The Geology of Gooseberry State Park

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An article in the July-August issue of this magazine emphasized the scenic values and other features of Gooseberry State Park. The present description may therefore place more emphasis than usual on the geology of the area.

The north shore of Lake Superior from Duluth to Grand Portage Island is underlaid almost entirely by a series of lava flows and later intrusives of similar composition. These are of Keweenawan age, and in fact represent part of the same series of rocks that are found on Keweenaw Point on the south shore. There the rocks dip to the northwest on the south limb of the Lake Superior syncline and in Minnesota they dip to the southeast owing to their position on the north limb of this great structural basin. Gooseberry State Park therefore shows exposures of lava flows which dip gently toward the lake. Gooseberry River has its headwaters about 20 miles back from the shore and drains an area of about 75 square miles. In such a cool, moist region this is sufficient to maintain a fairly good flow throughout the year.

The land rises rather rapidly from Lake Superior inland to as much as 300 feet above lake level at the hilltops in the northeastern portion of the park. About where the Gooseberry River enters the park it begins a series of rapids and falls that drop the water 60 feet within about 700 feet. These are referred to as the Upper Falls and in common with the Lower Falls are a result of erosion of lava flows. Below the Upper Falls the river runs in a low gorge with rapids separated by quiet water.

The Lower Falls is a series of separate falls with the uppermost just above the bridge for Highway 61. This has a fall of nearly 30 feet and is followed just below the bridge by the middle fall also about 30 feet. Below this fall the river splits around an island and drops over two falls with a total descent of about 50 feet.

The origin of these various falls is perhaps the most interesting feature of the park. As previously noted the

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rocks exposed in the park consist almost entirely of basalt lava flows. The flows vary in thickness from one foot to between 60 and 70 feet. Robert Grogan mapped the geology in detail as a CCC student technician in 1937 and counted 19 flows from the shore to the point where the river enters the park.

The upper parts of lava flows are normally vesicular owing to gas bubbles rising in the molten rock and collecting beneath the upper chilled scum at the surface of the flow. Often the vesicules become filled with various minerals, such as agate, and are then called amygdules. Usually the vesicular portion of the flow is much softer and more easily eroded than the massive portion. Therefore, when water flows over a series of flows it tends to erode the vesicular portion of a given flow more rapidly than the massive portion of the flow above. This develops a cliff and as it is undercut tends to break off in large blocks, thus maintaining a vertical face over which the river plunges to form a fall. It follows that each fall represents the massive portion of a flow. Thus five flows can be counted in the Lower Falls. The flow forming the upper fall displays fairly well developed columnar jointing. When the water is low it is easy to climb over the rocks and observe these features. At places in the stream bed well developed pot holes have formed by the whirling water in the rapids.

Below the falls the river has eroded a sizeable depression around which the river swings in a large meander. The east side is against a rock wall 80 feet high with a talus slope at the base. Along the lake a nearly vertical cliff is maintained by wave erosion at the base. The west side of the river is largely glacial drift and lake clay and the area is much more accessible and has been utilized for service to the public.

Practically the entire shore of Lake Superior within the park boundaries is faced with rock outcrops where the gentle dip (three to eight degrees) of the flows carries them gradually beneath the level of Lake Superior.

The beach gravel near the mouth of the river is a good place to search for agates and other pebbles of interest. The agates are worn out of the Amygdoloidal tops of the flows along shore. Other minerals such as calcite, zeolites, quartz and epidote also occur in the amygdules and veins in the lava flows.