

CHAPTER II

NATURE THROUGH SCIENCE

PROFESSOR SAMUEL WEIDMAN ON THE GEOLOGY OF THE COUNTY—PROFESSOR JAMES H. EATON'S PAPER—ORIGIN OF THE QUARTZITE—SLOW UPHEAVAL OF THE SANDSTONE AND QUARTZITE STRATA—THE DEFLECTION OF THE BARABOO RIVER—PIONEER SCIENTIST OF THE REGION—PROFESSOR LAPHAM'S FIELD NOTES—THE DREADFUL DELLS—FLORA ABOUT THE DELLS—GEOLOGY AROUND BARABOO AND LYONS—DEVIL'S LAKE DESCRIBED—IRON REGIONS OF SAUK COUNTY—THE WISCONSIN PINERIES—DEVIL'S LAKE STATE PARK.

An attempt has been made in the foregoing chapter to draw but the boldest lines picturing the natural features of Sauk County. The more scientific details and the fine-line etchings have been reserved for others who are so well qualified to present them. The first in this array of special talent is Professor Samuel Weidman, the widely known geologist.

Professor Weidman has been connected with the geological department of the University of Wisconsin and with the Wisconsin Geological Survey for many years. He is a recognized authority on the formations in Sauk County, having made a special study of this interesting field. Doctor Weidman is the author of volumes and special papers bearing on the subject in this county and state.

GEOLOGY OF THE COUNTY

By Samuel Weidman

The natural features of Sauk County, especially the Baraboo Bluffs and Devil's Lake, have not only been a great attraction to lovers of beautiful scenery, but also to geologists, because of the very interesting story revealed by the hills and valleys, the rivers and lakes, as well as the rock formations that make up the landscape of the surrounding region. The story of the rocks and hills is indissolubly connected with the history of the whole continent, for within the borders of the county are not only the very latest, but also the very earliest records of geologic events. Only a very brief sketch can, therefore, be presented of the most important features of interest.

ARCHEAN OR PRE-CAMBRIAN GEOLOGY

The oldest rock formations known to geology, the Archean, form the main body of the Baraboo Bluffs. The very earliest of these rocks in the Baraboo region are on the north side of the North Range at the Lower Narrows and on the south side of the South Range at various localities near Denzer, the Devil's Nose and farther eastward, at Alloa, in Caledonia, Columbia County. The oldest rocks are of volcanic origin, and after their eruption, with other similar rocks, formed the Archean land surface for a very long period.

Finally this oldest land of volcanic rocks became submerged, either by an ocean or an inland sea, and upon the bottom of this sea were deposited beds of sand which gradually accumulated until they reached the enormous thickness of 5,000 or 6,000 feet. This great thickness of sand was later changed to sandstone, and finally into the hard quartzite which forms the rock body of the bluffs.

Immediately following the deposition of the sand, thick beds of clay, and over the clay thick deposits of limestone and iron ore were laid down. These beds are now changed to slate and iron formation, and the latter is the source of the iron ores of the district. These beds of slate and iron formation are now found only in the valley between the quartzite ranges, but when originally formed they lay everywhere horizontally over the sands of the quartzite, and all of these formations extended over the surrounding region in flat lying beds.

Following the period when these formations lay in their original horizontal position, there was a time of extensive uplift and mountain-making movements throughout the region, and it was during this period of extensive uplift, probably accompanied by slight volcanic eruptions, extensive folding and faulting, that the once horizontal beds of sand, clay, and iron ore were uplifted into mountain ranges and the beds folded and metamorphosed into formations of hard quartzite, slate, and iron formation.

Accompanying this period of uplift and following it, there was a long period of erosion of the uplifted region, and as a final result the mountains were gradually worn down nearly to sea level, leaving only the very hardest and most resistant rocks to stand out as low ridges, as illustrated in the cross section. The degradation of the mountains to a nearly level plain was reached near the close of the Archean Age, and at this stage the Baraboo Bluffs stood out as mere remnants of a mountainous tract, only about 1,000 to 1,500 feet above the surrounding lower plain of Archean land.

PALEOZOIC GEOLOGY

When the early Paleozoic sea advanced, due to the low sinking of the land, the Baraboo quartzite bluffs had been formed essentially

as they stand today. The quartzite ridges stood as islands in the sea, and about the rocky shores were formed the sandstone and conglomerate that lie against the eroded beds of quartzite. The first deposits formed against the quartzite was coarse gravel and boulders, now hardened into conglomerate. Examples of the conglomerate are well exposed in the ravines at Parfrey's Glen, in Durward's Glen, and on the north face of quartzite at the Upper Narrows at Ableman, as well as many other places along the sides of the bluffs.

Over the coarse beds of conglomerate, and sometimes between them, are thick beds of sandstone and shale, all of which lie in a horizontal position against the tilted strata of the old quartzite.

The sandstone formation and the conglomerate beds associated with it belong to the Upper Cambrian period and has very generally been called the Potsdam sandstone, because it is the same age as the sandstone occurring at Potsdam, New York. The thickness of the sandstone is about 700 to 800 feet a short distance away from the bluffs, but on the slopes of the quartzite ridges it is necessarily much thinner, because the ridges stood as islands in the sea in which the sands accumulated.

Thin beds of limestone, ten to fifteen feet thick, occur in the upper portion of the Potsdam sandstone, well exposed at the old lime kilns at Eiky's quarry in section 25, Greenfield, and at Wood's quarry in section 10, Baraboo. The limestone of these old quarries is no longer used for burned lime, but at present is crushed and used for road purposes.

In the western part of the county there are much later limestone beds forming the highest portions of the uplands which belong to the Lower Magnesian formation. This limestone is found also in a few places on the uplands in the northwest part and in the southern part of the county. Above the Lower Magnesian limestone occur in a few places beds of the St. Peter sandstone. It is very probable that still later deposits of Paleozoic formation, such as the Trenton limestone and the Niagara limestone, may have been deposited above the St. Peter formation, but if so all traces have been removed by subsequent erosion.

The deposition of the various formations of the Paleozoic was not a continuous or unbroken series of events. Uplifts of the land took place, causing retreats of the seas, during which erosion of land would take place instead of the continuous accumulation of sediment in the sea bottoms.

While the 700 to 800 feet of Upper Cambrian (Potsdam) sandstone formation was being formed, only minor breaks in the progress of sedimentation took place. The Upper Cambrian may be divided into four or five minor formations which appear to be separated by slight intervals of erosion. Between the Upper Cambrian and the Lower Magnesian limestone, however, there was probably an important break

in sedimentation, and in many places in Wisconsin the Lower Magnesian itself may be divided into two formations—the Oneota and the Shakopee, which are distinctly separated by a marked unconformity and break in sedimentation. Between the Lower Magnesian and the St. Peter sandstone there was a very long interval of erosion, and likewise between the various formations that succeed the St. Peter formation.

EARLY PALEOZOIC LIFE

Before the Upper Cambrian sandstone was formed, when the quartzite, slate, and iron formation of the Archean was deposited, no forms of life existed, and hence no fossils are preserved in the Archean rocks. Some organisms may have existed during the latter part of the Archean, but if so the forms of life were of a low order, and no well-defined fossils have been preserved.

The life of the period when the Upper Cambrian sandstone and the Lower Magnesian limestone was formed, however, was fairly abundant, considering the type of organisms existing at that time. At that stage in geologic history the vertebrate animals had not been developed, hence the remains of fishes, the earliest of the vertebrates, have not been found in the strata of Sauk County. However, the invertebrates were well developed, and many species of crustacea, brachiopoda, gastropoda, and corals lived in the sea of that period.

Not all the beds of sandstone and limestone, however, contain fossils. The fossils appear to be concentrated in considerable abundance in certain beds and are not present in others. Following a break in sedimentation, when the sea again advanced over the land, life appears to have been especially abundant.

Not all the forms of life when the Paleozoic sandstone and limestone was formed can be mentioned. Trilobites, three-lobed forms of crustacea, were very abundant in the sea when the Potsdam sandstone was formed, and it may be of special interest to state that an important genus of trilobites has been named *Saukia*, after Sauk County. Thirteen species have been described as belonging to the genus, many of which occur in Sauk County and in other counties of Wisconsin, but some occur as far away as Texas, Colorado, Nevada, New York, and Nova Scotia.

A new species of brachiopod, an oyster-like organism, has been named *Eorthis winfieldensis*, from the fact of its discovery in the town of Winfield.

GLACIAL GEOLOGY

The eastern part of the county, east of Baraboo, is covered with glacial drift, but the western part contains no drift except a few

boulders. The terminal moraine at the border of the drift area consists of ridges and hummocks of loose boulders, gravel, sand, and clay. The moraine runs north and south from a short distance east of Delton, through Lyons and Devil's Lake, and crosses the Wisconsin River at the big dam at Prairie du Sac. Where the moraine crosses the East Bluffs at Devil's Lake a wide detour is made to the eastward as far as Point Sauk, because of the high elevation of the bluff.

West of the terminal moraine are a few boulders, scattered over the surface as far as Reedsburg. These boulders were probably deposited by an invasion of ice much earlier than the one that formed the terminal moraine.

The ice sheets that invaded Sauk County were parts of great ice sheets that covered a large portion of North America, north of the Ohio and Missouri Rivers. The terminal moraine, formed by the latest ice sheet, has been traced across the entire continent, from Long Island on the Atlantic to Puget Sound on the Pacific.

Although the glacial deposits directly overlie the hard rock formations of sandstone and quartzite in Sauk County, a very long period elapsed between the deposition of these rock formations and of the glacial drift. In other parts of America many thick formations were deposited after the Paleozoic rocks were formed and before the Glacial period began. This long period between the deposition of the Early Paleozoic sandstone and limestone and the Glacial drift is represented by nearly the whole of the Paleozoic age, the whole of the Mesozoic age, and a large part of the Cenozoic age—a period of time variously estimated at 100,000,000 to 200,000,000 of years in length.

The Glacial period itself is a relatively short and very recent epoch in geology as compared with the time which has elapsed since the sandstone was laid down against the rocky shores of the island of quartzite. The beginning of the glacial period, however, found the valleys of the district about 225 feet below their present levels, and these were filled with boulders, gravel, and sand carried by the ice and waters of the Ice age from the regions to the northward and northeastward. Therefore important changes in the superficial features of the county have been wrought even during the Glacial period, and very probably the earliest of the glacial deposits were formed as long ago as several hundred thousand or a million years.

Since glacial time the ordinary agents of erosion and weathering have been at work upon the drift and older rocks, weathering them into soils and removing them to lower levels, as in all the earlier periods of land degradation. Especially rapid has been the change in the aspect of the region since the land has been cleared, through the natural forces of erosion combined with action of man in the cultivation of the soil and in other active pursuits of our modern civilization.

THE HISTORY OF SCENIC FEATURES

The hills and valleys and other landscape features of Sauk County owe their origin to various geologic agencies that have been in operation from almost the very beginning of geologic history. Volcanism, mountain-making movements, marine sedimentation, erosion by the sea, the rivers, the wind, and the ice have all been active at various times, and to a varying degree, hence the final results observable today as the natural scenery are the inheritance of all the geological forces active in the past.

THE BARABOO BLUFFS

Nowhere in Southern Wisconsin or in the surrounding region are there elevations which so nearly approach mountains as the ranges of the Baraboo Bluffs. The usual altitude of the bluffs reach up to 1,200 and 1,500 feet above sea level, the highest, Point Sauk, reaching an altitude of 1,620 feet. The surrounding lowlands in the valley bottoms are usually from 800 to 900 feet above sea level, hence the bluffs generally rise from 400 to 800 feet above their surroundings.

The history of the bluffs involves the following stages: (1) The formation of the volcanic rocks, portions of which are exposed at the Lower Narrows and in the vicinity of Denzer, Devil's Nose, and Alloa; (2) the deposition of sands over the volcanic rocks in the Archean sea bottom; (3) the deposition of clays, limestone beds, and iron ore over the sand; (4) the uplift and folding of the Archean beds, forming a canoe-shaped structural basin in a mountain range, accompanied by igneous intrusions, faulting, crushing, and shearing, resulting in the metamorphism of the sandstone to hard quartzite and of the clays and iron ore to hard slates and iron formation; (5) a prolonged period of erosion of the Archean mountains during which the folds of the quartzite were largely worn away, leaving only high ridges of quartzite along the rim of the canoe-shaped basin standing above the surrounding Archean land; (6) the submergence of the region by the Early Paleozoic (Upper Cambrian) sea finally covering even the crests of the ridges of quartzite; (7) a protracted period of deposition, during which the Potsdam sandstone, Lower Magnesian limestone and probably later Paleozoic formations were laid down about and finally over the quartzite, completely burying the mountainous ridges; (8) the elevation of the Paleozoic sea bottom, again converting the region into land; (9) a long period of land erosion, during which the Paleozoic formations were largely worn away and the quartzite ridges partly uncovered, as they appear today.

The Baraboo Bluffs are, therefore, a "resurrected" mountain, though not with the full height which they attained in Archean time. When the Archean beds were folded by the mountain-making forces,

stage 4, the region probably reached the height of the Alps or the Rockies; after the Archean mountains had been worn down and submergence by the Paleozoic sea began (stage 6), the quartzite ridges, as mere remnants of the Archean mountains, stood only 1,000 to 1,500 feet above the surrounding Archean plains; while at the present time the bluffs stand only 400 to 800 feet above the surrounding lower land.

The Baraboo Bluffs, therefore, represent a fossil mountain of the Archean age, and as such is now so well known in the literature of geology and physiography that fossil mountains of a similar nature in other regions are often referred to as "baraboos."

THE NARROWS

These are four narrows or passes across the quartzite ranges, all of which are striking scenic features. Two of these are occupied by the Baraboo River, one by Narrows Creek, and one by Devil's Lake.

The Upper Narrows of the Baraboo River are located at Ableman, through which pass the river, the C. & N. W. Railroad, and the public highway. It has a depth of about 200 feet and a width of one-eighth to one-fourth of a mile. The slopes of the Upper Narrows are rugged and precipitous. The quartzite on the north side of the narrows is covered with Potsdam conglomerate, which overlies the truncated beds of vertical quartzite with unconformable contact. So clear an example of unconformity in the rock strata is not often seen, and for this reason the locality is a popular one for university classes in geology. An additional attraction is the quartzite breccia on the east wall of this narrows.

The narrows of Narrows Creek are located $1\frac{1}{2}$ miles west of Ableman, where a narrow pass in the quartzite is developed. This pass is narrower than the others. Its walls are nearly vertical and possess the same rugged beauty as those at Ableman.

The Lower Narrows, located about six miles northeast of Baraboo, is a conspicuous pass in the quartzite range about 400 feet deep and one-fourth of a mile wide, through which the Baraboo River flows. The north face of the range at the Lower Narrows is formed of volcanic rock, but the main part of the ridge is quartzite. The Lower Narrows is a much more prominent notch in the quartzite range than the narrows at Ableman.

The most prominent pass across the quartzite, however, is the one in the South Range in which lies Devil's Lake. This pass has a depth of about 600 feet and a width of about one-half mile, and because of its occupancy by the lake it is the center of interest for the whole region.

The history of each of these several narrows is much the same. They are gaps cut into the quartzite ranges by the erosive work of

ivers. The erosion of the passes, however, was not accomplished by the rivers that now flow through them, but by rivers belonging to an earlier drainage cycle.

The history of the narrows appears to involve the following stages: (1) Erosion of the passes in the quartzite during Archean time, when the Baraboo Bluffs were being worn down from a mountain range; (2) the submergence of the quartzite ranges and the filling of the passes with the Potsdam sandstone and the complete burial of the quartzite ridges; (3) a second period of erosion, during which the quartzite ridges were again exposed by removal of the sandstone and overlying beds, and the passes again occupied by streams and narrows cleaned out and deepened.

Although the pass in which lies Devil's Lake is not now occupied by a river, the form of this gap across the range is such as to leave no doubt about its origin through the work of a great river which slowly carved its way across the quartzite as erosion sank deeper and deeper into the quartzite and surrounding rocks.

DEVIL'S LAKE

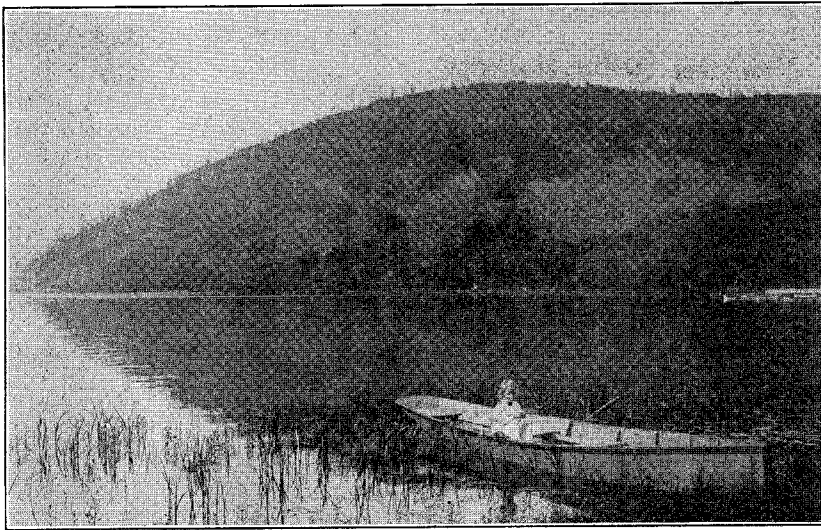
The origin of Devil's Lake is but a short episode in the history of the gorge in which it lies. The lake has a maximum depth of about forty feet. It was not formed in any manner by the action of volcanism. The huge blocks of rock that lie against the surrounding cliffs, and which add greatly to the wonder and beauty of the lake, are not of volcanic origin, but consist of quartzite blocks accumulated as loose talus on the slopes of the gorge by the ordinary action of weathering and erosion. When the great river flowed through the gorge the talus deposits were carried away, but since the gorge is no longer occupied by a river the blocks of loose rock and soil, fallen from the higher slopes of the rock walls, slowly accumulate on the lower slopes of the cliffs.

The lake is of glacial origin and was formed by the deposition of terminal moraine in the old river gorge, forming dams of glacial drift at the ends of the lake. The moraine at the north end of the lake lies very near the lake shore, but at the south end the moraine lies about a half-mile east of the lake. Between these drift dams the basin was formed, and the lake therefore occupies an unfilled portion of the old river valley. The lake was formed in the relatively recent glacial history of the region, and its origin is therefore only a very recent and short episode as compared with the long history of the gorge in which it lies.

Glens. Important scenic features are the numerous glens that lie along the sides of the Baraboo Bluffs. Parfrey's Glen and Durward's Glen are probably the best known of these, but there are many others

that are almost equally as attractive from the scenic point of view. The glens owe their origin to the work of erosion of small streams, which have carved deep gorges in the sandstone and conglomerate that lie against the quartzite bluffs.

The Dalles of the Wisconsin. The Dalles are a narrow canyon-like stretch of the Wisconsin Valley, seven miles in length, on the border of Sauk County, near Kilbourn. The depth of the gorge is from 50 to 100 feet. The part above the bridge at Kilbourn is the Upper Dalles, and that below, the Lower Dalles. The sides of the Dalles are nearly vertical much of the way, and usually so steep that landing



EAST BLUFF, DEVIL'S LAKE

is impossible. Between the walls the Wisconsin River formerly swiftly flowed, but since the construction of the dam at Kilbourn, still-water extends through the reaches of the Upper Dalles.

The Dalles was formed by the relatively rapid erosion by the river of the sandstone forming the walls of the gorge. The weathering and erosion processes follow largely along joint planes. The relative hardness of the sandstone beds also greatly affect the rate of erosion and largely control the development of the peculiar shapes formed by the erosion and weathering processes.

The beds of sandstone out of which the Dalles have been carved plainly show well-defined features of stratification developed when laid down in the Potsdam sea. The beds lie in an essentially horizontal position, and many show striking cross stratification, due to the strong currents along the shores of the sea in which they were deposited.

The main gorge of the Dalles is not only a feature of great beauty,

but it contains also many small gulches and canyons which add greatly to the charm of the whole. Witch's Gulch and Cold Water Canyon not only deserve special mention because of their beauty, but also because of the striking features of rapid erosion which they illustrate. They are much the same in their character and origin as the larger gorge of the Dalles, to which they are tributary, and are due wholly to the sculpture of stream erosion.

PROFESSOR EATON'S PAPER

Among the other widely known scientists of the state, Prof. James H. Eaton, of Beloit College, has made a thorough investigation of the region about Devil's Lake. His conclusions, which have been reported in the Transactions of the Wisconsin Academy of Sciences, Arts and Letters, were as follows:

"The formation of Sauk county is the Potsdam sandstone (Potsdam epoch of the New York Survey). It lies nearly horizontal, with a gentle dip to the southeast. The higher elevations, especially in the southern parts of the county, are capped with conformable layers of the lower magnesian limestone (Calcareous epoch of the New York Surveys). Running east and west through the center of the county are two parallel ridges, with an average elevation of 400 to 500 feet and a base of two to four miles. The distance between them is three to four miles. The Baraboo river runs in this valley and empties east into the Wisconsin. A north and south valley cuts half way through the eastern end of the southern ridge, and then trends east towards the valley of the Wisconsin. In the north end of this valley lies Devil's Lake.

"They are compact, crystalline sandstone, without cement or quartzite. The predominant colors are pink and red, often banded with straight or contorted parallel lines of lighter and darker colors. In some places the rock is an homogeneous white quartz, with distinct and well-formed crystals.

ORIGIN OF THE QUARTZITE

"Both the nature of the rock and its position give evidence that it is metamorphic Potsdam sandstone. The rock presents all gradations from the simple sandstone to the perfectly crystallized quartz. The Potsdam sandstone consists of small round grains of quartz, and is very loosely cemented. It can easily be crumbled with the fingers. Hand pieces of the quartzite may be obtained in all stages from this friable sandstone, to that where the grains are apparent and the rock is less friable, to that where the homogeneousness is here nearly approached, but the small grains can still be seen, and finally to the

perfect homogeneous quartz. No sharp geographical line of demarcation between the sandstone and quartzite, and no gradation in any direction, were observed.

"The homogeneousness of the colored quartzite is not as perfect as it appears. Whenever a surface has been subjected to the weather, the small grains come to view again. The bandings of the quartzite are very similar to those in the undisturbed sandstone. These bands sometimes consist of layers of fine grains of sand. Some of the great blocks of quartzite which have fallen down the sides of the valley are most beautifully covered with regular ripple marks. They must have been first made in the moving sands.

SLOW UPHEAVAL OF THE SANDSTONE AND QUARTZITE STRATA

"The layers are nearly as perfect as in the sandstone, and have a dip equal to the inclination of the ridges. The dip on either side can be seen best from the opposite side. The anticlinal ridge on the east side of the lake is removed by the valley, which trends to the east, and on the west by another valley, which comes down to the lake. Vertical joints also lead to the conclusion that the ridge has been formed by the upheaval of the horizontal layers of sandstone. The layers were not traced north and south to determine whether they are continuous horizontally.

"Both the nature of the rock and its position forbid the idea of aqueous fusion or active volcanic agency. The change must have taken place by the purely wet way of partial solution and crystallization, or by a low degree of heat, working for a long series of years through the moisture in the sandstone, probably aided by the pressure which lifted the ridges. If the latter, the change and elevation of the rock took place at the same time, and both effects were produced with extreme slowness.

"When was the ridge raised—before the glacial epoch? Wm. H. Canfield, of Baraboo, has found abundant proofs of the movement of glaciers over the rock since it has been metamorphosed. In many places on the elevated portions, smoothly polished surfaces of quartz of great extent have been exposed by removing the soil. Before the glacial epoch there seem to be no data for fixing the time of the elevating and metamorphic action. There has therefore been ample time for metamorphic action of the most extreme slowness.

"At a previous meeting Dr. Lapham, Secretary of the Academy, advanced in a paper the view that Baraboo river once ran through this valley on its way to the Wisconsin, and was turned from its former course into its present one by glacial drift. If this view is correct, as the facts seem to warrant, this valley may have been made at any time from the Lower Silurian up to the glacial period. It is not neces-

sary to introduce any great convulsion. The regularity of the layers would forbid any sudden and violent upheaval and cracking of the rock. During the slow process of upheaval a greater extent than the others, perhaps of nearly the present width of the valley, may have been made. The slowly acting agencies of the atmosphere and of water can have widened the fissure and have thrown down the great mass of debris which lies on the south of the valley. The valley is about half a mile wide. The sides slope up from 200 to 300 feet, as steep as the large blocks will lie upon each other, and the remaining height is a perpendicular wall cut by vertical fissures into most fantastic shapes, with natural fortifications and castles, turrets and towers, making one of the most charming bits of landscape in our state.

THE DEFLECTION OF THE BARABOO RIVER

"A word in evidence that the Baraboo river formerly ran through the valley, and was turned aside by the glacier drift. The surface of the lake is thirty feet above the courthouse at Baraboo, and 160 feet above the Wisconsin river to the south. [These figures are Mr. Canfield's.] The lake is more than thirty feet deep and has a bottom of sand. There is therefore a sufficient descent. The valley is a natural course for the river, and running water would have given it some of the features of its present form. In the valley, both north and south of the lake, there is an abundance of drift. A large variety of northern rocks was collected—granite, syenite, and Lake Superior rocks. They, with sand, have filled up a deeper valley to such a height that the river finds a new course to the Wisconsin.

"There is another point of great interest in this region, which does not appear to be easy of solution. On the top of the ridge and in lines running north and south are conglomerated boulders. They are local, and do not extend far to the south of the southern ridge. They consist of rounded, water-worn pebbles, and large boulders of quartzite, embedded in friable sandstone. Some of these conglomerated boulders weigh many tons. They are evidently deposited at a very little distance from the place of their origin. Evidently in this immediate neighborhood pieces of quartzite have been for a long time subjected to running water, and have found themselves in a bed of sand, which has been hardened, and some moving cause has carried them into their present positions. The place and time and agencies which have produced these effects demand a more careful and close study, such as it is the object of the Academy to encourage. There are also signs of a secondary metamorphic action in some of the quartzite. A number of specimens were obtained which were homogeneous, but contained large numbers of rounded pebbles, of the same quartzite or of white quartz, firmly embedded in them."

PIONEER SCIENTIST OF THE REGION

Dr. Increase A. Lapham, who died more than forty years ago, was one of the most patient, indefatigable, and brilliant scientists along botanical, geological, meteoric, and archaeological lines who ever lived in Wisconsin. He was a resident of Milwaukee for many years, but there was no locality in the state which promised to yield interesting results to which his mild, unobtrusive yet persistent personality did not penetrate. His great specialties were plant life, meteorites, and prehistoric mounds, and the so-called Laphamite Lines have been long accepted by scientists as marking a remarkable discovery in meteoric investigation. A few years before his death he had investigated the history and mapped the position of every meteorite which had fallen in North America, and his "Antiquities of Wisconsin" still forms the basis of all archaeological studies in the state. Doctor Lapham died at his farm, near Oconomowoc, Wisconsin, where his daughter still resides, on September 14, 1875.

In the course of his Wisconsin travels, Professor Lapham explored the Dells and the Devil's Lake region, but it will become evident that his theory then formed as to the origin of the famous Lake of the Hills was not substantiated by later investigations.

PROFESSOR LAPHAM'S FIELD NOTES

Some years ago Miss Julia A. Lapham, of Oconomowoc, Wisconsin, sent to the Sauk County Historical Society the field notes made by her father when he traveled through the Dells and Sauk County, from October 22 to November 1, 1849. Professor Lapham was the author of the first history of Wisconsin and a number of works of a scientific nature. The field notes were given to the Sauk County Historical Society in 1912, and were read by Mrs. J. E. English. The field notes are illustrated and make a valuable addition to the manuscript collections of the society. Mr. Lapham was accompanied by Samuel Linconde, taxidermist, and Henry O. Hubbard, a scientist and historical writer. In part the description runs as follows: "We arrived at Dell creek, near the foot of the Dells, just at night, but were much struck with the difference in the character of the sandstone here from that observed farther east. It undoubtedly belongs to the lower or older portion of the formation, being the True Potsdam sandstone of the New York geologist. The rock has a greater hardness and a somewhat regular stratification. The different degrees of hardness, and consequent power to resist the action of the elements, have given rise to many fantastic shapes in the cliffs. At the place where the ferry boat leaves the shore on the east side of the river we observed the layer of diagonal and curved strata which is so con-

spicuous a feature above. It is here about three feet thick, but gradually becomes thicker as we ascend the river from this place.

THE DREADFUL DELLS

"The next morning our eagerness to see the dreadful Dells induced us to leave our beds at 5 o'clock and drive four miles to the Dell house, situated at the foot of the steep rock gorge. The river is now unusually low, so that the current is not as rapid as usual. In this respect we were very fortunate, as we were able to find a man who was willing to paddle us up through the gorge in a small boat. When the water is high, about fifteen feet above its present level, the narrowness of the passage causes it to rise and rush through with great force and velocity. At such times it would be impossible to ascend with a boat. The constant flow of water has worn away the rocks on each side, so that the river is wider at the water level than a little higher up. The width of the gorge in the narrowest place is about fifty feet, so that the story recorded on some old maps that one could jump across is without foundation in truth. At this place a bridge is contemplated, for which a charter has been granted by the legislature of the state. The general width may be stated as from fifty to one hundred feet.

"It is related that a stick of timber thirty-two feet long was slid down the hill and precipitated over the bluff endwise into the water; that it went down and remained for some time out of sight. It may be supposed to be fifty feet deep.

"The Dells may be considered as extending from near the mouth of the Lemonwier, ten miles above the Dell house, to the mouth of Dell creek, four miles below, having, therefore, a length of about fourteen miles. Most of the way the gorge is not so narrow as the point visited by us.

"As we paddled along against the current we occasionally crossed from one side to the other, to take advantage of eddies and places where the water runs less swiftly. When passing some points of rock the force of three paddles was required to stem the rapid current. Our guide at one place directed the boat into an opening in the cliff just sufficiently large to admit us; and we passed for some yards through this wide channel and again emerged from another opening above the first. At another point we entered a large fissure which extends thirty feet from the edge of the water. It gradually diminishes the width above until it was nearly closed at the surface of the ground high above our heads. We noticed many other smaller fissures.

"As we ascended along the margin of the river we had a good view of the strata on the opposite side, and we could observe that the curved layers gradually increased in thickness, though it was always

placed between horizontal layers, both above and below. We soon came to where the curved strata were more irregular, resembling the banks of sand, gravel, and clay in the drift. This is said also to be the character of the sandstone on Lake Superior, forming the Picture Rocks.

"No trace of fossils was discovered. The navigation of the Dells is very difficult, requiring much skill and experience to guide the rafts of timber through without striking against numerous projecting rocks.

FLORA ABOUT THE DELLS

"Vegetation about the Dells presents some peculiarities. We find here the white, yellow, and scrub pine, the hemlock and cedar. Among the shrubs we notice *comptonia*, *asplenoids* not before credited to Wisconsin.

GEOLOGY AROUND ADAMS AND LYONS

"From the Dells we passed south over a prairie to the little town of Lyons, situated on the Baraboo, one mile above Adams, the county seat of Sauk county. About one mile north of Lyons we found a ledge of rock similar to that found at Portland, in the southwest corner of Dodge county. It has the same quality, character, and is evidently the same geological formation. Looking about, we found large fragments of conglomerate apparently of the same kind of rock, the pebbles of various size, usually less than an inch in diameter. A mile below Adams the sandstone is quarried in the high bluff. Limestone is also found, and lime is burned for the use of the people of Adams, some seven miles from the village.

DEVIL'S LAKE DESCRIBED

"About three miles south of Adams lies a small lake which is sunk deep in a group of very high, rocky hills. From the high bluffs a mile east of Adams the valley of this lake may be seen forming a sudden break in the hills, and it is apparent to the eye that the hills are higher at this place than on either side. This lake is vulgarly called Devil's Lake, from the wild, rocky place in which it is found. It is at most inaccessible except at one point for teams. It has no visible outlet on the surface, the surplus water being carried off by subterranean passages into a small branch of the Baraboo. From the stories I had heard about this little lake, I was prepared to find it one of much interest, perhaps the crater of an extinct volcano.

"Passing directly south from Adams, we soon began to ascend the hills and found the roads difficult on account of the numerous stones

and sharp ascents. About three miles from Adams we found, although we had ascended very considerably, we had a much higher hill on our left, between us and the lake. We halted opposite the south end of the lake and, upon approaching the bank, found a perpendicular escarpment of this rock, 250 to 350 feet high, reaching directly down to the water.

"The lake is not entirely surrounded by these rocks. There are three prominent cliffs, separated by narrow valleys. A large body of broken fragments have accumulated along the edge of the water, making it very difficult to walk along the shore; yet two of our party made the circuit of the lake, jumping from rock to rock as best they could.

"This rock appears to have a dip from the lake, as indicated by the distant view of the hills. We may, therefore, suppose this valley or notch to owe its origin to a violent uplift of the rocky strata, perhaps at the time they were altered by the volcanic heat which converted the sandstone into a quartzite rock. Such an uplift would naturally form a chasm and leave the strata inclining from it in different directions."

IRON REGIONS OF SAUK COUNTY

The following fair summary of the nature and industrial utilization of the iron ores mined in Sauk County is from Ellis B. Usher's recently published "History of Wisconsin":

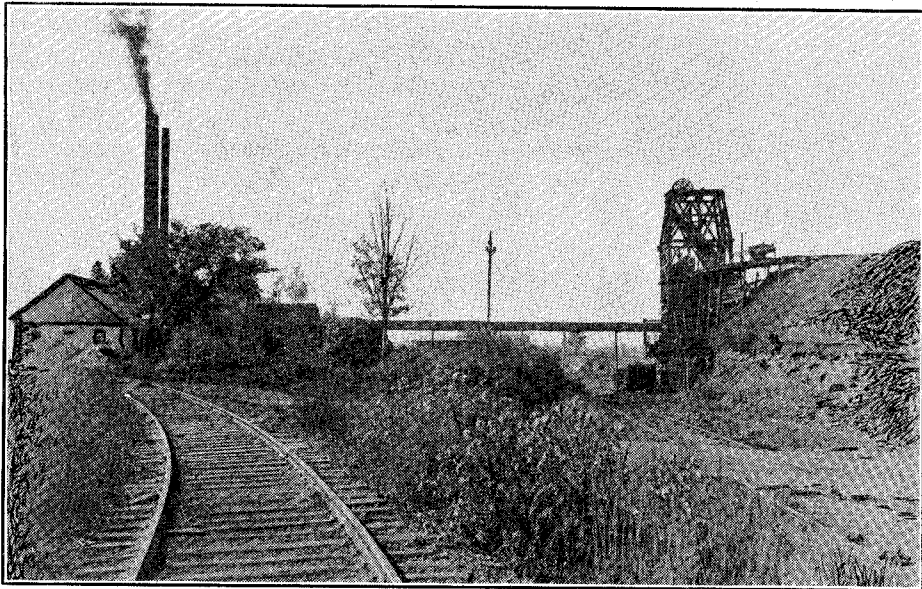
"An iron district which it is thought was visited by Dr. James Gates Percival, the first geologist of the state, as early as 1856, is in the quartzite region of Sauk county. In 1882 Prof. T. C. Chamberlin made the following statement: 'In the Baraboo region of Sauk county large bunches of brilliant specular iron in veins of white quartz are often met with, but no indication of the existence of ore in quantities in the Huronian of this region has been observed. It is a matter of great interest that while we have in the Penochee and Menominee Huronian the same kinds and succession of rocks as in the iron district of Marquette, in the Baraboo country and to the northeast from there, I find a great development of the porphyry, so characteristic of the Huronian district of Missouri. It is wholly within the possibilities that iron ores may yet be discovered in the Baraboo Huronian.'

"Iron had been known in this county prior to 1850, and between 1850 and 1880 an iron deposit at Ironton furnished sufficient ore to successfully operate a small furnace.* Prof. Samuel Weidman, in

* Smith's Furnace (John F. Smith). One stack, thirty by eight feet, built in 1857; warm blast; open top; steam and water power; annual capacity, in 1876, 2,000 net tons. Smith's and all the other furnaces of Wisconsin started at an early day were charcoal-burning plants.

his bulletin upon the Baraboo iron-bearing district, says that this Ironton deposit of ore occurs 'in the Potsdam sandstone, and thus in quite a different formation from the iron-bearing rock in which the iron ore at North Freedom occurs.'

"At North Freedom, as at Ironton, considerable surface ore was obtained before the discovery of the ore at a greater depth by W. G. LaRue. This surface ore was largely used for paint. At one time the business was so prosperous, and the excitement was so great, the name of the village of North Freedom was changed to Bessemer. Afterwards the former name was restored.



NORTH FREEDOM IRON MINES

"The mine which was opened by the International Harvester Company was abandoned after being operated but a short time.

"The iron ore of the North Freedom District was first discovered in April, 1900, by W. G. LaRue, although explorations had been started as early as 1887 by the Douglas Iron Mining Company. This company expended considerable money in development, and the best material obtained averaged about 35 per cent. Since that time the principal mine of the district was first acquired by the International Harvester Company, and from that ownership passed into the hands of the United States Steel Corporation, which, after a season of development and operation, has closed it, and the impression has gone abroad that it was found unprofitable to operate. There seems to be little doubt that the iron is of good quality and in considerable quan-

tity, but, because of its depth, the large area and thickness of Potsdam sandstone and water overlying it, and the cost of transportation, it is predicted that it will remain idle, and at least await higher prices for iron ore than rule at present. But, even at higher prices, it will be an expensive and somewhat perilous bed of ore to work, because no one can estimate the area of water above the limestone strata, which is said to be seventy feet thick, which will make very heavy pumping a precedent to reaching and mining the ore."

The principal development in the North Freedom iron field was made through the Sauk County Land and Mining Company, composed of Messrs. H. Grotophorst, W. G. LaRue, and Benjamin Dean. The original discovery of commercial ores is given to the father of F. T. Brewster, but it was not until these gentlemen commenced to practically promote the enterprise that anything tangible resulted. In 1909 they leased various properties a short distance southwest of North Freedom to the Oliver Mining Company, and in the following year engine houses, dumps, and other elements of a mining plant were erected, and the ore was actually mined and shipped over the Chicago & Northwestern lines to Milwaukee and other markets. Cottages were erected for workmen, and for several years the hopes of the promoters were intermittent. The Iroquois mine had been abandoned, it is true, but the Oliver people pumped the water from the old shafts, as well as from quite a large area in the vicinity. This, of itself, proved to be an expensive undertaking, and as the amount of ore finally mined did not come up to expectations and, as the work progressed, the deposits did not promise a rich future, the enterprise was finally abandoned. In May, 1914, the Oliver mine was wrecked, and no concerted attempts have since been made to revive mining operations at North Freedom.

Although many thousands of dollars have been spent in exploring the Baraboo region from the Caledonia Hills to the western part of the county, and in opening mines, ore is now being shipped from but one place—the Cahoon mine. This mine is located on the eastern slope of the terminal moraine, about a mile south of the City of Baraboo. The ore is brought from a depth of about 400 feet and shipped to Mayville and other places. For about three years from ten to twenty cars a day have been forwarded during the warm season. In the winter it is impossible to ship the ore, because it freezes in the cars, making it very difficult to unload. A. W. Rohn is the superintendent of the mine.

During the period of exploration by a number of mining companies it was found that ore underlies a greater portion of the region. Some is of low grade and may never be mined, but there are some rich deposits, and these have been purchased by a number of companies. Greater development of this industry is expected in future years.

THE WISCONSIN PINERIES

Sauk County was well within the region of the Wisconsin River pineries, which in the early '50s yielded twice as much lumber as any other in the state. But the lumbering industries of the great valley had comparatively little effect upon the development of the country; they were rather a passing show, although there were some busy rafting days along the waterfront of old Newport. Sawmills were also built on the Baraboo and other streams tributary to the lower reaches of the Wisconsin, but the pine was scattering and none of the minor water courses of this region had enough timber to last long, so that the running of logs from the interior streams of Sauk County was soon found to be impracticable.

Hunt's Gazetteer for 1853 contains the first and only attempt to publish the early statistics of the lumbering of the state that is available, and, as it gives some names of mill owners, as well as output, it is, though incomplete, of permanent interest and worthy of preservation. Hunt's introductory paragraph is more intelligent and comprehensive than was usual among the contemporary writers of the day. It is as follows: "To the lumbermen, the pineries of Wisconsin present inducements for investment and settlement which can be hardly overrated. That of the Upper Wisconsin and its tributaries is the most extensive; and distinguished still more for the fine quality, than the inexhaustible quantities of its timber. The other localities of the white pine and other evergreens are mainly on the Wolf, the great northern affluent of the Fox, and the tributaries of Green Bay, and on the La Crosse, the Black, Chippewa, and the St. Croix branches of the Upper Mississippi.

"The rapids of these streams furnish abundant water for the manufacture of lumber, and on the annual spring rise, and occasional freshets at other seasons of the year, the yield of the mills is floated from the Wolf into Lake Winnebago, and the lower Fox; and from most of the other streams into the Mississippi.

"Scarcely ten years have elapsed since the Alleghany pine of western New York and Pennsylvania had undisputed possession of the market, not only of the Ohio valley, but of the Mississippi and its tributaries, above New Orleans, at which point it competed with the lumber of Maine and New Brunswick.

"The course of the lumber trade may now be considered as permanently changed. The pineries of Wisconsin now control, and will hold exclusive possession of the market of the valleys of the Mississippi and its great western affluents.

"The amount of pine lumber estimated to be sawed in Wisconsin annually, is as follows:

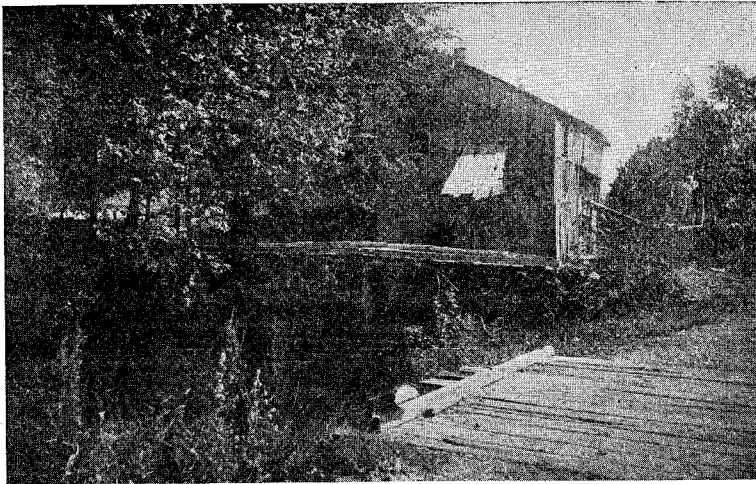
Black River	15,000,000
Chippewa	28,500,000

Green Bay	21,000,000
Manitowoc	24,500,000
St. Croix	20,000,000
Wisconsin	58,500,000
Wolf	25,500,000
<hr/>	
Total number of feet.....	193,000,000

RAFTING ON THE SAUK COUNTY RIVER FRONT

J. T. Huntington, of Delton, an old lumberman of Newport and several years ago bookkeeper of the Wisconsin State Senate, contributes the following paper, "Rafting on the Wisconsin When Newport Flourished":

"Those who now visit the Wisconsin river find only pleasure boats where formerly the lumber raft was very much in evidence. Just when the sending of lumber to market by rafts on the Wisconsin river commenced is not known to the writer, but undoubtedly by or before 1840. By 1855 there was almost a constant run of rafts from soon after the



OLD STYLE SAW MILL

going out of the ice, until the latter part of summer or early fall. The most of this lumber was cut above the mouth of Lemonweir river. Large amounts were cut at Necedah on the Yellow river. Grand Rapids, Stevens' Point, Wausau, Merrill and other points along the Wisconsin, were noted lumbering points. No considerable amount of logs were run down the Wisconsin below Grand Rapids. Some logs were run to Newport and Kilbourn from the Yellow river.

"It is now many years since a lumber raft passed down the Wisconsin river to market and it is safe to say that that method has passed forever.

"In early days the lumbermen started in late summer or early fall for the woods, camps were established, roads cut out and often much timber cut before the advent of snow made it possible to haul the logs to the bank; this banking being on the shore of some of the various streams tributary to the Wisconsin.

"Spring comes, rains melt the snow, the small streams become torrents, the ice breaks away and goes out and with it goes also the logs on their way to the mills. The loggers become drivers. Often extra men were employed for the drive, and do not think that the drive was a pleasure trip. The weather was yet cool if not cold; men were wet all day, sometimes day and night; some lost their lives. Logs were to be kept from lodging on shallows, jams were to be broken and altogether it was a strenuous life. At the mills when the lumber was being cut these loggers and drivers became rafters and rivermen.

"The first part of the raft was the 'crib'. The crib was a square of the length of the lumber and made from 16 to 24 boards deep, held together at the corners by pins known as grub pins. Seven of these cribs formed a single string; two or three single strings made a raft. Three strings made a full Wisconsin river raft.

"At dangerous points these rafts were uncoupled and the run made by single string. The dangerous points were the various falls, dams and the Dells. The most talked of dam up the river was known as Cliret's dam.

"The dam at Kilbourn, built about 1855 or 1856, proved very destructive to lumber and life and was soon removed by the up-river lumbermen.

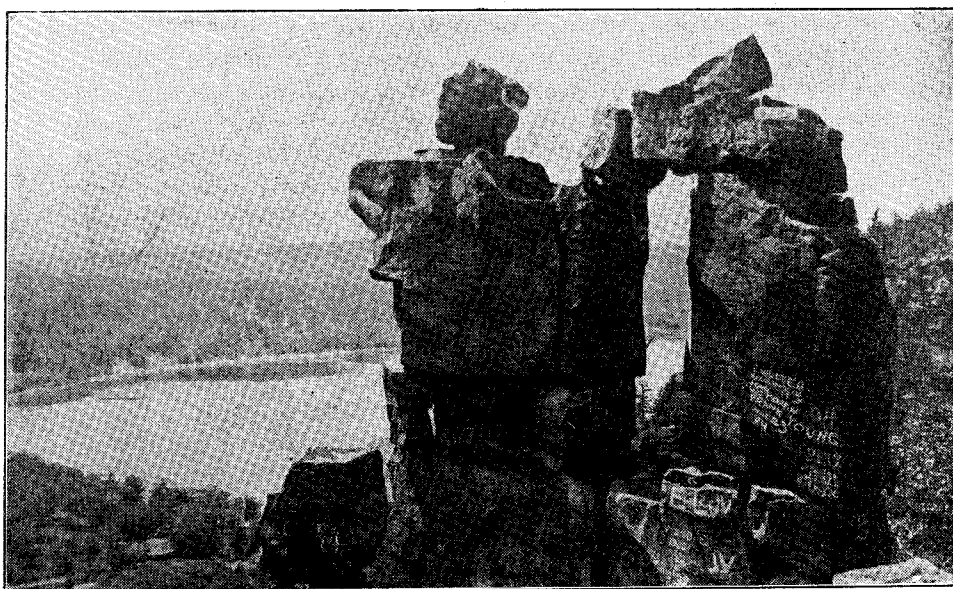
"The Dells was also a dangerous point for rafts at high water—and if the water was very high they could not be safely run. Then the rafts were tied up at the head of the Dells until such time as there was falling water.

"There were many men who earned the title of Dell Pilot, but the only one who left a permanent record was LeRoy Gates. Visitors to the Dells may see his name cut in the rocks at the Narrows, and there it will remain until some upheaval destroys the rocky banks of the Wisconsin at the Dells."

DEVIL'S LAKE STATE PARK

A substantial groundwork has been laid for one of the grandest and most fascinating state parks in the Middle-West, with Devil's Lake as its nucleus. In his report for 1916 F. B. Moody, the state forester, makes the following reference to Devil's Lake Park, in comparison with the other tracts in Wisconsin which the state commission, appointed for the purpose, is preserving from private encroachment and destruction:

"During 1916, under the administration of the conservation commission, the work of general improvement and extension of the various state parks was carried forward energetically. While the Wisconsin parks are well organized, and are located so as to best serve the people of all parts of the state, they are still somewhat inaccessible, due to the lack of proper road facilities. It was early realized by the commission that each park should be of maximum usefulness to the people of the state; that proper accommodations would have to be provided, and of these good roads and trails were of major importance. Consequently, during the past year a road and trail plan was marked out for each of the parks,



DEVIL'S DOORWAY AT THE LAKE

and the main efforts of the commission have been expended in the construction of these roads and trails within the parks, and in co-operating with local officials for the construction of better approaches. Wisconsin now has six state parks.

"Many permanent improvements have been started or are contemplated on the Devil's Lake Park. Its usefulness as a playground has grown to a wonderful degree in the past two years, and will increase rapidly in the future. The development of roads, trails and pathways, the repair of the hotel buildings and cottages, and the construction of sanitary closets at both ends of the lake, the installation of water systems and the improvement of playgrounds have been started. The new road from the hotel east to the park boundary is practically complete, and will become a part of the state highway system. This new road will make the

park easily accessible from the south and east. The proper location of a road from the north will be considered in co-operation with the town of Baraboo. The facilities for boating, fishing, swimming, and climbing, the major sports enjoyed by the thousands of people who annually visit the park, were materially improved during the year.

"A marked increase was noted in the numbers of people who visited the various state parks during 1916. This was especially pronounced on the Devils Lake and Peninsula parks. These parks are older, more accessible and better known than some of the others, and consequently receive greater patronage. There is every reason to believe that the state parks in the years to come will be of great benefit and value to the people of the state, and, as their worth is more appreciated, and they are made more accessible, they will become a still greater source of enjoyment.

"The acreage of the various parks is about as follows: Peninsula Park, 3,240; Devils Lake Park, 1,040; Marquette Park, 1,651; Interstate Park, 730; Brule Park, 4,321; Cushing Memorial Park, 8; Proposed Trempealeau Mt. Park, 500.

"A matter of the greatest importance is the purchase of the three remaining properties bordering on Devil's Lake. One 15-acre tract at the north end is in process of condemnation. The other two properties should be condemned and purchased. It is recommended that \$50,000 be appropriated to purchase these properties, and the remainder of the interior holdings within the peninsula state park."

An addition to the foregoing information is made by the Madison Democrat of March 22, 1917, in the following words:

"Devil's Lake State Park has been enlarged by the addition of fifteen acres at the north end at an expense of \$7,500. The transaction was hastened by the welcome activities of Assemblyman George Carpenter, representing the Sauk county district. Admittedly, it is a valuable acquisition and at a cost to the state entirely reasonable. A great commercial company, however, continues to blast to pieces the beautiful east bluff, causing a cruel scar that the elements through half a millenium or more cannot efface. To put a stop to this pitiless vandalism should now be the unceasing endeavor of the conservation commission, which then will have secured to the people of the commonwealth eternal possession of altogether the loveliest gem of nature in all this vast central West."

Since the Democrat published the foregoing (in May, 1917), the Town of Baraboo officially accepted the \$40,000 bequest of the late W. W. Warner, of Baraboo City, for the building of a concrete road from Oak Street bridge to the State Park, about two miles and a half south. Mr. Warner had left \$75,000 to the City of Madison for a public park, with a proviso that if it was not accepted by May 3, 1917, \$40,000 should go to the Town of Baraboo for the purpose named. The final arrangements to secure possession of the fund were made by Assemblyman George

Carpenter and Supervisors Wilbur Cahoon, Charles Getzman and E. C. Kunzelman, in consultation with County Judge Zimmerman. The fund was promptly passed over by those who had it in charge at the required presentation of a receipt showing that the town had raised \$5,000 for the laying out of a foot and bicycle path parallel to the main road. The highway between Baraboo and the State Park, which will probably be completed in 1918 or soon after, is known as the Warner Road, and will be a welcome addition to the other fine drives which vein the region about Baraboo and Devil's Lake.

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