

# ROCKS and MINERALS

PUBLISHED  
MONTHLY



Edited and Published by  
PETER ZODAC

November  
1944

Vol. 19, No. 11

(( The Official Journal  
of the  
ROCKS AND MINERALS  
ASSOCIATION ))

Whole No. 160

## GEOLOGY AS SEEN AT BUCK HILL IN THE POCONOS

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To tell the story of the Geology at Buck Hill is to tell the story of the Poconos, for it is only by understanding the whole that we can fully appreciate the part.

### Location

Buck Hill is in Barrett Township, Monroe County, eastern Pennsylvania—one mile west of Canadensis. Its altitude at the inn, as shown on the Pocono Quadrangle (U.S.G.S.) is about 1350 A.T.

### Sedimentary Rocks on Buck Hill

The rocks one sees exposed in the woods on Buck Hill, and in the gorge at the falls, are known as sedimentary rocks, that is, they are composed of fragments that at one time were parts of other rocks. These preexisting rocks were broken up by forces of weathering, frost, rain, hail, etc., and their debris washed down by streams to the sea, where they were eventually deposited in layers on the sea-bottom. This same process is going on today. At a later date the sea-bottom was elevated, and the layers of deposited material, now cemented and lithified, rose as the rocks which you now can see. The layers are still clearly visible, and are known as strata.

The types of sedimentary rocks visible in this area are three in number, and can easily be identified. The first of these is sandstone, and is made of closely cemented sand grains all about the same size. The second is shale, which is composed of grains of silt and mud, so small that the individual grains are not visible without magnification. The third

is conglomerate, which contains grains of various sizes and materials, from pebble size down thru sand grains to silt particles.

It might be well to explain where the original materials that compose these rocks came from, and how they arrived in their present position.

Countless eons ago, a great continent or land mass existed somewhere south-east or along our present Atlantic coast. The region now occupied by the Poconos was then part of a submerged trough, known to geologists as a "geosyncline", which reached from Alabama northeast beyond Maine. Into this trough the sediments from the land mass which has been named "Appalachia", were washed and deposited. This continued for millions of years. The trough became filled, and Appalachia was worn down—almost to sea level. Eventually the shift of weight on the earth's surface, caused by the removal of this material from one great region, and its resulting deposition in another, resulted in the adjustment of the earth's crust to the shifted load, and the bottom of the trough was slowly heaved up to great heights, and the strata were folded and crumpled in this great uplift or mountain building era, known as the Appalachian Revolution, and named from the mountains that it created.

These mountains after some more millions of years passed, were in turn worn down by erosion, until they became almost a level plain. Such a feature is called a "peneplain" by physiographers.



This peneplain was in turn slightly uplifted and gently warped, thus making essentially the present land surface of the eastern United States. Thus we can see that the rocks which form this Pocono area are the consolidated masses of sediments that were at one time washed from Appalachia into the sea, and later elevated into their present position.

#### **Evidences of Glacial Deposits**

However the final scene was enacted in the relatively recent geological past with the coming and passing of the last great Ice Age. There were several periods of ice encroachment in Monroe County, and several inter-glacial periods while the ice had melted back to a more northern position. An ice age usually consists of several advances and corresponding retreats of the ice front. Roughly speaking the last ice left this region in the neighborhood of 50,000 years ago, and to people used to thinking in terms of millions of years, such as geologists are usually doing, this was only yesterday. As a result there is much evidence left lying around the landscape to tell us about glacial times. Large areas of ground are covered with boulders, cobbles, pebbles, and smaller fragments of rocks that are decidedly not of local origin. Such material is known as glacial till. Many of the boulders are so large that the only agent that could possibly have moved them any distance is ice, and geologists have suggested that a number of these visitors had their origin in the Adirondacks, Ontario, and Labrador.

In many places at higher elevations where the bed rock of the Poconos is exposed, parallel scratches or grooves may be seen in the sandstones, mostly in a northeast-southwest direction. These "striae" are the work of the large boulders and cobble frozen in the bottom of the advancing ice, gouging out these marks as they were slowly but surely moved along with the ice. Such scratches may be seen on the summit of Buck Hill, west of reservoir.

Another interesting type of evidence, observable best by studying topographical maps of the area, consists of drainage changes shown by the present position of

streams flowing thru the region. A great deal of water from the melting ice washed thru the region in front of the ice cover, and as the ice front melted back, this melt water gradually became less and less. Finally it vanished entirely leaving empty channels and at places where it had been ponded in front of the ice, old shore lines. Many valleys thru which streams flowed prior to the invasion of the ice were filled with till, either pushed in by the ice or washed in by the melt water. Several such filled valleys exist in Monroe County, one just north of Buck Hill beyond the creek. Buck Hill Falls is the result of a valley being filled with till, and the stream no longer being able to find its way thru its old channel, escaped from its original valley by flowing over a low spot in the rim, and gradually worked its way back to its present position, thus forming the gorge below the falls.

#### **Geology as Seen From Buck Hill Inn**

If one goes to some high point, such as the observation deck of the Inn at Buck Hill, and is fortunate enough to have a clear day, much more geology may be observed. To the north and west lies the wall of the Pocono Escarpment, the even-crested top of which forms the rim of the Pocono Plateau, with an average elevation of slightly over 2000 ft. Looking south one sees on the horizon the line of the Blue or Kittatinny Mountain, broken by the Delaware Water Gap. Between this mountain and the Pocono Plateau a series of parallel ridges, all lying more or less in a northeast-southwest direction, with long narrow valleys in between. This region is a portion of the area known to physiographers as "The Valley and Ridge Province", and its name is indeed descriptive. The ridges are composed of the harder rocks, sandstones and conglomerates, while the valleys are composed of the softer shales and limestones. An interesting feature of this province, is the transverse drainage pattern. All the major streams flow across it at right angles to the mountain structure, thru the great gaps that they have cut in the mountains. In this region the Delaware is a splendid example, and



a little further west the Lehigh, Schuylkill, and Susquehanna, all cross the province in the same manner. Geologists are not in complete agreement as to exactly why this is the case, nor do they explain the origin of the water gaps to each other's satisfaction. It might be a good idea to describe two of the major theories concerning the origin of gaps, and allow the reader to draw his own conclusions.

#### **Two Theories on the Origin of Gaps**

Theory number one postulates that after the development of the peneplain the major streams flowing over its relatively even surface gradually cut deeper and deeper into the folded rocks. The tributary streams to the main streams found their courses in the softer rocks, and began to erode long narrow longitudinal valleys. The main streams which were those flowing down the general slope of the land across the structure to the sea, continued in their courses, while their tributaries were busy etching out their long valleys, leaving the harder rocks to stand up as ridges between them. The major streams began to flow across these ridges as they slowly took form, and of course cut down thru them at the same time in order to keep at grade with their tributaries. Thus the water gaps were formed.

Theory number two states that after the peneplain was formed, the whole area was again submerged, and a cover of coastal plain sediments was laid down upon it. Later this area rose, and the streams formed on the loosely consolidated surface of recent sea-bottom sediments, were lowered upon the buried folded structure as they cut down thru the cover, and thus their courses were established at right angles to the structural trend. As they cut deeper they cut gaps thru the ridges. Eventually all of the coastal plain cover was removed by erosion, and we have the present landscape.

It is not our purpose here to discuss the good and bad points of these theories, but merely to call the reader's attention to them, and in passing mention that there are several others that have been

advanced by students of this subject which space does not allow us to outline here.

In the origin of the wind gaps there is little difference of opinion. Originally these gaps were water gaps, but the streams that flowed thru them were removed by various causes, chief of these being piracy. This means that one stream is "captured" by another stream having a steeper gradient. Altho other factors may remove streams from their gaps, such as glacial changes of drainage, the great majority of the wind gaps in the Valley and Ridge Province had their streams removed thru the work of piracy that was in turn the result of headward erosion.

#### **Poconos 350,000,000 Years Old**

In closing let us again turn our attention to the rocks of the region. How old are they? Roughly about three hundred and fifty million years old. Now that is a lot of years to account for, and the question may reasonably be asked, "How do you know it?" Geologists have various ways of reckoning time and determining the ages of the rocks, but among these ways there is one which makes use of the remains of one time living creatures that are found in the rocks of today. These remains are called "fossils". When the sediments that later became consolidated to form the rocks of the Poconos were being deposited in the sea, countless numbers of creatures lived in the sea, as is the case today. However, at that time, called by geologists the Devonian, many creatures were living that no longer exist in our times, as they have become extinct. Their remains found in the rocks, help the geologist date that rock, for when they died their shells or skeletal remains fell to the bottom and became incorporated in the muds and slime that later became the rocks we see in the Poconos today. At many places between the Blue Mountain and the Pocono Escarpment, remains of these creatures may be found in the rocks. Mostly they consist of sea shells called Brachiopods, but there are also remains of corals, and queer little animals that resemble the horse-shoe crab of today in miniature, known as Trilobites. Between Stroudsburg and Analomink there is a coral reef exposed along the

side of the road (U.S. 90) that can be traced halfway across Pennsylvania. As these fossils are the remains of life that existed in the Devonian Period, we can date the rocks in which they are found as Devonian, and thus form some idea of their age.

So we see that all around us in the Poconos there are clues by means of which we can piece together the story

of the earth's past, and surely as we ponder over these things in our minds, we can not help but agree with the thoughts of the poet Tennyson:

"There rolls the deep where grew the tree,  
O Earth what changes hast thou seen,  
There where the long street roars, hath  
    been,  
The stillness of the central sea."

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