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GEOLOGY OF VILAS COUNTY

by

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Vilas County might well be called a divide county. In the northern part the Presque Isle and Ontonagon have their headwaters. The central and western part drains to the Chippewa. Much of the southern and eastern part is in the Wisconsin River drainage area. A small area in the north-eastern part drains to the Brule River. The county is a gently sloping roof from which part of the run-off goes to Lake Superior, a smaller amount to Lake Michigan, and the larger proportion to the Gulf of Mexico.

As might be expected the county is high, the general average being about 1650 feet above sea level and 1050 feet above Lake Superior. The highest known point is the Muskellunge Fire Tower Hill in section 34, T.41N., R.7E., which is 1,847.7 feet or but 100 feet lower than the highest known elevation in the State. The hills east of Lake Laura rise to an elevation of about 1810 feet. It is possible that future surveys will disclose even higher points in the county. All cities and villages are at elevations over 1600 feet above sea level.

Following are elevations:

Arbor Vitae	1627
Boulder Junction	1653
Conover	1658
Eagle River	1638
Lac du Flambeau	1633
Land O' Lakes	1708
Phelps	1681
Plum Lake	1654
Sayner	1674
Star Lake	1679
Winchester	1637
Winegar	1644
Woodruff	1611

The lowest measured points are on the south boundary in Lake Shisebogama (1565) and the Wisconsin River (about 1570). Local differences in elevation of over 50 feet are not common.

Geology

Outcrops are few. There are three small outcrops of granite in sections 34 and 35, T.43N., R.7E., near Wildcat Lake. Otter Rapids in the Wisconsin River west of Eagle River were due to outcrops of gneiss and granite. Near Highway 45, a short distance north of Eagle River ($\frac{1}{4}$ mile S of NE corner, section 9, T.40N., R.10E.), numerous granite boulders indicate that ledge is near the surface. There is a doubtful exposure of gneiss on the narrows between Spider and Island Lakes. The large granite boulders called "Picture Rocks" north of Upper Buckatabon Lake in the SW$\frac{1}{4}$ of section 14, T.41 R.9E. suggest that they have not been moved a great distance.

At what is locally known as "Gold Diggers' Point" in the SW$\frac{1}{4}$ of section 10, T.40, R.11E. there are a number of outcrops and some shallow test pits. The southerly outcrops are diabase, the northerly ones are cherty limestone. There is some yellow sulphide in the cracks of the limestone, hence the prospectors may have been looking for gold. Mr. Tuttle informs me that a man named Edan settled here about 1900 and began prospecting for gold. In 1911 a syndicate was formed to undertake the geologic examination and magnetic survey of a large area extending westward from Lake Vieux Desert to near Butternut. The magnetic data indicated that there are five ranges or districts. The Marenisco range crosses the extreme northwest corner of the county; the Turtle range passes through Winegar; the Manitowish range extends from Watersmeet, Michigan southwesterly through Manitowish Lake; the Vieux Desert district is south of that lake and the Conover district is near Conover. Thirty seven diamond drill holes in this county furnish rather satisfactory information regarding the concealed bedrock. The rocks disclosed by this drilling are ancient slate, quartzite, dolomite, iron formation,

gneiss and schist as well as granite and greenstone. The general geology is much like that of the Gogebic Range except that sedimentary rocks have suffered more severely from intrusion by granite.

The geology of the drift covered non-magnetic areas remains practically unknown except where water wells have been drilled. At Eagle River granite is encountered at depths of 30 to 140 feet. At Woodruff basalt occurs at a depth of 213 feet. Prior to glaciation the county was fairly level. The "ranges" were not prominent topographically. Granite and greenstone knobs were probably the most conspicuous features. We have no evidence that any outcrops of Cambrian sandstone remained.

Glaciation

The 37 exploration holes show a maximum thickness of glacial drift of 234 feet at Winegar, a minimum of 89 feet between Conover and Eagle River (Sec. 33, T.41N., R.10E), and near High Lake (Sec. 5, T.42N., R.8E.), an average of 170 feet. A well at the Point on Trout Lake encountered no ledge at a depth of 223 feet. This deposit of drift is the result of the invasion of this area by several great continental ice sheets. We are interested in the last or Wisconsin glaciation, when the ice moved southwesterly to its line of farthest advance in Lincoln and Oneida counties about 40 miles south of the south Vilas county line.

At this outermost edge of the ice the boulders, sand, gravel and clay carried in the ice were deposited. We speak of an ice front as stationary when the forward flow of the ice just balances melting; advancing when forward flow exceeds melting; retreating when flow is exceeded by melting. The strikingly rough topography north of Antigo on 45 and north of Merrill on 51 is an end or terminal moraine. Similar deposits forming during a pause in the retreat of the ice sheet are called recessional moraines. If the moraine has

undrained depressions or kettles it is called a kettle moraine. The streams flowing from the melting ice carried sand, gravel, and silt which was deposited to form outwash plains. Pitted outwash is due to the burial and subsequent melting of ice blocks. The size of kettles varies from tiny ones a few square rods in area to large ones several square miles in extent. The kettles may be so closely spaced that there is no upland left between the kettles, thus making a terrain quite similar to a kettle moraine. The unpitted outwash is monotonously level.

The important drift deposits of Vilas county are outwash and recessional moraine. Pitted outwash is the most extensive drift deposit. There are 496 named lakes in the county, a large percentage of which are kettle lakes in pitted outwash. Many of the marshes occupy kettles. It is estimated that 15% of the area is occupied by lakes. The uplands between lakes may be small, but the observer can see that the summits are the remnants of a once continuous plain. Road cuts show that the outwash in this county consists largely of horizontally bedded sand. There is some cross-bedding.

Terminal moraines are characterized by knobs and sags; there are no level uplands or equality of summits. The moraines rise above the adjacent outwash. Boulders are a conspicuous feature. The material is till, the unassorted mixture of material deposited by the melting ice without later transportation by wind or water; various proportions of fairly well assorted gravel, sand and clay are to be found. Lakes occupy many of the kettles formed as in pitted outwash by the burial and subsequent melting of ice masses. Some of the more conspicuous terminal moraines are: (1) the Muskelunge Moraine south of Trout and Muskelunge lakes, (2) the Boulder Moraine southwest of Boulder Junction, (3) the Winegar Moraine in the northwestern part of the county, and (4) the moraine south of Lake Vieux Desert.

Drumlins are a glacial feature of special interest. A drumlin is a smooth oval hill composed mainly of unassorted glacial drift. The long axis is parallel to the direction of glacial movement. Many have a length which is several times the width. The end toward the glacial center is steeper than opposite end. The shape is like the longitudinal section of an egg. Drumlins were formed under moving deep ice at a considerable distance from the ice front. They are produced by the molding of previously deposited drift, in part by plastering on of new material. In forested areas drumlins are not easily identified. With vertical aerial photographs or accurate topographic maps recognition is easy. There are a large number of drumlins in the area southwest of Phelps.

Dunes. In an area of sandy soil it is to be expected that the wind will form low sand hills called dunes. Vegetation obscures such hills and prevents sand movement. There is a dune not far from the highway 45 in the southeast corner of section 21, T.42, R.10E.

The lakes and streams of Vilas County are probably her most valuable geological resource. The largest and deepest lake entirely within the county is Trout Lake which has an area of over 6 square miles and a maximum depth of 117 feet.

The lakes and streams were an essential transportation route. Over one hundred years ago the federal Geological Survey made surveys in Iowa, Minnesota and Wisconsin. Dr. J. G. Norwood and his party left LaPointe for the headwaters of the Wisconsin on September 18, 1847. They reached Trout Lake on September 29th and Prairie du Chien the morning of October 19th. Following is a part of their narrative.

"There is an Indian village at Trout Lake, which is only occupied, however, during the summer and fall months. They have gardens for corn and potatoes at this place, though their principal dependence for food is upon the lake, which yields them a plentiful supply of fine fish. We received from an Indian here a lot of very fine potatoes, a most acceptable present, as more than two-thirds of the provisions we had brought from LaPointe were consumed, and we had not yet performed more than one-third of our journey.

"Trout Lake is seven or eight miles long by about four miles wide, and contains a number of small islands. It is surrounded by drift hills, from twenty-five to forty feet high, supporting a sparse growth of small pines and birch. Our course across it was northeast, to a trail leading to Lower Rock Lake. (Palette?) We encamped on the trail, a short distance from the lake. At six o'clock, P.M. the thermometer stood at 31° Fah., and our tent and baggage, which had got wet in crossing the lake, were frozen.

September 30. Ice formed one-fourth of an inch thick last night. The portage between Trout and Lower Rock Lakes is about two miles and a quarter in length and runs along the base of drift hills. These lakes are connected by a small stream, not navigable for canoes. The Lower Lake is about half a mile in diameter. A portage of three hundred yards leads to Upper Rock Lake, which is one mile in its largest diameter, and contains a number of small islands. These lakes are also connected by a small stream. They derive their name from the immense number of boulders which line their shores, and show themselves above the water in the shallow parts. The islands, in the upper one, are made up almost entirely of boulders, with a thin soil covering them, and supporting a few small trees. Some very large masses of syenitic granite, hornblende, and greenstone, with smaller ones of amygdaloid, were seen near the east end.

"e had great difficulty in finding the portage from this lake. It begins

on the northeast shore, and is about two and a half miles long. Its course is nearly due east, passing a good part of the distance along the margins of cranberry marshes. Three small ponds were passed in the first two miles. They are connected by a small stream flowing into Upper Rock Lake (Birch Creek), which is navigable for canoes up to the second pond. From this point a portage of everything has to be made to Lower White Elk Lake. (White Birch). The country passed over yesterday and today is made up of drift hills, from twenty to sixty feet nigh. The sand is white and coarse, while the boulders, which are disseminated through the upper part, were derived almost entirely from granitic rocks. The soil is thin but supports a growth of small pine, poplar, birch, spruce, hemlock, fir, a few oaks, and some bass-wood; the swamps, as usual, being filled with tamerack, or, where that is wanting, overrun with cranberry bushes.

Lower White Elk Lake, where we camped, is about three-quarters of a mile long and a quarter of a mile wide. Here we found a number of deserted wigwams and the remains of a garden. The lake affords great numbers of fish, and the quantity of their remains scattered around shows they are the principal article of food among the Indians who occasionally inhabit it.

October 1. A very heavy frost this morning; the thermometer standing at 25° Fah. at half-past six o'clock. We crossed First White Elk Lake, and, by a stream twenty feet wide and a quarter of a mile long, passed into Second White Elk Lake (Ballard) which is about two miles long and one mile wide. From this we passed into Third White Elk Lake, (Irving)by a stream ten yards wide and three hundred yards long. This lake is nearly circular, and about one mile in diameter. It is very shallow, not having a depth of more than three feet at any point, and has a mud bottom. We noticed here a phenomenon, not hitherto observed in any of the great number of small lakes we have seen in the territory. The whole surface of the lake was covered with bubbles of light carburetted hydrogen gas, which were constantly ascending from the bottom.

From this lake, a portage of a quarter of a mile brought us to the Fourth White Elk Lake. (Laura). The portage leads due east, over drift, covered with a better soil than any met with for several days past. It supports a tolerably good growth of sugar maple, birth, oak, poplar, and a few pines. This lake is a beautiful sheet of water, about one mile long and three-fourths of a mile wide. The bottom is covered with pebbles and the shore with boulders, some of which are very large; one of them being over fifty feet in circumference. This is the source of the east or Manidowish branch of Chippewa River; all the lakes and streams beyond this point, which send their waters to the Mississippi, being tributaries of the Wisconsin. The hills bounding the north and east shores, are about one hundred and fifty feet high, and are composed of white sand, with occasional boulders scattered over the surface. Almost all the boulders seen, for the last three days, were granitic and small. Today, however, at the Fourth Elk Lake, (Laura), boulders of other rocks were numerous, and, from the size of some of them I infer that the source from which they were derived is not very distant.

The portage to the head-waters of Wisconsin River starts due east from this lake. In about half a mile the trail divides, the left-hand branch leading directly to Vieux Desert Lake, the other to a small lake which discharges its waters into the Wisconsin, about ten miles in a direct line south of Vieux Desert. We determined to take the shortest route, principally on account of the little provisions we had remaining, and the certainty that they would be exhausted before we could reach any point where supplies could be had.

The portage is about six miles long, over a high, rolling pine country, which does not afford a drop of water, from the Upper White Elk Lake (Laura) to within a quarter of a mile of the end of the portage, where a small stream, ten feet wide, from the northwest, crosses the path. (Buckatabon Creek).

The high and broad strip of land which divides the waters of the Chippewa from those of the Wisconsin is made up of white sand, with small boulders thinly

scattered over the surface. The pines with which it is covered are small, but very tall and straight, many of their trunks rising fifty or sixty feet without a branch. On some of the higher hills a great many small birch were seen; and in the vicinity of Muscle Lake the sugar maple began to appear.

October 2. The ground was whitened by a heavy frost, and the atmosphere cool and bracing. Muscle Lake, (Upper Buckatabon), upon which we began our voyage to the Mississippi, is about one mile long and rather more than half as broad. A small stream, about one hundred and fifty yards in length, led us into another lake, rather more than half a mile in diameter. (Lower Buckatabon). It discharges its waters into the Wisconsin River, through a small creek, from one to five yards wide, running east. The creek is very shallow, very crooked, and much obstructed by drift-wood, but without a rock of any description. Its whole course is through swamps, bordered by sand-banks covered with pine. The banks have quite a reddish appearance, although the sand in the bed of the river is white. The entire bed of the creek, in many places, is covered by several species of Unio.

At half-past twelve o'clock we entered Wisconsin River, which is twelve yards wide at the junction, and from three to four feet deep. Its course is south for several miles, but gradually changes to southwest, which was the prevailing course during most of the afternoon. We encamped about eighteen miles below the mouth of Muscle River, (Buckatabon), although in a direct line, probably, not more than six or seven miles, as the river is remarkably crooked. It is from ten to fifteen yards wide, and is occasionally obstructed by drift-wood. We did not see a rock or pebble of any kind, until just before reaching our camping ground, when a solitary boulder showed itself; and, a few minutes afterwards, the shores were found lined with pebbles, washed out of the banks, which are composed of sand, and are from three to twenty feet high, and covered with pine, fir, and spruce, with a few aspens and small birch. The low grounds,

which frequently intervene between the river and the high banks, support elm, and, where very low, tamerack in abundance. The margin of the water is overhung by alders and cranberry bushes. At one point the drift was seen resting on a bed of reddish-coloured indurated clay. The banks, where slides have taken place, present all the appearance of stratification, with a dip to the south greater than the fall of the river. A few first-rate and many second-rate pines were seen.

October 3. We left camp at 8h. 30 min. this morning, and at 1h. 30 min. reached the first rapids. They are made by a low range of gneiss and gneissoid granite, bearing northeast and southwest, and are half a mile long. The fall is not very great, but the navigation was rendered rather difficult by the great number of boulders, some of them very large, which cover the bed of the river for nearly the whole distance. Above the rapids the river is fifty yards wide; below them it contracts again to thirty yards in width.