A GEOLOGICAL CLIMB OF SCHUNEMUNK MOUNTAIN

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GENERAL INTRODUCTION

This trip focuses on the area known as the Hudson Lowlands. To the east are found the Hudson Highlands, an area of Precambrian terrane of high relief which strikes northeast-southwest. The Catskill Mountains of Devonian age, with Silurian and Lower Devonian outcrops along their eastern front are found to the west. The Hudson Lowlands are an area of relatively low elevation which are underlain by Cambro-Ordovician calcarenites and argillites. It is part of a physiographic trough that extends from the St. Lawrence Valley south into Pennsylvania. This region has a major down-fold referred to as the Schunemunk Outlier. Schunemunk Mountain which is a portion of the central axial region has a height of 507 meters (1664 feet). The synclinal fold that makes up the axial region of the lowlands has flanks upon which older rocks are exposed in topographic highs. The central part is underlain by the youngest rocks which, being resistant sandstones and conglomerates, form ridge-like masses of northeast-southwest trend along the axis. (Kothe, 1960).

The word Schunemunk, pronounced Skun-uh-munk, is the Algonquin Native American name given to the mountain by its early inhabitants. The name means "excellent fire-place" in the Algonquin language and may be the result of the fact that this group at one time occupied a fortified site somewhere near the northern end of the mountain.

Schunemunk is a folded and faulted mountain, unlike the Catskills to the north and west which are erosional remnants of a plateau. Schunemunk is a complexly folded and faulted remnant of the Devonian. Despite the ravages of glaciers, erosion, mass wasting, and the frost action of the Hudson Valley, it stands out as one of the highest peaks in Orange County and one of the highest west of the Hudson River.

HISTORY

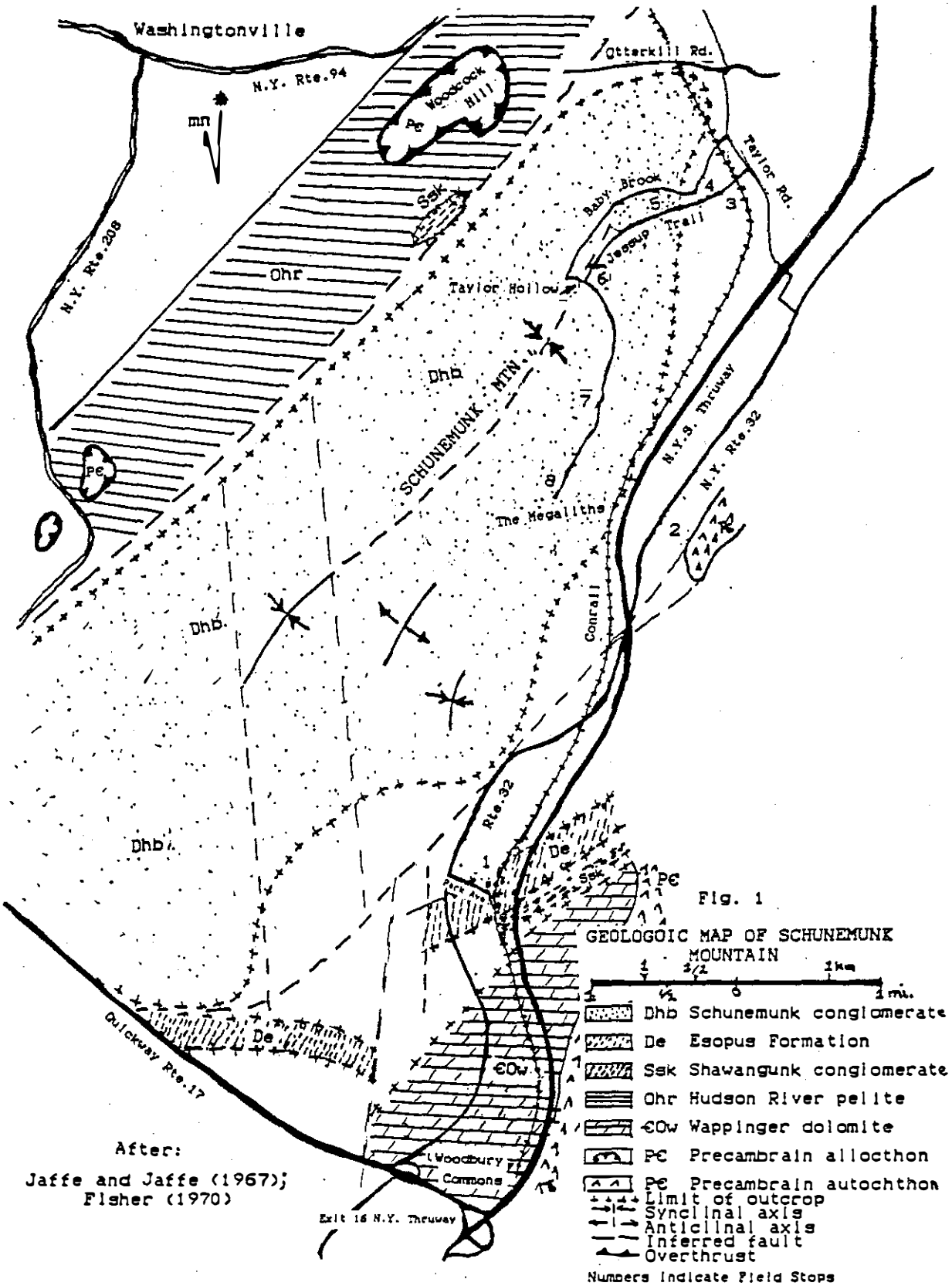
Topographically the mountain is almost indistinguishable from the Precambrian Hudson Highlands to the east and Woodcock Hill to the west. However, it is composed of much younger Devonian sediments deposited after the Taconic Orogeny ended the Ordovician Period.

Although several interpretations of the geological evidence may be made, the following ones seem intellectually satisfying. Rodgers (1987) makes the point that the Alleghanian event certainly deformed the entire Valley and Ridge province and transported the Blue Ridge and Inner Piedmont and "probably also those of the Highlands from New York southwest into the Reading Prong."

The equivalence of the Green Pond formation and the Shawangunk conglomerate (Kothe, 1960) and the Shawangunk's occurrence around the flanks of the Schunemunk Outlier relate the Green Pond, Shawangunk and Schunemunk conglomerates stratigraphically. Fraill (1985) further indicates that the folding and faulting of the Green Pond was Alleghanian, with perhaps some further faulting during the Jurassic. It would seem logical to conclude that the folding of the Schunemunk was also associated with this event. The Alleghanian orogeny, approximately 260 m.y.a., marked the last crustal collision of the continents and folded these Devonian beach deposits to form the syncline that was to become Schunemunk Mountain.

Schunemunk may be described as an island of Devonian sediments in a sea of Ordovician and Precambrian metasediments (See Fig. 1. Geologic Map of Schunemunk, after; Jaffe and Jaffe, 1967 and Fisher, 1970) The stratigraphic column (Fig. 2.) shows the relationships among the various rock units which underlie Schunemunk Mountain. Notice that the uppermost layer in the section, the glacial deposits, have been eroded along the ridge of the mountain exposing the Schunemunk Conglomerate.

The cross-section (Fig. 3.) shows the structural relationship between the rock units of the stratigraphic column and their influence on the topography of the region. ("Geology is the mother of topography.") The vertical exaggeration of the cross-section serves to illustrate the resistance to erosion of the Schunemunk conglomerate and the gneisses of the Hudson Highlands.


Washingtonville
N.Y. Rte.94
mn
Woodcock Hill
Pc
Otterkill Rd.
Taylor Rd.
Baby Brook
Jessup Trail
Ssk
Ohr
N.Y. Rte.208
Taylor Hollow
Dhb
SCHUNEMUNK MTN.
N.Y.S. Thruway
N.Y. Rte.32
The Megaliths
Conrail
Rte.32
De
Quickway Rte.17
Woodbury Commons
Exit 16 N.Y. Thruway
After:
Jaffe and Jaffe (1967);
Fisher (1970)
Fig. 1
GEOLOGOIC MAP OF SCHUNEMUNK MOUNTAIN
1km
1 mi.
Dhb Schunemunk conglomerate
De Esopus Formation
Ssk Shawangunk conglomerate
Ohr Hudson River pelite
€Ow Wappinger dolomite
Pc Precambrain allocthon
Pc Precambrain autochthon
Limit of outcrop
Synclinal axis
Anticlinal axis
Inferred fault
Overthrust
Numbers indicate Field Stops

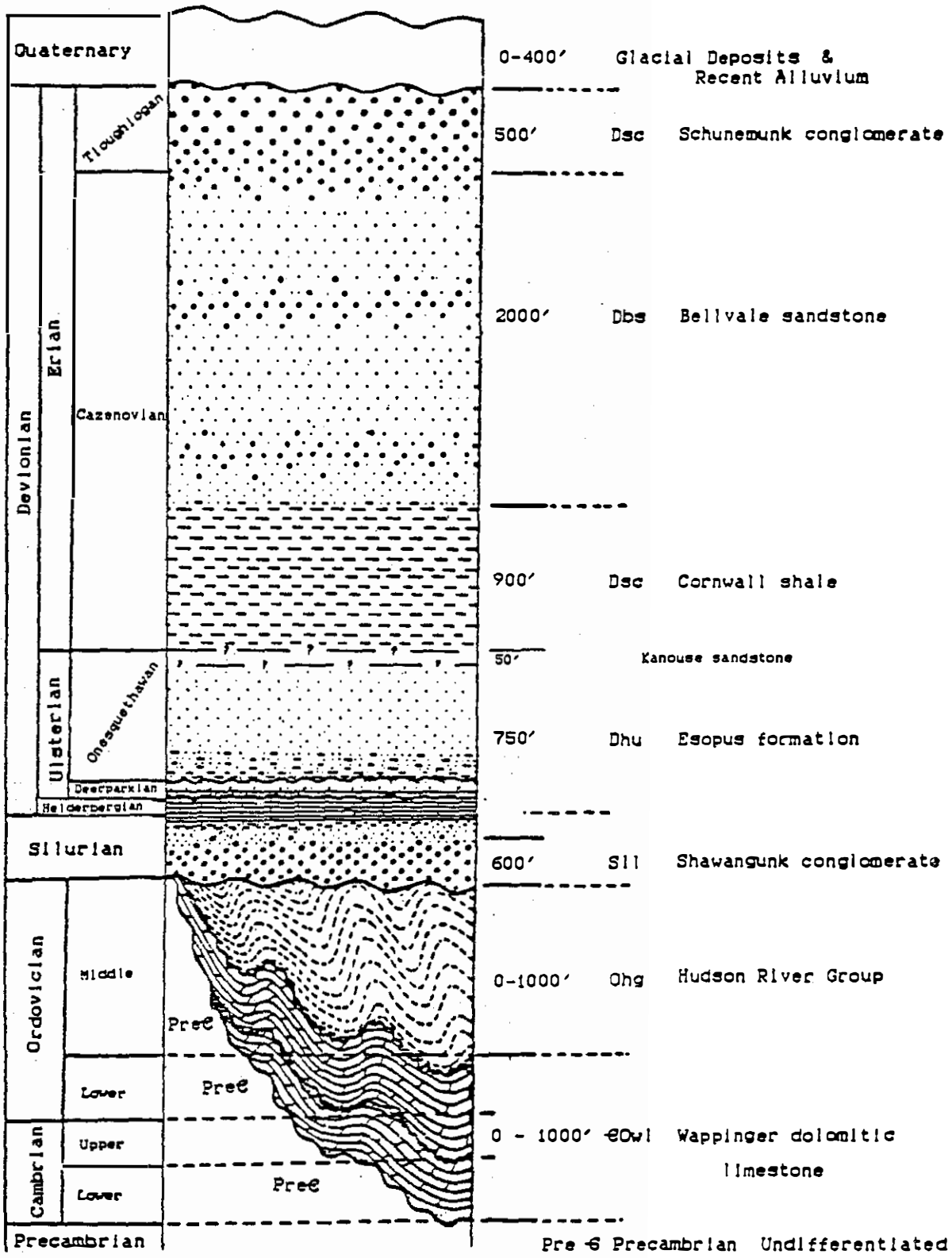


Fig. 2. Generalized Stratigraphic Section in the vicinity of Schunemunk Mountain. (after: Kothe, 1960).

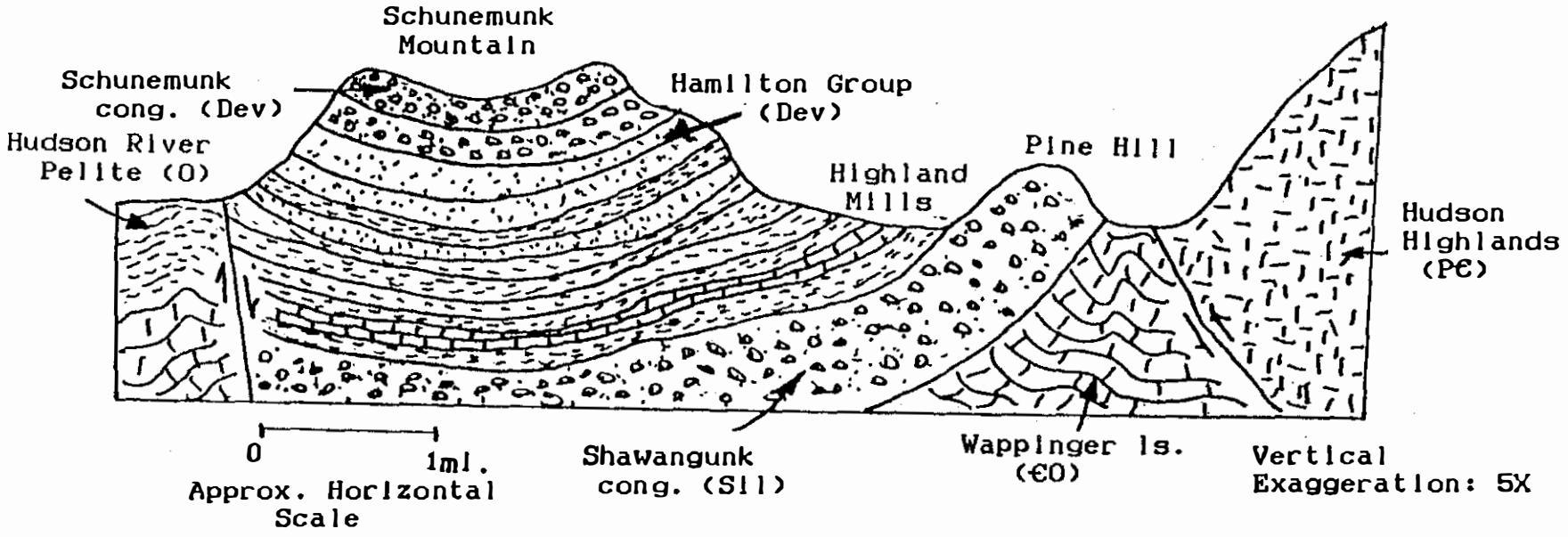


Fig.3. Generalized cross-section of Schunemunk Mountain in the vicinity of Highland Mills. (after: Schuberth, 1968).

Folding and Faulting

The rock units shown in the stratigraphic column were subsequently folded during the Alleghanian event which marked the last closing and opening of the proto-Atlantic Ocean, between 220 and 280 million years ago. The faulting of the rock units on Schunemunk, according to Kothe (1960), occurred as a result of the stresses produced during this folding event. Jaffe and Jaffe (1967) and Faill (1985) further speculate that some of these faults may have been produced or enlarged as a result of the Triassic/Jurassic deformation.

Glaciation

One of the striking features of Schunemunk Mountain is the effect of glacial scouring and polishing along the ridge. The faceted quartz pebbles, the roche-moutonnee, and the glacial striae on the outcrops bear witness to the power of the glacial ice as it moved southward during the ice advance 20,000 plus years ago. The mountain may well have been 90 to 120 meters (300 to 400 feet) higher prior to the glacial erosion (Kothe, 1960).

TOPOGRAPHY

Schunemunk Mountain stretches from the intersection of Otterkill Road and Taylor Road south to New York Route 17. Its total relief is almost 420 meters (1380 feet) from 91m (298 feet) at Taylor Road to its summit 507 meters (1664 feet) above sea level. The actual structure extends beyond Monroe where it is broken by a series of faults and continues into New Jersey.

The Schunemunk Conglomerate occurs in an almost continuous outcrop along Schunemunk Mountain it is a coarse reddish brown conglomerate with lenses of interbedded deep reddish-brown sandstone. The sandstone has the same composition as the matrix of the conglomerate. The conglomerate contains rounded pebbles of milky quartz and quartzite. Some of these elongated pebbles are 15 cm along the A-A axis. In addition, sandstone lenses show crossbedding in many instances. The sandstone and matrix materials are composed of 60% angular quartz grains from 0.3 mm to 0.5 mm in diameter and about 30% finer quartz grains. The remainder is argillaceous material with hematite. These pebbles are remnants of an ancient Taconic beach, deposited 350 m.y.a. The relative age of the Schunemunk Conglomerate has not been determined since no fossil evidence has yet been found. (Kothe, 1960)

The mountain overlaps the following U.S.G.S. 7.5 minute topographic maps: Maybrook, Monroe, Popolopen Lake, and Cornwall. A hike along the Jessup Trail leads to the summit of Schunemunk and one of the mountain's most spectacular features: the Megaliths. These huge blocks have been split from the bedrock by faulting and frost heaving, and have moved down slope. Slickensides can be observed on fault surfaces here. Even in summer some of the deeper crevices will be cool and sometimes continue to retain winter ice. Caution should be exercised at this point in the trip since surfaces tend to be slippery. The views (See Fig.4) of the Hudson Highlands, Catskills, and the Hudson Valley are spectacular from the ridge.

Schunemunk is criss-crossed by a network of seven trails: the Jessup, Western Ridge, Barton Swamp, Sweet Clover, Long Path, Forest, and Dark Hollow Trails -- all marked and maintained by the New York-New Jersey Trail Conference.

The trail used for this field trip is the longest, the Jessup Trail. It is almost 7 miles long and runs the entire length of the ridge from Taylor Road to Seven Springs Road (Zimmerman, 1987). The Jessup Trail was selected since it leads quickly to the summit, provides access to the greatest number of features, and provides clear views of the surrounding topography. A secondary reason for the selection of the Jessup Trail is that it is one of the easiest walks to the summit. This is an important consideration since there is a wide diversity in the physical conditioning of the participants who make the trip. People whose medical condition would preclude a strenuous walk should not take this trip.

CAUTIONS

There are no serious physical threats on the mountain from vegetation (no observations of poison ivy have been made). However, there is the threat of venomous snakes. Copperheads and Rattle Snakes are known to inhabit rocky ledges and ridges. It is best to remain on well used trails. The Deer Tick is also known to be found in the region. Precautions followed should be to: a) wear long pants, b) tuck pants legs into socks, c) wear a long sleeved shirt and keep the collar turned down.

The trip is best made during early spring before the nights become warm and the snakes emerge or late in the fall after the trees have lost their leaves and the reptiles have hibernated for the winter.

Acknowledgements

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References Cited

Faill, Rodger T., 1985, The Acadian orogeny and the Catskill Delta, Geological Society of America, Special Paper 201, p.15-37.

Fisher, Donald W., Isachsen, Yngvar W. and Rickard, Lawrence V., 1971, Geologic Map of New York: New York State Museum and Science Service Map and Chart Series n.15, Lower Hudson Sheet, colored map (1:250,000).

Jaffe, Howard W. and Jaffe, E.B., 1967, Structure and Petrology of the Precambrian Allochthon and Paleozoic Sediments of the Monroe Area, New York, Trip F, New York State Geological Association 39th Annual Meeting, New Paltz, N.Y., p.F1-F17.

Kothe, Kenneth R., 1960, Structural Relations of the Paleozoic Rocks in the Schunemunk Quadrangle of Southeastern New York, unpublished Doctoral Thesis at Cornell University, Ithaca, New York, 82p.

Lowe, Kurt E., 1958, Pre-Cambrian and Paleozoic Geology of the Hudson Highlands, Trip D, Field Guide Book, New York State Geological Association, 39th Annual Meeting, Peekskill, New York., p.41-62.

N. Y., N. J. Trail Conference, 1987, The New York Walk Book, Anchor Press, Doubleday, 5th Edition, Garden City, N.Y., 393p.

Rodgers, John, 1987, Unusual Features of the New York Sector of the Appalachian Mountains (1967 version slightly amended), New York State Geological Association, 59th Annual Meeting, New Paltz, N.Y., p.1-5.

Sorrentino,Anthony V., 1979, Geology of Orange County, N.Y. Road Guide, Special Publication: Monroe - Woodbury Central School, Central Valley, N.Y., 92p.

Schuberth, Christopher, 1968, The Geology of New York City and its Environs, New York City Museum of Natural History Press, New York, New York, 302 p.

Zimmerman, Nell H., Map Chairman, 1987, West Hudson Trails, Schunemunk, Map 87 The New York-New Jersey Trail Conference Inc., First Edition, New York City, N.Y.

ROAD LOG FOR A GEOLOGICAL CLIMB OF SCHUNEMUNK MOUNTAIN

CUMULATIVE MILAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
0.0	0.0	Start from Woodbury Commons Shopping Mall, Central Valley, N.Y. at the junction of N.Y. Rte. 32, Rte. 17 and the N.Y. Thruway at Exit 16. Proceed north on N.Y. Rte. 32.
0.8	0.8	Bright Star Diner on the right. This is a good pit stop.
2.2	1.4	Right turn on Park Ave., Highland Mills, N. Y. Notice the use of the Schunemunk Conglomerate as a building material.
2.6	0.4	Stop 1. Pull off on the left into the old Railroad Station.

STOP 1: DEVONIAN FOSSILS

USE CAUTION HERE. THIS IS AN ACTIVE RAIL LINE. Park vehicles west of the tracks and proceed along the tracks about 110 meters (363 feet) to a worked outcrop of the Lower Devonian Esopus Formation (Lowe, 1958). This outcrop contains a wide variety of brachiopod and pelecypod fossils and (rare) trilobite fossils, as well as ripple marks in the tilted bedding planes. Note that Schunemunk Mountain is visible at N 15 E from this point.

2.9	0.3	Return to N.Y. Rte. 32 along Park Ave. turn right and continue north.
3.2	0.3	Note glacial erratics and stratified sand and gravel deposits of glacial origin on the left of N.Y. Rte. 32.
3.6	0.4	Cemetery of the Highlands. Note the use of Schunemunk Conglomerate to build cemetery walls.

5.3	1.7	N.Y.S. Thruway underpass.
5.5	0.2	STOP 2. Pull off on the left to a small unsurfaced road and walk north to the abandoned sand and gravel quarry.

STOP 2: KAME TERRACE

Proceed north along the unsurfaced quarry road to a large outcrop of Precambrian schist and gneiss exposed by a quarrying operation. Glacial striae, grooves and chatter marks are common on the glacially polished bedrock. A fine view of Schunemunk Mountain can be observed to the southeast from the top of the exposure. This site is an abandoned sand and gravel quarry. The glacial deposits appear to have been formed as melt waters flowed from the edge of the ice and deposited their sedimentary load at the base of the Precambrian outcrop (Sorrentino, 1979). Much of the original formation has been removed by the quarrying operation. A variety of cobbles, pebbles and sand has been deposited against the bedrock of the Hudson Highlands. Return to the vehicles and continue north on N.Y. Rte. 32.

6.0	0.5	Notice the view of Schunemunk on the left.
7.7	1.7	Star Expansion Co. on the left.
8.0	0.3	Turn left at Black Rock Fish and Game Club.
8.1	0.1	Left turn past Club House.
8.3	0.2	N.Y.S. Thruway overpass.
8.4	0.1	Parking lot on the right of Taylor Road.
8.8	0.4	Walk north on Taylor Road to the beginning of Jessup Trail.

From this point: Follow the well-marked (yellow markers) Jessup Trail to the Megaliths.

STOP 3: GROUND WATER

Follow the faint foot path through the cornfield. Observe the hillside to the south (left) of the dirt road for traces of surface water. Proceed about 160 to 170 meters (approx. 500 ft.) along the trail to a large oak tree bordering the woodland on the north. At this point the land to the south slopes upward and a small spring, which flows throughout the year will be observed emerging from the plowed field. About 100 meters (300 feet) further along the trail note a concentration of erratic boulders along the north side of the path. The boulders are part of a ground moraine, a deposit left by glaciers melting in place. Take note of the size and shape of the boulders.

STOP 4: RAPIDS OF BABY BROOK

Baby Brook is a youthful stream and is actively downcutting its bed. Several important observations and definitions can be made at this stop: earth flows, gravity falls, soilification, "V" shaped valleys, mass wasting, and hillside creep. Observe the large boulders in the stream bed and the curved boles of the trees along the sides of the stream.

STOP 5: WATERFALL OF BABY BROOK

Cross the railroad track and continue along the trail following the yellow markers. Walking time expended about 40 to 45 minutes. You will hear Baby Brook far below in a steep valley it has cut into the softer sandstone (Bellvale) below the resistant Schunemunk Conglomerate capstone.

Note the nature of the bedrock that is visible on the trail surface. This is part of the Hamilton Group which consists of Devonian sandstones. At about 50 minutes walking time a small side trail to the west will appear. This trail leads to the Baby Brook Falls. Here one can observe the Schunemunk Conglomerate as bedrock for the first time. The conglomerate acts as a resistant cap-rock which produced Baby Brook Falls. Beyond this point note the preponderance of Schunemunk Conglomerate (with its dark reddish brown matrix and milky quartz pebbles). Continue along the Jessup Trail (yellow markers).

STOP 6: APPROACHING THE SUMMIT OF SCHUNEMUNK

This site is said to be the site of an Algonquin Indian encampment. The connection between geology, topography, ecology, and the Algonquin's adaptation to these natural features can be explored. The participants should be encouraged to find the connection between these factors by placing themselves in their position and exploring their needs for food,

shelter, wood, game, water, and protection from their enemies. Return to the Jessup Trail (yellow markers) and continue toward the summit. Along the way the many glacial features of the mountain should be noted: glacial polish, faceted pebbles of the Schunemunk conglomerate, chatter marks, plucking, and "white" carbonate erratics which have been transported from the north.

STOP 7: THE SUMMIT

From this elevation much of the topography of the region can be observed: the Catskills, the Shawangunks, and the Hudson Highlands. A question poses itself at this point: Why have Schunemunk and Woodcock Mountain, part of a nappe, (a remnant of a sheet like, allochtonous rock unit that has moved in a horizontal surface) remained? Continue along the trail to the Megaliths.

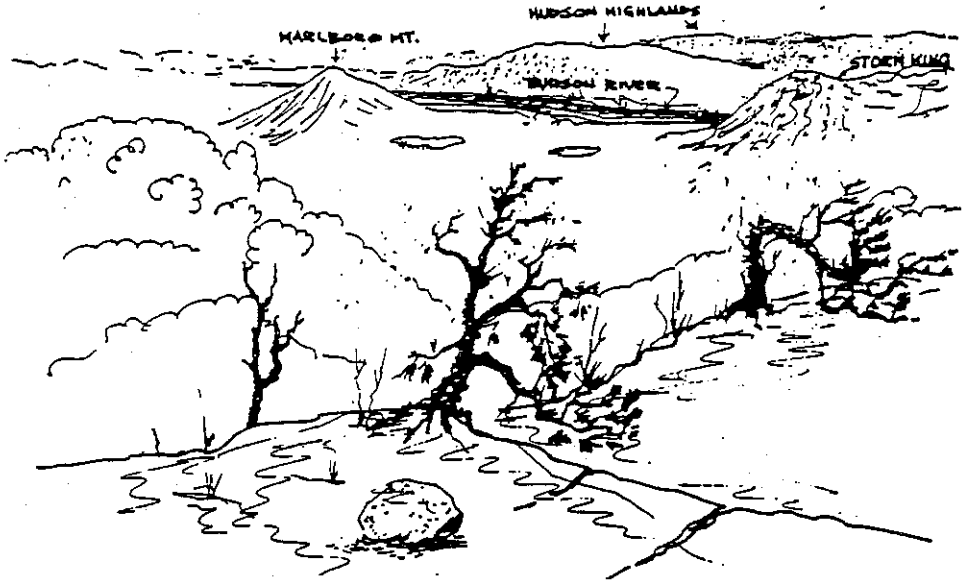

Fig. 4. View to the north from the summit of Schunemunk.

STOP 8: THE MEGALITHS

The Megaliths are the result of faulting. These large blocks, originally fractured by faulting, have tumbled together to form "caves" as a result of glacial plucking and/or mass wasting. Snow can sometimes be found well into spring in these "caves". At this location many features of faulting and jointing can be found. Joints, joint pairs, faults, slickensides (show direction of movement), frost heaving, and weathering can be identified.

The return to the cars can be made by several different routes. The most direct return is along the Jessup Trail. However, if arrangements have been made in advance, a return can be made to Route 32 via Long Path (turquoise markers), Dark Hollow Trail (white on black markers), or Sweet Clover Trail (white markers). The return trip can be dangereous because the temptation to travel quickly (gravity is on our side) can cause falls, etc.