

THE LEVELS OF LAKE TRAVERSE

During the first week of September, 1934, Lake Traverse had about a foot of water in it, and its low stage caused considerable interest among the residents of the vicinity. Mr. Frederick S. Fleischer of Wheaton, among others, walked around the north end of the lake, which at that time was almost completely dry, looking for buffalo skulls with horns attached. He noticed a large stone, about twelve feet from the water's edge, that appeared to be inscribed with a date. Upon his return to Wheaton he reported his find to friends and told them that the date was 1835. The local papers took up the matter, and it was finally called to the writer's attention through a dispatch in the *Minneapolis Journal* for October 21, 1934, which stated that the date was 1852.

Mr. Ernest MacGowan, Mr. E. Fitch Pabody, and the writer, all of whom are interested in lake levels, left Minneapolis for Wheaton and arrived at Lake Traverse on November 7, 1934. The lake was entirely dry, and we walked across its bed dry-shod. Despite our earnest efforts, even with Mr. Fleischer's assistance on the second day, we were unable to locate the dated stone, as there were thousands of stones around the old shore line.

The bed of the lake was made up of a mixture of silt and clay, dried into cakes and containing literally thousands of clam shells. For long stretches the bed was entirely bare, then there would be an area containing a hundred or more smooth boulders ranging from six to thirty-six inches in diameter. Halfway between the Minnesota and the Dakota sides we encountered a large rock, firmly embedded in the lake bed, and projecting upward about four feet. We chiseled the date 1934 on this stone and took a picture of it. We also took a picture of the bed of the lake. These

are reproduced herewith. This stone and others noted in the lake bed were of red quartz granite, of the same type that is to be found in enormous quantities farther north, notably along the Winnipeg River north of the Lake of the Woods.

The question whether this lake has been dried up before is of interest. Within the memory of the local residents, it has not been dry. Had we been able to locate positively the dated stone reported by Mr. Fleischer, there might have been some definite evidence that in 1835 the lake was at least as low as it was in the first week in September, 1934, when the water was only a foot deep. As this paper is written, it is over a year since the writer visited the lake, and it has begun to refill.¹ Will the water continue to get deeper, or will the lake again dry up in the next few years?

In attempting to understand the behavior of this lake, recourse has been made to the known oscillating levels of other lakes in this section and in other parts of the globe, to a search through Minnesota history with special reference to Lake Traverse, and to an engineering process of analysis of varying levels called cycle analysis. Although there is nothing to be done if Lake Traverse and other lakes dry up, students nevertheless are interested in knowing when, if at all, the lake was dry in the past, whether it will again be dry in the future, or whether the condition of 1934 was merely a local phenomenon not likely again to take place. If one is a hunter, his interest goes deeper, for ducks do not light and feed upon dry ground, and Lake Traverse has been a marvelous hunting ground for ducks for many years. In its best years one store at Wheaton alone sold twelve hundred dollars worth of ammunition in a single season. When the lake dried up, however, it sold almost no ammunition.

It is known that certain lakes, notably Lake George in

¹ It is important to note that this article was written in December, 1935.

Australia, repeatedly dry up and refill. Lake George is about the same size as Lake Traverse, although it is a little deeper when full. It was completely full in the seventies of the last century, and it was dry ground in 1905. It is now half full. Great Salt Lake was low in 1850, high in the seventies, and very low in 1905. Since then it has been rising, although there has been a recession in the past three years. It will be high again, however, in the near future. Grass and Wood lakes at Richfield, just outside Minneapolis, have been dried up completely for about three years. They were similarly dried up in 1865. There is every reason to believe that they will again refill. The Great Lakes rise and fall along certain well-known cycles. Lake Minnetonka, twelve miles from Minneapolis, rises and falls in synchronism with sunspot numbers, just as does Victoria Nyanza in South Africa; both lakes are relatively higher when sunspots are at a maximum, and lower when sunspots are at a minimum. Lake Minnetonka is due to rise two to three feet within the next four years or more. Judging, thus, from the behavior of other lakes, on which there is more complete data, it may be expected that Lake Traverse will not remain dry, but will refill and again provide a paradise for ducks and hunters.

In historical accounts of Lake Traverse there are several bits of pertinent information. Frequent mention is made of trips up the St. Peter's River, now known as the Minnesota, through Big Stone Lake and Lake Traverse, and thence down the Bois des Sioux and Red rivers. In 1820, Laidlow, superintendent for Lord Selkirk, went from Pembina to Prairie du Chien to purchase wheat. On April 15, 1820, he left Prairie du Chien, ascended the Minnesota River to Big Stone Lake, where his boats were placed on rollers and dragged a short distance to Lake Traverse, and on June 3 he reached Pembina. Here is evidence that the lakes were low—at least so low that a portage was necessary between Big Stone Lake and Lake Traverse.

In 1823 Major Stephen H. Long's expedition passed up the Minnesota and down the Red River. Of the latter stream Long remarks:

Red River is navigable for canoes, and even pirogues of two tons burden, from its mouth to its source . . . when swollen by freshets. On such occasions, canoes have been known to pass from Lake Travers, its source, into the St. Peter, and back again, without inconvenience.

The Long expedition reached Big Stone Lake on July 22. William H. Keating, who wrote an account of the journey, describes the trip through Lake Traverse:

We continued our route in what appeared to have been an old water-course, and, within three miles of the Big Stone Lake, found ourselves on the banks of Lake Travers. . . . The space between Lake Travers and Big Stone, is but very little elevated above the level of both these lakes; and the water has been known, in times of flood, to rise and cover the intermediate ground, so as to unite the two lakes.²

Dr. Folwell, in his small history of Minnesota published in 1908, mentions the fact that in 1826 a great flood on the Red River did great damage. Lake Traverse must, therefore, have been fairly high at that time.

George W. Featherstonhaugh as United States geologist made a Minnesota trip in the summer of 1835, the date of the inscription said to have been found on a stone in Lake Traverse. In his description of the trip, under the dates October 4 and 5, 1835, Featherstonhaugh writes:

The remaining part of our ride was bitterly cold, but a little after 2 P.M. I saw a few scattering trees, which Milor [*the guide*] said were growing near Lake Travers; and before three o'clock we reached an edge of the prairie from whence I looked down upon the valley below, in which was Lake Travers, with real water in it, being the most southern source of the waters that flow into Hudson's Bay. . . . As soon as I had got my luggage brought in and my *toilette* made, I walked down to the lake, and found its waters very dead and turbid. The drought had lowered its level to such a degree, that the channel by which it communicates with Red River, that flows into Lake Winnipeg, was dried up, and Lake Travers had consequently become

²In 1916 Lake Traverse was about nine feet higher than Big Stone Lake, probably a much greater discrepancy than existed in 1823.

stagnant. . . . I went to the lake, where, although it was certainly not drinkable, yet I never met with such fine, slimy, viscous stuff as it was for my purpose, scarcely wanting any soap at all.

This reference to the condition of the lake cannot be construed to mean that the lake was dry, as it was in the fall of 1934. It might mean, however, that it contained only a foot of water, and hence Featherstonhaugh could have inscribed the date 1835 on the stone reported by Mr. Fleischer. The chances are, however, that Featherstonhaugh's camp was on the Minnesota side of the lake, and as the stone was found near the Dakota edge, it is doubtful that he is responsible for the inscription.

John H. Stevens, in his *Personal Recollections of Minnesota and Its People*, refers to high water in 1859 throughout the Northwest, especially in the rivers. He reports that "The steamer Anson Northrup [*sic*] went through Big Stone Lake and Lake Traverse to the Red river of the north. . . . This was the beginning of a large trade by steamers on the Red river of the north."

These references are sufficient to show that at different times the levels of Lake Traverse varied greatly. The description of the region in the vicinity of the lake written by Joseph N. Nicollet after he had explored it in 1838 also should be quoted:

The Coteau itself is isolated. . . . The plain at its northern extremity is a most beautiful tract of land, diversified by hills, dales, woodland, and lakes; the latter abounding in fish. . . . At its eastern border particularly, the prospect is magnificent beyond description, extending over the immense green turf that forms the basin of the Red river of the North, the forest-capped summits of the *hauteurs des terres* that surround the sources of the Mississippi, the granitic valley of the Upper St. Peter's, and the depressions in which are lake Travers and the Big Stone lake. There can be no doubt that in future times this region will be the summer resort of the wealthy of the land.

It is evident that there must have been ample rainfall to give such beauty to the landscape at the time of Nicollet's visit to the region.

These extracts have brought out the following facts: that Long found the lake fairly low in 1823, and that he found it necessary to portage between the two lakes, although he knew from hearsay that at times the water was high enough to permit canoes to pass from Big Stone Lake to Lake Traverse; that the lake was higher in 1826 than in 1823; that Featherstonhaugh found the lake lower than did Long and found the water undrinkable; and that Nicollet thought the country beautiful beyond description. These historical observations fail to disclose that there was law or order in the rise and fall of the level of Lake Traverse. They can be used, however, to check up on certain assumptions made from an engineering standpoint.

In the case of a river or a lake, where records of the mean annual discharge or the mean annual level are available for a considerable number of years, it is possible, by cycle analysis, to break up these observational data into component elements, or cycles, as they are called. These cycles are variable in periodicity, just as the solar cycle is variable. A great many scientists now believe that weather is directly affected by the heat output of the sun, the small variation of which changes the paths of air circulation; and it is found that certain cycles in weather, as registered by temperature, rainfall, lake levels, and river run-off, are multiples or submultiples of the average solar cycle of eleven and two-tenths years. Two or more smaller cycles may operate in conjunction with a longer cycle, the combined effect of which would be manifested in varying lake levels or river discharge.

Lake levels are a function of rainfall and evaporation, one tending to raise and the other to lower levels. Evaporation is dependent upon temperature, wind velocity, humidity, and other factors. When rainfall gradually decreases at the same time that temperature is increasing, the result is the lowering of a lake's level, and this is exactly what has happened to Lake Traverse.

Mention is made here of only four cycles that have an important bearing upon lake levels. They are the solar, Bruckner, secular, and a cycle twice the length of the secular. These cycles have average periodicities of eleven and two-tenths, twenty-three, seventy-five, and a hundred and fifty-two years, respectively. Nomenclature is undeveloped in this branch of science, and the names of the cycles given here are employed by certain groups of investigators. By using rainfall records in the region of Lake Traverse, developing the cycles therein, and making comparisons with similar cycles derived from data of longer duration in other parts of the globe, it is possible to set up a diagram of the probable cycles in the levels of Lake Traverse, extending back to about 1750. Such a diagram has been made by the writer, and examined with a view to seeing whether historical comments about levels coincide with the various cycles. It is interesting to note that many of them do.

In 1856 the secular cycle was at a crest or high point, and the Bruckner cycle was high in 1859. This concerted effect resulted in the high water that, according to Stevens, occurred in 1859. In 1822 the secular cycle was low, and the Bruckner cycle was similarly low in 1830. Long found the lake fairly low in 1823, and Featherstonhaugh found it very low in 1835. These two dates straddle the low of the Bruckner cycle of 1830, and this cycle has more effect than the secular. The flood of 1826, referred to by Dr. Folwell, probably was caused by one of the shorter cycles, not mentioned here. In 1918 the secular cycle was at or near its last low, and the Bruckner cycle was low in 1916 and will again be low about 1938. Lake Traverse was completely dried up in the fall of 1934, sixteen years after 1918, the last low of the secular. In 1766 the secular cycle was low. This was a hundred and fifty-two years before 1918, and it might be probable that Lake Traverse was dry about sixteen years after 1766, or about 1782. We cannot prove this,

as rainfall and temperature records for that time are not available. Further search might bring to light an account of the Lake Traverse region by some voyageur of the late eighteenth century that would give some evidence on this point. Early explorers almost always mentioned the weather and the condition of the water in lakes and rivers.

The writer has a section of wood taken from a large sugar maple tree cut down on the shores of Lake Minnetonka in the fall of 1933. The rings show that this tree was having a very hard time of it from 1760 to nearly 1800, indicating that a continued period of drought occurred at that time in the region where it grew.

One cannot be positive about the former levels of Lake Traverse, but certain facts are evident. Some lakes alternately dry up and refill in a period of less than a hundred years, but Lake Traverse has not been dry for over a hundred years. An analysis of rainfall records for a long period of time in New England and of the flow in the River Nile indicates that the hundred-and-fifty-two-year cycle has a decided effect upon the magnitude of the annual values of rainfall and river run-off. It may not be assuming too much to suggest that the levels of Lake Traverse also may have a relation to this cycle; that its previous dry condition, if it occurred at all, must have been in the neighborhood of 1782; and that for the next hundred and fifty-two years the lake again will be a feeding ground for ducks. There are conditions that throw doubt upon this comment—not enough is known about this lake's behavior in the past to appraise fully the effect of the various cycles upon its levels, and it is of course possible that some cycle that has not been considered will still have to be heard from.

We must not forget that our climate, or weather, gradually has been getting warmer since the sixties, and lake levels and land surfaces have been suffering greater evaporation than formerly. At least two proponents of cycles in our

weather think that the rest of this century will be more or less dry, with a wet period around 1950. Despite these ominous hints, the writer feels that, barring the possibility of a second low oscillation of the level of Lake Traverse a few years hence, it will gradually refill and remain full for a great many years to come. The evidence now available points to a major swing of a hundred and fifty-two years between conditions of extreme dryness.

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