INTRODUCTION

When looking around North Park, one can see some landforms (hills and valleys) that were millions of years in the making. Even so, much of this topography is very recent in geological terms. The bedrock layers that have been carved to form the current topography are more than 300 million years old. An understanding of why the land looks as it does today begins with understanding how the bedrock was formed.

BEDROCK

The rock exposures in North Park represent only a fraction of the total rock record preserved in western Pennsylvania. Most of the rocks in the park were deposited over a geologically short, three-million-year time span. This span is a small part of a 20-million-year interval, more than 300 million years ago, when a great ice age gripped the world's polar regions. At that time western Pennsylvania was a coastal flatland composed mainly of swamps and rivers and located in a tropical region surrounding the equator. Periodically, shallow seas flooded the coastal regions and, for a time the area was submerged by warm tropical waters. Rapidly fluctuating climate and sea level during this interval in Earth's history produced the vertically varied rock types that characterize the region. So well known and characteristic are these changes that the rocks from this time interval are termed the Pennsylvanian Period by geologists.

Although the topography in North Park is the result of geologically recent events, the bedrock layers that underlie the park were deposited more than 300 million years ago. These bedrock layers are assigned to a unit that geologists call the Conemaugh Group. The Conemaugh Group gets its name from rock exposures along the Conemaugh River, but this unit is distributed throughout the Tri-State area. This group is subdivided into two rock formations, the Glenshaw and Casselman Formations (Figure 1). The layers of rock exposed in North Park are only a portion of the Conemaugh Group.

Rocks in the region were formed by stacking one layer on top of another layer to create the pile of rocks that we see today. Relatively recent stream erosion has created the valleys that expose individual rock layers, called strata, that are stacked up like layers in a cake. The first layers to form are on the bottom of the stack, and are, therefore, the oldest. As time passed more and more layers accumulated. Each of these layers is progressively younger in age.

The oldest rocks exposed in the park are those that are assignable to the Saltsburg Sandstone Member **(1)**. This sandstone unit represents the deposits of an ancient river system. Located above the Saltsburg Sandstone, and therefore slightly younger, are the red shales of the Pittsburgh Red Beds and followed by the Ames Limestone **(2)**. The red shales, which are poorly exposed within the park, are an ancient soil that suggests that the climate in western Pennsylvania was very warm and dry during the interval of time when it was formed. In contrast, the

Ames Limestone represents a period when the entire region was submerged by a shallow sea. The marine creatures that lived in this sea are preserved now as fossil shells within the limestone and attest to the fact that the waters were very warm. The Ames Limestone can be found over much of southwestern Pennsylvania, eastern Ohio, and northern West Virginia.

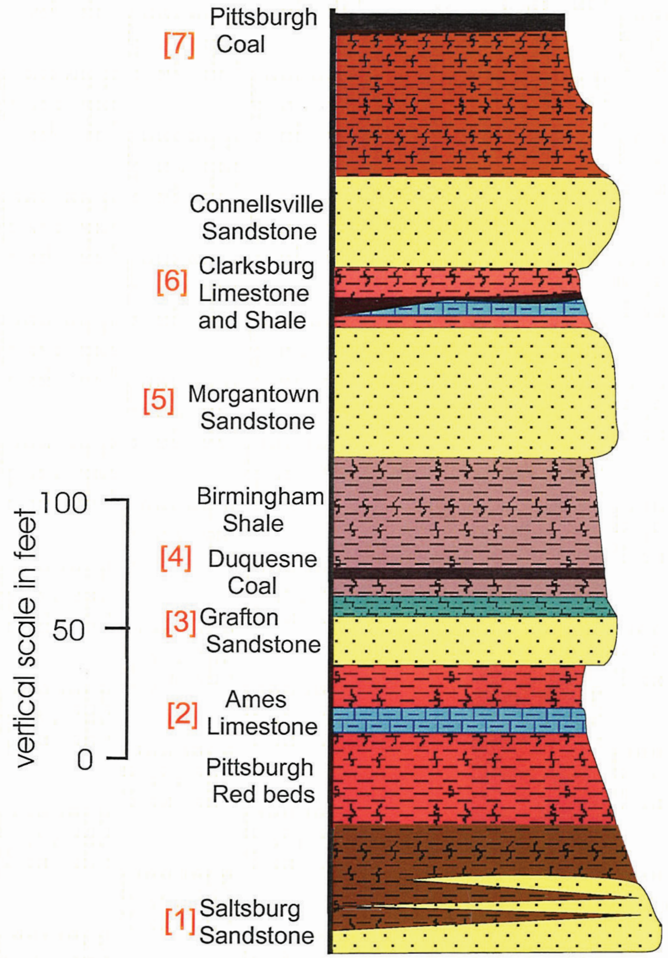


Figure 2. Section layers and geologic names of rock units exposed in North Park. Red numbers correspond to locations on cover map.

Overlying the Ames Limestone is the Grafton Sandstone **(3)** of the Casselman Formation of the Conemaugh Group. This sandstone, like the Saltsburg Sandstone below it, represents ancient river channel deposits that were formed when rivers flowed across the region as the Ames Sea withdrew. The drop in sea level allowed these rivers to flow from east to west across the nearly flat, previously submerged, coastal plain. Above the Grafton Sandstone are the Duquesne Coal and Birmingham Shale **(4)**. These rocks indicate that following the Grafton cooling episode, the climate again warmed so that tropical coastal swamps once more developed across western Pennsylvania forming the Duquesne Coal. Nearshore marine fossils are sometimes found in the shale above the Duquesne Coal and indicate that full-fledged marine waters lay not too far to the west in southeastern Ohio. The fact that full marine conditions were not experienced in the Pittsburgh area suggests that the submergence of the continental areas during this time interval was not quite as extensive as during the Ames deposition.

Situated above and chronologically following the formation of the Birmingham Shale is the Morgantown Sandstone **(5)**. This sandstone, like the Saltsburg and Grafton sandstones below, is the result of climate changes as sea level dropped and large river systems criss-crossed the region. Weathering of the Morgantown Sandstone has provided a supply of sand for use within the park.

Overlying the Morgantown Sandstone are the Clarksville Limestone and red shale **(6)** and in some places the Barton Coal. These beds do not have any marine fossils, but the presence of fresh-water limestone and red shales indicates that the climate was again warm and dry during this time period. However, just as in the previous cases, the Clarksburg warming episode was followed by a cooling event that produced the overlying Connellsville Sandstone. Because this sandstone is resistant to erosion, it caps some of the highest hills on the western edge of the park. Much of the remainder of the present and exposed beyond the western boundary of the park. The top of the Conemaugh Group is at the base of the Pittsburgh Coal. This coal is part of the overlying Monongahela Group, locally present on hilltops just outside the park **(7)**.

TOPOGRAPHY

The topography of North Park is the result of dissection of the flat-lying bedrock layers by relatively recent streams. Following the deposition of the coastal sediments that created the area's bedrock 300 million years ago, the entire region was uplifted as part of an intense folding and faulting episode that marked the final stages of the formation of the Appalachian Mountains to the east. The culmination of this mountain-building event occurred approximately 250 million years ago. During the ensuing 250 million years, much of western Pennsylvania has been slowly, but continuously, worn away by erosion and scouring by the region's streams. The rate of erosion increased approximately 1.5 million years ago when the Earth was again gripped by an ice age. Areas to the northwest of North Park and as nearby as New Castle and Elwood City were buried by a mass of glacial ice that stretched northward to Hudson

Bay and was as much as a mile thick. The Monongahela River of that pre-Ice Age time did not flow to the Gulf of Mexico via the Ohio River. Instead, the Monongahela continued northward from the Golden Triangle, up the Beaver River to New Castle, and then to an ancestral St. Lawrence River confluence under what is now Lake Erie. Damming of that river by the ice sheet caused a rerouting of the river system into what we now know as the Ohio River.

With the formation of the modern Ohio River at the end of the Ice Age, local streams had to adjust their course because the river level was approximately 200 feet lower than it had been prior to the Ice Age. As a result, streams carved out deep valleys and ravines to reach the new river level. The resulting steep hillsides and valley walls are generally unstable over long periods of time because erosion by water and gravity combine to smooth out sharp landscapes. In North Park these forces have genereated numerous landslides and rock slumps (Figure 2).

Landslides generally form where hill slopes are too steep to support the underlying rock type. In the Pittsburgh area the rocks consist of alternating layers of sandstone, shale, and coal. While sandstone layers are generally resistant to erosion, shale layers are highly susceptible to its effects. Therefore, in areas of North Park where steep slopes are underlain by shale layers, abundant rainfall or frost wedging can soften the clay-rich rock and make the slope unstable, allowing a slump or rockslide to occur. These forces are not restricted to North Park, but are characteristic of the entire Pittsburgh region.

GEOLOGIC HIKE

A geological hike through North Park is outlined on Figure 3. This hike begins in the parking area near the swimming pool. From there proceed northeast along South Ridge Road and down the trail near pavilion 101.

Site A- At this location the ancient river channel deposits of the Morgantown Sandstone can be observed. The resistance of this sandstone to erosion is a main reason for the flat-topped hill on which South Ridge Road and the swimming pool are located. Over tens of thousands of years weathering has loosened the sand grains of this unit so that now these layers of rock are soft and easily broken.

Site B– When proceeding down the trail to creek level near pavilion 2 you have descended more than 150 feet vertically and perhaps as much as a million years in geologic time. At this location the Saltsburg Sandstone is exposed. These fossilized river channel deposits still bear the layering called cross-bedding that was created by the currents in the river. The cross-beds are recognized by their inclined layering and herringbone appearance.

Site C– Proceed northwest along Hemlock Drive from Site B to the stream that parallels the road at Site C. Here the Ames Limestone can be observed. Many fossil shells are preserved in this deposit

that was formed when an ancient sea covered the region. Continue up the stream bed or along the road and you can see sandstone layers assignable to the Grafton Sandstone. This sandstone like the Saltsburg and Morgantown is an ancient river channel deposit.

Continue up Hemlock Drive and then to the road that heads directly north back to the swimming pool.

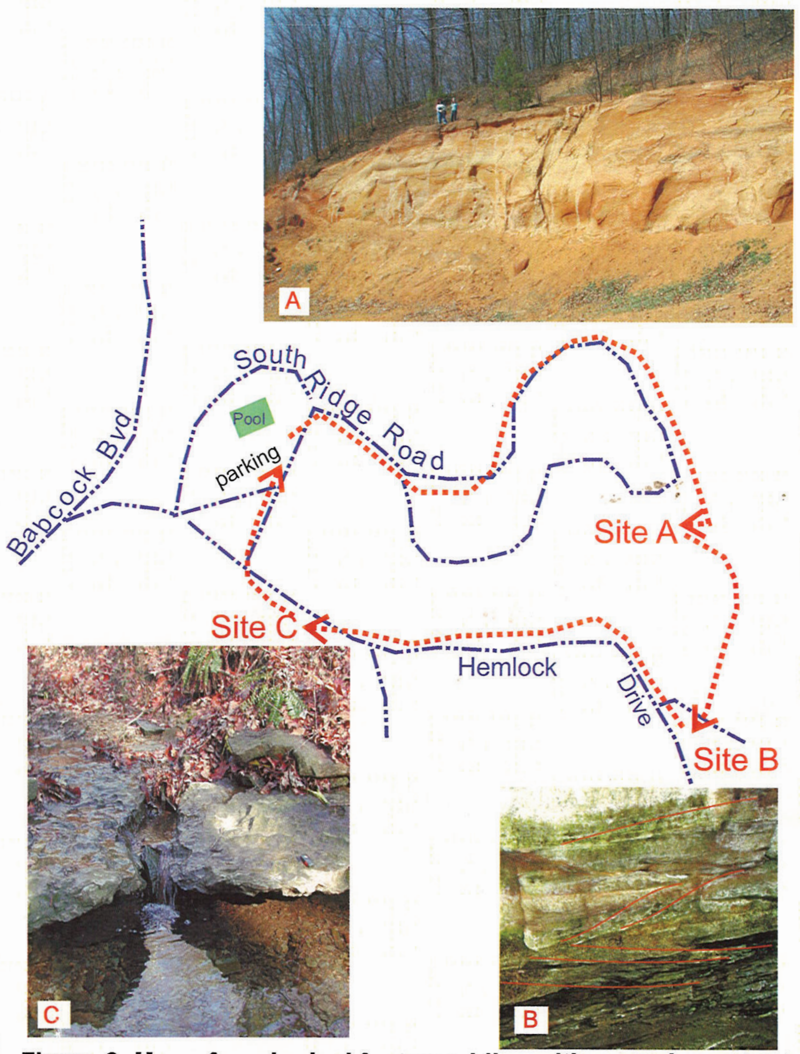
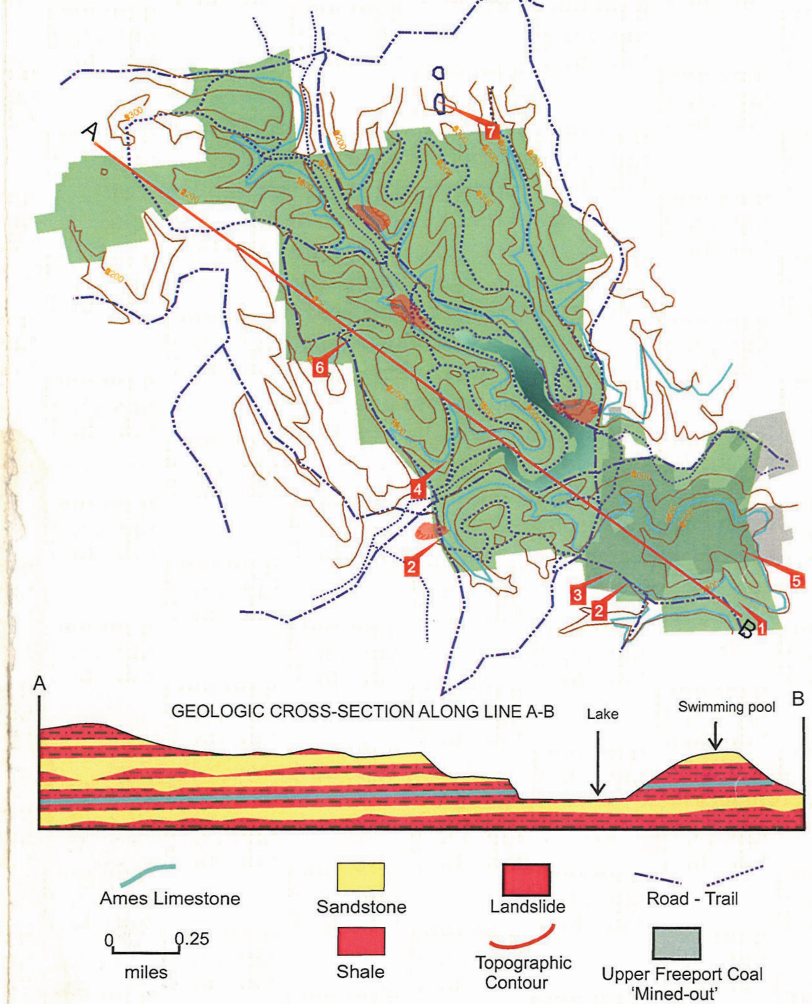


Figure 3. Map of geological features hike, with some important rock outcroppings. See text for descriptions.

Figure 1. Map of North Park with locations of important rock outcrops in red numerals. Generalized cross section A-B illustrates subsurface position of individual rock layers.

GEOLOGY

OF NORTH PARK



David K. Brezinski and Albert D. Kollar
Section of Invertebrate Paleontology
Carnegie Museum of Hatural History
in cooperation with

ALLEGHENY COUNTY

RAD works here Allegheny Regional Asset District

Allegheny County Parks