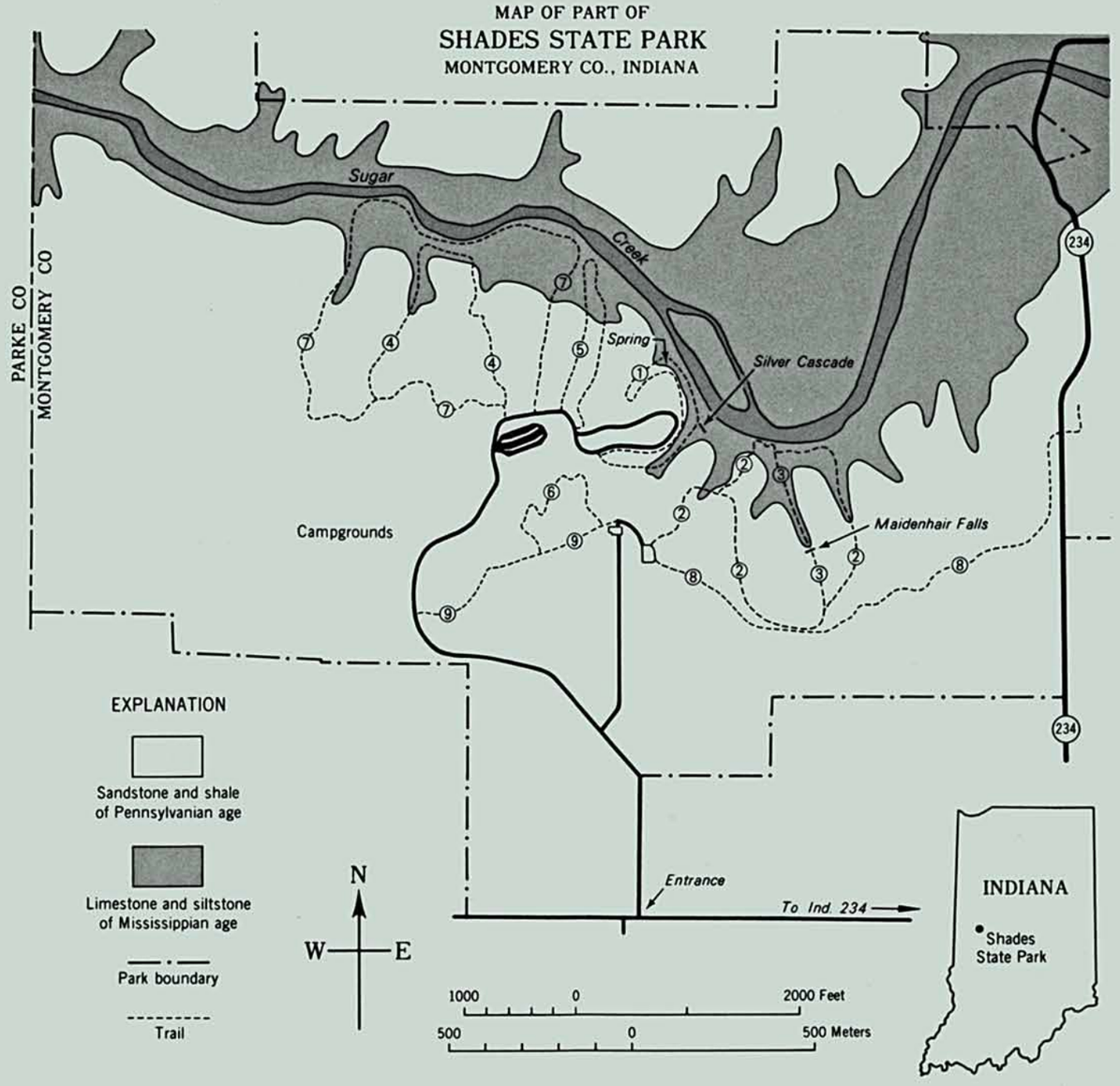
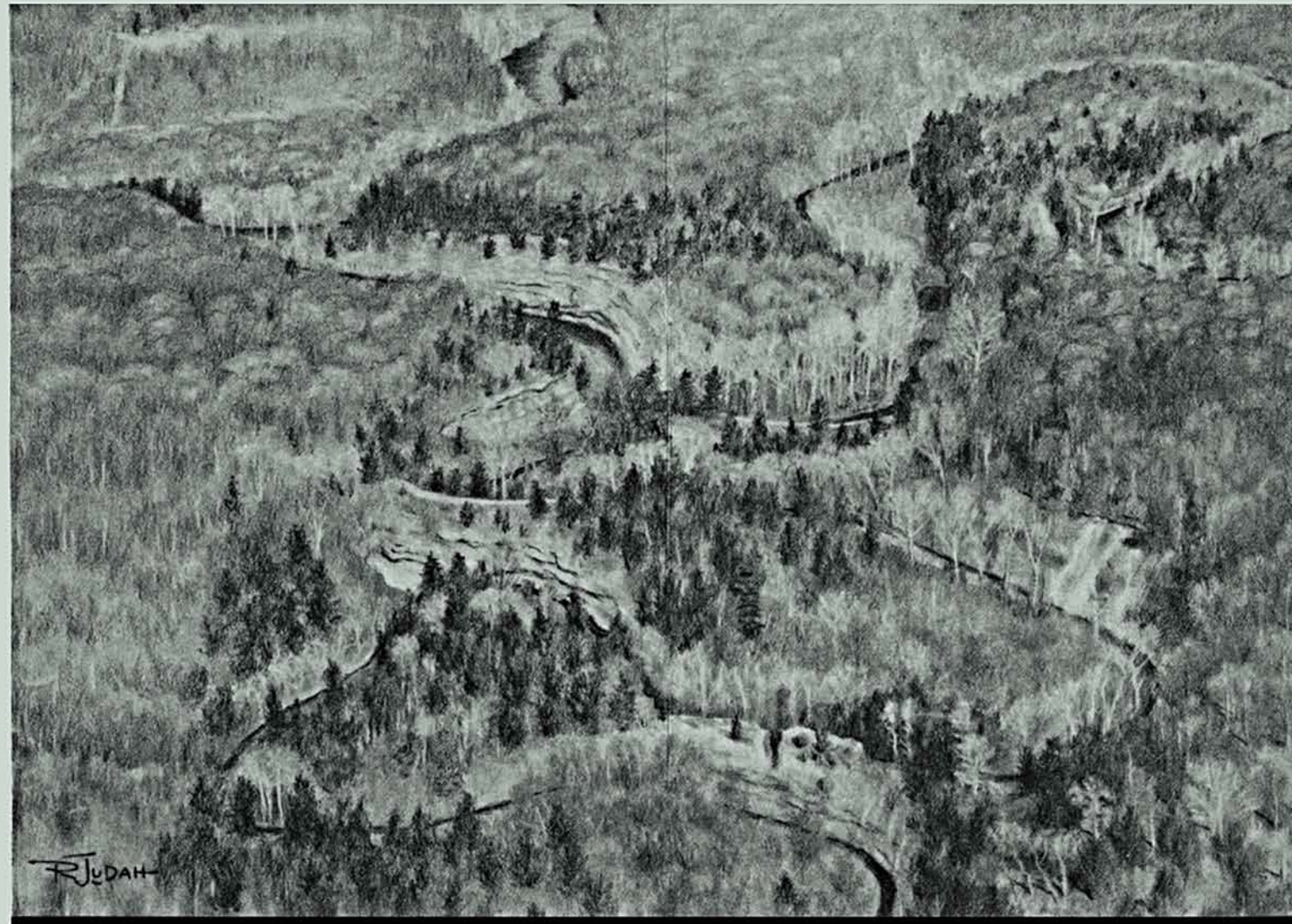
GEOLOGIC STORY OF SHADES STATE PARK





Aerial sketch of incised stream meanders at Devils Backbone, east of map area, looking north. Sugar Creek is at upper left.

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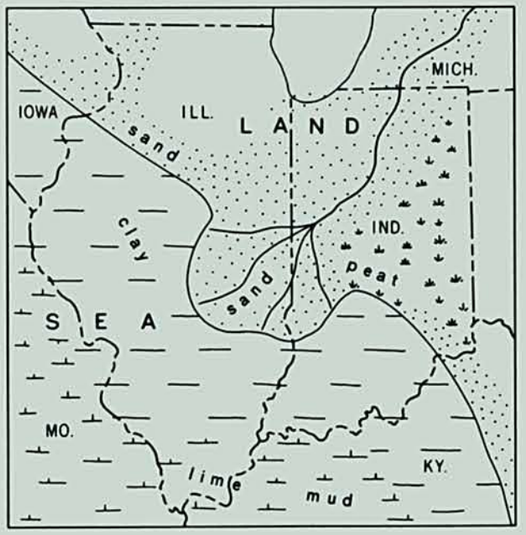
INTRODUCTION

The deep gorges and beautiful waterfalls in Indiana's Shades State Park exist because of a special combination of geologic phenomena in this area. The long and complex geologic story is summarized here to answer some of the questions asked by visitors.

THE ANCIENT ENVIRONMENT

The bedrock at Shades is sedimentary in origin. The character of the rock and the kinds of included fossils suggest the environment in which the sediment was deposited.

About 250 million years ago, during a time known as the Mississippian Period, a vast shallow inland sea covered much of Indiana. The area that is now the



An interpretation of ancient depositional environments

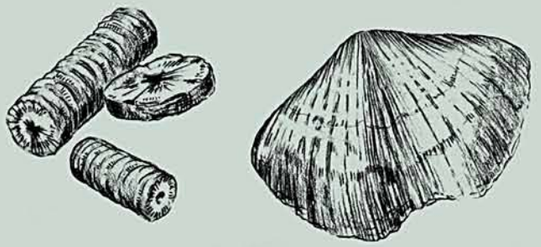
Shades was part of a broad river delta system that extended southwestward into the sea. Silt and lime mud were deposited in thick layers as the ancient delta grew. Millions of years passed and the seas retreated, leaving the land exposed to erosional processes. During this time no new sediment was deposited. When deposition resumed during the Pennsylvanian Period, about 225 million years ago, a different sediment, quartz sand, was supplied. The surface, or contact, that separates the two distinct sedimentary units represents a long period of erosion and is called an erosional unconformity.

During Pennsylvanian time, coarse-grained sand with layers of pebbles was deposited in the Shades area. The thick sand accumulation is evidence that large rivers flowed over the land enroute to an inland sea farther west. Pressure and cementation later converted these sediments into sedimentary rock. Siltstone and limestone represent sedimentation during Mississippian time, while sandstone and conglomerate, as seen along Trail 7, represent Pennsylvanian sedimentation.

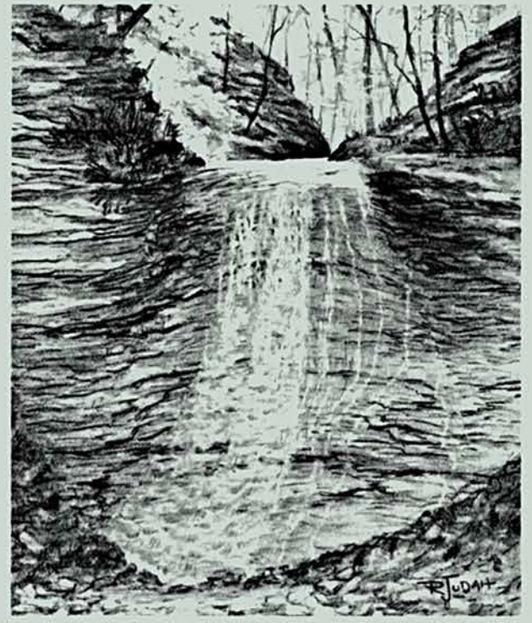
FOSSILS IN THE PARK

Some remains of ancient life that inhabited the warm, shallow Mississippian seas are found in the bedrock in the form of fossils. The oldest and the lowest bedrock formation at Shades is siltstone that belongs to the Borden Group, formed during the Mississippian Period. The siltstone is a uniformly fine-grained sedimentary rock. It contains discontinuous lenses of a coarse-grained fossil-fragmental limestone, examples of which can be seen at the base of the Silver Cascade and at Maidenhair Falls. Close examination of this limestone reveals a variety of fossil forms. Structures that resemble short strings of beads are segments of the stem of a crinoid, an ancient relative of the starfish that looked like a plant, but whose entire form is rarely found preserved. Bryozoans are found in two forms: a branching type resembling small twigs and a perforated or lacy form of the animal. Shells of spirifers are found nearly whole in a few places. These are remains of brachiopods that once lived in the shallow seas that covered the area. Please do not collect these specimens in the park.

Crinoid stems



Spirifer



Silver Cascade along trail 1

The uppermost and therefore the youngest bedrock is the Mansfield Formation, a coarse-textured sandstone deposited during the Pennsylvanian Period. Few well-preserved fossils are found in the sandstone because of the high-energy environment in which the sediment was deposited. Occasionally fragments of primitive plants were preserved, but most remnants of life were tumbled and broken before they were finally buried and fossilized.

MODERN TOPOGRAPHY

Many years after the formation of the bedrock, this area was lifted above sea level, and streams again began their work of erosion. During the last million years the work of massive continental glaciers helped to reshape the land. The ice sheet accumulated in Canada and periodically flowed as far south as central Indiana, obscuring many of the existing landforms and drainage patterns in its path. About 20,000 years ago the last of a series of glaciers that covered Indiana began to melt and retreat northward. Great volumes of glacial meltwater carved deep into the bedrock to form the present valleys and canyons. Special examples are the deeply cut meanders near the Devils Backbone, in the Pine Hills Natural Area at the east edge of the park.

An interesting detail of the topography at Shades is the Silver Cascade along Trail 1. The face of this waterfall is bowed out (convex) rather than concave as would be expected of an erosional feature. This is because a phenomenon called frost wedging plays a more important role in weathering the Borden siltstone than does running water. Water seeps into cracks in the siltstone face. During spring and fall, the water freezes and thaws with daily temperature changes. Expansion of the water as it freezes exerts pressure on the rock, which causes small slabs to scale off the rock face. The frost wedging action is hindered beneath the waterfall, where the almost continually flowing water insulates the rock from freeze-thaw action.

SPRINGS

Numerous springs have formed at Shades where sandstone overlies siltstone. Rainwater percolates downward through the coarse-grained Mansfield sandstone until it is impeded by the less permeable Borden siltstone below. The water then flows through the lower part of the sandstone to the nearest hillside, where it emerges as a spring. A good example can be seen at the level of the footbridge along Trail 1 just below Inspiration Point.

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