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PHYSICAL GEOGRAPHY AND GEOLOGY, LANGLADE COUNTY

by

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LANGLADE COUNTY

PHYSICAL GEOGRAPHY AND GEOLOGY

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Basement Rock

Langlade County is underlain throughout by ancient crystalline rocks. Granite is dominant. Exposures occur and the formation was struck by wells in sections 6, 15, 24, 30, 31, 32, 33 of T.31, R.10; in section 7, T.32, R.9; on Wolf River downstream from Pearson in section 15, T.33, R.12; in sections 7, 8, 15, 21, T.33, R.14; on Wolf River in section 31, and near S¼ section 8, T.31, R.15. Diorite occurs in sections 6, 9, and 19, T.31, R.10; in sections 24, 26, T.31, R.9. Schists of various sorts have been located in section 7, T.32, R.9; in an oil test hole in section 6, T.34, R.9; on Wolf River at the highway bridge south of Pearson. There is evidence in magnetic attraction of two belts of similar types of rock, one about a mile wide striking across sections 3, 9, 17, 19, T.33, R.13; the other about 2½ miles wide striking NE-SW from the SW of T.31, R.9, to Kempster and possibly extending farther to connect with the exposures on Wolf River at Pearson. At the last point, however, the rocks are not magnetic. Quartzite and quartzite conglomerate is the country rock in sections 4 to 1, and 10, T.33, R.14. The eminence here is controlled by this quartzite which extends eastward to climax in McCaslin Mountain in southeastern Forest County. The common corner of sections 28, 27, 33, 34, T.33, R.9 (locally known as Bavaria) is evidently cored by granite, as shown by a 16-foot well. The city wells at Antigo struck granite at 58 feet.

There are no sandstones, shales or limestones. No mineral industry, based on bed rock, can be foreseen.

Surface Materials

The entire county has been glaciated. The unconsolidated materials down to basement rock are, with minor exception, the deposits or drift of invading ice fields. The only exception is in the region in the town of Ackley where residual disintegrated granite is locally important. The soils are all glacial and hence quite young.

Thickness of the drift naturally is a variable. In the regions cited as containing bed rock exposures it is comparatively shallow. Greater depths are recorded by wells in section 24, T.32, R.9; section 31, T.32, R.12; and section 34, T.32, R.12 which went down 100-125 feet without striking rock. The maximum known is 240 feet as measured in the oil test hole in the terminal moraine of section 6, T.34, R.9. There is reason to believe that thickness may even exceed 300 feet in the most rugged moraines. In general, probably the terminal moraines represent the greatest thickness, and outwash plains the least.

Resources from the Geological Aspect

The economic values of the county are due to glacial geology. They are derived through either the use of the drift as (1) soil for agriculture or forests, (2) as materials of construction, or (3) through capitalization and development of the potential recreational values of the topography, waterways, and forests.

Physiography - Land Forms

Except for a few areas where rock is in control, the topography is glacial in origin. Elevations of the county range through about 700 feet of relief. The highest point, near Kent, is about 1800 feet above sea level, and the lowest is 1100 on Wolf River where it leaves the county. The topographic map shows the distribution of elevations by means of 50-foot contours, the reading of which has been facilitated by the coloring of 100-foot intervals. Five main provinces are evident.

(1) The Antigo Plain is readily distinguished. It is characterized by a smooth, gentle, southwestward slope which in areal extent (15-20% of county) is quite unique. The average slope is 10' per mile, although the rate of rise increases toward the higher ground on the northern border. Stone is restricted to small pebbles. Bowlders are rare.

(2) The Terminal Moraine Province immediately to the north and east is higher and rougher, and as a rule is characterized by parallel, discontinuous ridges and knobs interspersed with elongated sags and kettle holes, in many of which are lakes or bogs. Large bowlders are common but variable in quantity. This province is shaped like an elbow with the joint in the vicinity of the county summit near Kent. One limb turns southwestward to pass south of Antigo, the other extends northwestward through Kempster and toward Parrish. Fully 40% of the county lies in this province.

(3) The Valley of the Wolf with its main branches, Hunting, Pickerel, and Lily rivers, including their flood plains and higher terraces constitutes a province of intermediate characteristics. In the aggregate there is considerable area characterized by smooth, gentle, bowlder-free slopes analogous to the Antigo Plain. However, there are but few instances where dissection, gullying, and pitting have left extensive tracts. The local relief in regions of dissection may be quite as great as in the ridge province just outlined.

(4) South of the southern limb of the ridge province, topography is again intermediate. This Province is very much like the last named. In the vicinity of Polar and near Phlox are large areas analogous to the Antigo Plain in their smooth, gentle slopes. However, streams have cut deeply into the border of the ridges to the north and relief of 50 to 100 feet makes for steep slopes. Long, smooth or rolling, broad stony uplands trend south and east between stream channels.

(5) Immediately west of the Antigo Plain is a province characterized by smooth slopes of variable steepness. It is a region that was covered by the ice field of an earlier period of glaciation. The group of hills around Morley, for example, exhibit slopes in steepness not wholly unlike those of the ridge province, but they are long and continuous rather than short and choppy. Another prominent hill occurs in the town of Summit. It is known locally as Bavaria. The major part of this province is, however, moderately flat and poorly drained. The parts of T.31, Rs.9 and 10 lying in this province have this condition because of shallow drift over bed rock.

(6) In T.33, R.14 and part of T.32, R.14 is a small province in every way analogous to the main province of stony, belted ridges. It extends NE from Lily between Lily River and Nine Mile Creek and is an extension of the south limb of the main ridge province. East of Nine Mile Creek is an area of relatively smooth but bowldery country which has been mapped as ground moraine. It is a part of this province.

Smaller areas in T.34, R.13 including Rolling Stone Lake are too small to call for much comment other than that they are patches of rough, stony, terminal moraine and consist of high knobs and deep kettles.

The drainage of the county is mainly a response to conditions imposed by recent glaciation and is therefore poorly developed. The northeastern part of the county is drained by the Wolf River, which flows southeastward. The western part is drained by the Eau Claire, Pine, and Prairie rivers flowing southwestward into the Wisconsin.

History of Development of Surface Forms

Preglacial topography was controlled by bed rock. This was the floor of the ancient sea in which sandstones and limestones were laid down. These formations long since had been eroded away but representations are still present in eastern and southern counties. The surface was probably gently rolling, because of the control by granite, and it presented an even sky line broken only by residual monadnocks of the more resistant rocks such as the quartzite ridge in the extreme northeast of T.33, R.14. The average relief was probably somewhat less than today. The surface was very likely covered by the residuum from the wasted sandstones and limestones and under this cover was a deep zone of weathered igneous rocks.

Earlier glaciers had traversed the county probably in its entirety and are responsible for the surface materials and topography in the southwestern townships.

The last of the ice fields to invade the region from the far north reached the line represented by the south and west boundary of the elbow-shaped terminal moraine province.

There are evidently three lobes of ice operating in this vicinity. These are represented and named for convenience in reference on the sketch map of Fig. (1). They were more or less contemporaneous but they had gathered their load of till from different regions and therefore they left quite different materials for the making of soil. They were halted here in a balanced condition by a moderating climate. Long-continuing forward movement was held in check along this line by melting. Melting freed the load of till carried by the ice. A heterogeneous, structureless, assortment of bowlders, pebbles, sand, silt, and clay was dropped in place building up the great ridge province of terminal moraine.

The melt waters from the Langlade Lobe issued in myriads of streams along a 25 mile front, Kent to Parrish. They escaped over the regional slope to the south, southeast, and eventually southwest toward the Wisconsin River, and they moved whatever free solids they could handle. From along 18-20 miles of this 25 mile front came the materials that constitute the greater part of the Antigo Plain. It is an outwash plain built up, layer on layer, of this sorted sand and gravel. Bowlders are scarce because they could not be carried by the streams. It has roughly the shape of an equilateral triangle, 18-20 miles on a side. Moraines form two sides and the hills of old drift form the third. It rises upstream at an increasing rate, averaging 10 feet to the mile, to merge with the northern moraine. No major stream developed and hence dissection is of slight importance.

Prior to the building of the outwash plain this was a region of moderate relief. There were broad, rounded hills rising fifty to one hundred feet above the valleys. Such hills had experienced earlier glaciation of an apparently milder sort. The smooth slopes of the well-rounded hills near Morley and Bavaria represent this older topography, which is similar to that of central Marathon County.

In the building of the outwash plain these higher of the older hills were not buried. It is quite probable that in the concealed area were many other hills as well as valleys. The thickness of the outwash therefore varies widely. In the vicinity of Ormsby, for example, the outwash thins out against the lower slopes of the Morley Hills of older drift. Again, in sections 2, 11, 15 of T.31, R.10E. is a small area of thin outwash over disintegrated igneous rock. The Antigo Plain in general is more poorly drained in this western portion and its shallowness upon the compact and impervious old drift is the probable cause. Farther south, in the town of Ackley, the outwash and older drift alike are thin. Outcroppings of disintegrated granite explain faulty drainage.

The discharge from the remainder of the Langlade ice front, west of the west branch of the Eau Claire, found escape through the Pine River branches and Prairie River. This unequal division of water by the divide in the northeast of the town of Summit, T.33, R.9, offers a satisfactory explanation for the meager outwash marginal to this northern part of the moraine. Still farther to the northwest, in the vicinity of Parrish, and just beyond Prairie River, lies another rugged moraine. It trends NE-SW across the north half of T.34, R.9 and continues southwest into Lincoln County. It was built by the Wisconsin Valley lobe.

Eventually, the melting of the Langlade lobe attained a rate greater than the rate of replacement from the rear. The ice front receded for a time and the concentration of drift and ridges ceased. Melt waters were held in temporary lakes between the outer moraine and the ice front.

This Langlade moraine, northwest from Kent, is crossed only by the two branches of the Eau Claire River. Just inside the moraine they flow parallel to the ridge from northwest to southeast. Along these inner courses are many lakes. In point of fact, in this particular belt of locally lower ground are concentrated the majority of all the lakes in the county. The divides between the lakes do not vary much in height. They are ice-block lakes. The melt waters held temporarily behind the terminal moraine washed the drift over masses of ice. On later melting of this buried ice, its covering of sands and gravels slumped, and the depressions came into being. One such, Boganaquia Marsh, (locally known as Bogus Marsh), is probably a fair example. It gradually filled up with peat and sediment and is now but a grass or sedge marsh. This inner area of outwash was for a time apparently a single large lake which finally burst its dam at Neva. The east branch has cut a wide gap in the moraine. The issuing floods spread added layers of sands and gravels over the Antigo Plain and gave it a top course of fine rock flour or silt which constitutes the excellent soil of the plain.

This Langlade lobe made a temporary stand along the high ground extending from Enterprise Lake through Summit Lake station and Koepenick. Once more replacement had matched melting through a considerable period and a recessional terminal moraine was built along this belt. Later, however, the ice melted farther to the northeast. Water no longer drained away transverse to the morainic ridges. Rather, it gathered temporarily in what is now the valley of the Wolf and its tributaries, Hunting River, particularly in the region of Elcho, the plain-like area east and south of Post Lake, the valley of Pickerel Creek, the region about Pickerel Lake, Twin Lakes, and the valley of Lily River. Sand and gravel were brought from the higher and spread about in the lower parts, the finer rock flour was in large part carried away into the Wolf River. Ice-blocks were buried, later to melt producing the beds of lakes. It is believed that the strong moraine at Lily, through which Wolf River now flows in a narrow gap, was a temporary dam retaining waters for a time in the areas referred to above.

The succeeding steps inthe development of the surficial features within the area of the Langlade lobe are a repetition of the foregoing. One marked variation is the loss of "organization" with successive recessions of the ice toward the county boundaries and beyond. The moraines are less well-defined. They are discontuous and patchy. In this there is the suggested analogy to the retreat of an army. With increasing rate the orderly and disciplined retreat along a continuous front became a rout. Masses of stagnant ice became detached and buried by outwash impelled by melt water, the product of disorganization, which in addition wreaked its own havoc in erosion, dissection, and dismemberment of the moraines.

The moraine which trends northeast and southwest thru Kent and south of Antigo was built by the Green Bay lobe or ice field operating to the east and moving mainly southwest. It is a lateral moraine built by ice flowing outward, that is, westerly. The behavior of its melt water appears to have been essentially as depicted for the northern moraine with the specific difference that excepting the Plover River headwaters at Elmhurst the natural direction of drainage (regional slope) was to the southeast. On this account, from the time of melting back southeastward from its line of maximum advance, this lobe appears to have contributed nothing to the Antigo Plain of outwash. As long as the ice maintained this maximum stand it made contributions, but once it receded, the melt waters were held against the moraine by the ice front as a temporary lake or lakes effecting quite distinctive results upon the morainic deposits. The topographic map shows elevations to drop steadily southeastward from the moraine. Phlox, for example, lies 150 to 200 feet below the Antigo Plain. There is evidence of washing of the tongues of higher land between the streams flowing from NW to SE, in the town of Rolling, and especially Norwood. Here the lands are commonly bowlder-strewn. However, locally there is evidence of strong washing in the direction parallel to the ice front on short, tributary streams in the town of Rolling. One outstanding example is the head of Plover River flowing southwest through the village town of Elmhurst. The bottom of this valley ($\frac{1}{4}$ mile wide) is literally bowlder-strewn. As fine an example is the drainage way cutting southwest across the southeast corner of section 26 in the town of Rolling. These bowlder-strewn belts testify to the washing away of the finer material from the drift and the concentration of the coarse bowlders presumably by these flood waters. Cross-bedding in general dips southeastward. Along highway 64 in the town of Polar (31-12E) similar bowlders of practically uniform size are to be seen in stone fences or strewn about on a high, nearly plain or pitted surface of stratified material. Muller Lake is an example of a pit left by melting of an ice block. The withdrawal of impounded waters to the south and east away from the outer moraine is evidenced throughout this part of the county. The streams through sections 26 and 27, T.31, R.12E., show good examples of terracing, demonstrating two or more periods of strong water action.

Reference to Fig. 1 shows that the ice lobes that built the three moraines had moved in different directions and had therefore crossed different areas. The till that they dropped had been acquired in this push across country and accordingly represents country rock of the different regions traversed. The Langlade lobe extending from Kent, thru Neva, to Kempster and Parrish was moved by ice coming down from the northeast. It had crossed a granitic and crystalline terrain of Oneida, Forest, and Florence counties. The drift therefore is highly siliceous and sandy. It contains a considerable percentage of iron formation from the iron ranges. The Green Bay lobe that built the southeast moraine thru Kent and south of Antigo moved up from the east crossing the limestone region in Oconto and Marinette counties and adjacent Michigan. More immediately it had crossed the region of the coarse, pink granites of Oconto and Shawano. This is the local country rock of southeastern Langlade. The most conspicuous feature of this moraine is the profusion of bowlders of this coarse, porphyritic pink granite. Equally distinctive and more important, however, because of influence on soil character is its high content of limestone debris. Pebble counts show as high as 54% of dolomitic limestone. Compared to the northwest moraine, it contains higher proportions of the finer constituents, silts and clays, and less of the sand. Moreover, in the fine material is a considerable amount of dolomitic flour. The road cuts demonstrate its finer texture and warm buff color. Largely because of the topographic situation it is better drained. Its lake waters are hard, and invariably there are marl beds which are not found in the Langlade drift. The presence of limestone in the drift adequately explains these marl deposits, the hard lake waters, and contingent differences such as in forest growth.

This southeastern moraine extends to the northeast thru Kent, passes south of Lily, and trends diagonally across T.33N.,R.14E. This is the contact between the Langlade and Green Bay moraines. Whether the ice fronts were continuous, being contemporaneous, or whether the one or the other was the earlier, is largely a matter of conjecture. There is no economic interest, but it is most likely that no great length of time separated them. The materials in the Antigo outwash plain, for example, are seemingly mixtures from both ice fields suggesting contemporaneity.

Economic Geology of the Glacial Drift

Sands and gravels are the sole economic mineral resources which can be foreseen. They have been taken from countless small borrow pits distributed widely throughout the county for town roads and for construction, and not a few deposits have been exploited on a large scale for county and state highways. On the geological map the location of many of these pits is given by conventional symbol. They are sufficiently numerous and regular in distribution to guarantee road surfacing at reasonable cost wherever it is likely to be desired. The greater number of the preferred and extensive ones are found within the area affected by the Langlade ice field, and more particularly within the outwash of the Antigo Plain. The town of Ackley, T.31, R.9, seems to be most poorly endowed, although disintegrated diorite in part offsets this lack of road gravel.

Some years ago brick yards were operated in Sec. 24, T.31, R.10. It is apparent that they utilized the top course of the outwash plain, removing the coarser pebbles by screening. The plants are no longer in operation.

Water Supply

In general, water supplies for farms as well as for communities of whatever size appear to be entirely adequate. The glacial drift is, of course, the main source, and since in every part of the county where settlement has taken place or may be reasonably expected the drift is upwards of 20 feet thick, it is apparent that the problem of water supply is simple. In the Antigo Plain wells go to considerable depths, exceeding

100 feet in many places, but water is of first quality and sufficient in quantity. At Antigo the city wells go 58 feet into the sand and gravel to take water off the preglacial granite floor. In the lake regions the water table is closer to surface and supplies are available everywhere.

As to quality, the main comment to record is that within the Green Bay moraine the waters are in places known to be considerably higher in dissolved solids, and throughout would be expected to run higher than in the Langlade moraine because of the known fact that the former contains abundant limestone and dolomite materials. The lakes evince the same situation, those of the southeast being invariably several times harder than those of the northern townships. They commonly contain marl beds. To illustrate the point, the water of Summit Lake has been analyzed and found to contain 64 parts of dissolved solids per million, while that from the 24-foot railroad well at Elton contained 257 parts or more than 10 times as much as that of Summit Lake. In the former, calcium, magnesium and carbonate radicle were respectively 11.3, 3.8, and 14.3. In the latter, the corresponding figures were 53.9, 23.4, and 140.1.