

Notebook No. 182 - Leverett

COUNTY

Alcona: 6, 14, 18

Alpena: 6, 7

Arenac: 19

Calhoun: 23-24

Cass: 24-29

Cheboygan: 2-5

Eaton: 22-23

Genesee: 19

Ingham: 22, 23

Jackson: 22

Iosco: 6, 9-11, 18, 19

Oakland: 19-20

Ogemaw: 11-12, 13

Oscoda: 12-18

Presque Isle: 1-2, 5-6, 7-9

Van Buren: 28, 29

Wayne: 20, 21

Michigan Elevations above Lake Michigan: 21-22

I N D E X

N O T E B O O K N O . 1 8 2

(October 21 to October 29, 1902)

- October 21. Drive south from Onaway to the sinks near Lake Francis, then west to Cornwall's mill.
- October 22. Sink near Cornwall's mill. Drive Cornwall's mill to Onaway. By rail, Onaway to Alpena.
- October 23. Alpena to East Tawas by rail. Altitudes on D. & M. railroad. East Tawas to Rose City by rail.
- October 24. Drive Rose City to McKinley and Fairview.
- October 25. Drive Fairview to Comins through north part of Oscoda County. By rail, Comins to Oscoda and Flint.
- October 26. By rail, Flint to Ann Arbor. Altitudes on M. & N.E. railroad.
- October 27. Ann Arbor to Lansing.
- October 28. Lansing to Dowagiac. Drive west from Dowagiac and back.
- October 29. Drive from Decatur south and west and back.

October 21, 1902. 6:00 a.m.

Donated by _____

Onaway, Michigan. Aneroid 29,580 at Chandler Hotel, 10 feet \pm above railroad station, or about 830 feet; 29,600 at 7:20 a.m. I drive south across an undulating till tract standing 50-75 feet \pm above the station, or nearly 900 feet. W. P. Davis, northwest corner Section 29, has a well 96 feet that does not strike rock. It was largely a gray hard material. Water in gravel at bottom. S. M. Nickerson, in south part of Section 20, has one 114 feet that did not strike rock. Water in sand at bottom. Altitude of wells about 900 feet.

Lake Francis is 19 feet higher than Crooked Lake by hand level. The ridge between is only 20-25 rods. Aneroid 29,710 at bottom of deep sink hole east of Lake Francis = 725 feet \pm . The aneroid reads 29,610 on a rim between this sink and one east of it, but by hand level it is only 80 feet. The one east is only separated by a narrow rim 20 rods or less at base, and about 4-5 rods at level of steep parts. Aneroid 29,540 at level of tableland south of the sink holes. This 27 sights or $27 \times 5\frac{2}{3}$ feet from bottom = $18 + 135 = 153$, or about 875 feet A.T.

Lake Francis is only 30 rods from west side of this sink hole and its level is more than 100 feet above the bottom of the sink hole. There are 5 of these deep sink holes in a chain leading west-southwest - east-northeast in a distance of scarcely $\frac{1}{2}$ mile. Beyond there, toward Rainy Lake, is a depression with shallow sinks. Rainy Lake has some underground discharge, for it receives more water than runs out of it, and in dry seasons, the underground outlet draws it down to a small pond, so I was told by Mr. Chandler of Onaway.

Aneroid 29,510, 900 feet A.T. on upland east of Mr. Severance's, in Section 18 -- a till tract; 29,550 at Mr. Severance's at noon; 29,570 at 1:00 p.m. = 865 feet \pm . I take road south-southeast up east side of Canada

Creek, past the large boulder in Section 17. It is about 7 x 12 feet, and stands 5-6 feet above the ground. Aneroid 29.510 on boulder on a nearly plane tract thickly set, in places, with boulders. The soil is sandy, but there is a till subsoil. It is timbered with jack pine. I soon descend to the low plain on Canada Creek, aneroid 29.580; 29.590 at creek near line Sections 27 and 32. I go westward past an old camp in Section 30, and after crossing a swampy tract, rise to a high plain timbered with jack pine and some other kinds of pine. Aneroid 29.460 on plain, probably in Section 25, T.33N., R.1E. There is considerable undulation in the jack pine.

West from here, the road winds to avoid knolls. There are boulders and, in some places, some till occurs. It is similar to the tract east of Canada Creek. A hardwood timber tract comes to within about a mile of this road (see map). Aneroid 29.500 at Black River about 2 miles north of county line at 3:15 p.m. There is a sandy tract for about a mile west of the river here, with a few knolls, but farther west is till and hardwood timber. Aneroid 29.310 on summit $1\frac{1}{2}$ miles west of McNaughton's; 29.340 at railroad at end of tract in Section 33 (?); 29.280 on bluff east of Cornwall's mill; 29.350 at Cornwall's mill. There is a neck of jack pine timber running north into Section 34, east of this mill. (The mill is at center of Section 34). From the mill westward, the border between hardwood and pine runs through Sections 4, 5 and 6, being north of west, and swings north in Section 36, as indicated on the map. There is considerable undulation in the pine southwest from here and south, and boulders are fully as numerous on it as on the hardwood tract northeast of the mill.

October 22, 1902. 6:00 a.m.

Aneroid 29.100 at Cornwall's mill. Sink holes near Cornwall's mill: There is a sink hole with lake in it about 80 rods west of Cornwall's mill on south side of railroad on the high plain. Aneroid 29.020 at rim. The banks are very steep and 30-40 feet high above water. The water is deep. Water surface 800 feet \pm . I am told of another a mile west in Section 5. Aneroid 29.060 at Cornwall's mill at 7:00 a.m. = 800 feet \pm .

Aneroid 28.980 on high plain east of river = 880 feet. This plain is as I mapped it from Mr. Gaston's account. The moraine that passes north of Cornwall's mill runs through the north and east parts of this township and is separated by a plain about two miles wide from the moraine outside of it. Aneroid 29.040 at camp near corner Sections 14, 15, 22 and 23 = 820 feet \pm .

Aneroid 28.950 on high upland at corner Sections 9, 10, 15 and 16 = 900 feet \pm ; 28.990 1/2 mile north; 29.000 at line of Sections 4 and 9 near east end, on plane tract of till; 29.050 near corner of Sections 4, 5, 8 and 9, at edge of a sand plain; 29.125 at Pigeon River on line of Sections 5 and 8. The sand plain rises abruptly 60-70 feet above the river on east side. West, there is a low plain to a southwest tributary, but west of that tributary is a rolling tract of sandy land on which the aneroid reads 29.010-29.050. It is the tract that Mr. Richards of Wolverine marked as plain, and is timbered with jack pine and very barren, but it is as undulating as the hardwood tract that lies northeast of it. There are very few boulders on it. In this respect, it differs from the more level tract of barrenness east of river which is rather bouldery.

I come to the hardwood near east end of line of Sections 26 and 35, on a trail running east to connect with north-south road between Sections 25 and 26, T.34N., R.2W. Aneroid 28.970 on crest of moraine on the hardwood near corner Sections 23, 24, 25 and 26. The sandy tract west of the

moraine becomes rather level in Sections 22 and 23 and north part of Section 26. The moraine in Sections 23, 24, 25 and 26 is strewn with boulders, especially in its clayey parts. There are sandy places in it.

Aneroid 29.040 at corner Sections 13, 14, 23 and 24, on the moraine. Limestone outcrops at a level 15-20 feet lower, on south side of a ravine 40 rods north of corners, and on north side of ravine it outcrops clear to the top of ridge. Aneroid 29.050 at top = 800 feet \pm . This is the ridge on which the school house in Section 14 stands which, as noted in the drive from Indian River a few days ago, is about 800 feet A.T.

Aneroid 29.100 where road leaves the hardwood and enters a sandy, stony tract in Section 2, about 1/2 mile south of the east-west state road; 29.140 at west bluff of Pigeon River at township line on state road; 29.200 at river at 11:10 a.m. = 690 feet; 28.980 on crest near middle of line of Sections 5 and 32 = 890 feet; 29.030 in ravine, 845 feet; 28.980 on hill, 120 rods east of section corners 4, 5, 32 and 33 = 915 feet. This is capped by several feet of sandy gravel. The till is rather sandy all through this hardwood.

Aneroid 29.050 at Stony brook = 825 feet near corner Sections 3 and 4, 33 and 34. There is a flat here 1/2 mile wide, at the east edge of which is a sharp gravel ridge running north-south that seems likely to be an esker, but as this is all heavily timbered with hardwood, I cannot see but 60-80 rods of it. It is 30-40 feet high. The road crosses the south slope of a prominent knoll that contains sand and sandy gravel so far as exposed. It is fully 60 feet above a flat tract east of it; aneroid 29.090 on flat east of it = 790 feet \pm . There is a sharp gravel ridge of esker type, 6-75 feet high, running southward or slightly east of south from Section 35 nearly across Section 2. The state road runs southward on its west side. It terminates in a swamp and has a swampy tract each side of it. Perhaps

it continued farther, but the timber is so thick I cannot see it. I can see south 1/2 mile, or more, on a road between Sections 11 and 12 and at that distance, some higher land is visible on west side of the road.

There is another sharp, esker-like gravel ridge crossed by the state road in Section 1, near center of SW $\frac{1}{4}$, that is 30 feet \pm high. From there east to Milligan Creek, sharp gravelly and sandy knolls occur south of the state road, but I see none north. Aneroid 29.125 at Milligan Creek at 1:00 p.m. = 745 feet; 29.050 at corner Sections 5, 6, 7 and 8 = 815 feet where a road leads south. This is about the highest part between Milligan Creek and Black River on this road, and has rock at slight depth.

Aneroid 29.140 at marsh 1 mile west of Tower, at a stream flowing north. It is about 8 feet lower than a sand plain east of it. Aneroid 29.140 on low plain bordering Black River at Tower, thought to be bed of Lake Algonquin, = 717 feet. This is 6-8 feet above river above dam. Aneroid 29.120 at east edge of sand plain, about a mile east of Black River = 735 feet. East from here for 1/2 mile, there is a clay flat with patches of sand. About 1-1/8 miles west of county line, the road rises 15-20 feet to a higher flat. Aneroid 29.080. This also has patches of sand in it. The surface becomes uneven about 1/2 mile west of county line. The great number of limestone blocks on the surface suggests outcrops at slight depth. Aneroid 29.060 at county line; 29.040 at Onaway Station, 821 or 829 feet A.T. I am told by Mr. Chandler that the hill on which the waterworks reservoir stands is 115 feet above the railroad station, or 936 feet A.T.

I take train east at 3:00 p.m. Aneroid 29.050 at Onaway; 29.090 in swamp about 2 $\frac{1}{2}$ miles east. There are till knolls, with a red clay, cut into between here and Case. I was told by Mr. Chandler of Onaway that all of T.34N., R.2E., has till except occasional small sandy spots and the swamps in it are not extensive. Parts of those shown in the Land Survey charts are

high enough to be drained easily when the timber is removed and ditches made. The barren or pine tracts cover much of T.33N., Ranges 2, 3 and 4 East.

Aneroid 29.100 at Case Station; 29.070 at Laroque = 822 feet. There is till for about 3 miles west of Laroque on the flat tracts and on some of the knolls, but the majority of the knolls along the railroad are sandy. Aneroid 29.150 at Posen at 5:50 p.m.; 29.190 at Polaski; 29.220 at Bolton = 730 feet \pm ; 29.350 at Alpena Junction at 6:50 p.m. = 605 feet \pm .

October 23, 1902. 6:30 a.m.

Aneroid 29.630 at Alpena Junction, 605 feet \pm ; 29.640 at Ossineke. Just south of here, after crossing the creek (Devil's Creek), the railroad runs for 1/2 mile or more along the base of a cut bank 10-15 feet high. Aneroid 29.635 at base; 29.620-29.625 at top. The bank is a sandy gravel with small pebbles. Boulders appear in a swampy tract near the county line for a short space, 80 rods \pm . They are the only ones I have noted since leaving Alpena. I pass a very large boulder 6 or 8 feet in diameter, on west side of track, 2 miles or more north of Black River.

Aneroid 29.650 at Black River. About $1\frac{1}{2}$ -2 miles from Black River Station the railroad rises above the Nipissing beach and soon passes a very bouldery strip 1/4 mile or so across. Aneroid 29.650 at Alcona. This is below the Nipissing beach, that beach being but 40-80 rods from the shore in this vicinity. But the railroad soon rises above the beach and at Sturgeon Point is 34 feet above Lake Huron. Very stony near Harrisville. Aneroid 29.615 at Harrisville Station; 29.590 where the moraine comes to shore of Lake Huron, north of Greenbush 2 miles; 29.600 on Algonquin beach at Greenbush Station. The moraine sets in about 20 rods west of the station; 29.630 at Lincoln Junc. From here to E.Tawas, see notes taken in 1901; 29.640 at E.Tawas Station.

Altitudes on the D. & M. railroad from Alpena to Onaway. (51 chains from Alpena Station = 1180 from Black River.)

<u>Distance from</u> <u>Black River</u>		<u>Lake</u> <u>Huron</u>	<u>A.T.</u>
	Alpena	9	589
	Alpena Junction	22	602
51 ch.)			
1180)	Head block - Alpena and north	26	606
1124	North-south road	47	627
1324	East-west road	78	658
1329	North-south road	81	661
1343	Sag	76	652
1383	Steady upgrade to north-south road	113	693
1398	Base of beach on south side	115	695
1398	Base of beach on south track	119	699
1402	East-west road on ridge (track)	123	703
1402	East-west road on beach ridge	132	712
1423	Summit	128	708

(Very low grades track between 120 and 130 from 1423 to 1512)

1513	Cut in ridge (Algonquin beach) not surface	133	713
1516	Sag back of ridge; not surface	128	708

(Very low grades, mainly rising, but with slight descent in places to:-

1613	Summit just east of Cathro	146	726
1616	Cathro Station	144	724
1642.5	Crest of ridge (Algonquin beach 736 and 713) not surface	156	736
1642.5	Crest of ridge on track	151.5	731.5
1659	In sag	131	711

(Continues at 130-132 to 1678)

1683	East-west road, not surface	147	727
1683	East-west road, track	144	724
1710	Crest of ridge (Algonquin beach 733) not surface	153	733
1710	Crest of ridge, track	150	730
1741	Bolton Station	150	730

(Continues 150-153 to 1778, then a descent)

1797	Sag	138	718
1800	Rock cut, not surface	144	724
1813	Sag, not surface	130	710

(Very flat from 1830 to 1890 at 142-143)

1898	Crest of ridge, not surface (Algonquin beach)	153	733
1910	Crawford's old camp	140	720
1998	Polaski Station	168	748
2020	Low ground, not surface	148	728

Distance from <u>Black River</u>		Lake <u>Huron</u>	<u>A.T.</u>
2070	Ridge (Algonquin beach 765?), not surface	185	765
2075	East-west road, not surface	170	750
2075	East-west road, track	174	754
2145	Posen Station	208	788
2163	Summit	219	799
2175	Base of ridge	204	784

(Several shallow cuts and mainly an upgrade from 2190-2320)

2260	North-south road and siding	227	807
2320	Summit, not surface	233	813
2345	Norvitski	224	804
2373	North-south road	204	784
2413	Summit and switch	238	818
2428	North-south road, west end of switch (Metz Station)	234	814
2485	South Rogers in swamp	207	787
2525	Ridge, not surface	230	810
2533	Base of ridge	215	795
2566	Ridge, not surface	231	811

(2572-2632 - nearly plane at 218-225)

2654	Summit east of Laroque	248	828
2659	Laroque	242	822

(On profile Laroque to Onaway, Laroque is 234 instead of 242)

Chains

0	Laroque	234=242	822
10	Low ground	227	815

(10-98, nearly all level)

98	Sag on track	222	
	Not surface	218	
154	Summit (Buntins)	250	838

(Sandy knolls set in at 238. There is a general downgrade from 154 to 304)

304	Base of sharp, esker-like ridge	222	810
308	Top of esker-like ridge, not surface	281	869
312	West base of ridge, not surface	211	799
341	Low ridge crest, not surface	225	
465	Millersburg Station	206	784, 786
480-82	Ocqueoc River, water level	196	784
	Ocqueoc River, bridge	204	792

(Cuts through occasional small knolls west of here to Rainy River. No points exceed 215 feet, and the highest one crossed is at first cut west of Ocqueoc River. The knolls are about 200 feet and sags less.)

<u>Chains</u>		<u>Lake</u>	<u>A.T.</u>
731-35	Rainy River, water surface	175	763
731-35	Rainy River, bridge	198-99	
747	Low ground, track	193	

Additional from another profile:

562	Austin Station	197	785
647	Case Station, not surface	187	775
662	East Branch Rainy River, bridge	180	
731-35	West Branch Rainy River	198-99	
820-30	Level	223.5	
842-43	Stony Creek, bridge	225	
	Stony Creek, water	217	
884	State road	245	825,833
930	Summit, not surface	253	
940	End of profile	241	821,829

Another profile starting at Black River gave the place an altitude of 131-37 above datum in north part of Tower. The highest point northwest from there is 177 feet, but some ridges cut by the railroad are a few feet higher. They are at 1450-1500 chains from Black River. There is a flat tract at 175-177 feet.

East Tawas, Michigan. 1:15 p.m., 588 feet A.T. I take train to Rose City. The railway enters a bouldery till tract with slightly wavy surface about $1\frac{1}{2}$ miles southwest of Tawas City that extends to Marko siding. Aneroid 29,500 at Marko = 643 feet. There are sandy ridges just west of this station 10-15 feet high. Farther west, there is a sandy, swampy tract with rather level surface. It was timbered with pine that had trees 2 feet in diameter. Water is within 2-5 feet of the surface over much of it. There may be clay to hold it from sinking down.

Aneroid 29,480 at McIvor Station and post office = 663 feet A.T.;
 29,470 at Emery Junction = 671 feet. A well at the hotel here has 4 feet of sand, below which is a blue gray clay extending to rock at 48 feet. The clay comes to the surface in spots west of here, this side of Au Gres River.

A boring at Whittemore mine for coal reached a depth of 214 feet. It entered rock at about 60 feet, or about 717 feet A.T. There are flowing wells 1-2 miles south of Whittemore. One, a mile south, at George Coyle's, is 48 feet. Aneroid 29,440 at Emery Junction at 3:00 p.m. where it read

29.470 45 minutes ago = 671 feet. The railway is on a clay plain for 2 miles northwest from Emery Junction. It then enters a tract of sandy gravel with gently undulating surface. The altitude is 710-720 at north border of the clay. The sandy ridges extend to where altitude is 760 feet (barometric). Above this, a bouldery till appears with gently undulating to flat surface. It sets in about the north part of Section 30 at 775 feet \pm .

Aneroid 29.300 = 790 feet at corner Sections 24, 25, 19 and 30, on a gently undulating till tract. This continues to Taft Station. Aneroid 29.280 = 810 feet \pm . This station is in a cut 8-10 feet deep in a clayey till. The swells are 5-15 feet high. Small boulders abound on this Tract. It is under cultivation from Sections 25 and 30 to Sections 11 and 12 (at Taft). Farther north, it is not farmed, but has stumps and brush. It was timbered with pine, yet there appears to be more clay soil in it than sand. It will probably be a good farming district. I am told that this township (T.22N., R.5E.) is all good for farming except the southeast corner where the railroad crossed is sandy. The altitude soon reaches 850 feet and holds this altitude to Hale Lake. Aneroid 29.240, 843 (barometric) at Hale Lake Station. This is on the gently undulating till, and there are farms for a mile or more south from this station.

There is a gently undulating till tract nearly to Loon Lake, but this lake is surrounded by morainic knolls that stand 40-75 feet above it. Aneroid 29.160 at west end of Loon Lake, 50 feet \pm above it. Aneroid 29.160 at south side of Long Lake, 15-20 feet above it; 29.170 at marsh along west part of Long Lake. There is some sandy gravel at Long Lake Station and I am told that from here east and north there is more sand and gravel than till. There is a till ridge north of the lake along south side of the South Branch of AuSable River. A plain of sandy gravel sets in north of this stream.

Aneroid 29.140, 935 (barometric) at South Branch Station. There is a rising slope north from here, and till sets in within a mile north and west from here. This is on line of Sections 13 and 24 within 80 rods west of the county line. There is a descent south of the station of about 25 feet in .8 of a mile to the water tank, the tank being about 910 and South Branch about 935 feet by aneroid.

Maltby is 920 by aneroid. For two miles east-northeast from this station, the moraine is close to the railroad. It has till here and many boulders. The high knolls to the north 1/2 mile to a mile are a mixture of drift, both till and assorted material. Aneroid 29.140 at Lupton = 935 feet \pm . For about 1 1/2 miles east of Lupton, the high hills are back nearly a mile north of the railroad, but farther east to Maltby, they are close by the railroad. For notes on moraines and sand plains south of Lupton, see last year's notebooks. Aneroid 29.120 at Rose City = 955 feet \pm . Last year's notes made it 975 feet. W. M. Gregory makes it 920 feet in Water Supply Paper 183, p. 289.

Mr. E. Atherton made a well for Isaac Lupton, 1 1/2 miles north of the village of Lupton, 125 feet. It is on a high ridge. Water rises 20 feet. It had 10 feet of till at top, but the rest was sand. In Lupton, good wells are obtained at about 40-50 feet. They have about 20 feet of water. They are mainly in sand and gravel. In Rose City and also in West Branch, there is a great body of blue clay, soft enough to bore easily. The deep well at the Leadway mill in Rose City, 241 feet, was mainly blue clay to the rock at about 232 feet. It is on ground fully as low as the depot, or 955 feet \pm .

Mr. Atherton made a boring, 180 feet, north of Maltby about 3 miles, at a sawmill. It was mainly sand and gravel. It was abandoned without reaching water. A well east of Rifle Lake, for Monaghan and Ward, was sunk 60 feet

through blue till. It is on an undulating till tract. Mr. James Campbell at Campbell's Corners, has a well 130 feet. It has only 20 feet of water. It was nearly all sand after passing through a few feet of till. This well blows quite a little, so it will lift a paper. Another flowing well was made in southeast part of Section 25, T.24N., R.2E., for Mr. Orin Graham. It was 100 feet. It had clay 40 feet and then sand below that had air rising from it. The water rises about 40 feet in the well. Emerson Ennis, about $1\frac{1}{2}$ miles eastward from Comins, has a well 180 feet. It is on high land. It has only a few feet of water. It has clay at surface 13 feet, then sand to 160 feet. Below this, was a thin bed of clay overlaying the water-bearing sand.

October 24, 1902. 6:30 a.m.

Aneroid 28.780 at Rose City Station = 920 feet (Gregory); 28.530 $1\frac{1}{2}$ miles west at corner Sections 1, 2, 35 and 36 on a till tract. This runs west a mile, 1175. Aneroid 28.540 at corner Sections 25, 26, 35 and 36. There is a loamy soil in places, but generally there is clay. On the line of Sections 25 and 26, some little knolls of gravelly sand cap the large till ridges. Boulders are numerous. Aneroid 28.435, 1260, at corner of Sections 23, 24, 25 and 26; 28.390 on crest about 120 rods west of corners = 1300.

A sand plain sets in near the corner of Sections 22, 23, 26 and 27, and extends north over the west part of 23 and 14 and east part of Sections 22 and 15. Aneroid 28.470 on the plain near middle of line of Sections 22 and 23 = 1225 feet; 28.460 $1/2$ mile east of center of township on the plain. A hill 120 rods south-southwest in Section 22 is fully 200 feet higher, or about 1425 feet. I ascend one on line of Sections 9 and 10. Aneroid 28.270 = 1420 feet \pm ; 28.490 at Mr. Woodrow's on east side of

Section 4 on sand plain = 1210 feet \pm . From the gravel hill on line of Sections 9 and 10, I could see an uneven surfaced tract to the west and southwest as far as Sections 17 and 18, T.27N., R.2E., and Sections 12 and 1, T.27N., R.1E. North of this is a flat tract of sandy land, about 1200 feet A.T. This connects at the north with the "valley" that I noted a few weeks ago in T.25N., R.2E. East of this valley is a low moraine on which the aneroid reads 29.410-450. Near the county line, in Section 34, T.25N., R.2E., Mr. Abbott has a farm with considerable till, and there is till to the south, in east part of Section 3, T.24N., R.2E. Basins are numerous, and some of them contain water. Boulders are not rare. The swells are low and have gradual slopes.

I take a road northeast across Sections 26 and 24, and come to the inner or northeast border of the moraine near center of Section 24. I go east between Sections 18 and 19, 17 and 20, 16 and 21, through a plain timbered with jack pine on which the aneroid reads 28.450 much of the time. It has basins and a few low swells. Usually it is sandy and gravelly, but in places, it has small boulders. Aneroid 28.520 = 1175 feet at Long Lake; 28.485 on plain southeast of lake on line of Sections 11 and 19; 28.460 on plain near line of T.25N., Ranges 3 and 4 East, corner of Sections 12, 13, 7 and 18. There is a very high range of hills south-southeast of here near the county line. They seem to be 150-200 feet above this plain. They lie in Sections 30 and 31.

Aneroid 28.450 at 11:10 a.m. at place where we stop for dinner in Section 18, T.25N., R.4E., at Mr. Gillespie's; 28.450 at 12:10 noon, same place. Boulders and cobble abound in Sections 18 and 17. The well here is about 80 feet and largely gravel and sand. I go north across east part of Section 7 and find it has till and boulders. Its surface is flat and swampy.

In Section 8 there are swells 10-25 feet high and basins. The swells, in some cases, have sandy soil but others are composed of till. The altitude is 10-25 feet above the edge of the plain. Aneroid 28,425-440. This till tract is narrow, for in less than a mile, I leave it and enter a pitted plain with sandy gravel soil timbered with jack pine and scrub oak. Aneroid 28,420-430 on the plain = 1275 feet \pm . This changes, in a mile or so northeast, to an undulating tract of sandy gravel with an occasional small boulder. Aneroid 28,420 on the highest points. The moraine from here to the AuSable south of McKinley is nearly all sandy gravel with few boulders. A small tract of bouldery clay loam a mile south of McKinly is cultivated. Aneroid 28,730 on sand plain bordering AuSable River south of McKinley = 1000 feet \pm ; 28,880, 875 feet \pm , at AuSable River at McKinley at 1:30 p.m. The station is 25 feet or more above the river and probably 900 feet A.T. There is an extensive sand plain 100 feet \pm above the river (AuSable)back of McKinley. It appears on the south side as a narrow strip 1/2-1 mile wide. There are very prominent hills south of it extending east into the edge of Alcona County and west past Mio.

Aneroid 28,900 at AuSable River 6 miles above McKinley at 2:40 p.m.; 28,750 on high sand plain north of river; 28,730 at base of moraine near town line; 28,650 on hill 1/2 mile north near middle of line of Sections 35 and 36. This range runs west-northwest - east-southeast from Section 27 to Section 6 and was timbered with pine. It contains till and there is a gently undulating narrow strip of lowland north of it.

Aneroid 28,570 at middle of line Sections 23 and 24. David Watson's well, in west part of Section 24, is 93 feet deep and is mainly sand. George St. Peter's well, 80 rods east, is 78 feet deep. The water in each well is scarcely 10 feet. William Durkee, in southwest corner of Section 13, has one about 70 feet. There is one in northeast part of Section 23

nearly 100 feet. The drift is sandy and gravelly at top of hills in Sections 23 and 24, but in Sections 13 and 14, 11 and 12, there is a loamy soil, and boulders are rather numerous. The surface is gently undulating in Sections 11, 12, 13 and 14 and north half of Sections 23 and 24, but very hilly farther south.

Aneroid 28.600 at O. D. Albertson's, in southeast part of Section 11, where I stop for the night, at 5:30 p.m. This may be 1200 feet or more, as the barometer is becoming higher this afternoon, as indicated by the readings at McKinley and at bridge 6 miles above McKinley. Alex E. Scott, in west part of Section 2, has a well 214 feet -- gravelly clay, 14 feet; mainly sand to bottom. R. S. Madden, in southeast of Section 34, T.28N., R.3E., has one 203 feet. Both these were dug and were similar in structure.

October 25, 1902. 7:00 a.m.

Aneroid 29.000 at town hall in Comins Township, corner Sections 11 and 12, 13 and 14, = 1225 feet \pm A.T.; 28,960 at summit on road 1/2 mile west, 1260 feet. West from here, on the border of a small lake, there is gravelly sandy land, but the west part of Sections 10 and 15 has a clayey soil. Aneroid 29.100 at corner Sections 9, 10, 15 and 16 = 1135 feet. The surface is nearly plane in Section 16 and a stiff clayey till. In Section 15 there is an undulating tract with sandy knolls in west part. Aneroid 29.130 at corner Sections 15, 16, 21 and 22 on clay plain = 1110 feet. I am told that the east part of Section 15 is sandy land.

I return north to corner Sections 9, 10, 15 and 16, aneroid 29.100. I then go west through a clay tract for a mile or more. A sand plain is then entered. Aneroid 29.115. This extends but little south into Section 17, but covers Section 8. There is a flat sand plain running northwest across

the northeast part of Section 7 and west part of Section 8 into Section 6. West of it, in Sections 7 and 18, is a higher tract of sandy land. Aneroid 29.030 on it at corner Sections 7, 8, 17 and 18. There are deep basins in east part and knolls in west part of these sections. A small lake occupies a basin in Section 18. This high tract has hardwood timber.

Aneroid 28.940 on hill near west end of line Sections 7 and 18; 29.000 in low place on town line at corner Sections 7, 18, 12 and 13; 28.730 on highest point on the knob in Section 12. This is probably the highest point in Oscoda County. This hill is about 1475 feet A.T. Aneroid 29.060 at edge of sand plain near corner of Sections 1 and 12, 6 and 7, = 1175 feet. There is a flat tract here 1/2 mile wide, thickly strewn with cobble. It looks like the scourway of a channel. It runs northwest-southeast. On its northeast border is a steep bluff about 50 feet high. There is a pitted gravel plain on this higher tract with basins 20-40 feet or more in depth. Aneroid 28.980 at general level of pitted plain on this line of Sections 31 and 36 = 1250 feet A.T. \pm . There is pine here, but in the east part of Section 31 there is hardwood, that being the northeast border of the pitted plain.

Cobblestones and boulderets are very numerous in Sections 19 and 24 and north part of Sections 25 and 30. There are a few knolls in these sections and deep basins among them. The border next to the hardwood is very uneven surfaced. Aneroid 28.950 at edge of the till and hardwood on range line in north part of Sections 19 and 24 = 1275 feet \pm ; 28.870 on line of Sections 12 and 13 near east end on highest hill in this range, 1350 feet \pm . This overlooks a valley-like lowland that leads from the head of Hunts Creek east-southeast past Comins, but does not extend farther west than Hunts Creek. Aneroid 29.180 in this valley on line of Sections 8 and 17, T.28N., R.3E. It has an uneven surface, = 1070 feet \pm . Aneroid 29.215

at swamp by an old camp in Section 17, 1030 feet \pm . This is about as low as any place in the valley. Aneroid 29,190 at Comins at 11:30 = 1080 feet \pm . The valley west from Comins is more uneven than east, there being a sand plain with jack pine timber to the east and southeast from here. The valley to the west is very stony. North of it is a very hilly tract with more or less hardwood timber.

Water is struck at Comins at about 20-25 feet in the wells. There is a gap in the range of hills north of Comins through which Gilchrist Creek has a passage. It is not a flat tract, however, but has knolls that border the creek closely on each side. Aneroid 29,200, 1060 feet \pm at Comins at 12:30. I take train for AuSable. About a mile southeast of Comins, knolls appear on the east side of the railroad in west part of Section 25 and east part of Section 26. They rise only 25-40 feet above the plain that borders them on the north.

I am told by a man on the train that there is a tract of land with mixed soil, spots of clay with the sand and gravel, running east along the east flowing part of the Upper South Branch of Thunder Bay River, in south part of T.28N., R.4E. It has some knolls in it. Both north and south from this tract is a sand plain with but little undulation. It stands about as high as at Comins.

Aneroid 29,200 at junction with the Cutting Branch, near corner Sections 16, 17, 20 and 21 on the sand plain. There are sharp knolls southeast from here on the east side of the railroad in Sections 21 and 28. The hardwood has its border 1/2 mile or more southwest of this junction in southwest part of Section 17 and northwest part of Section 20. There were points about midway between Comins and this junction where aneroid read 29,240.

About 3/4 mile southeast of the junction, opposite the north end of the

high range of hills, aneroid 29.180. The high land has a level top and stands 125-150 feet above the railroad. There is a strip 1/4-1/2 mile wide of nearly level land between this range and the moraine west of the railroad. The range east of the track is high and continuous for nearly 2 miles. The hills on the west are of irregular height. The highest are fully 200 feet above the railroad. Aneroid 29.290 at edge of jack pine plains in Section 3, T.26N., R.4E. The hills west of the railroad extend only to Section 33, and the range east to about the north edge of Section 34. They rise boldly 150 feet \pm above the plain south of them.

Aneroid 29.300 at Twin Lakes or McKinley Junction at 2:15 p.m. on sand plain. The high range of hills northeast of this plain is $2\frac{1}{2}$ -3 miles distant and barely enters Oscoda County in T.27N., R.4E. Aneroid 29.330 on sand plain where the descent begins into the AuSable valley about the corner of Sections 16, 17, 20 and 21, T.26N., R.5E. There are large boulders in the ravine down which the railroad passes, but there is a thick deposit of gravelly sand on the slope above.

Aneroid 29.440 at Flat Rock Station on a terrace of AuSable River, 100 feet \pm below the sand plain. Aneroid 29.440 at Bamfield; 29.370 at west end of plain where a change of track was made last year. (See notes as to altitudes from there eastward to Bryant). Aneroid 29.280 on upland tract about a mile west of Vaughn; 29.260 at Vaughn = 1000 feet \pm ; 29.390 at place where railroad leaves wagon road near Lott Post Office and near corner Sections 21, 22, 27 and 28, T.25N., R.6E.; 29.440 where sandy land begins, northwest of Bryant, in Section 35; 29.450 at water tank by Bryant = 835 feet \pm . This level is maintained for two miles or more southeast from Bryant.

Aneroid 29.470 at brow of AuSable bluff in Section 10, T.24N., R.7E.,

= 815 feet \pm . The railroad soon drops to a terrace, aneroid 29.515; 29.530 at Bissonette on edge of a creek, 10 feet \pm below level of the river terrace; 29.550 at Doan Station = 740 feet; 29.585 at brow of "Seven Mile Hill" in Section 23, T.24N., R.8E., = 720 feet \pm ; 29.670 at foot of hill in southeast part of Section 23 = 635 feet \pm ; 29.705 on AuSable River bridge 2 miles northwest of AuSable village = 590-595 feet; 29.700 = 600 feet \pm at crossing of D. & M. railroad at 4:30 p.m.; 29.700 at D. & M. station, 6:00 p.m. I take train south. Aneroid 29.710 at East Tawas = 588 feet A.T.; 29.600 at Emery Junction; 29.620 at Turner; 29.625 at Twining = 638 feet; 29.650 at Omer = 611 feet; 29.650 at Bay City at about 600 feet A.T.

October 26, 1902. 5:00 a.m.

Aneroid 29.260 at Flint = 709 feet; 29.180 at north edge of moraine where sharp knolls set in. There seems to be a strip of them near the creek. Height of knolls, 15-30 feet. Aneroid 29.130 at Grand Blanc, 840, on gently undulating till tract without many surface boulders -- swells 10-25 feet. Aneroid 29.060 at a long cut 3-4 miles south of Grand Blanc. It is nearly a mile long and 10-20 feet in till. Swell and sag till tract as far as this from near north edge of moraine.

I now enter a tract with small lakes and scattering large knolls. It sets in a mile north of Belford. Height 20-50 feet \pm . Aneroid 29.050 at Belford, 930 feet \pm . Just south from here is a range of sharp knolls, apparently running east-west, height 25-40 feet \pm . These, and the scattering ones north, make a belt 2 miles wide \pm . Farther south there is an undulating tract for 2 miles. A plane tract is then entered that extends to Holly. It has about the same altitude as Holly. Aneroid 29.050 at Holly = 935 feet. There is a range of morainic hills a mile or so west

from here and a moraine is entered at south edge of village that becomes very prominent within 2 miles south, with knolls 30-60 feet \pm and a liberal supply of boulders. The aneroid soon reaches 29,000. The moraine continues prominent past Rose Center. Aneroid 29,000 at Rose Center; 28,990 about a mile south in cut 30 feet deep -- mainly till; 28,990 where road passes between hills 75 feet \pm higher than track about 2 miles south of Rose Center. Till is exposed farther south in cuts 20-30 feet. There are basins and lakes among the knolls from Holly south, and lakes occur in the plain north of Holly.

The railroad rises to Clyde through a strong moraine with knob and basin topography. Aneroid 28,950 at Clyde = 1026 feet. South of Clyde is a pitted plain, very much broken by basins, that stand 30-40 feet below the plain. The plain has about the altitude of Clyde Station at its north edge. There is a morainic tract on the west near Highland and for 1-1 $\frac{1}{2}$ miles north, but on east side of railroad, the plain extends south beyond Highland. Aneroid 28,980 at Highland. There is a flat tract leading southwest from here, as noted in 1900, that was the line of discharge for glacial waters. There is a very prominent ridge in view east of the railroad, 1-2 miles south of Highland. It probably reaches an altitude 100 feet above Highland Station.

The railroad cuts through a moraine before reaching Milford. Aneroid 29,060 at Milford, among the morainic knolls. From Milford to Northville, notes were made in 1900. Aneroid 29,070 at Wixom on a plain outside the Huron-Erie drift. Possibly the Huron-Erie includes the morainic tract south of Milford. There are complications in the tract between Milford and South Lyon that are not fully cleared up. Aneroid 29,100 at Novi; 29,250 on flat at Waterford, just below the Warren shore lines. This is underlaid by till at slight depth; 29,270 on Belmore beach at Plymouth =

735-740 feet; 29.300 at Newburg; 29.330 at Wayne on Electric Railroad, 662 feet; 29.300 at Caution on Electric Railroad, 682 on Warren beach.

Altitudes on M. & N. E. Railroad and lakes near it, by J. J. Hubbell, chief engineer M. & N. E. Railroad, Manistee:

Above Lake Michigan

Manistee M. & N. E.	16
Newland	208
Onekama Junction	173
Onekama	10
Goodrich	151
Chief Lake (water)	124
Chief Lake station	146
Bear Creek, water level	106
Bear Creek station	130
Manistee Crossing	164
River Branch	181
Ward's Switch	196
Lemon Lake	210
Dougherty Switch	203
Copemish	225
Henry	205
Betsey River	135
Nelson's Switch	248
Nessen City	273
Nand Switch	270
Twin Lake Switch	298
Twin Mountain	303
Harrison	286
Green Lake Station	274
Green Lake, water	221
Wylie	264
Duck Lake	237
Interlochen	264
Long Lake Branch	254
Cedar Lake	235
Filers Switch	284
Sherman Mill	229
Honor	29
Lake Ann	234
Lake Ann, water	197
Cedar Run	174
Solon	44
Cedar City	15
Maple City	126
Carp Lake	12
Fouch	18

Above Lake Michigan

Hatch Siding	59
Traverse beach resort	36
Greilickville	24
Traverse City	7
Traverse City T. C. & W. M. railroad	23

October 27, 1902. 1:40 p.m.

I take train on M. C. railroad, Ann Arbor to Lansing. Aneroid 28.970 at Jackson at 2:35 p.m.; same at 4:20 p.m. The Rives Esker takes on a typical form near corner of Sections 9, 10, 15 and 16, Blackman Township, and, though broken by a few gaps, it is a typical esker to Rives Junction. It usually is 10-20 feet, but in places is fully 30 feet high. This is the case at Rives Junction. There is a continuous trough from Sections 9 and 10, Blackman Township north to Grand River valley north of Rives Junction that is 40-50 rods or more wide. The esker is near its west side from south end up to within a mile of Rives. It there appears on the east side and follows the east bank closely. Aneroid 28.950 at Leslie = 930 feet \pm ; 29.010 at Mason = 880 feet \pm ; 29.050 at Lansing = 840 feet.

October 28, 1902. 8:00 a.m.

Aneroid 29.050 at Grand Trunk Station in Lansing. I take train for Battle Creek. Aneroid 29.010 at Millett. There was till in nearly every cut for 2 or 3 miles east and the surface is plane except for sloughs, but near Millett, there are some sharp knolls containing gravel as well as till. They are just south of station each side of the railroad. The highest is 30 feet \pm or so east of track. The others are 15-20 feet. There is considerable fresh grading along this line, both northeast and

southwest from Millett and the cuts are nearly all in a stiff clayey till.

Aneroid 29.030 at swamp southwest of Potterville. Very strong drift south of this swamp. This continues to Charlotte. There is gravelly drift in the knolls near Charlotte Station, northeast of it. Aneroid 28.980 at Charlotte. See Notebooks for 1887 and 1900 for esker and esker delta near here. Aneroid 29.010 on pitted gravel plain in the southwest part of Charlotte. There is a ridged tract west of the railroad for at least 3 miles southwest from Charlotte, but on the east, the surface is nearly plane. For about two miles, the surface is plane on both sides the track, then an undulating tract is entered that has swells 15-30 feet high but is not thickly strewn with boulders. There is considerable fresh grading here that exposes usually a clayey till.

Aneroid 29.050 at the abandoned valley near Olivet Station, noted in 1900; 29.035 at Olivet Station. The natural surface of this abandoned valley is 20-25 feet lower than Olivet Station. The altitude southwest of the station, on a flat tract, is about as low as in this old valley northeast of the station, the aneroid reading being 29.050.

The moraine south of Battle Creek shows well along railway between Olivet and Bellevue. Aneroid 29.060 in Bellevue in the broad valley that Battle Creek follows. This is floored with limestone southwest of Bellevue and the railroad cuts 15 feet into rock. Aneroid 29.070 on plain of old stream 2 miles southwest of Bellevue south of the limestone outcrops. Where the railway cuts into this plain near a flag station, it shows gravel hills on which there is some cross bedding and southward dip. This plain is much below the high one that forms an outwash south of the moraine along north side of Kalamazoo River, probably 50-60 feet. The railroad keeps on this plain to Nichols except where it crosses the creek, and there it is a plain but a few feet (10-12 feet). Aneroid 29.100 at

Nichols at crossing of M. C. railroad; 29.115 at Battle Creek Station of Grand Trunk railroad at 10:00 a.m.

Aneroid 29.200 at Dowagiac at 12:50 = 758 feet; 29.180, 776, on ridge of sandy drift in northwest part of city. This is cut through by East Dowagiac River. It then runs southwest as a distinct ridge on east side of the Pokagon pike for more than a mile and stands about 780 feet A.T. It is only about 1/4 mile wide. There are a few boulders on its west slope, but it seems to be a gravelly, rather than a till ridge. It is perhaps morainic, though very feeble. It breaks up about two miles southwest of Dowagiac into low gravelly knolls scattered over a nearly plane tract. These knolls are distributed over much of the strip of land that lies between the M. C. railroad and Dowagiac River. They are gravelly, but 10-12 feet high. The flat land around them seems to be underlaid with sand and gravel.

Wells go about to the level of the Dowagiac River to Obtain water. The depth is about 40 feet on the highest points and 20-25 feet on the level ground. There is a strip of swamp along the river and this has a pebbleless laminated clay where I cross the river in southwest part of Section 9, T.6S., R.16W. There is hardwood timber -- beech, maple and elm, on this flat strip, but the ridged tract east of it has oak. The river here seems to be 717.25 feet A.T.

Near the quarter post of Sections 8 and 17, the road enters a basin tract with lakes and swamps. The dry ground among them stands about 20-25 feet above lakes and swamps and 750 feet \pm A.T. In the west part of the section (7), is a group of knolls that reaches 780 feet. I go south among basins through Section 18 and then go west, reaching a tract with well-defined knolls in east part of Sections 13 and 24. They reach 800 to 820 feet A.T. They are composed of gravelly drift and have few

boulders. They are only 15-20 feet high. I go north between Sections 13 and 14, 11 and 12, reaching a tract with some till and a few boulders in north part of Sections 11 and 12. South from there, the drift is gravelly and nearly free from boulders. I go east across Section 1 and find till in west part and gravel in east part.

There is a nearly plane surface of gravel south of Indian Lake at about 800 feet in which the several lakes are embedded, their surfaces being 30 feet or more below the plain. Indian Lake is 752 feet. I go east past south side of Indian Lake and find, on the descent toward the Dowagiac River, occasional boulders and an uneven surface. Possibly an eroded surface. I come to a flat tract about a mile west of the river and a mile east of Indian Lake. It is swampy above here and stands about 730 feet A.T. I go north between Sections 32 and 33, 28 and 29. The flat tract covers Section 33 and the southeast part of Section 28 but Section 32 and northwest part of Section 28 have an undulating surface and there are boulders in moderate number. The soil is gravelly and sandy loam with little, if any, till. There is a tract 2 or 3 miles wide that has this sort of land with basins and low swells and a gravelly, sandy soil lying west of the Dowagiac flats. Its east border is 750-760 and it rises to about 800 feet toward its west border next to the strongly morainic tract mapped in 1887. I followed this tract northeastward into Section 22 and found boulders rather conspicuous in Sections 21, 22 and 28 and my earlier notes refer to them in Sections 10 and 15.

I cross the Dowagiac swamp in Sections 22 and 27; it is only 1-3 feet above the stream and is on the west side here. Aneroid 29.250 at the swamp. On the southeast side of the Dowagiac in Section 26, there is a plane tract, 15-20 feet above the river, with a sandy gravelly soil and an occasional boulder. In Section 36 I come to basins and an uneven surfaced

tract that stands 750-760 feet. Aneroid 29.210 at Dowagiac = 758 feet at 5:30 p.m. I take train to Decatur at 7:30 p.m.

October 29, 1902. 7:30 a.m.

Aneroid 29.470 at Decatur Station, 779 feet. I am told by John Conden, County Drain Commissioner, that there is 30.75 feet fall from county line of Van Buren and Cass counties to where I crossed on line of Sections 9 and 16, Pokagon Township, and there is 7 foot fall from Pickerel Lake in Section 21, Decatur Township, to the county line, and this lake is near the divide between Paw Paw and Dowagiac, the divide being in Section 22. The swamp is about 755 feet A.T. at the divide between Paw Paw and Dowagiac Rivers. Aneroid 29.500, 740-745 feet, in swamp south of Decatur.

Aneroid 29.310 on bluff south near county line = 930 feet. This is at a high gravel plain. There are only a few knolls in view along this bluff. One, 1/2-3/4 mile southwest, in Section 6, Volinia Township, reaches about 975 feet. It is the highest point near here. There are knolls in view on the part of the bluff east of Decatur. The high range west of here runs southward from Section 6 and comes to the east branch of Dowagiac River west of Volinia Township, Section 30. From there, as noted about two years ago, it follows down the west side of the river nearly to the La Grange mill pond. The large hills are in its eastern part in Sections 1 and 6, 12 and 7, 13 and 18. The height of the range is 950-975 feet on its prominent points.

I follow the inner border of the moraine around to Glenwood and find that there are a moderate number of boulders on the slope though the drift is sandy. I then go south between Sections 11 and 12 and to middle of line of Sections 13 and 14, then east across Section 13. Aneroid 29.285 on a

high point in east part of Section 13 = 940 feet \pm . There is a point nearly 50 feet higher $1/2$ - $3/4$ mile northeast, near line of Sections 7 and 18, probably the highest point on the range and nearly 1,000 feet A.T. There are sandy knolls in Sections 13 and 14 that drift by the wind. The higher part of the moraine to the east has gravelly material and a few boulders. The boulders are not a conspicuous feature on this range.

I go south a mile to middle of line of Sections 19 and 24 across a flat tract with a range of hills each side that trend northeast-southwest (see map). This flat tract has shallow basins. It is probably an outwash from the range west of it. Aneroid 29,320 on flat tract near middle of line of Sections 13 and 18; 29,340 on it at middle of line of Sections 19 and 24 at 10:20 a.m. I go west across Section 24 and find that the morainic tracts each side of this plain converge and unite so the discharge from the plain was eastward. The surface continues undulating to the edge of the high moraine in east part of Section 21. Aneroid 29,325 on high point, northwest part of Section 22, east of cross roads on moraine. This overlooks Twin Lakes which are situated near the inner or northwest edge of the moraine. A boulder in front of house, owned by Ira Gage, in Section 21, is 9 or 10 feet high (it stands on end) and about 5 feet in diameter. Several others near road near there are 2-3 feet. This is at base of moraine. Aneroid 29,450.

Aneroid 29,450 at M. C. railroad in Section 20, near east side. This section has boulders and low gravelly swells except in the northwest corner which is on the edge of the Dowagiac swamp. Aneroid 29,500 at edge of swamp in Section 19. There are boulders here as well as on the gravelly land between here and the M. C. railroad. Aneroid 29,510 at Dowagiac Creek on line of Wayne and Silver Creek Townships. The swamp is

3-5 feet above it. Aneroid 29.470 at Mr. Bresnau's, on the edge of the undulating upland in east part of Section 14, Silver Creek Township. There is a mill in Silver Creek in Section 13. In very dry weather it would run only a couple of hours each day. There is another mill, near corner Sections 1, 2, 11 and 12, Silver Creek Township. Mr. Bresnau says the soil is sandy for only a short distance back from Silver Creek, on west side, 1-1½ miles. Farther west, there is a gravelly loam. Wells are shallow near the creek, but on the higher land west, in Sections 10 and 15, they are 75-100 feet or more.

I go west through south part of Section 11, rising to a higher tract near line of Sections 11 and 10. Aneroid 29.430 = 800 feet ±. There are several small deep basins in east part of Section 10. I can see 2-3 miles west and there is a nearly plane tract, aside from basins. There is probably a westward rise to the edge of the sharp moraine east of Pipestem Lake. This tract of nearly plane upland is like a pitted plain, though it has a few swells and a few boulders. The drift on it seems to be gravel.

Aneroid 29.400 on high ground in southwest part of Section 2, Silver Creek Township. This overlooks a flat country to the north, extending to Keelerville and the moraine north of there. This high tract runs only into the SW¼ of Section 2, there being lower land east and south and north. But it is high to the west, along south side of Magician and Sister Lakes. The surface of Section 2, south of Silver Creek, is undulating, but the north part of that section and almost all of Section 1 and Section 12 is flat, aside from a few shallow basins and is a continuation of the flat plain in Keeler Township. Aneroid 29.440 on this plain near middle of line of Sections 1 and 12. It is about 20 feet above Silver Creek. Aneroid 29.460 on swampy tract near corner Sections 5, 6, 7 and 8, Wayne Township, 8-10 feet below bordering plain and about same level as Dowagiac

swamp. This plain has a few cobblestones but is mainly a sandy tract. It is remarkably flat in Sections 5, 6 and 7, Wayne Township, as well as in Sections to the north and west. I enter the Dowagiac swamp near middle of line of Sections 5 and 8 and it extends over all of Section 4 except 60-80 acres in northwest part and all of Section 8 except about 40 acres in northwest part.

I go north between Sections 4 and 5 into Hartford map area and into Van Buren County two miles to a road leading east to Decatur. This leads through a plain of sandy gravel on which there are a few low sandy knolls. Those in Sections 27 and 28 form a chain leading east-west and are 15 feet \pm above the plain or about 795 feet, the plain being about 780 feet. There is a rather wet tract 10-15 feet below the plain, leading from Lake of the Woods, in Section 13, T.4S., R.15W., southwest to the Dowagiac swamp. It has a few boulders and a slightly uneven surface with dry spots 5-10 feet above the swampy parts. Lake of the Woods is 750 feet. East of this is a pitted gravel plain on which Decatur stands. There are occasional basins on the plain west of the outlet of Lake of the Woods.

Aneroid 29.370 = 779 feet at Decatur at 4:00 p.m. There are low swells in the northeast part of Decatur, 15-20 feet higher than the station, but they do not extend east along the railroad but a mile.

-0-0-0-0-0-0-0-0-0-