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ON THE COVER

Tilted beds of sandstone and siltstone in the Devonian Scherr Formation along the Juniata River, west end of Warriors Path State Park, Bedford County (see article on page 12). Beds are inclined approximately 60 degrees. Photograph by W. E. Kochanov.

PENNSYLVANIA GEOLOGY

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STATE GEOLOGIST'S EDITORIAL

Pennsylvania's Parks and Forests—on the "Trail of Geology"

Pennsylvania is blessed by outstanding natural and scenic features and vistas, many geologic in origin. A large number of these geologic features are preserved in our Commonwealth's state parks and forests.

Visiting Pennsylvania's state parks and forests is a common activity during the warm summer months but is much less so in other seasons of the year. Yet visiting these parks and forests during the off-season can be very rewarding, particularly if geological features are your interest. The natural sites and scenic views are less crowded and are often more scenically appealing, especially if photography is planned. The geological features, sometimes obscured or hidden by foliage (and people) during the summer, become much more evident and are easier to examine and photograph.

As part of our Department's activities in accomplishing its major initiatives, one of which is to encourage tourism by promoting our state park and forest systems, we have prepared for this issue of *Pennsylvania Geology* three articles that explain

(1) how you can obtain guides to the geology in more than 20 state parks;
(2) the geology and industrial heritage of one of our newer state parks, Canoe Creek; and
(3) the mysteries behind a few common geologic features that you may have seen or might encounter in the future in our state parks and forests.

Now is a fine time to visit and enjoy our state parks and forests! Take along a copy of Educational Series (ES) 4, *The Geological Story of Pennsylvania*, our newest free publication. If you encounter a geologic feature in our state parks or forests that you can't explain with these articles or ES 4, let us know and we will provide you with the answer to your geologic mystery.

Donald M. Hoskins
State Geologist

From the Ice Mine to Oil Creek: Touring Pennsylvania on the "Trail of Geology"—the Survey's Park Guide Series

by John H. Barnes
Pennsylvania Geological Survey

Pennsylvania's state park system is among the most extensive and accessible in the nation. State parks are located in every region of Pennsylvania and provide wonderful settings for observing and appreciating all aspects of nature, including the state's geologic wonders. The land protected by the park system includes many of the most interesting geological features of the state. In recognition of this, the Pennsylvania Geological Survey long ago began to publish a series of "Trail of Geology" Park Guides, meant to be used by park visitors so that they might be better aware of the geological features found in each park and better understand how the landscape that they are enjoying came into being (see map on back cover).

AN ICE MINE, A BOULDER FIELD, AND A POTHOLE. The Park Guide series was launched in 1969 with three fold-out brochures. Park Guide 1 covered Trough Creek State Park, in which visitors encounter the strange phenomenon known as the Ice Mine. To quote the guide, "The Trough Creek Ice Mine is not a real mine but is a short opening into the hillside. Dug, perhaps, as a prospect hole in the early days of mining, it now serves as an air duct for the release of cold air trapped during the winter in the rock mass above. . . . [I]n the springtime, outside air begins to warm . . . and dense cold air flows downhill out of the rock mass. Melting snow water enters the mine opening and freezes as it meets the flow of cold air. . . . This freezing continues well into the summer until the flow of cold air from the rock mass ceases" (Wilshusen, 1969).

Park Guide 2 introduces park visitors to the mysteries of one of the more unusual geological features of Pennsylvania, a 400- by 1,800-foot boulder field in Hickory Run State Park (Figure 1). The boulders are believed to be the product of freeze-thaw erosion of rock from nearby outcrops 20,000 years ago when the great continental ice sheet of the Wisconsinan glaciation lay nearby (Geyer, 1969). The exact mechanism by which the boulders reached their present location, many becoming polished and rounded, remains a mystery. Interpretation of evidence uncovered since Park Guide 2 was written

Figure 1. The Hickory Run boulder field has long fascinated visitors as they try to figure out how the boulders reached their present position. Photograph by W. D. Sevon.

raises the possibility that the boulders moved in several distinct flows, possibly in mixtures with sand and ice (Sevon, 1987).

The topic of the third of the initial offerings was a pothole, claimed to be "the largest pothole in the world." (Are you surprised that Pennsylvania should claim this honor?) The pothole, in Archbald State Park, is another feature related to the Wisconsinan glaciation. According to the Park Guide, "A surface stream flowing on a glacier probably broke through a crevasse in the ice of the glacier and fell to the bedrock located hundreds of feet below. Enough force would have been generated by the falling water to begin a whirling motion of rock fragments in an already existing small depression in the rock surface. As the rock fragments swirled and bumped each other and ground up the bedrock, they became smaller and smaller and the depression became deeper and larger. As time progressed, new rock fragments tumbled into the hole, enabling the grinding process to continue" (McGlade, 1969).

EXTENDING THE TRAIL. Of the first three of the Geological Survey's Park Guides, only the one on Hickory Run State Park is presently in print. But the Park Guide series has hardly become dormant. The series now includes 21 Park Guides, 15 of which are in print (Table 1 and Figure 2). Some Park Guide authors focused on one or two prominent features in each park; others considered the overall geologic setting of the park. Most of the Park Guides are in the form of fold-out brochures. The newest ones (20, 21, and a revised edition of 8) and future ones follow a new enlarged format—each is a 6- by 9-inch booklet containing more and larger illustrations, larger type, and suggestions for activities while visiting the park.

Pennsylvania's geology is known for its diversity, and that diversity is reflected in the Park Guides that have been added or revised in the past 12 years (Table 1).

Table 1. *Park Guides Issued by the Pennsylvania Geological Survey*

Park Guide	Year	Park	Geologic features
1*	1969	Trough Creek	Ice Mine, Balanced Rock (erosional remnant)
2	1969	Hickory Run	Hickory Run Boulder Field
3*	1969	Archbald	Archbald Pothole (glacial feature)
4*	1970	Moraine	Glacial features (lake, esker, moraine)
5*	1971	Leonard Harrison and Colton Point	Grand Canyon of Pennsylvania
6	1987	French Creek	Diabase and historic ore deposits
7*	1971	Ohiopyle	Waterfall and gorge, rock deformation
8	1993	Valley Forge National Hist. Park	Extensive geologic record, karst features, quarry
9*	1975	McConnells Mill	Gorge, historic iron ore deposit and furnaces
10	1978	Gifford Pinchot	Diabase intrusions
11	1980	Ravensburg	Castle Rocks (erosional remnant), Big Rock Spring
12	1980	Worlds End	Loyalsock Gorge, the Rock Garden (erosional remnant), fossil lungfish burrows
13	1980	Ricketts Glen	Waterfalls, Midway Crevasse, fossil lungfish burrows
14	1980	Nockamixon	Sentinel Rock (erosional remnant), epidote crystals in quarry
15	1981	Caledonia and Pine Grove Furnace	Historic iron ore and furnace, Pole Steeple overlook
16	1982	Swatara	Fossils (brachiopods, trilobites, crinoids, gastropods, cephalopods, pelecypods, bryozoa, graptolites, starfish)
17	1983	Samuel S. Lewis	Scenic overlook of the lower Susquehanna Valley, outcrops
18	1984	Promised Land	Crossbeds, joints, glacial striations, potholes, peat bogs
19	1984	Raymond B. Winter	Ridge and Valley features, fossil worm tubes, stream piracy, springs
20	1991	White Clay Creek Preserve	Metamorphic rocks, pegmatites, valley development
21	1991	Presque Isle	Shoreline processes and features
22†		Oil Creek	Glaciation, fossils, bedrock structures, early oil exploration

* Out of print
† In press

PG 6, French Creek State Park. This park is adjacent to the Hopewell Furnace National Historic Site in southeastern Pennsylvania. The two parks preserve an important colonial settlement that grew up in proximity to minable iron ore. The ore was processed at Hopewell Furnace to allow the manufacture in colonial America of goods that might otherwise be shipped from England. The furnace operated from 1771 until 1883. Some places where the magnetite ore that fed the furnace was obtained are indicated in the Park Guide.

Park Guide 6 contains detailed descriptions of several sites in both parks. Among these is Mount Pleasure, an elongate, smoothly contoured 885-foot hill, about which are some of Pennsylvania's youngest and oldest rocks, ranging in age from 200 million years to

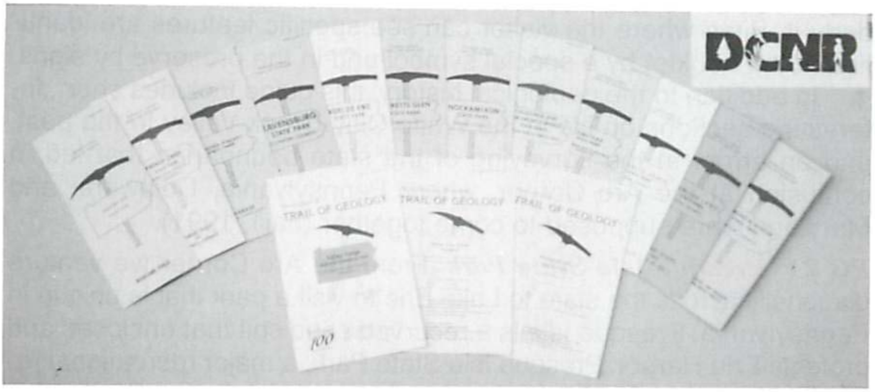

Figure 2. The Pennsylvania Geological Survey currently has 15 Park Guides in print.

at least 1 billion years old. The authors lead the reader through the interesting series of events that were recorded by the formation of these rocks (Inners and Fergusson, 1987).

PG 8, Valley Forge National Historical Park. Originally Valley Forge State Park, this park opened in 1893 as Pennsylvania's first state park. Similarly to French Creek, this park is located in a historic area of southeastern Pennsylvania. The historical significance of Valley Forge is familiar to everyone who has read of Gen. George Washington's encampment over the winter of 1777–78. The geological features of the park are less well known but are also interesting.

The author of this Park Guide explains the origin of the landforms found in and near the park. He also directs visitors to specific sites where geologic features can be observed in detail, revealing clues to the geologic history of the region. Among these is the Port Kennedy quarry, where rocks having an age difference of 300 million years are in contact, the older rocks tilted at an angle to the younger rocks. The remnants of ancient caves and sinkholes are also preserved in this quarry (Wiswall, 1993).

PG 20, White Clay Creek Preserve. Recalling a period in the colonial era when Pennsylvania and the three "Lower Counties" that were to become Delaware were administered jointly, this Park Guide was published jointly by the Pennsylvania and Delaware Geological Surveys. The creation of White Clay Creek Preserve was a joint venture of the two states to preserve a quiet and scenic valley in the Piedmont Upland that straddles the state line near the heavily developed Philadelphia-Wilmington area.

The author of this Park Guide makes clear the story of the origin of the landscape and of the complex metamorphic rocks that underly it. Sites where the visitor can see specific features are identified in the booklet by a special symbol and in the preserve by signs.

In addition to the geological history, this guide includes short, interesting sections on life in the White Clay Creek Valley in the past, and on errors in the surveying of the state boundaries that led to confusion at the Arc Corner, where Pennsylvania, Delaware, and Maryland were supposed to come together (Faill, 1991).

PG 21, Presque Isle State Park. From the Arc Corner we venture diagonally across the state to Lake Erie to visit a park that is unique in Pennsylvania. Presque Isle is a recurved sand spit that encloses and protects Erie Harbor. Presque Isle State Park, a major recreational resource for residents of Erie, is the most heavily visited of Pennsylvania's state parks. In this Park Guide, the author describes the combination of glacial and shoreline processes that formed Presque Isle.

The shoreline is a dynamic environment in which a fragile sand structure such as Presque Isle constantly changes (Figure 3). The author describes geological processes that can be seen operating on Presque Isle, eroding sand from one area and depositing it in another to make new land. The effects of these processes and the attempts to stabilize the peninsula are discussed (Delano, 1991).

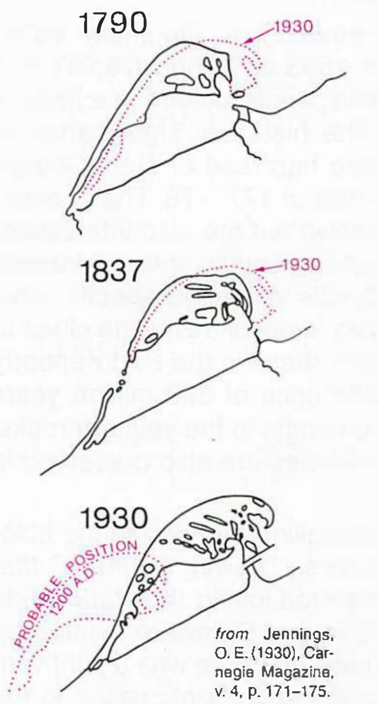

Figure 3. Presque Isle has changed considerably through recorded history, sometimes even becoming an island instead of a peninsula (from Jennings, 1930).

PG 22, Oil Creek State Park. The newest Park Guide, which is not yet available, covers Oil Creek State Park in northwestern Pennsylvania and focuses on two topics: the effects of glaciation on that part of Pennsylvania and the early exploration for oil. The oil industry began in Pennsylvania with the drilling of the Drake Well in nearby Titusville in 1859. Long before that, oil seeped naturally from the ground into Oil Creek and was used by Native Americans and later by settlers for medicine and for waterproofing canoes and clothing. After the success of the Drake Well, the area along Oil Creek boomed with fortune hunters seeking "black gold" (Figure 4). Remnants of this era can be found within Oil Creek

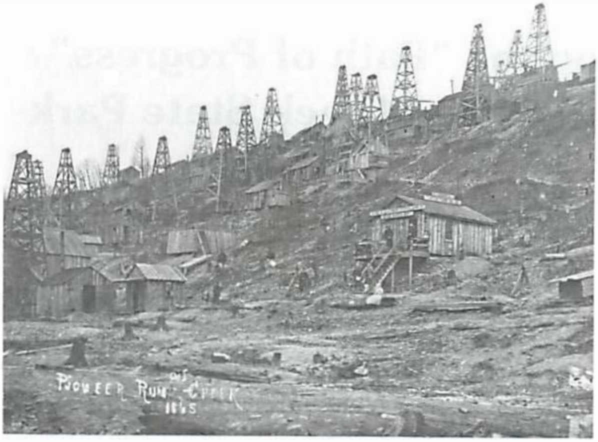

Figure 4. This area, now a part of Oil Creek State Park, was quite unparklike when this photograph was taken in 1865. It became the destination of many seeking riches after the success of the nearby Drake Well gave birth to the oil industry. Photograph from the collection of the Drake Well Museum.

State Park as well as in nearby areas such as the ghost town of Pithole City. The park is also the site of a scenic gorge and several waterfalls, the result of changes in drainage routes brought about by glaciation. This and other effects of glaciation are explained by the author (Harper, in press).

HOW DO I GET A PARK GUIDE? The Park Guides that are in print are available at the respective park offices. Copies are also available by writing to the Pennsylvania Geological Survey, P. O. Box 8453, Harrisburg, PA 17105–8453.

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Geology Along the "Path of Progress" in and Around Canoe Creek State Park

by Robert C. Smith, II, and John H. Barnes
Pennsylvania Geological Survey

Life in any mountainous region includes special challenges to transportation, agriculture, and the manufacturing industries. To a person cruising past on the Pennsylvania Turnpike or glancing out the window of an airliner, the gentle Allegheny Mountains of Pennsylvania may not seem to impose obstacles to compare to the rugged White Mountains of New Hampshire or the Sierra Nevada of California. In the eighteenth and nineteenth centuries, though, before the era of turnpike tunnels and jet aircraft, the Alleghenies provided as much of a challenge to life as any mountain range. Yet, life in the mountains of Pennsylvania also provided opportunities. The region was rich in coal, iron ore, and limestone—raw materials that would fuel the industrial revolution in America and improve the productivity of its farms. The problem of overcoming the obstacles posed by the terrain to take advantage of the richness of the land stimulated innovative thinking that led to ingenious solutions. This spirit of innovation is celebrated by DCNR's Pennsylvania Heritage Parks Program, which has established the Allegheny Ridge State Heritage Park in this region to better tell the story of the people who built the region.

The Path of Progress Heritage Route, which was established by the Southwestern Pennsylvania Heritage Preservation Commission, is a 500-mile road link that carries travelers through several state heritage parks and past many other sites that were instrumental in the development of commerce in the Alleghenies. Some are well-established tourist attractions, such as the Allegheny Portage Railroad National Historic Site, where one can learn about an engineering triumph of the 1800's, a system to carry canal boats over the Alleghenies by way of a network of inclined planes, stationary engines, and horse-drawn cars. This system, which seems cumbersome today, was essential to the development of Pennsylvania, and for 20 years, from 1834 to 1854, it was the primary link between the eastern and western regions of the state. Although the system would not have been necessary were it not for the mountains, those same mountains were the source of building stone needed to anchor the tracks and construct the bridges and other structures that were needed to make it work (Figure 1).

Figure 1. Instead of wooden ties, sandstone "sleepers" were required to anchor the rails of the Allegheny Portage Railroad in the steep slopes of the inclined planes used to haul canal boats over the Allegheny Mountains. The sandstone is believed to have been obtained from nearby outcrops.

Some other sites are less well established for tourism, but are nevertheless of historical importance. An example is the iron furnace at Mount Etna, Blair County, about 1 mile east of U.S. Route 22 along a dirt road. At its peak, from 1830 to 1870, this furnace could produce more than 1,000 tons of cast iron per year (Inners, 1986). Looking at the crumbling ruins of the stack (Figure 2), seemingly all but forgotten, it is hard to imagine that iron produced there was used in the construction of the U.S. Capitol Building (Sternagle, 1986).

Figure 2. The Mount Etna iron furnace stack in Blair County is now braced to prevent it from crumbling. From 1830 to 1870, it was a center of activity and produced iron used in the construction of the U.S. Capitol Building.

Nestled in the majesty of the Alleghenies is Canoe Creek State Park, yet another stop along the Path of Progress. Canoe Creek offers visitors a wide variety of recreational and educational activities. Many of these can be accomplished at the same time. For example, the park has a high-quality beach from which one can, among other things, review the mountain silhouettes and attending hawks with a minimal effort. The park offers easy to moderate trails where the interaction of geology, animals (including humans), and plant life can be observed. If you contact a state parks naturalist, you can even learn about the relation of bats to geology and underground limestone mining in this park!

On the easy Limestone Trail to the foundations of turn-of-the-century limekilns, one can observe the seeming medieval splendor of structures where limestone was once burned to produce lime (Figure 3). The builders of the foundations left the mark of their technique in the wood-grain "fossils" in cement poured against rough-cut wood forms that left a lasting impression (Figure 4). On the more difficult Moores Hill Trail, one can observe how rapidly mother nature is reclaiming abandoned limestone quarries with ferns (Figure 5). Look sharply, or you will only see the ferns, or in the right season perhaps the lime-loving orange butterflyweed attracting orange butterflies! More serious plant lovers can contrast the lime-loving flora with that on the acidic sandstone-derived soils on the same trail. Both are beautiful.

Figure 3. The foundations of the limekilns at Canoe Creek State Park have taken on an almost mystical quality as they stand in solemn tribute to those who built and operated them at the beginning of the century.

One of the most recent additions to the park is the Visitor Center, in which the role of geology, and of limestone in particular, to the development of the area is revealed. Exhibits include information on the nature of limestone, its uses, how it is found, and how it was mined and processed at Canoe Creek. These exhibits include artistically mounted samples of minerals, fossils, and rocks from the park area and larger, hands-on specimens that were provided by New Enterprise Stone and Lime Company, Inc., from a nearby quarry so that the limited outcrops in the park could be preserved. Central to the exhibits is a model of the limekiln operations (Figure 6). The model depicts the mining, burning, and transport of limestone and finished lime at Canoe Creek in detail.

Additional exhibits are concerned with Pennsylvania's geological history and the park's wildlife, including the star attraction—bats!

Figure 4. The wooden forms that were used to construct the limekilns at Canoe Creek State Park made a lasting impression in the concrete.

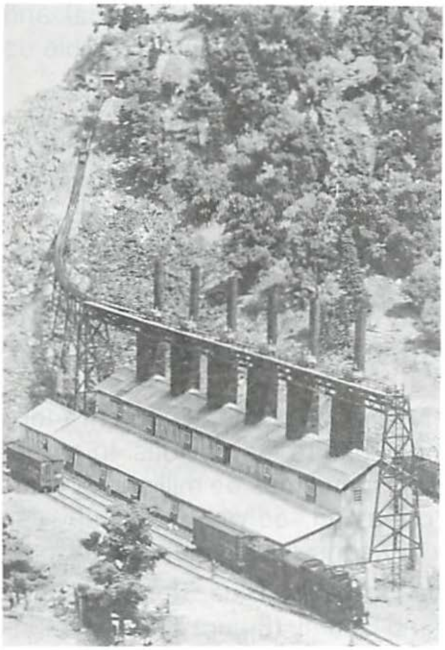

Figure 6. The past is recreated in a detailed model of the limekiln operations at Canoe Creek State Park.

Figure 5. Ferns are now taking over limestone quarries at Canoe Creek State Park.

The exhibits were prepared under contract by the design firm of Inside Outside with technical assistance from the Pennsylvania Geological Survey. Funding was obtained from the Southwestern Pennsylvania Heritage Preservation Commission. Further information on the Path of Progress or any of its attractions can be obtained by writing to the Commission at P. O. Box 565, Hollidaysburg, PA 16648–0565.

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Rocks, Rivers, and Landscapes: Solving Some of the Geologic Mysteries of Pennsylvania's State Parks

by William E. Kochanov
Pennsylvania Geological Survey

Imagine yourself as a traveler in Pennsylvania long before the convenience of paved highways or even dirt roadways. You follow the paths made by white-tailed deer along hollows studded with oak and chestnut, boat down rapid streams and lazy rivers, and scramble up rock-covered slopes to look out over the Great Valley.

You may have wondered what forces created the unique features of Pennsylvania's magnificent landscape. The answers lie in the rocks. Many of these rocks and formations can be seen and explored in Pennsylvania's state parks.

The state parks attract millions of travelers each year, who, like their early counterparts, have come to enjoy the scenery, to recreate, or to simply satisfy their curiosity. Whether it is your first visit or one of many return visits to Pennsylvania, each state park has an interesting geologic story.

The geologic story is a mystery, and, as with any good mystery, there are clues that range from the subtle to the obvious. In a geologic mystery, however, the clues can sometimes be millions of years old! Let's examine some of these clues and see what story they can tell us about the geology at some of Pennsylvania's state parks.

MYSTERY 1. Put yourself near the foot of the Blue Stone quarry at Linn Run State Park in Westmoreland County (Figure 1). As you look at the outcrop, you note the obvious, a criss-crossing pattern angling across the face of the bedrock. Can you figure out what the cross-cutting pattern indicates?

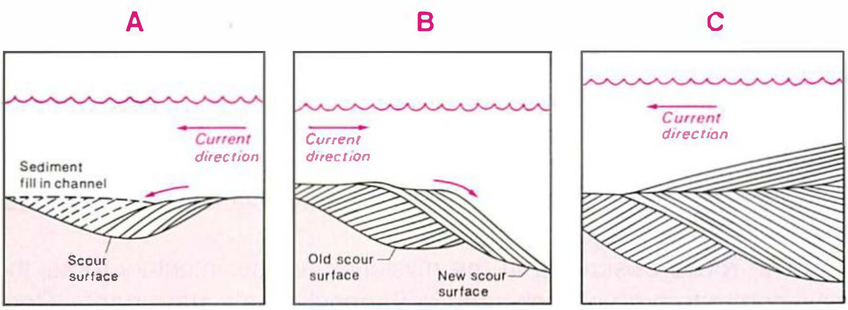
One place to look for clues is in the rock itself. Take two pieces of the rock and rub them against each other while holding them over a piece of dark paper or cloth. Small pieces of the rock will fall off. If you look at the small pieces through a magnifying glass, you will see that the small bits of rock are grains of sand, usually composed of the mineral quartz. Next, you may ask yourself, "In what present-day environment can I find sand?" Answers: the beach, a river or stream, or the desert. Using one of these environmental settings, one can piece together a story to explain the criss-cross pattern.

Figure 1. Crossbedding in the Loyalhanna Limestone in the Blue Stone quarry at Linn Run State Park, Westmoreland County. Crossbedding can be seen at other state parks such as Baughmans Rocks overlook, Ohiopyle State Park, Fayette County; the Forest Fire Warden Monument, Hyner View State Park, Clinton County; Phyllis Run at Clear Creek State Park, Beartown Rocks area, Jefferson County; Geology Trail, Oil Creek State Park, Venango County; and The Glens, Ricketts Glen State Park, Luzerne County.

The cross-cutting patterns could have been created by changes in water current direction, as shown in Figure 2.

One could have easily used a wind-blown desert setting and had similar features created by wind instead of water currents, or a beach setting where a combination of wave action and wind could produce similar crossing patterns.

Figure 1 shows a sedimentary rock feature called crossbedding. It is characterized by a distinctive cross-cutting pattern. Thin layers within a bed (laminae) or thin beds appear to cross-cut other sets of layering. The thin layers are typically parallel to one another and are inclined at some angle.



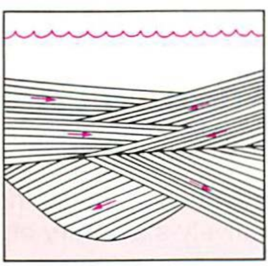


Figure 2. A. A channel is scoured by the current. Sediment carried by the current is deposited in layers and fills the channel.
B. The direction of the current shifts. The previously deposited layers are scoured, and deposition of sediment in layers is repeated.
C. The direction of the current continues to shift. The amount of scouring depends on the strength of the current.
D. If the strength of the current lessens, the scouring is decreased, and the layering will not be as steep. Many cycles indicating changes of current may be visible.

As one examines the rocks more closely, the clues become more obvious. Let us continue to explore this idea of different environments.

MYSTERY 2. Travel north with us to Warren County and stand among huge, house-sized boulder (Figure 3). What do these rocks tell us?

It is easy to see that the rock is composed of pebbles of different sizes and that the pebbles are rounded. Imagine places where pebbles of this size and shape can be found. One of the most common places is in streams, particularly streams that have fast-moving water. The pebbles are made smaller and rounder by abrasion as they are bounced along the bed of the stream by the fast-moving water.

Figure 3. Huge conglomerate boulders make interesting "rock cities" atop the ridges of plateau country, Chapman State Park, Warren County. Boulder cities can be seen at other state parks such as Clear Creek State Park, Beartown Rocks area, Jefferson County; along Geology Trail, Oil Creek State Park, Venango County; and at the Rock Garden in Worlds End State Park, Sullivan County.

The pebbles found in the conglomerate compare to pebbles found in existing streams. We can use the relationship between present and past environments to help us interpret the features found in different rocks. In this instance, the pebbles in the conglomerate were deposited by a fast-flowing stream during the Pennsylvanian Period, about 310 million years ago.

The rocks described in the mysteries are sedimentary rocks, the most common type of rock seen in Pennsylvania's state parks. Conglomerate, sandstone, siltstone, shale, and limestone are all sedimentary rocks.

MYSTERY 3. Beds of sedimentary rocks are generally in horizontal layers. At Whipple Dam State Park, Huntingdon County, the beds of sandstone appear to be folded (Figure 4). How did these rock layers get folded?

Observe in Figure 5 how an applied force (your hand pushing from one end of a rug) acts on an attached, relatively stationary ob-

Figure 4. Gently folded bedrock along Whipple Road near the dam, Whipple Dam State Park, Huntingdon County.

ject (the piece of rug). Pushing from one direction compresses the rug and shortens it, causing the fold. When the continental plates that make up the earth's crust came together during the Alleghanian orogeny, the compressional force from the collision was passed on to the different layers of rock, shortening the layers and causing them to be folded.

Inclined bedding prevails in the Ridge and Valley province. The photograph on the cover shows a section of rock layers in Warriors Path State Park that were originally horizontal and have been folded. The exposed section is just one part of a larger fold. If the vegetation were removed, additional rock layers would be visible, and they would reflect the same inclination. This inclination of bedding is called the dip of a bed (Figure 6). Dip is measured in degrees from a horizontal plane. The dip of a bed helps to identify the orientation of the rock layers in a given area.

The outcrop shown on the cover is part of the west side of a large syncline that includes the Broad Top coal field. Anticlines and synclines are specific types of folds that occur throughout much of Pennsylvania. If the letter "S" is laid on its side, it looks much like a syn-

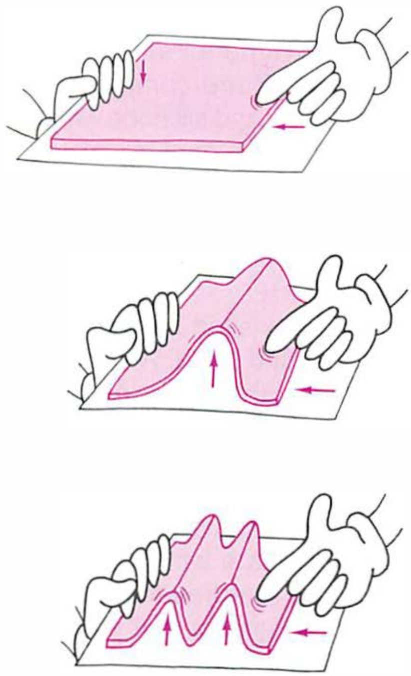


Figure 5. To get a general idea of how rock layers are folded, take a piece of rug, and hold down one end while slowly pushing from the other end. You will note that the piece of rug will bulge at or near the center. Continue to push the rug and it may develop more than one fold, giving the surface a rippled appearance.

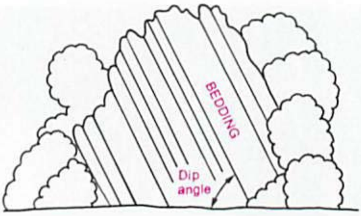


Figure 6. Inclined bedding showing dip angle.

cline and anticline sequence (Figure 7). However, there is more to understand about anticlines and synclines than their shape. Because of the way the rocks are folded, an anticline has the oldest layers of rocks in the core of the fold, whereas a syncline has the youngest rocks in the core. Notice how the dip of the beds changes from left to right in Figure 7.

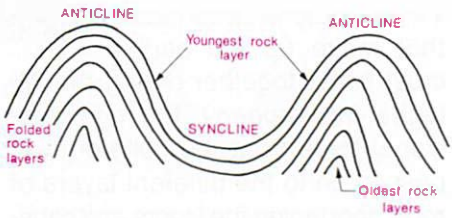


Figure 7. Anticline and syncline.

At Warriors Path, the layers of rock are composed of sandstone and siltstone, which are more resistant to erosion. More easily erodible shale, to the right of the outcrop, is therefore not as prominent as the sandstone and siltstone layers.

MYSTERIES SOLVED? We have been to different parts of Pennsylvania, visited some of the state parks, and examined some of the rocks found there. We have noted that the rocks contain clues to help unravel part of their mystery. The mystery is only solved in part because we are only looking at one clue in a much larger picture.

The Pennsylvania Geological Survey is in the process of preparing a book about the geological story of our state parks for publication in a format similar to this article (Kochanov and others, in press). We will share with the visitor and the armchair traveler some of the geologic features to be seen in our state parks and the clues found within the rocks that help explain some of the mysteries of how the rocks were formed.

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REFERENCE

Kochanov, W .E., Sevon, W. D., Whitfield, T. G., and Yannacci, D. S., in press, Rocks, rivers, and landscapes: the geologic story of Pennsylvania's state parks: Pennsylvania Geological Survey, 4th ser.

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Donald M. Hoskins, *Bureau Director*

Access no. for the hearing impaired: 1-800-654-5984 (TDD) Pa. AT&T relay service
Bureau staff may be reached by Internet using the following format: lastname.firstname@a1.dcnr.state.pa.us
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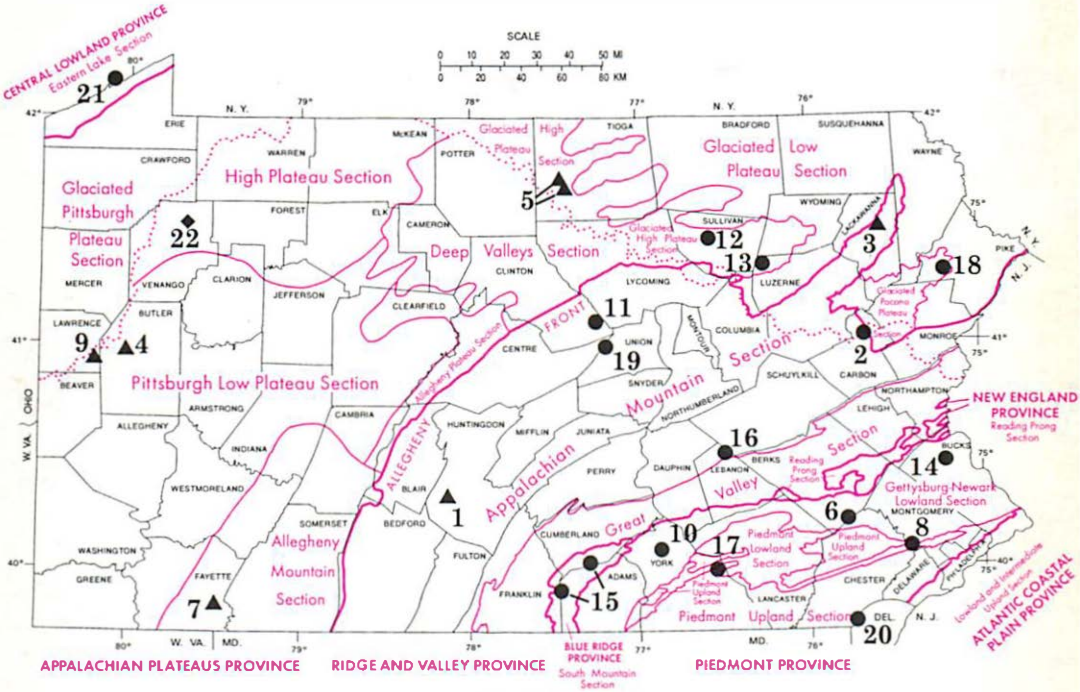
(Parks are shown in relation to the physiographic provinces and sections of Pennsylvania, which are characterized by particular types of landscape. See article on page 2.)



EXPLANATION

- Approximate boundary between physiographic provinces
- Approximate boundary between physiographic sections
- Late Wisconsinan glacial border

● 8 In print ▲ 4 Out of print ◆ 22 In press

"TRAIL OF GEOLOGY" PARK GUIDE NUMBER AND LOCATION OF PARK
(see Table 1, page 4, for names of state parks and more information about park guides)

Bureau of Topographic and Geologic Survey
Department of Conservation and Natural Resources
P. O. Box 8453
Harrisburg, PA 17105–8453

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