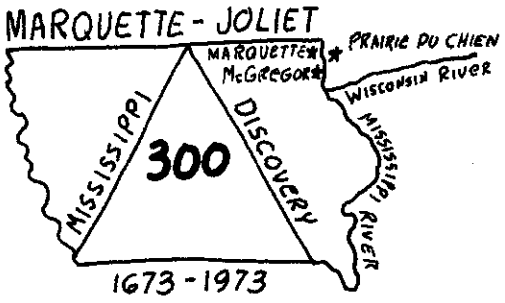
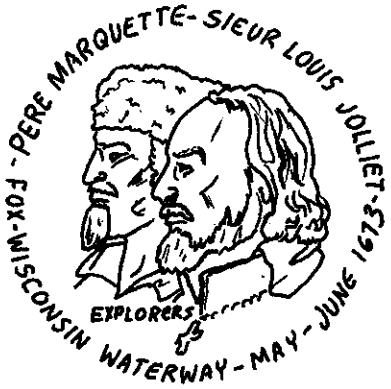
GEOLOGY OF

PIKES PEAK STATE PARK

CLAYTON COUNTY, IOWA





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INTRODUCTION

Geology is the study of the Earth. It is concerned with the history of the planet and the processes that acted, and continue to act upon it, to affect its historic and present forms. While driving through the countryside you may have observed someone scurrying up a roadside rock slope with hammer in hand. What on earth was this person doing? Perhaps your thoughts were similar to those expressed by Sir Walter Scott:

> And some rin up hill and down dale,
> knapping the chucky stanes to pieces wi' hammers,
> like sae many road makers run daft.
> They say it is to see how the
> warld was made.
>
> Sir Walter Scott
> St. Ronan's Well--1824

The world was made slowly, and only a small increment of geologic time is represented by the record left in the rocks of the McGregor-Pikes Peak area. At the base of the Mississippi River bluff a sandstone unit is exposed that geologists call the Jordan Sandstone. This sandstone was deposited along an ancient shoreline about 510 million years ago. Proceeding up the bluff, layer after layer of successively younger rocks are encountered. The youngest indurated rock unit in the area, the Galena Limestone formation, occurs at the top of the bluff some 485 feet above river level. This limestone was deposited about 445 million years ago. A great hiatus in the sedimentary record occurs at the top surface of the Galena Limestone. The veneer of unconsolidated sediments that covers this

surface is only about one million years old, and the gap in the record is 444 million years. Younger rocks that account for most of this tremendous gap occur in other parts of Iowa, but that is another story.

The story to be related here is a brief geologic description of the rock strata that comprise the "mountains" of the Pikes Peak area, and the landforms of the great valley of the Mississippi River.

PHYSIOGRAPHY

Much of the Upper Midwest, as viewed from the vantage point of an aircraft or from an orbiting satellite, displays a patch-quilt pattern of farm fields and section-line roads imposed with geometric regularity on a subdued, gently rolling land. Only occasionally do these distinctive demarkations of man's hold on the land give way to the natural flowing curves which attend rivers and their valleys as they cross the land, gathering waters for the main-stem journey down the Mississippi River to the sea.

Amid these more gentle landscapes, bound by networks of farm roads and furrows, protrudes a cluster of verdant, rock-rimmed hills and deep valleys which hold at their center the island-laced valley of the Mississippi and the tri-state region of northeast Iowa, northwest Illinois and southwest Wisconsin. It was to these hills that the French explorers Marquette and Joliet traveled via the Wisconsin River and gained their first glimpse of the land later to be known as Iowa. Pikes Peak State Park now sits at the threshold of this 17th century view of Iowa preserving for the generations which have come later,

the same steep wooded slopes, the sheer rock bluffs, and the joining of the silent unceasing flows of the Mississippi and Wisconsin Rivers.

Though explanations are glibly given and textbooks carefully recount the geologic events which produced such a landscape, there is no better way to understand the meaning of the words and to feel the immensity of time than to stand on the brink of this valley and let the magnificence of the view fill the senses.

Pikes Peak is one of the highest points along the Mississippi River and from this vantage point, some 485 feet above the river level, the view expands north and south along the great valley of the Mississippi and eastward up the valley of the tributary Wisconsin. At this juncture, the Mississippi River level is at an elevation of 611 feet and the bluffs bordering the valley rise abruptly to elevations of over 1,100 feet. The width of the valley from bluff to bluff varies between three and four miles in the vicinity of Pikes Peak.

The valleys are sharply etched into the surrounding upland plateau, and the precipitous bluffs are cloaked in forest greenery except for the occasional mural-like exposures of bare rock. Small tributary streams entering the great valley spill quickly out of the uplands and form steep narrow ravines which occasionally break the smoothness of the skyline on the distant valley sides. The wide floor of the Mississippi valley is braided with interwoven shades of blue and green. The multiple water channels break and close again around numerous elongate timber-covered islands. Across the valley, the waters of the Wisconsin River empty into the Mississippi. The Wisconsin valley is bordered on the south

by a long, forest-covered bluff line and on the north by low hills. Within the Wisconsin valley, north of the confluence, lies a broad flat plain or terrace of cultivated fields.

Alternating transgressions of ancient seas and shorelines provided the particle by particle and crystal by crystal accumulation of sediments that were to harden and give form and durability to the landscapes of Pikes Peak. A Middle Ordovician rock formation, the Galena Limestone, forms the backbone of the ridge crests and caps the promontory overlooks along the valley. These rocks once formed a relatively flat continuous surface over all the land within view. The accordant levels of the upland summits aid in visualizing the once continuous plateau surface.

During the last one million years of geologic time, continental ice sheets advanced over the Midwest burying the ancient rocks and leaving behind a mantle of debris released from the glacier's grasp by melting. This tri-state region was touched only during the earliest glaciation and bears almost no mark of the presence of grinding ice or its thick clayey deposits. The bedrock-dominated topography still reigns, though virtually surrounded by the gently rolling Midwest landscapes which eventually were subdued by repeated glaciation.

Though unscathed by actual contact with the glacial ice, other effects of the Ice-Age environments were important to the development of the Pikes Peak landscape. Torrents of water released by the melting glaciers excavated the valleys of the Mississippi and the Wisconsin deep into the bedrock plateau. At times the valley floor was as much as 150 feet lower than its present level here;

at other times, the valley was choked with alluvial sands and gravels so that the river floodplain existed at higher elevations than now. Renewed downcutting and lateral migration of the river channel across the valley later erased many of these remnant floodplains or terraces.

The river stages alternated between tremendous summer flood flows and greatly reduced winter volumes when the waters remained locked in crystal form. During these periods of reduced flow, the sediments deposited across the valley floor by the summer floods lay unanchored by vegetation and exposed to the prevailing winds. Great clouds of dust were winnowed from these exposed sediments and were redeposited over the glaciated Midwest landscapes. This covering of loess forms the parent material for the rich agricultural soils of the Midwest. Here, in the so-called "driftless area," it provides a silt veneer over the bedrock surface.

The evolution of this land through the geologic past has resulted in landscapes that have been appreciated from practical and aesthetic viewpoints by the men who have stood here before - men of the ancient mound-building tribes, the European settlers who followed Marquette and Joliet, and today's visitors to Pikes Peak State Park.

GEOLOGY ALONG PARK TRAIL

As we stand near the edge of the bluff in the park we can appreciate the scenic beauty of the adjacent wooded areas and the Mississippi River valley far below. At our feet we see blocks of the Galena Limestone, the youngest rock

unit exposed within the park. From this location we will follow a trail that leads toward the north down the rocky slopes that reveal increasingly older rocks as we descend most of the 450 foot vertical distance to the Mississippi River. The area to be traversed on this excursion is shown in figure 1. The cross section in figure 2 shows the rock formations that are exposed within the park.

Galena Limestone Formation

The Galena Limestone is exposed intermittently along the trail as we proceed along the ridge top. Effigy mounds, such as The Bear on your left, similar to those in Effigy Mounds National Monument north of Marquette serve to remind us of an earlier time when man lived more harmoniously with nature. In the calm of this masterpiece of nature one can visualize the deft strokes of an Indian's hands as he fashions an arrow point from a piece of chert (flint) obtained from chert nodules in the Galena Limestone.

This formation is an aquifer of major importance in northeast Iowa. Many farm wells are completed in this rock, and the aquifer is relied upon for stock and domestic use. Recently, a large number of wells have been found to contain unsafe levels of coliform bacteria and nitrate. The source of this pollution must be controlled to insure a safe water supply.

Decorah Formation

After descending about 50 feet in elevation we see the upper beds of the Decorah Formation. Here the step-like ledges of rock are closer spaced, the result of weathering of thinner bedded limestone layers. This formation is subdivided as follows:

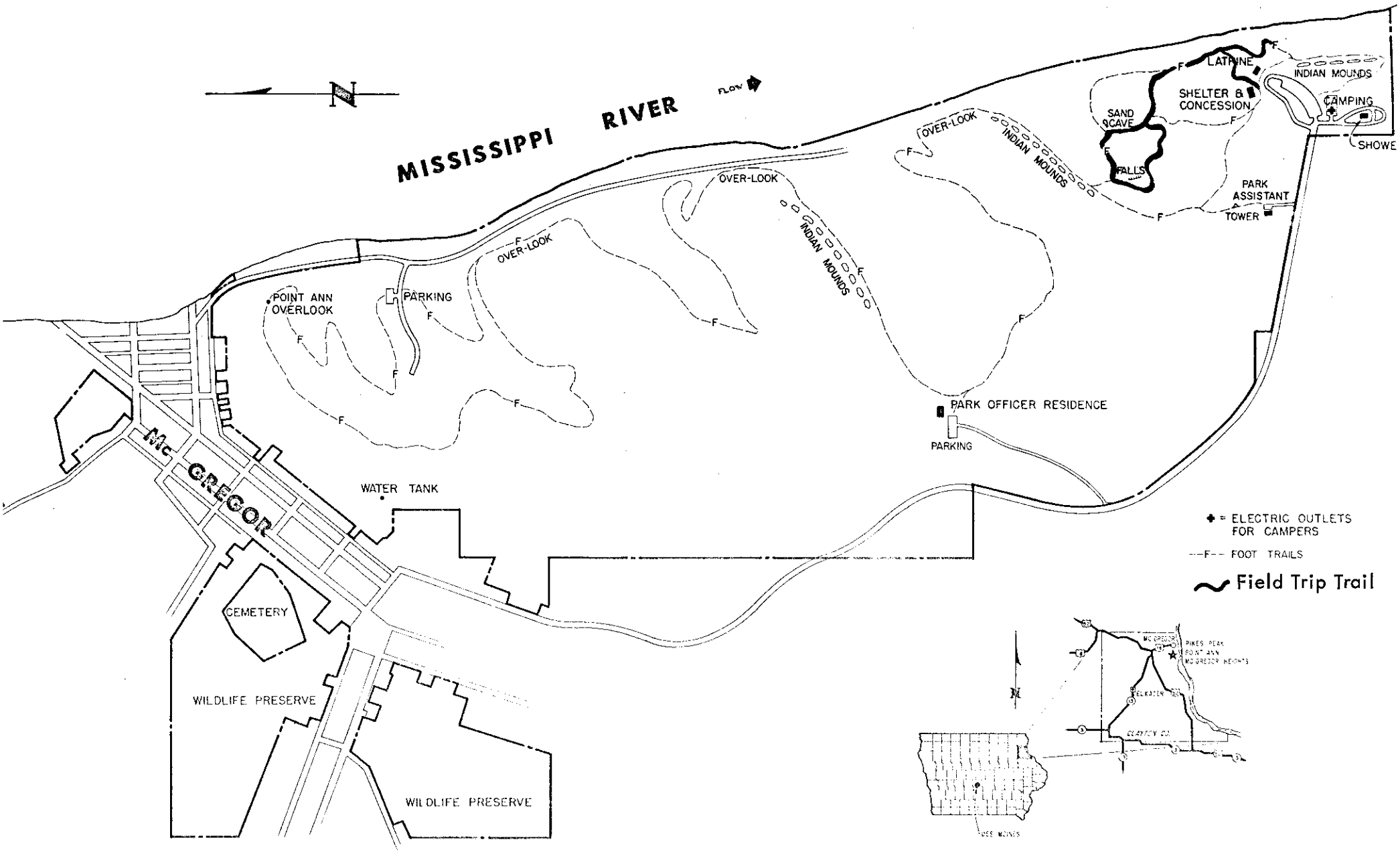

Figure 1.

Map Source: Iowa Conservation Commission

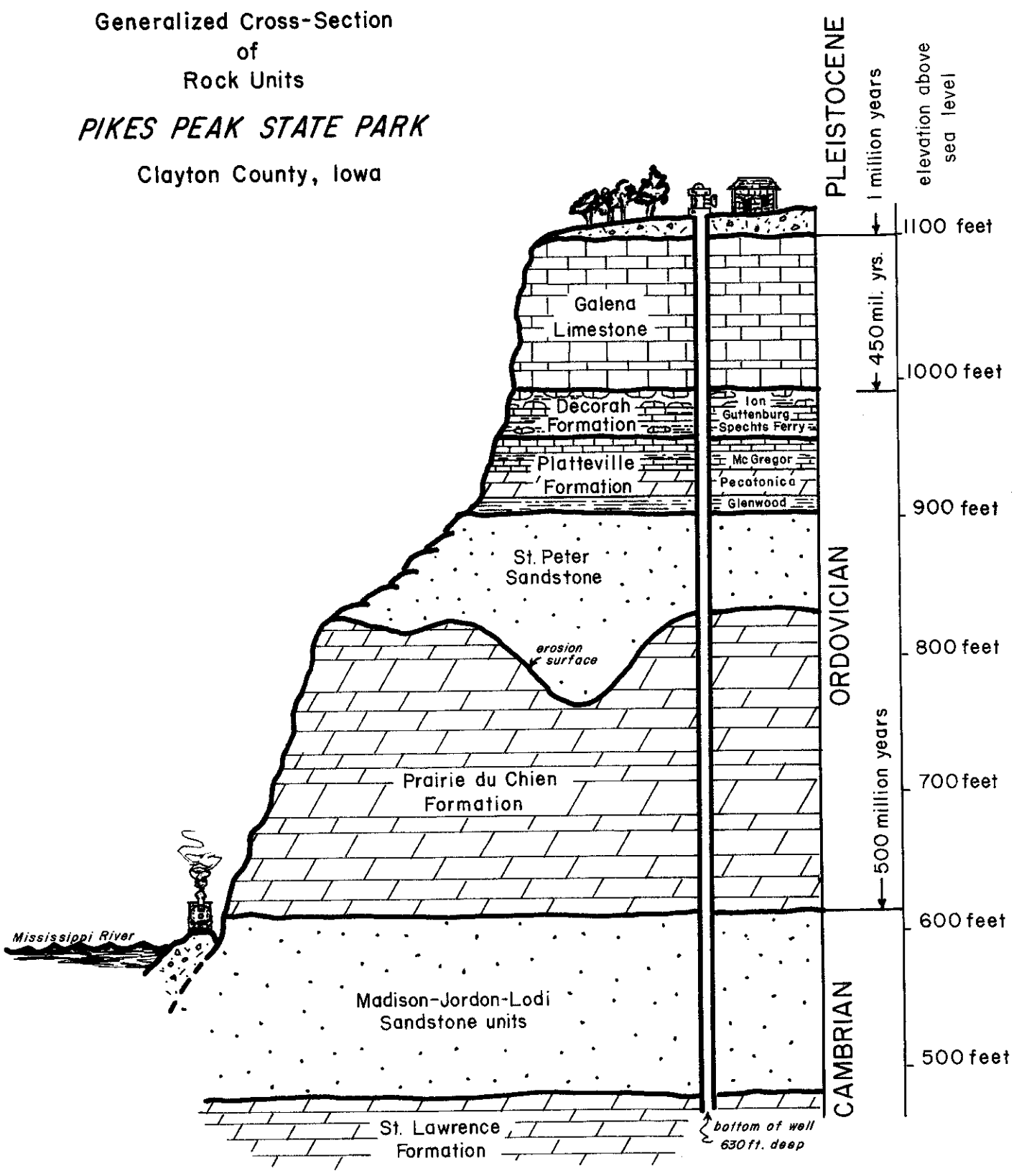
Generalized Cross-Section
of
Rock Units
PIKES PEAK STATE PARK
Clayton County, Iowa
PLEISTOCENE
1 million years
elevation above sea level
1100 feet
450 mil. yrs.
1000 feet
Galena Limestone
Decorah Formation
Platteville Formation
Ion
Guttenburg
Spechts Ferry
McGregor
Pecatonica
Glenwood
900 feet
St. Peter Sandstone
erosion surface
ORDOVICIAN
800 feet
Prairie du Chien Formation
700 feet
500 million years
600 feet
Mississippi River
Madison-Jordon-Lodi Sandstone units
CAMBRIAN
500 feet
St. Lawrence Formation
bottom of well 630 ft. deep

Figure 2

Member	Description	Thickness
Ion	Shaley, nodular, greenish-gray limestone	15 feet
Guttenberg	Brown limestone with dark brown shale partings	10 feet
Spechts Ferry	Green shale, interbedded with greenish-gray limestone	10 feet

Some of these beds contain numerous fossil shells, principally brachiopods and gastropods, but because the beds are relatively soft, much of the interval is slump-covered and over grown with vegetation. The shale zones in the Guttenberg have been called "oil rock." The shale contains organic matter that will support combustion for a short period of time.

Platteville Formation

Thirty-five feet lower we see the top of the Platteville Formation, which is subdivided as follows:

Member	Description	Thickness
McGregor	Thin-bedded limestone separated by shale partings; fossiliferous zones	25 feet
Pecatonica	Thick-bedded, brownish-gray dolomite	16 feet
Glenwood	Bluish-gray shale; sandy at top	5 feet

At other locations the McGregor Member is much more fossiliferous than within the park. Certain zones contain abundant brachiopods, gastropods, trilobites and bryozoans. The fossils may be so plentiful as to constitute a "hash." The Pecatonica Member is a resistant ledge former. Near its base this member contains embedded black, polished phosphate grains and grains of frosted quartz sand. The Glenwood Shale Member is not visible because of slump and vegetative cover.

St. Peter Sandstone

The St. Peter Sandstone is encountered about 175 feet down the slope. The Formation juts out on the point of the ridge in a relatively open area with vegetation

dominated by mosses and ferns. This formation consists of quartz sandstone whose grains are fine to coarse in size, the medium fraction predominating. The grains are well rounded and are frosted and pitted. Usually, very little cementing material is present, and the sandstone is very soft and friable. Except for localized iron-stained patches and streaks, it is one of the cleanest sandstones known. Sand for glass and refractory products has been excavated from workings south of Clayton, Iowa, since about 1876. Now the open excavations have been replaced by underground mining operations.

The thickness of the St. Peter is extremely variable within the park. For the remainder of our vertical descent we will be walking over this sandstone all the way to Sand Cave and Pictured Rocks. At the park well, the St. Peter is about 95 feet thick. However, the sandstone has been measured along three of the park trails and found to be 123, 178, and 223 feet thick respectively. This is the result of a period of erosion on the subjacent Prairie du Chien Formation prior to deposition of the St. Peter. The sand filled in the irregularities on the surface of the Prairie du Chien, and where the St. Peter is thicker than normal, the Prairie du Chien is correspondingly thinner. Despite the associated variations in thickness, the composite thickness of the interval from the base of the Prairie du Chien to the top of the St. Peter is usually about 300 feet.

The scene at Sand Cave and Pictured Rocks was well described by A. G. Leonard in 1906:

> Clambering down through a tangle of ferns and wild flowers one reaches the bed of a small stream just below where it tumbles twenty feet over a lichen-

> covered ledge. The steep walls dotted with mosses, harebells and rock ferns, rise to such a height as to exclude all save the noonday sun and bury the gorge in fragrant coolness.

Sand Cave and Pictured Rocks opposite the cave display a range of bright colors which probably were produced by the oxidation of pyrite in the sandstone.

Return Traverse

The Mississippi River lies about 85 feet below the level of Sand Cave. Because we are not continuing to river level we will not see the contact of the St. Peter with the Prairie du Chien formation, nor the contact of the latter with the subjacent Jordan Sandstone. Rock from the Prairie du Chien has been utilized for dimension stone, road aggregate, and railroad ballast. Many municipalities in other parts of Iowa obtain their water supply from the Jordan Sandstone at depths of from 500 feet to over 2,500 feet.

We will follow a more sinuous trail to our starting point that permits less arduous climbing. A short distance west of Sand Cave we see Bridal Veil Falls where a small stream cascades 20 feet over a ledge of St. Peter Sandstone. As we continue along this trail we cross a foot bridge over the stream and gradually ascend to the top of the St. Peter. Ahead we see another small waterfall where the McGregor Limestone has been undercut to form a recessed niche that permits us to pass beneath the stream. From this point the rock units generally are covered by soil and vegetation until we reach the Galena Limestone and follow the step-like ledges upward to the line of effigy mounds, and finally reach the lookout point from which we started.

The landforms that we have seen can be more meaningful to us individually, and may leave a more lasting impression when considered in a geological context.

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