 9 and 10 on flat till tract with boulders; 29.270, 665 feet  $\pm$  at Lower South Branch of Thunder Bay River on line of Sections 3 and 10. The banks are very steep and about 40-45 feet high. They are a stiff, red till. Aneroid 29.170 at corner Sections 1, 2, 11 and 12, on a till ridge = 750 feet  $\pm$ .

We wind around on a tote road in Sections 11, 14 and 15, and find that the till ridge is very gently undulating. We cross the South Branch on the Hobo bridge in Section 15. Aneroid 29.265 at river = 694.5 feet (Wisler). We then go south on line of Sections 21 and 22, 27 and 28, to Hubbard Lake store. This gives a view of a high range of hills running north-northeast - south-southwest from about Section 13 to the forks of Hubbard Lake. The range west of the river runs south to the west side of the lake. The two ranges are only a mile or so apart at the north end of Hubbard Lake. It looks as if a tongue of ice laid between them from Hubbard Lake north, and perhaps at that time a stagnant mass occupied the lake basin. Aneroid 29.260, 695.2 feet, at South Branch, a mile north of Hubbard Lake store, near corner Sections 21, 22, 27 and 28; 29.210 at the store at 3:45.

We go east, rising to the high range near corner of Sections 25, 26, 35 and 36. Aneroid 29.000 = 925 feet  $\pm$ ; 29.040 at Jackson's marsh in Section 25. This has some cranberries at its south end. It covers about 80 acres. The drift here on this high range is a sandy loam with numerous boulders. Aneroid 29.085 at line of Ossineke and Sanborn Townships, near corner Sections 19, 30, 24 and 25; 29.140 at a creek near center of

Section 19 on a till plain drained by Devil's River; 29.160 at northeast corner of Section 19. From here north and east there is a rise to the moraine that I crossed in Section 35 this morning.

There seems to have been a lobe of ice running southeast here to the hills east and south of Spruce (Alcona County), and having this moraine in Sections 35, 26, 22, 15 and 16, 8 and 9, T.29N., R.8E., on its north-east border. Aneroid 29.120 at school house at corner Sections 16, 17, 20 and 21 on the slope of the moraine, 40 rods from its southwest border = 770 feet  $\pm$ ; 29.090 on crest of moraine = 800 feet  $\pm$  at corner Sections 15, 16, 21 and 22. There are some gravelly knolls along the crest, one of which is crossed here. This has considerable till, even where soil is sandy. Aneroid 29.145 at brow of bluff of Lake Algonquin on line of Sections 15 and 22 west of middle 40 rods  $\pm$  = 750 feet  $\pm$ ; 29.215 at base of bluff at the quarter post = 680 feet  $\pm$ ; 29.250 at Devil's Creek = 645 feet  $\pm$ ; 29.225 on gravel ridge east of creek = 670 feet  $\pm$ ; 29.300 at Ossineke = 604 feet at 5:40 p.m.; 29.360 at Ossineke at 6:45 p.m.

October 15, 1902. 6:00 a.m.

Aneroid 29.120 at Ossineke = 604 feet; 29.100 on gravelly beach east side of Devil's Lake, about two miles north of Ossineke, probably the Nipissing beach, at 620 feet  $\pm$  A.T. The aneroid changed from 29.130 to 29.170 at Alpena in an hour. Aneroid 29.170 at 7:30 a.m. = 589 feet.

I take train to Posen. Aneroid 29.100, 650 feet  $\pm$  at the road crossing near corner sections 4, 5, 8 and 9; 29.050, 713 feet at Algonquin beach at township line, near corner Sections 31, 32, 5 and 6 -- a strong ridge of cobble and gravel running east-west. It stands 14 feet  $\pm$  above the tract south of it, or 713 feet A.T. (Algonquin beach 713 feet). There

are many boulders as well as limestone slabs in fields all over this region. Aneroid 29.040 at Cathro, 724 feet  $\pm$ , on limestone ridge, large blocks being on surface in field east of here. Much of the surface is flat and swampy. A low ridge runs northwest-southeast parallel with railway, about 1/4 mile west of Cathro station. Is it a beach? Yes. Railroad summit on wide ridge 1/2-3/4 mile west of Cathro, 736 feet. Aneroid 29.036 at Bolton = 730 feet; about 1 1/2 miles northwest of Bolton, a narrow sharp ridge with some cobble appears, south of the railroad. This is a beach. Altitude 724 feet. Aneroid 29.040 on the railroad near it. The ridge is 10 feet  $\pm$  higher, or 734 feet  $\pm$ . Much of the surface is swampy, and the aneroid stands at about 29.040 for several miles.

Just east of Polaski there is a cut in till 6-8 feet deep. Aneroid 29.020 at Polaski, 740 feet. Knolls 8-10 feet high in this vicinity. Aneroid 28.950 at Posen = 788 feet. Rock is at surface in some of the low swells in this vicinity. On the flats among them, it is at various depths up to 20 feet or more. The distance at the mill is 20 feet, but at the hotel at Adam's, it is only 6 feet. Aneroid 28.940 two miles west of Posen at a rock knoll = 795-800 feet. I go south through swampy tracts, making a gradual descent. Aneroid 28.990 at school house, corner of Sections 19, 20, 29 and 30 in a swamp. There is a drift ridge, 20-25 feet high, in northeast part of Section 30, running north-northwest - south-southeast, composed of clayey till. There are others on the beaches of North Branch of Thunder Bay River, south from here. Aneroid 29.030 at the river below dam = 720 feet  $\pm$ . (See notes on return this afternoon).

The sunken lake is south of here in west part of Section 32. Aneroid 29.070 = 690 feet  $\pm$  at east rim of the sink over which water poured from a basin of several acres east of it. That basin has a clay bottom filled within

10 feet of level of this rim. The west rim has a rock cliff fully 50 feet high. The river discharged all its water into this basin in the dry season of the year, and the lake in it often became low, but in the wet season, the main flow was the present course down to Thunder Bay. A lumber company made the dam. Aneroid 28.910 on rock ridge 1 mile south of Sunken Lake at Leer, at end of north-south road = 825 feet. Striae on east slope of this hill, in Section 5, have a magnetic bearing S5<sup>OW</sup>. They are on a surface that dips rapidly northward. The ledges in this vicinity show much variation or dip. Aneroid 28.990, 775 feet  $\pm$ , at rim of a sink hole on line of Sections 8 and 9 that is fully 75 feet deep, and covers less than an acre. I am told there is one over 100 feet deep in Section 16.

Aneroid 28.980 at a swamp near corner Sections 8, 9, 16 and 17. This has a stream draining southeast that the map has terminated in Section 16. Aneroid 29.030 at a swamp near corner Sections 20, 2k, 28 and 29 = 780 feet  $\pm$ ; 29.040 at Long Rapids at noon; 29.040 at 1:00 p.m. = 717 feet. I drive south a mile, and find low drift swells standing 15-20 feet above the swamp. Looking east, I see higher knolls and ridges, as noted a few days ago.

I return to Long Rapids and go west. Aneroid 28.950 at a drumlin-like hill with rock nucleus in south part of Section 30 and north part of 31. This is one of the highest in the region, altitude 815 feet  $\pm$ . Aneroid 29.010 at beaver meadow in north part Section 19 = 775 feet. I drive northeast across it to road at corner Sections 17, 18, 19 and 20, then wind around past west side Section 7 and back to line of 5 and 6. Aneroid 28.960 at middle of line Sections 5 and 6, near striae noted this morning = 825 feet, Leer Post Office; 29.085 at North Branch Thunder Bay River, below dam = 720 feet; 29.030 at Posen, 788 feet, at 4:15 p.m.; 29.040 at Posen at 4:50 p.m.; 29.100, 748 feet  $\pm$ , at Polaski at 5:00 p.m.

Cut in a till knoll 15 feet without striking rock. This is near a switch between Polaski and Bolton. Rock quarry in a ridge  $1\frac{1}{2}$  miles northwest of Bolton. Aneroid 29.130, 727 feet, at Bolton at 5:20 p.m.; 29.150, 724 feet, at Cathro at 5:30 p.m. Is ridge  $1/8$  mile north a beach? Yes. Aneroid 29.290 at Alpena Junction = 605 feet. There seems to be a very thin coating of drift from Posen southeast to the point of land east of Alpena. The ridges and sags are largely due to irregularities in the rock surface. It is difficult to discriminate between those with limestone nucleus and those without, when they take on the form of hummocks and small knolls. The drift is generally a heavy clay and has a large number of Canadian boulders in it as well as blocks of local limestone.

October 16, 1902. 7:20 a.m.

Aneroid 29.590 at D. & M. Station, Alpena. I take train to Posen. Aneroid 29.470 at Cathro = 724 feet. The ridge just west of station is a loamy clay till to depth of cut 10-12 feet. One,  $1/4$  mile north, has uneven crest and looks like a beach. It is a beach, and is about 730 feet. Aneroid 29.450 at Bolton = 730 feet; 29.400 at Posen, 788 feet; 29.380 on rock ridge at church 1 mile north of Posen Station, 806 feet; 29.400 on limestone ridge at a school house 2 miles north of Posen = 788 feet.

I go west through a swampy tract for  $3/4$  mile, then rise to a high limestone ridge. Aneroid 29.330 on crest  $1\frac{1}{4}$  miles west of southwest on line of Sections 5 and 32 = 850 feet. I go north, making gradual descent through a plane tract. Aneroid 29.360 at corner Sections 29, 30, 31 and 32 = 820 feet; 29.380 at corner Sections 19, 20, 29 and 30 at school house = 800 feet. The drift here is sandy, but between Posen and here it has been a loamy clay. In Sections 19 and 20, there is an undulating surface. Is this Taylor's Hagensville moraine?

Aneroid 29.410 at corner Sections 17, 18, 19 and 20 in a valley 30-40 feet deep; 29.370 on upland at town line, corner Sections 13 and 24, 18 and 19, a mile east of Hagensville Post Office = 810 feet  $\pm$ ; 29.350 on drumlin-like hill  $3/4$  mile = 825 feet  $\pm$ . A well here, 22 feet, is in gravel at bottom. Rock was struck at south end of this ridge at 50 feet, or about 775 feet A.T. The well at Hagensville store, W. H. Wilson's, is 31 feet and got water in gravel at bottom. Aneroid 29.440 at stream 1 mile north of Hagensville = 750 feet  $\pm$ ; 29.415 at Mr. Heslip's in Section 11 at 11:45 a.m. = 775 feet  $\pm$ . The well here is 50 feet to rock, making rock surface 725 feet. The well was continued to 90 feet. Water is 15 feet below surface. The topography is of a gentle swell and sag moraine type in this vicinity. Aneroid 29.450 at Mr. Heslip's at 1:00 p.m. = 775 feet  $\pm$ .

Aneroid 29.470 at base of bluff on line of Sections 35 and 36 at border of Lake Algonquin = 750 feet  $\pm$ ; 29.450 on a strong beach of limestone rubble and gravel in Section 26, southwest part. It stands 20 feet  $\pm$  above the tract south of it, and is as narrow as an esker. It swings around in Section 27 into Section 34, T.35N., R.5E., in a south-southwest course (see map). It seems to be 750 feet A.T., or possibly 770 feet. I go south on line of Sections 34 and 35, crossing a drift ridge that runs west a little into Section 34. I then come to a flat tract of thick drift covering Sections 3 and 4 and parts of border sections on south, but there is rock to the north in Sections 33 and 34 of T.35N., R.5E. This flat runs parallel with, and just north of, a rock escarpment that trends west-northwest - east-southeast and leads from Section 6, T.34N., R.5E., through Sections 5, 8, 9, 15, 14, 23 and 24, 25, and across Sections 30, 31 and 32, T.34N., R.6E. Aneroid 29.410 at base of escarpment on line of Sections 8 and 9 = 790 feet; 28.350 at top = 845 feet. There is scarcely

any drift on it. It has a sharp face trending about northwest-southeast. The highest points on the rock surface probably reach 850 feet A.T., or about the same as on the ridge northwest of Posen, line of Sections 5 and 32.

Aneroid 29.370 at Nagels Corners, corner Sections 15, 17, 20 and 21 = 825 feet. Rock here very near surface. Aneroid 29.410 at creek 2 miles north of South Rogers = 790 feet  $\pm$ . South of this for  $1\frac{1}{2}$  miles are low drift hummocks. Wells on them strike rock at 20-25 feet. Aneroid 29.415, 787 feet, at South Rogers in a sandy swamp that has its border  $\frac{1}{4}$  mile east and  $\frac{1}{2}$  mile north. It extends south a mile or more. Wells west of Metz  $\frac{1}{2}$ - $1\frac{1}{2}$  miles enter rock at 8-17 feet on the knolls that stand about that much above swamps. The knolls give the surface a morainic aspect, for they are sharp hummocks. Aneroid 29.390 at railroad in south part of Section 1, T.33N., R.5E.; 29.360 on drift ridge in Section 12. Three wells 16-25 feet do not reach rock. Aneroid 29.400 at Posen at 6:00 p.m. = 788 feet. I am told that rock is exposed around Lake Augusta in the southeast part of T.34N., R.6E. There are swamps alternating with low rock ridges north of the lake. The country is largely uninhabited from Lake Augusta east to Grand Lake. There seems to be very little drift in Presque Isle County east of the meridian of Posen.

October 17, 1902. 8:15 a.m.

Aneroid 29.470 at Posen, 788 feet. I take train west to Millersburg. Aneroid 29.455 at Noweski's,  $1\frac{1}{2}$  miles east of Metz; 29.450 at Metz; 29.490 in a swamp in Section 32, T.34N., R.5E. This extends almost to Laroque. There is a sharp, esker-like gravel ridge here, 50 feet  $\pm$  high, cut by the railroad. There is a gravel pit in it, south of track. Aneroid 29.465 at

Laroque. There are hills in view south of here 1-2 miles in Sections 1, 2, 11 and 12, but along the railroad the surface is nearly all plane and sandy to Sections 20 and 29. There, large sandy and gravelly knolls and ridges set in that cover much of Sections 18, 19, 20 and 29. One, near line of T.34N., Ranges 3 and 4 East, is cut into, and shows gravel and cobble horizontally bedded. It runs north 1/2 mile  $\pm$  and is sharp as an esker and 40-60 feet high. West from this, there is a swamp extending nearly to Millersburg. It has some low sandy ridges and knolls in it. Aneroid 29,500 at Millersburg at 9:00 a.m., 794 feet. There is limestone along the river north from this village for several miles, but I do not learn of its occurrence or outcropping farther south.

I take a road leading north through center of Section 10. It is on a gently undulating till tract with swells 10-20 feet high -- a stiff, clayey till (red). To the east is a swamp. The till is reported to continue north down the Ocqueoc River, but to the east, sandy knolls and ridges set in. I go east into them on the line of Sections 3 and 10, 2 and 11, and find a very light soil and few boulders from there to the Little Ocqueoc in Section 32, T.35N., R.4E. The aneroid read 29,390 on the highest points and 29,460 at Little Ocqueoc River (in Section 32). The knolls are 20-40 feet or more high, and show a tendency to run in chains from southeast to northwest. This region was timbered with pine of light grade. There is jack pine in part of it.

Upon crossing Little Ocqueoc River, I enter a moraine that has till and boulders interspersed with sandy knolls. Some of the ridges southeast of the road are 50 feet high, but there are only low swells in view to the northwest. Aneroid 29,380 on hill in northeast part Section 33; 29,410 in sag at corner Sections 27, 28, 33 and 34. There is a strongly morainic tract east from here to the township line, with a good soil -- clay loam.

This extends south into Sections 1 and 2, and covers Sections 34, 35 and 36. There is a strip of it leading north from Laroque to here.

Aneroid 29.310 at north side Section 26 where I stop for dinner at Edward Browning's. His well is 126 feet and water comes within 46 feet of top. It was in clay loam for 30 feet, then quicksand 80 feet, then a hard clayey material extending to the water. Fred Reiger, in north part of Section 26, on ground about same height, has a well 147 feet deep, that has a similar rise. Fred Sargeufrei's, in Section 23, NW $\frac{1}{4}$ , altitude 850 feet, was drilled to rock. It is 260 feet deep and is a little way into rock -- a shale rock. In Section 21, southwest part, Mr. Albert Repke made a well on high ground, 875 feet  $\pm$ , only 65 feet. William Bruder, across road, has one about 70 feet  $\pm$ , altitude 875 feet  $\pm$ . Albert Carson in Section 26, northeast part, has well 98 feet, 825 feet  $\pm$ . A well across road, in southeast corner Section 23, is about 88 feet. Water rises considerably in them. Aneroid 29.290 at Mr. Browning's at 1:00 p.m.

Aneroid 29.250 at town hall, at corner Sections 22, 23, 26 and 27. Points 80-120 rods southeast are 25 feet higher. Aneroid 29.400 at shore of Lake Algonquin, 1 $\frac{1}{2}$  miles north of town hall, near middle of line of Sections 14 and 15; 29.270 at corner Sections 14, 15, 22 and 23, at about the level of Fred Sargeufrei's well = 840-850 feet A.T.; 29.290 at corner Sections 15, 16, 21 and 22 in a swamp.

There is a ridged tract running southeast-northwest across the southwest part of Section 26, the northeast of 27, the central part of Section 22 and central part of 16, that stands 50-95 feet above a gently undulating till tract on its northeast border that extends to the bluff of Lake Algonquin. I come to ridge on line of Sections 16 and 21, aneroid 29.190 = 920 feet  $\pm$ . This commands a view of the knobs east of Black Lake

and of the country to the west and southwest far beyond the Ocqueoc River.

The moraine extends west from here about to the range line between Ranges 3 and 4 East, T.35N. I go west on it to corner of Sections 17, 18, 19 and 20 and am able to see the jack pine timber a mile or so to the west. Sections 6, 7, 18 and 19 have considerable till of clayey or loamy character and good to farm, only the west side being barren. It has a strongly morainic topography with knolls from 10 up to 75 feet or more in height. Boulders are rather numerous. The moraine runs out or drops below Lake Algonquin level in south part of Section 31, T.36N., R.4E., and west part of Sections 6 and 7, T.35N., R.4E., though boulders extend west into Sections 1 and 36, R.3E.

Aneroid 29.350 at edge of jack pine plain in northwest part of Section 6, T.35N., R.4E.; 29.380 at edge of swamp 1/2 mile west of the northwest end of the moraine in south part of Section 36, T.36N., R.3E. This swamp was probably under Lake Algonquin and perhaps the jack pine plain northeast of it was also. This seems soon to be made clearer by the occurrence of a well-defined narrow ridge of gravel and cobble north of the swamp on which the aneroid reads the same as at the base of the moraine -- 29.350. The road crosses it near a railroad grade utilized by a wagon road that runs north probably near corner Sections 25, 26, 35 and 36, though perhaps southeast of the corner, for the state road continues to bear north of west after crossing it, and by the map, that is its course only to these section corners. This old beach bears very little north of west, perhaps 5-10 degrees. The road, within 1/2 mile, comes to a plain below the series of Algonquin beaches. Aneroid 29.405, or about 50 feet below the highest Algonquin beach. The lowest of the Algonquin beaches is 20-25 feet (at top of ridge) above this altitude.

The land seems to be swampy north from here to the Lake Huron shore, but stands much above Lake Huron. The Land Survey plats indicate that there is a bluff 130 feet high, south of Hammond's Bay, in Sections 21, 22 and 23, which lies north of this swampy plain. I am told that the bluff is rather sandy. In less than 1/2 mile farther I come to a north-south road and here the state road runs west, so I suppose I am now at corners of Sections 25, 26, 35 and 36, and I crossed the Algonquin beach 3/4 mile east-southeast of here. It passes 1/4-1/3 mile south from this cross road. In places, small boulders abound along the foot of the Lowest Algonquin beach on edge of lake plain and, in places, also on the face of the beach toward the lake.

I soon rise on line of Sections 26 and 35 to the lower Algonquin, aneroid 29.370. The higher one runs west parallel with this line and 60-80 rods south of it. The upper Algonquin beach comes to the corner of Sections 28, 29, 32 and 33. Aneroid 29.340 (storm is brewing, so aneroid reads lower than this morning for same altitude). The beach here is composed of finer gravel than two miles east. Excavations in it in northwest part of Section 33 show sand, but south from here at brow of north bluff of Ocqueoc River, there is gravel several feet thick that belongs to the Algonquin beach. Under it is sand. Aneroid 29.400 at top of clay in north bluff of Ocqueoc River. It is a laminated, pebbleless silt of yellow color, so far as exposed (15-20 feet). It is evidently a lake deposit back of barrier beach. Aneroid 29.475 at Ocqueoc River. The gorge or river valley is 40-60 rods wide and has precipitous bluffs. About 1 1/2 miles south of the river, a fine sand sets in on south side of a small tributary near corner Sections 4, 5, 8 and 9, T.35N., R.3E. Aneroid 29.385 on the sand at quarter post Sections 8 and 9. A well here, in east part of Section 8, has

6 feet of sand and below this is in a stiff, red clay. The sand has a few stones scattered over and in it.

I continue on this lake bottom to corner of Sections 16, 17, 20 and 21. There is a bluff here, rising abruptly 40-50 feet. Aneroid 29.350 at base; 29.295 at top = 775 feet. This is composed of clayey till. Ocqueoc Post Office stands on the bluff here. I am told that the bluff runs northwest across Section 17 and crosses into Section 18 about 80 rods from north end of the section line. It runs out in Section 18, or becomes very obscure. It runs from Ocqueoc Post Office east-southeast to the river, through Sections 21 and 22, and is composed of till all the way to the river. The stream is in rock there, but the rock does not extend to the junction with Little Ocqueoc. There is a sandy plain east of the main Ocqueoc in Sections 23, 24, 25, 26 and 27, T.35N., R.3E. Farther south, there are knolls and ridges (as noted this morning) of sandy constitution, except a narrow strip on east side for a couple of miles north of Millersburg. I am told that rock is struck at slight depth in south part of line of Sections 20 and 21 and for two miles south from there. It also outcrops along the Ocqueoc River from opposite the post office up to the hemlock dam near Millersburg.

October 18, 1902. 7:00 a.m.

Aneroid 29.090 on ledge of limestone 1/2 mile south of Ocqueoc Post Office = 810 feet. It is coral limestone. The surface is rotten, so no striae are preserved. The rock is exposed also about 40 rods south of the post office at level of post office. Aneroid 29.130 = 775 feet. I find low swells of drift, 8-10 feet high, occur in both rock shelves.

I go west from the post office, and pass limestone ledges 1/2 mile west. The surface is ridged in a northwest-southeast direction with

drumlin forms, but the ridges may have a rock nucleus. I find the shore of Lake Algonquin runs northwest to the southeast part of Section 12 from Ocqueoc Post Office. It then runs west across the south part of Section 12 and swings around to the south, passing near the corner of Sections 11, 12, 13 and 14. It there is a gravelly ridge 10-15 feet above the swamp northwest of it. It runs into a sand plain in Section 14 that extends south across Section 23 on east side of Rainy River. Aneroid 29.180 on sand plain near middle of line of Sections 14 and 23 = 730 feet  $\pm$ . Rock is near surface in south part of Section 12, all of 13, and east part of Section 14. The east part of Section 24 and northeast of Section 25 are also rocky. All this rocky tract has hardwood timber. It is probable Lake Algonquin extended to the head of the sand plain in Sections 23 and 26. Aneroid 29.220, 680 feet, at Rainy River, line of Sections 15 and 22. It is in a narrow valley about 40 feet deep. Aneroid 29.100 on highest ridges of limestone west of river 1-2 miles.

Aneroid 29.160 at school house, 4 miles north of Onaway. There is limestone here, and for at least 4 miles west. It extends north to Black Lake and south to Onaway with very little drift covering. Aneroid 29.060 at Onaway Station at 10:15 a.m. There is a prominent hill in south part of Onaway, over 100 feet high, on which the reservoir of waterworks stands. It is a drift hill. I am told that there is an undulating hardwood tract east of Black Lake, southeast of the high gravel hills that I visited from Cheboygan, so the moraine may continue nearly to Ocqueoc River.

I drive east from Onaway across a tract with swamps and flat-topped ridges running north-northwest - south-southeast. I see no limestone outcropping, though it may occur at moderate depth. As it is still in timber, no data from wells are to be had. Aneroid 29.000 on highest ridges between

Onaway and Rainy River about a mile west of the river; 29.675 at a limestone outcrop on west bluff near base; 29.125 at Rainy River bed; 29.000 on summit about a mile east of Rainy River. There are large blocks of limestone west of here 20-30 rods, at nearly as high an altitude, but I am not certain that they are in situ.

Aneroid 29.060 at junction with north-south road leading to Ocqueoc; 28.970 on hill a mile south. Small boulders of Canadian rocks rather numerous here. Aneroid 29.000 at swamp 1/4 mile farther south; 29.030 on a limestone ridge south of the swamp at top of limestone = 825 feet  $\pm$ ; 29.010 at highest part of drift surface, near where the road turns east into Millersburg. A well just east of the town, on south side of road, has been down 27 feet without reaching rock. Rock outcrops on west side of Ocqueoc River where roads descend.

Aneroid 29.080 at river in Millersburg above the hemlock dam; 29.070 at station = 786 or 794 feet; 28.985 on crest of till ridge about 3/4 mile south of Millersburg. This ridge runs southeast as a till tract to the end of road on line of townships, south end of line of Sections 35 and 36. Beyond that, there is a sandier drift. Aneroid 29.060 at Millersburg Station at 3:30 p.m. = 786 or 794 feet.

I take train to Laroque. It cuts a sandy ridge two miles east of Millersburg at a high gravel ridge 3 miles. This high ridge is as sharp as an esker, and I am told that it runs southward to the Valentine Lake branch of D. & M. railroad. East of it are knolls 30-50 feet high for a mile. From there to Laroque there are only low sandy knolls and much swamp. Aneroid 29.025 at Buntins Station; 29.030 at Laroque, Hawks post office. I go north 1/2 mile along the sandy, gravelly, ridged belt, and find that it runs out about a mile north-northwest of Laroque. There is a swamp north

and east of it in Sections 24 and 25, T.34N., R.4E., and Sections 19, 30 and 31, T.34N., R.5E. There is also swampy land west of it with a very stiff clay. A well in it, 33 feet deep, just west of Wilson's Hotel, has not been walled or curbed and the clay does not cave in. The ridge runs from Laroque in a south-southeast course for two miles, crossing the line of Sections 31 and 6 at the quarter post and running to the southeast corner of Section 6. It runs out in a poplar swamp near there.

The gravel pit at Laroque shows great variations in coarseness, both horizontally and vertically. Part of it, in middle of the pit, is sand from top to bottom, while both north and south, there is cobble and gravel. The south end has coarse material from top to bottom, but the north end has a series of alternating fine and coarse beds. Mr. Wilson says that from the gravel pit southward for the two miles that the ridge runs, it is composed of coarse gravel and is a sharp esker. Its north part is bordered by knolls that are about as prominent as the esker and are of sandy gravel.

The ridge cut by the railroad 3 miles east of Millersburg is said to be 72 feet higher than the track. The knolls east of the ridge are 30-50 feet and seem clearly connected with it in origin. This chain of knolls and ridges may be a complex esker system, though it seems quite as probable that they are morainic. They seem to run into a moraine both at the north and south ends. Further study ought to be given these esker-like systems, so far as they are accessible. Mr. Wilson states that the rock is struck in one well, within 1/2 mile southwest of Laroque Station, at 14 feet, but others, on ground nearly as low, go 25-40 feet and do not reach rock. The railway well at Laroque struck a boiling spring at shallow depth. I take train to Alpena from Laroque. Aneroid 29.310 at Alpena Junction, 605 feet  $\pm$  at 7:10 p.m.

October 19, 1902. Alpena, Michigan

Taylor and I leveled up to the delta of Thunder Bay River connected with Lake Nipissing, and found it 35 feet above Lake Huron, or 615 feet A.T. It is a fine sandy gravel and there are perceivable water snail and small bivalve shells in it (see specimens). North of the poor house, there is a very stony, low knoll, with cobblestones and small boulders in a matrix of sandy loam. There is bedding that dips northward in north part of the knoll. It has been excavated to a depth of 15-20 feet.

October 20, 1902. 7:20 a.m.

Aneroid 29.610 at Alpena, 589 feet  $\pm$ ; 29.440 at Posen, 788 feet; 29.440 at Laroque, 815, 822 feet. There is a till knoll between the sandy ones east of Buntins Station. Aneroid 29.460 at Millersburg, 786 or 794 feet; 29.490 at Case, 767 or 775 feet. There is swamp south of railroad to within a mile of here. Knolls of till then appear in the swamp that rise 10-15 feet or more. Aneroid 29.490 at Rainy River, 779 feet. There is an undulating tract west from here with considerable swamp. Aneroid 29.430 at Onaway Station at 9:30 a.m., 821 feet or 829 feet; 29.420 at Chandler Hotel at 10:15 a.m. = 830-838 feet.

I drive west through an undulating tract for two miles that seems to be drift. The ridges run east-west and are 15-20 feet high. I then enter a very flat tract, aneroid 29.460; 29.480 1/2 mile farther west. There is a changeable soil on it -- sandy spots -- but much reddish clay. The sand becomes conspicuous to the west, and forms a belt on the east side of Black River 1/2 mile  $\pm$  wide. Aneroid 29.510 at Black River, at Tower, 11:10 a.m. Aneroid 29.515 at Black River at Tower at 12:10 = 725 feet  $\pm$ . This is on a low plain, 5-10 feet or so above the stream. There is a higher plain south

of Tower on which it reads 29.490 = 745 feet. This may be a delta of the highest Algonquin, and the low plain may stand for the lowest Algonquin.

Rock is struck in wells, from Tower west, on the hardwood tracts, at 5-15 feet. Mr. Mitchell's well strikes it at 15 feet; at a school house, north part of Section 8, at 12 feet. Aneroid 29.410 at Mitchell's, in north part of Section 7 = 815 feet; 29.490 at Milligan Creek, near range line on state road. There are prominent knolls on the west side of creek south of here, but not toward the north -- at least not near the creek.

I return to Mitchell's and take road north through Sections 6 and 31 through a gently undulating till tract for a mile or more, then across a swamp 40-50 rods (aneroid 29.490) and on through undulating till to the Milligan Creek in north part of Section 31. Aneroid 29.510 at stream. Rock outcrops here on north bank, 12-15 feet above the stream. There are only low swells north of here, but the hardwood timber and clay loam and sandy loam soil extend north into Section 19.

I return to Mitchell's. Aneroid 29.430 at 3:45 p.m.; 29.540 at Tower on low sandy plain; 29.520 at top of bank south of station; 29.510 1/2 mile southeast, on sand plain. From here to the south and east, the surface becomes undulating and, within 1/2 mile, morainic, with boulders and a sandy loam soil.

There are drumlin-shaped ridges in the bend of Black River near corner Sections 18, 19, 13 and 24 with a northwest-southeast trend. The river runs between two of them where it crosses from Presque Isle into Cheboygan County on line of Sections 18 and 13, that stand 30 feet  $\pm$  above the stream. They are composed of stiff, clayey till. The valley is only 20-30 rods wide between them. There is a flat swampy tract west of the one on southwest side of stream that is wider than the river valley, being 60



rods  $\pm$ . Aneroid 29.450 at Chandler Hotel in Onaway at 6:00 p.m. = 830  
feet A.T.  $\pm$ .

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