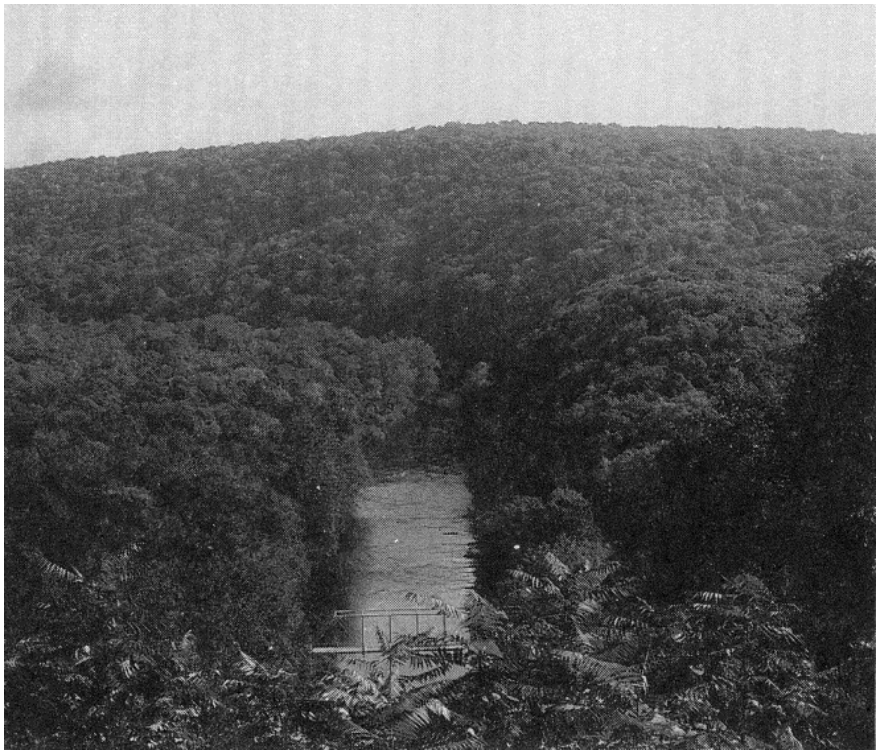
OIL CREEK STATE PARK
VENANGO COUNTY
ICE AND OIL SHAPE THE LAND



If you visit the scenic overlooks along the hiking trails in the higher portions of Oil Creek State Park, you will see that Oil Creek has cut a deep, steep-sided gorge into the surrounding hills. This part of Pennsylvania is situated in an area of broad, rolling uplands and deeply incised stream valleys. The hilltops in the park rise 400 feet or more above the bed of the creek.

Oil Creek State Park has an abundance of natural geologic features, such as waterfalls, boulder fields, and glacial deposits. The park also contains many historical features related to man's search for petroleum. Old oil-field equipment, including pumping machinery, wooden and metal pipes, and storage tanks, can be found in the park at various places.

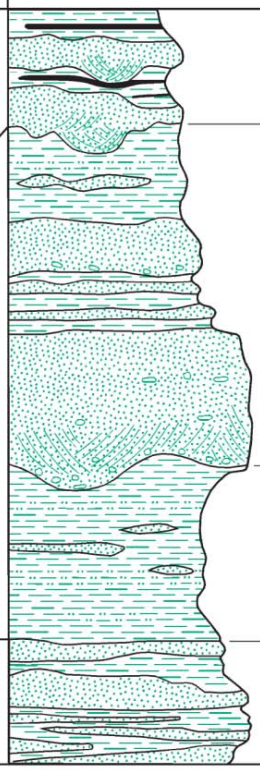
How to Use This Guide

The geological features in the park are explained in this guide. Take it with you as you hike or bike the park trails, or drive the roads in and around the park.

* The map in the center of the guide shows the locations of many sites of geologic interest within Oil Creek State Park.
* The guide starts with descriptions of the bedrock and the surficial deposits.
* That is followed by the story of how Oil Creek gorge formed.
* Next, you learn why large angular blocks of sandstone dot the hillsides of the park.
* And the last section of the guide addresses where oil comes from and some of the attempts made over the years to produce it.

IDENTIFYING BEDROCK

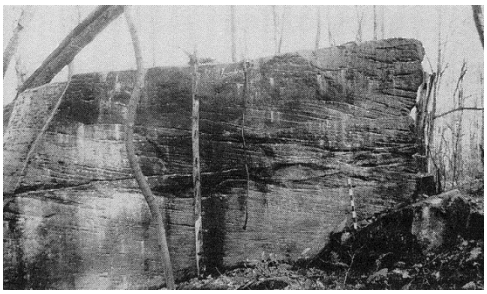
A limited amount of bedrock crops out in Oil Creek State Park. Much of it lies beneath a thin layer of soil and weathered glacial debris.



PERIOD	WHAT TO LOOK FOR	WHERE TO SEE IT
PENNSYLVANIAN	POTTSVILLE FORMATION Mostly interbedded gray to brown sandstones and shales and some minor coal seams. Deposited by a great river system flowing over a broad coastal plain.	Highest elevations in the park and surrounding areas; above 1,500 feet.
MISSISSIPPIAN	SHENANGO FORMATION Predominantly shale and siltstone in the upper part; light-gray to white sandstone in the lower part. Sandstones contain pockets of less-resistant material, such as chunks of shale or patches of poorly cemented sand that erode more easily than the rest of the rock; removal of this material leaves fist-sized and larger pits in the surface of the sandstone. Forms cliffs in parts of the park and waterfalls in smaller streams. Eroded cliffs break up to create boulder fields of large, angular sandstone blocks, in which crossbedding is very common.	Three hundred (300) feet above creek level in the gorge. See cliffs at Site 1; waterfalls at Sites 7, 10, 12, 13, and 15; and large boulders at Sites 2 and 5.
MISSISSIPPIAN	CUYAHOGA GROUP Gray, interlayered shales, siltstones, and flaggy sandstones.	Covered with soil and eroded debris from higher rock strata.
DEVONIAN	CORRY SANDSTONE Predominantly gray to yellowish-brown, thinly layered sandstones having fossil tracks and trails of animals that crawled along or burrowed into the bottom of a shallow sea that once covered the area. Includes rare body fossils.	Along bike trail, such as at Sites 8, 9, and 14, and at Site 3. Shell fossils sparse in park. Best exposed at the Drake Well Museum.

Shenango Sandstone

The Shenango sandstone has layers of sand that are tilted at different angles. This crossbedding represents the movement of large ripples or underwater sand dunes downstream with the current.

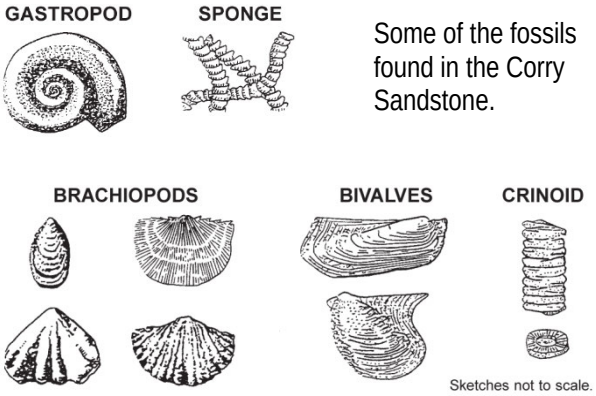


The sandstone contains pockets of sand grains that are not tightly cemented together. These pockets weather more rapidly than other parts of the sandstone, creating large holes in the surface of the rock.

Because it is harder to erode than the rocks above and below it, the Shenango sandstone forms prominent cliffs, overhangs, and scenic waterfalls.

Corry Sandstone

Fossils are present in the Corry Sandstone. They are mostly tracks and trails of animals that crawled along, or burrowed into, the seafloor about 365 million years ago. Molds of marine animals called brachiopods (lamp shells) and bivalves (clams) occur in some layers, but these types of fossils are relatively sparse in the park. Exposures of the Corry Sandstone at the Drake Well Museum contain abundant fossils, including many different kinds of lamp shells, clams, snails, stem segments of sea lilies (a relative of starfish), and an unusually shaped sponge named *Titusvillia drakei*.



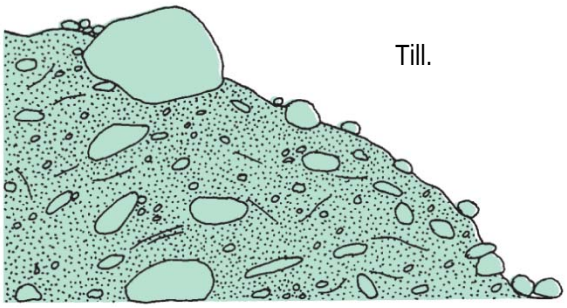
Some of the fossils found in the Corry Sandstone.

A Legacy of Ice

During the Ice Age, when continental ice sheets covered parts of North America, the glaciers moved southward across northwestern Pennsylvania, including Oil Creek State Park, to as far as the Allegheny River. The moving ice scraped rock from the earth's surface to the north, ground it down to sand and gravel, and left it scattered over broad areas of the park. Two types of glacial debris, called *till* and *stratified drift*, occur in the park. Till, which is material left behind as the ice melts, has no distinct layering. Stratified drift, as its name suggests, is glacial material deposited in layers or beds, usually by quick-flowing glacial meltwaters.

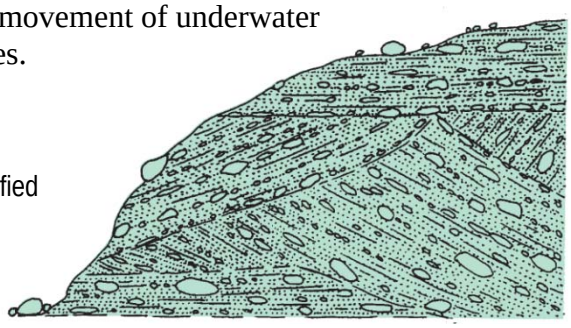
About 250,000 years ago an ice sheet formed and advanced into northwestern Pennsylvania. The glacier moved over only part of the park area, crossing Oil Creek near Miller Farm, leaving the area to the south unglaciated. The sand and gravel left behind when the glacier melted is called Titusville Till. Examples of this debris can be seen in the drainage ditches cut at the edges of the unpaved roads within and outside the park.

At Site 6, there are two or three pits that were once quarried for sand and gravel for construction material. These pits contain about 50 feet of sand and gravel held together by carbonate cement, giving the rock the look and feel of poorly made concrete that was just dumped in layers on the ground. The sand and gravel form a *kame terrace*, a mound of stratified drift left by meltwater streams flowing between the glacier and the valley wall of Oil Creek gorge. Like the



Till.

Shenango sandstone, this stratified drift exhibits crossbedding due to the formation and movement of underwater dunes.



Stratified drift.

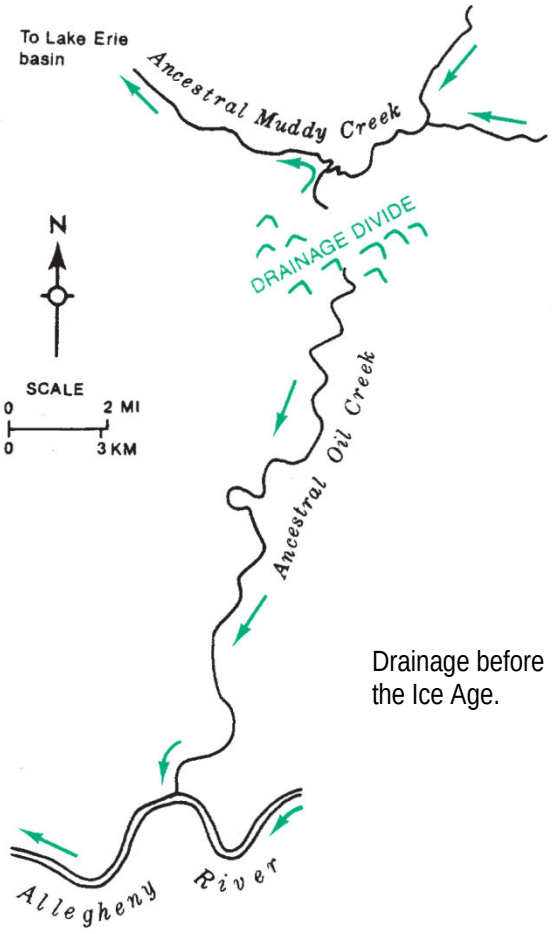
Ancient Streams Take New Directions

A map of northwestern Pennsylvania shows that Oil Creek begins at Lake Canadohta in Crawford County, about 20 miles northwest of Oil Creek State Park. The creek flows southeastward to Titusville, then south to Oil City where it drains into the Allegheny River. But Oil Creek did not always follow this course.

Long Ago . . .

Before the Ice Age began, Oil Creek had its headwaters within Oil Creek State Park near the historic site of Boughton (see map on next page). At that time, Oil Creek probably was a slow stream winding in a shallow valley only a little deeper than the surrounding landscape. Although the creek flowed in the same channel it occupies today, it was probably 400 or 500 feet higher than it is now. Prior to the Ice Age, the area just north of Boughton was a highland that formed a drainage divide separating the south-flowing ancestral Oil Creek and the northwest-flowing ancestral Muddy Creek. The old Muddy Creek drained the areas east and north of present-day Titusville, flowing northwestward to what is now Lake Erie.

During the Ice Age, the glaciers blocked the channels of northwest-flowing streams, such as Muddy Creek. The water had nowhere to go; therefore it formed large ponds in front of the ice sheet. Eventually, the water became so deep that it flowed over the drainage divide at Boughton and cut a new channel. This allowed Muddy Creek and its tributaries to drain southward into Oil Creek. As the glaciers melted, the land was uplifted, and Oil Creek, swollen and swift-flowing with glacial meltwater, eroded a deep gorge along its preestablished channel.

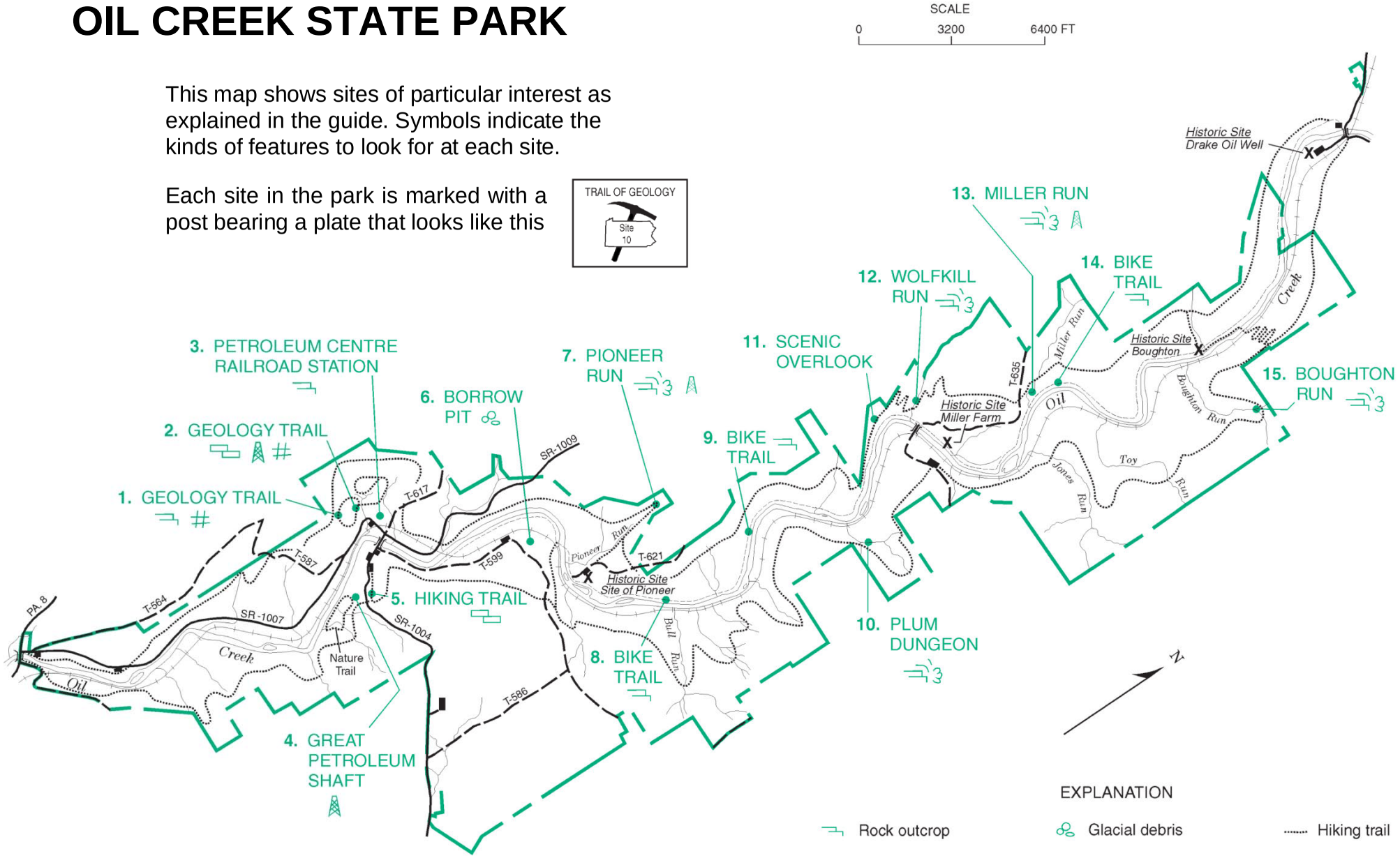


Drainage before the Ice Age.

OIL CREEK STATE PARK

This map shows sites of particular interest as explained in the guide. Symbols indicate the kinds of features to look for at each site.

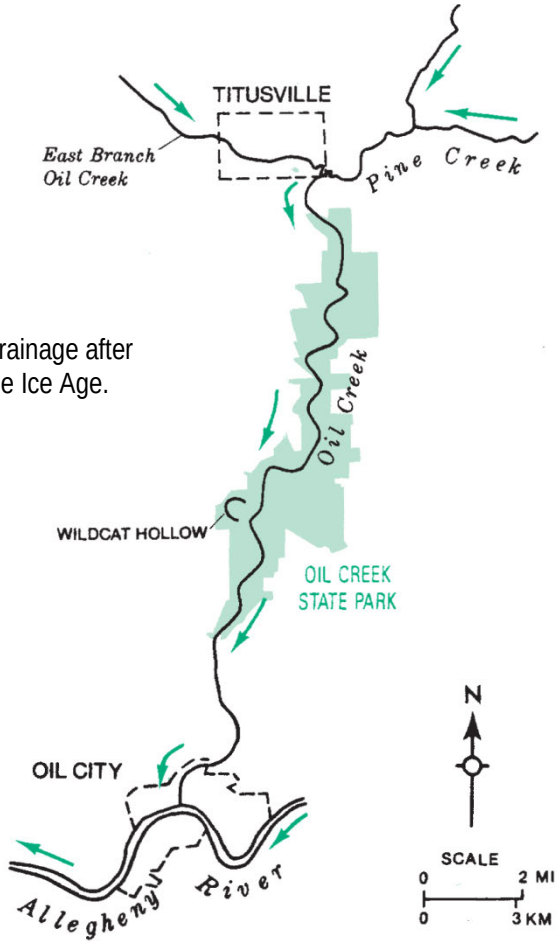
Each site in the park is marked with a post bearing a plate that looks like this



Base map information is modified from *Recreational Guide for Oil Creek State Park* (revised 1991), Bureau of State Parks.

And Today . . .

After the glaciers retreated, the formerly northwest-flowing ancestral Muddy Creek was so clogged with sand and gravel in Crawford County that a new drainage divide formed. Today, on the west side of the divide, Muddy Creek flows northwestward toward Lake Erie. To the east of the divide, what used to be Muddy Creek (now Oil Creek and its tributaries) flows southward to the Allegheny River. As Oil Creek cut down through the rolling landscape, it created the scenic gorge that is the central feature of Oil Creek State Park. The gorge has steep walls and a rather flat valley floor. The tributaries of Oil Creek also have steep sides and flat valley floors, but on a smaller scale. At several places, including Sites 7, 10, 12, 13, and 15, waterfalls as much as 10 or 15 feet high occur where the tributary streams flow over the Shenango sandstone. Oil Creek itself has no waterfalls, indicating that the main stream cut down into the bedrock much faster than its tributaries.

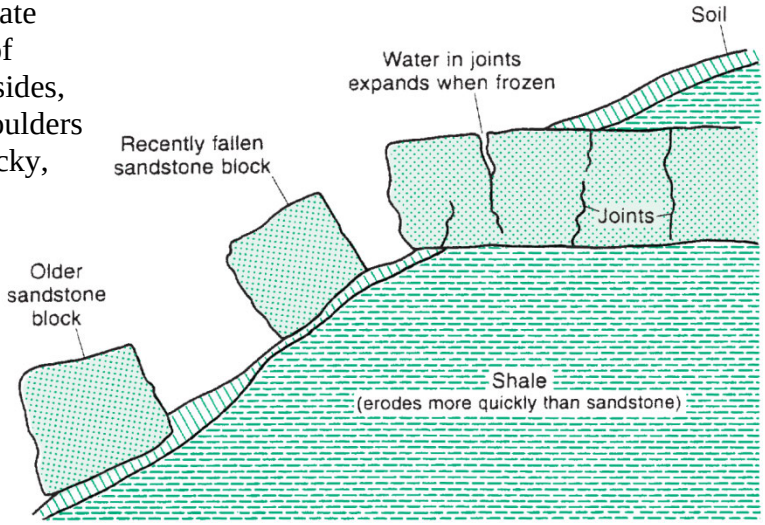


Drainage after the Ice Age.

Joints, Boulders, and Creek Bends

Joints are naturally occurring fractures in rock that result from stresses within the earth's crust. Rock joints almost always occur in more or less parallel groupings called *sets.* When you travel around Oil Creek State Park, you will notice large boulders of Shenango sandstone lying on the hillsides, particularly at Sites 2 and 5. These boulders commonly appear rectangular, or blocky, because two main joint sets in the sandstone occur at nearly a right angle to each other. One set trends from northwest to southeast, and the other set trends from northeast to southwest.

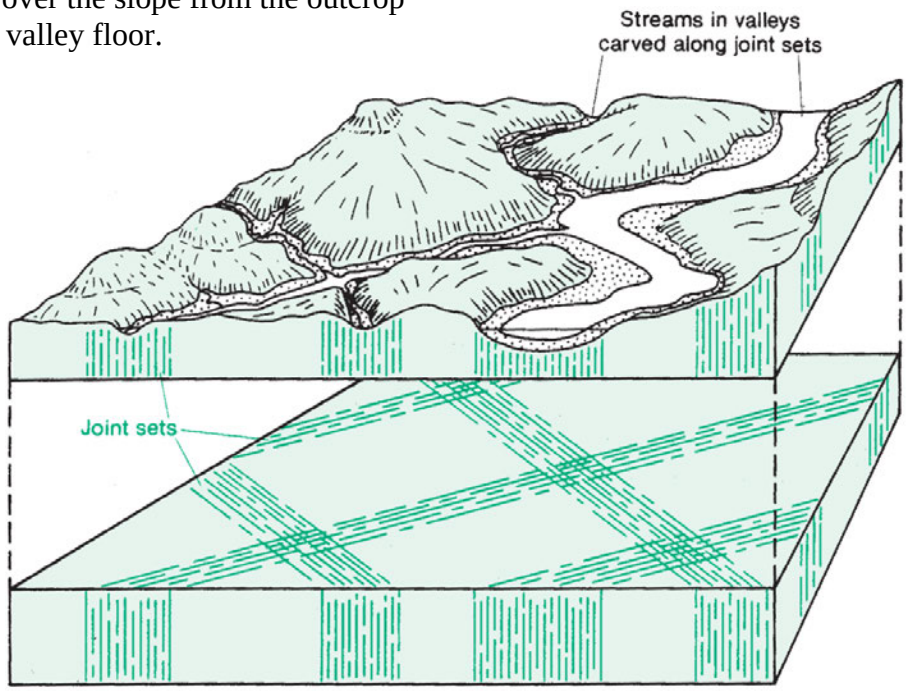
The rock joints are also partly responsible for the boulders being where they are. Water from rain and snow collected in the joints. When the water froze, it expanded and pushed against the sides of the joints, opening the fractures



a little wider than they were originally. In this way, over many periods of freezing and thawing, the moisture pushed the rock apart bit by bit. In time, these fractures opened enough to completely split the rock.

As the soft shales and siltstones beneath the sandstone eroded away, it became undermined. This caused the blocks of rock, now completely separated along joint planes, to become unstable and slide or fall away from the cliff face. *Soil creep,* a kind of slow, steady, downhill movement of soil due to gravity, carried the blocks to their present positions. Many sandstone blocks with sharp, flat joint faces can be seen at Site 2. They are scattered over the slope from the outcrop almost to the valley floor.

Rock jointing also affected the direction of the channel of Oil Creek. Oil Creek flows in a generally southward direction, but it is a crooked course made up of almost straight segments separated by sharp bends. Most of the straight segments of the creek run either from northwest to southeast or from northeast to southwest. These are the same directions as the two major joint sets in the Shenango sandstone. This is not merely a coincidence. Oil Creek follows an ancient course that has not changed greatly since before the Ice Age. Rock jointing influenced the course of the creek by providing a more easily eroded path for the creek to follow while cutting its channel.

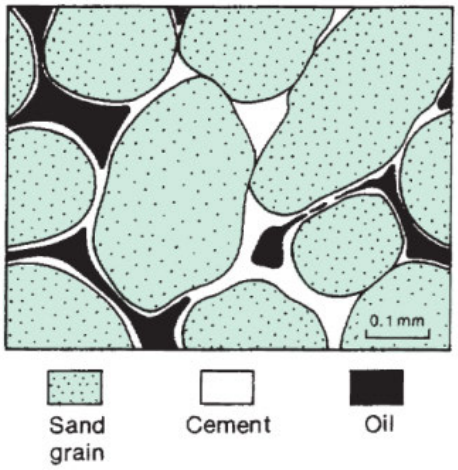


"Black Gold"

Oil was known to occur along Oil Creek many years before "Colonel" Edwin L. Drake drilled his historic oil well near Titusville. The oil escaped from underground rock reservoirs through joints and other fractures. It eventually found its way to the surface where it flowed into Oil Creek at various springs or "oil seeps." The American Indians and the early colonists used oil skimmed from the surface of the water for medicine, or to waterproof canoes and garments. Drake shrewdly used this knowledge of seeping oil in choosing the location to drill his well.

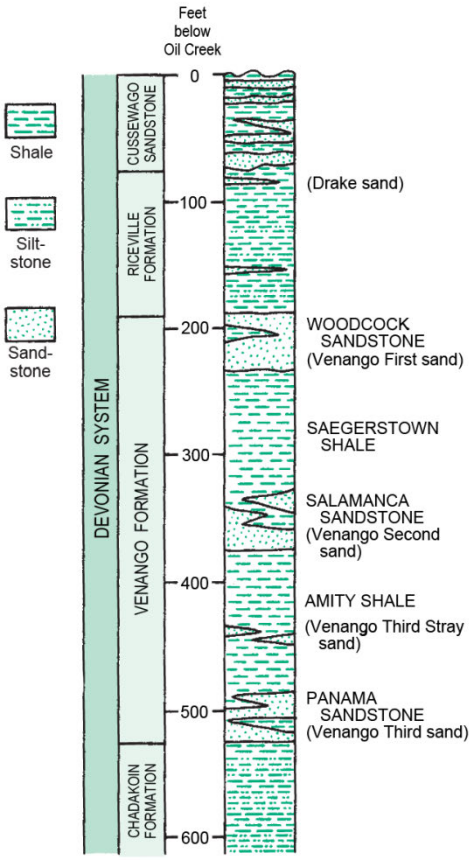
It is commonly believed that oil is found in underground lakes and rivers. In reality, oil is found in rocks such as sandstones and limestones. In Pennsylvania, oil fills some of

the *pores*, or tiny open spaces between grains of sand, in sandstones. These sandstones occur as distinct rock layers. When someone in the oil business talks about an oil "pool," that person is referring to a layer of porous rock. When oil is produced, it flows through interconnected pores to a well bore.



The main oil reservoirs beneath Oil Creek are sandstones in the Venango Formation. The shallowest of these rocks, the Woodcock Sandstone (or "Venango First sand" of oil-well drillers), lies about 150 to 200 feet below the level of Oil Creek. Drake's well, which was drilled only to 69½ feet, produced from a thin sandstone "stringer" (a thin, discontinuous lens of rock) in the Riceville Formation.

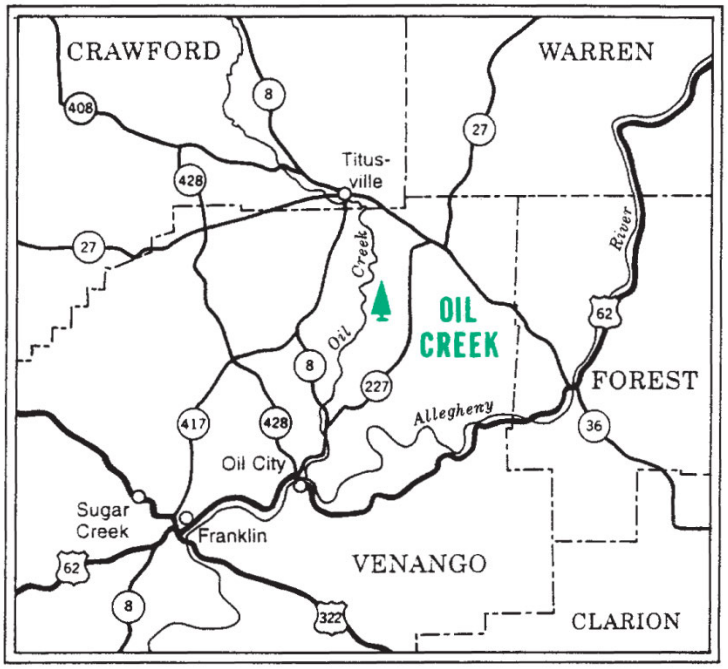
Drilling for oil along Oil Creek increased quickly after Drake's discovery. Thousands of wells were drilled in the gorge and in the surrounding hills. In those days, oilmen drilled quickly and then walked away if the well had no oil. Very few records were made, and the very existence of many of the wells has been long forgotten. There are many places in Creek State Park where remnants of oil wells can still be seen by the park visitor. Old wells are abundant along the Geology Trail at Site 2, at Miller Farm, Pioneer, and many other areas. They range from shallow depressions in the ground to wells with pumps and storage tanks.



Rocks encountered in wells drilled beneath Oil Creek.

The large pit at Site 4 was dug in 1865 and 1866 by oilmen who wanted to gather oil faster and in larger amounts. They planned for the shaft to be dug 500 feet deep. The digging was suspended after only 90 feet because of lack of money and because water began to fill the hole. Today, the site is a circular pit that has been mostly filled in to protect farm animals. Some stone blocks at one side of the pit, all that remain of the engine foundation, serve as a reminder of the efforts of Pennsylvania's oil industry during the "boom" years of the 1860's.

—John A. Harper, Geologist
Pennsylvania Geological Survey
1998



LOCATION MAP

Park Manager
Oil Creek State Park
305 State Park Road
Oil City, PA 16301
Phone: (814) 676–5915

PREPARED BY

Department of Conservation and Natural Resources
Bureau of Topographic and Geologic Survey