Geology of Buffalo River State Park

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Buffalo River State Park, established in 1937, consists of about 242 acres of bottom land along the Buffalo River about 12½ miles east and one mile south of Moorhead in Clay County. The park is situated on the edge of a large area in northwestern Minnesota which contains very few lakes. There are two other, smaller areas in the state which are also lacking in natural lakes. These are the southeastern and southwestern counties.

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So well established is the idea that Minnesota is the "Land of 10,000 Lakes" that mention of any large area which has none, or only a few of them probably will raise doubts as to the truth of the statement. A glance at almost any map of the state will verify the assertion, however. There remains the question, why, or "how come"? The answer to this, different for each of the areas named above, is packed with the geological history of the state. Indeed, the answer to this question for the northwestern corner of the state gives us the reason for the existence of Buffalo River State Park.

The area which interests us here is somewhat the shape of a funnel split down the middle with its pointed end at the southern tip of Lake Traverse and its top flaring outward toward the northeast. More specifically, the pointed part of our funnel is about the width of one row of counties along the west edge of the state. Its eastern margin runs roughly from south to north as far as Maple Lake, near Mentor, southeast of Crookston. Here the flaring top of the funnel begins and swings sharply to the east and, passing just south of Lower Red Lake, continues east by northeast and crosses into Canada at a point almost directly north of Duluth. In the entire area west and north of this line, some 15,000 square miles, there are very few lakes. Why?

The most casual observer who travels in this part of the state cannot fail to notice how extremely level the land appears. He may also notice the scarcity of rocks and boulders, except along certain rather well defined ridges. In the vicinity of Buffalo River State Park these ridges trend in a generally north-south direction. There is usually a long sweeping slope from the west up to one of these ridges and

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a comparatively level bench or terrace to the east for some distance. In the roadside ditches, if freshly cut, one sees that a fairly thin layer of black top-soil rests on a fine-grained, often laminated, light gray soil beneath. This represents quite a contrast to the soil profile commonly observed over most of the state.

All these unusual features are well explained by the existence of a large lake which covered, at its highest stage, some 6,500 square miles in North Dakota and 65,000 more in Canada in addition to that in Minnesota, outlined above. This was Glacial Lake Agassiz which came into existence at the close of the last glacial period and disappeared perhaps 10,000 years ago. It was approximately the size of all five of the present Great Lakes combined. The water for Lake Agassiz was largely furnished by the melting of a tongue of ice which lingered somewhat longer in that area than in most of the rest of the state. The lake was apparently quite small at first, occupying a pointed area in the immediate vicinity of present Lake Traverse. It was outlined on the west, south and east by the natural basin and on the north by the ice-wall of the melting glacier.

Melting of the glacier caused this north wall to recede gradually toward the north. Since the glacier was doubtless several times thicker than the depth of the natural basin, much more water resulted than could possibly be contained in it. Lake Agassiz overflowed at Lake Traverse into what is now Big Stone Lake and the Minnesota River just as a pan overflows first at the lowest dent in its rim. Finally enough melting took place to open still other, probably lower, outlets to the north and/or east. This tended to cause the lake to abandon the Traverse-Big Stone outlet. This finally occurred, of course, but it would have happened much sooner had it not been for the intervention of an unusual series of geologic events.

Although continued melting of the ice in the northern regions opened new outlets, it also unburdened the earth's crust of the huge load of ice under which it had been sagging. Upon relief of pressure the earth's crust rose and in doing so tilted the Lake Agassiz basin toward the Traverse-Big Stone outlet again! At first it would seem impossible to know this — events which occurred so long ago. However, our evidence comes from a study of the rocky ridges mentioned earlier. These ridges represent the beach lines which were formed when the lake was at that level. Careful study of these beaches reveals much interesting information.

It is found that there are two principal series of beaches, an upper series and a lower series representing different lake levels. The upper series consists of five beaches named for towns they pass through or near.

They are, beginning with the highest, the Herman, Norcross, Tintah, Campbell and McCuleyville beaches. They have been traced for hundreds of miles in Minnesota, North Dakota and Canada. In doing so a strange fact comes to light. As one of these beaches is traced northward it is found to get higher and higher. This alone would be sufficient proof of the tilting mentioned above, since there can be no doubt that these beach lines were level, when formed, just as are those being formed today. However, from this alone we would not know when the tilting occurred.

A comparison of all the beaches reveals that they all rise to the north but not by the same amount. Their divergence is greater the farther north they go. This convinces us that the tilting took place by stages, some of it between the formation of each of the beaches and the next one lower. All the beaches mentioned above, point, both geographically and in slope, toward Lake Traverse. This is taken as evidence that the southern outlet remained open most if not all of the time during the formation of these five beaches. If our understanding of the process described above is not clear let us try an analogy. Think of a small boat loaded with bricks with most of them at one end. The boat will sink most where it is loaded most, and as it is unloaded a few bricks at a time, will rise most where there is the greatest relief of pressure.

Seldom does a state park hold within its boundaries sufficient reason for its being, either historically or geologically. More often it simply accentuates or symbolizes a setting which extends far beyond its premises. A better example of this than Buffalo River State Park would be hard to find. The foregoing story, covering thousands of years and nearly a hundred thousand square miles, comes to one's mind as he reads the plaque near the park entrance. It marks the Campbell Beach of Old Lake Agassiz 1000 feet above the sea. Even the casual visitor can see, in the ridge there, the rounded pebbles which remind him that wave action once occurred where he is standing.

The Buffalo River arises just outside the margin of the region just discussed, in the morainic lake area of Western Becker County. It flows in a southwesterly direction to a point about two miles southwest of Hawley, then west northwest through Buffalo River State Park and finally into the Red River near Georgetown. Thus the river flows stepwise from one beach level to another until it reaches the low bottoms of the Red River. In the Park advantage has been taken of the rapids at the Campbell Beach and a dam has been built. Here water is impounded and used for various purposes, one being the supply for

a swimming pool. A representative view of the Campbell Beach cannot be had adjacent to the river because a notch has been eroded out of it at this point by the river.

Exposed along the river some 50 yards above the dam is a nearly vertical bank 25 or 30 feet high. It is composed of grayish boulder clay with little or no evidence of lake clays above it, though possibly the cover of grass conceals some. This bank is undoubtedly cut in an old moraine which wave action was not successful in completely erasing. A few cases of such moraines are found within the boundary of Lake Agassiz large enough to be mapped. One quite long one is found in Clay County southwest of the Park and paralleling the South Branch of Buffalo River.

Most of these moraines were probably deposited in the water by the melting of the glacier. They were undoubtedly lashed hard by the waves when the lake fell to near their level. That this action was successful in erasing most of them and distributing the material into the depressions is shown by the levelness of the land and the scarcity of either lakes or moraines. Those few remaining probably represent the largest or deepest depressions and the largest and strongest moraines.

Along the river within the park a nice stand of timber is found. It consists mostly of elm, cottonwood, box elder, basswood and willow. The higher ground is mostly meadow and grassland.

As the visitor to Buffalo River State Park relaxes and reflects upon the geological story which it commemorates he is reminded that the area now described as "river bottom" was once lake bottom. The present swimming pool is just a hint of the big "swimming pool" that once existed there – though perhaps only polar bears and their kin could enjoy it.