Geology of Itasca State Park

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Itasca State Park is located in southeastern Clearwater County, northern Becker County, and eastern Hubbard County. The bulk of the park's area of over 1,300 square miles lies in Clearwater County, about 200 miles northwest of the Twin Cities.

Geographically the park is noted for the headwaters of the Mississippi River, which officially begins at the north end of the North Arm of Lake Itasca at an elevation of 1475 feet above sea level. Theoretically the headwaters should be one of the tributaries flowing into Lake Itasca from some higher elevation. The maximum topographic relief (difference between the highest and lowest elevation) of the park is about 300 feet. Many isolated hills within the park boundary rise to elevations of 1500 and 1600 feet above sea level, for example Nicollet Heights (1660 feet), Alton Heights (1675 feet), Okerson Heights (1665 feet), and Tornado Hill (1525 feet). At least one point in the park reaches an elevation of 1700 feet, namely a point just west of the headwaters of Howard Creek in the south-central part of the park.

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Geologically the park has several features of interest to the casual observer, not the least of which are the linear shape of Lake Itasca, the main body of water in the park, and the multitude of smaller lakes within the park boundary. To account for the origin of these and other surface features of Itasca Park it is necessary to consider the past geologic history of northwestern Minnesota, because therein lies the key to the origin of the topographic elements of the park and its surrounding area.

Most of Minnesota lies in a region once invaded by continental glaciers of the Great Ice Age, technically

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known as the Pleistocene Epoch, and the present land surface is a direct result of this glaciation. Recent evidence based on radioactive carbon in remains of plants and animals that lived near the ice borders during the Pleistocene indicates that the least glacial advance reached its maximum position about 11,000 years ago.

The positions of the glacier front during periods of advance and retreat of the glacier itself are marked by *end moraines*, belts of hummocky terrain usually termed "knob and kettle" topography. The knobs are mounds of debris (mixture of silt, sand, and rock fragments) deposited directly by the ice at the glacier margin, or by meltwater streams flowing from the glacier surface. The kettles are depressions, commonly filled with water, formed by stagnant ice masses buried or partially buried under glacial debris. Melting of such an ice mass long after retreat of the ice front leaves a depression at the surface which, when filled with ground water, becomes a lake. Other kettles are formed simply by the chance distribution of the knobs in such a manner that a depression develops among them.

Occasionally the position of the kettles is determined by a river valley which existed prior to the advance of the ice. Such valleys caused the localization of a single stagnant ice mass or several masses in them, and a single elongate lake or a chain-of-lakes results.

Itasca State Park lies in what early Minnesota geologists designated as the Altamont-Gary morainic system formed by ice which entered the state from Manitoba to the northwest. In the Itasca Park area much of this morainic material shows evidence of having been washed or slightly reworked by running water, presumably water derived from the melting ice front. The evidence is manifested in the nature of the surficial debris itself.

Among several good exposures of the water-washed material is one occurring just south of the intersection of Middlewest Trail and Bohall Trail in the northwestern quarter of the park. There in a road cut, the material consists of a bouldery gravel containing some limestone pebbles. The absence of the finer sand and silt is explained by the washing action of glacial meltwater. Wherever the gravelly and bouldery material contains a higher proportion of fine material (clay, silt and sand), it is assumed that the material was deposited directly by the glacier ice without the subsequent action of meltwater of any great importance.

Evidence for the widespread stagnation of the ice during retreat from the park area lies in the presence of the many kettles which are now lakes of varying size, or swamps that mark the dying stages of once more extensive lake basins. Most of these lakes and swamps are sporadically distributed throughout the park and seem to

bear no relationship to the pre-glacial terrain. However, a special case can be made for Lake Itasca and for Elk and Mary lakes, which lie south of the west and east arms of Lake Itasca respectively. The position of these lakes and of Lake Itasca was probably governed by a drainage system which existed previous to the last advance of the ice in this area.

Stagnant ice masses were undoubtedly left in the pre-glacial valleys and buried by glacial debris released by the melting ice. No other explanation seems plausible in explaining the elongated character of Lake Itasca and the position of the other two lakes along the same trends of the east and west arms. Nothing is known about the extent or the direction of flow of the pre-glacial drainage because it has been so completely masked by the deposition of glacial debris except for the segment now occupied by Lake Itasca and Elk and Mary lakes.

Other evidence of glacier stagnation can be found just east of the East Arm of Lake Itasca, between the lakeshore and the Park Road (State Highway 92). There an elongated ridge, 50 to 60 feet high and trending in a north-south direction, marks the position of a former ice-tunnel river. The water flowing in the ice tunnel deposited sediment in the form of sand and gravel until the tunnel was completely filled. Final melting of the glacier ice left the tunnel deposit as a ridge, marked by steep slopes on each side where the debris, formerly in contact with the ice-walls, slumped to the present steep condition. Such a ridge is technically known as an *esker* and is regarded by glacial geologists as a feature associated with stagnant glacier masses. Had the glacier been moving, the ice-tunnel would have been destroyed before the ice completely melted, or perhaps not even formed.

A few of the smaller lakes in the park are credited to the activities of beavers that cause the impounding of water behind dams which they build on small streams and creeks. Much of the swampy land along the streams in the park is attributed to the presence of beaver's dams downstream from the swampy areas.

Itasca State Park is another example of an area in Minnesota full of natural features, particularly those of geologic interest, which await the interpretation of the careful observer and imaginative thinker.