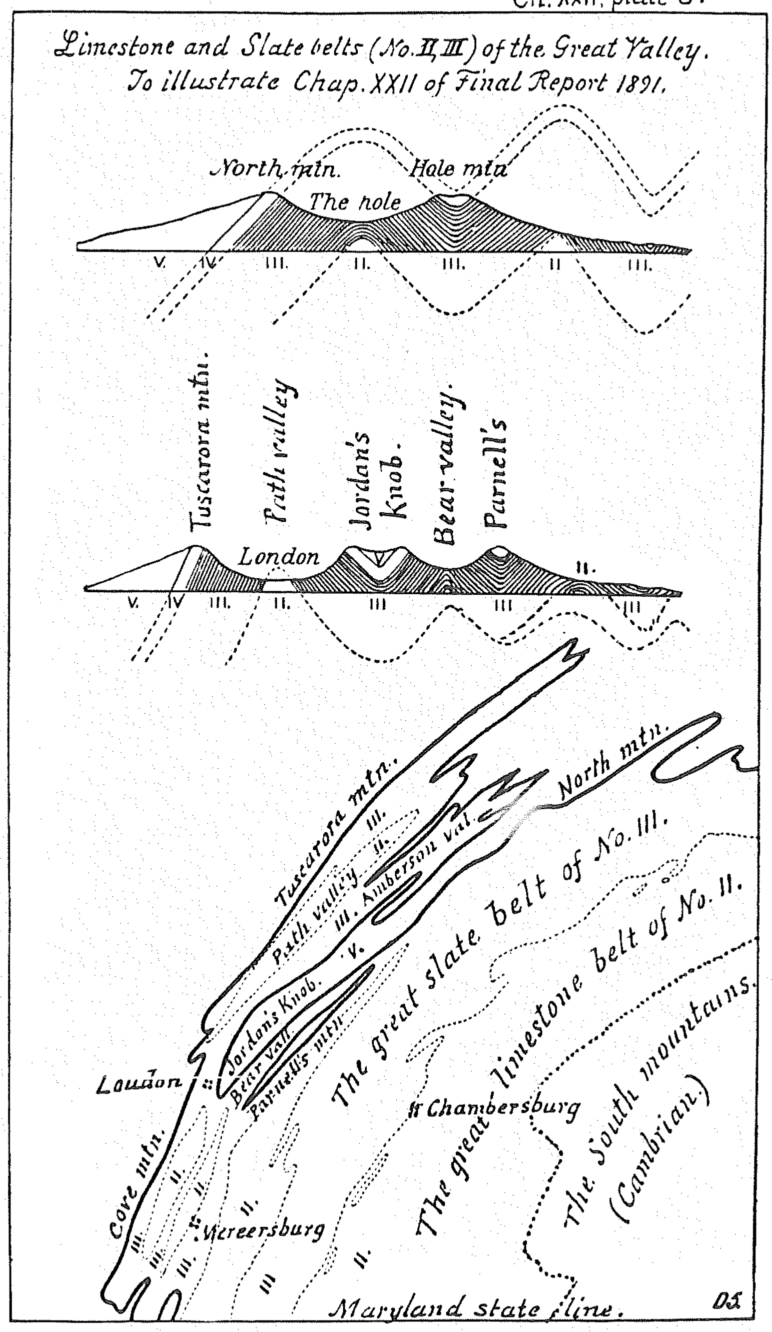
Guidebook for the 10th Annual Field Trip of the

HARRISBURG AREA GEOLOGICAL SOCIETY

June 1, 1991

THE RIDGE AND VALLEY PHYSIOGRAPHIC PROVINCE

Ch. XXII. plate 6.



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Front cover: Lesley, 1892, p. 285.
Back cover: Lesley, 1892, p. 650.

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THE RIDGE AND VALLEY PHYSIOGRAPHIC PROVINCE

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"Every valley shall be exalted, and every mountain and hill shall be made low: and the crooked shall be made straight, and the rough places plain."
Isaiah 40:4

INTRODUCTION

The subdivision of large areas of landscape into smaller areas of similar character for purposes of classification has been done for a long time. The practice has considerable value because, for the knowledgeable reader, the few words naming a specific subdivision will evoke a mental image which might be duplicated only by many sentences or paragraphs of text. I want to examine briefly the history of the Ridge and Valley physiographic province classification, define the subdivisions viewed on this trip, and review a new scheme for even greater subdivision.

HISTORY

Possibly the first description of the area viewed on this trip is that of Evans in 1755. He noted the "valley of pretty even good land, some 8, 10 or 20 miles wide" between South Mountain and Blue Mountain and suggested that it is properly called Piedmont. The area between Blue Mountain and the Allegheny Front he referred to as the Endless Mountains (based on translation of the Indian name for the area) and described it as an area of "long uniform ridges scarce half a mile perpendicular in any place above the intermediate vallies."

Rogers (1858, p. 5-32) referred to the area as the second and third belts of the second district -- the Appalachian chain. The second belt, the area between South Mountain and Blue Mountain, was called the Appalachian Valley and the third belt, the Central Appalachian Ridges. He described the landscape in considerable detail, but provided no concise definitions. Work done by the Second Geological Survey of Pennsylvania was done primarily by topic or by political subdivision, and no regional discussion of landscape was done.

Fenneman (1916) created the broad subdivision of landscape for the whole United States and elaborated those subdivisions of the eastern United States in 1938. It is his work which forms the basis of subdivisions still used.

Ashley (1933, p. 3-16) presented a map of the physiographic subdivisions of Pennsylvania (Figure 1) and brief descriptions of the sections. He followed Fenneman's province boundaries, but both modified and added sections as well as names. He referred to the Ridge and Valley and Appalachian Valley Sections within the Appalachian Valley Province.

In the early 1960's the Pennsylvania Geological Survey printed a physiographic provinces map of Pennsylvania which refined the boundaries of the provinces and added sections. The map became the reference for the State, but did not define any of the subdivisions. This map was revised by Berg and others in 1989 at which time new sections were added, boundaries were refined and defined, some names were changed, and an 8-part table describing the sections was added to the back of the map (p. 24).

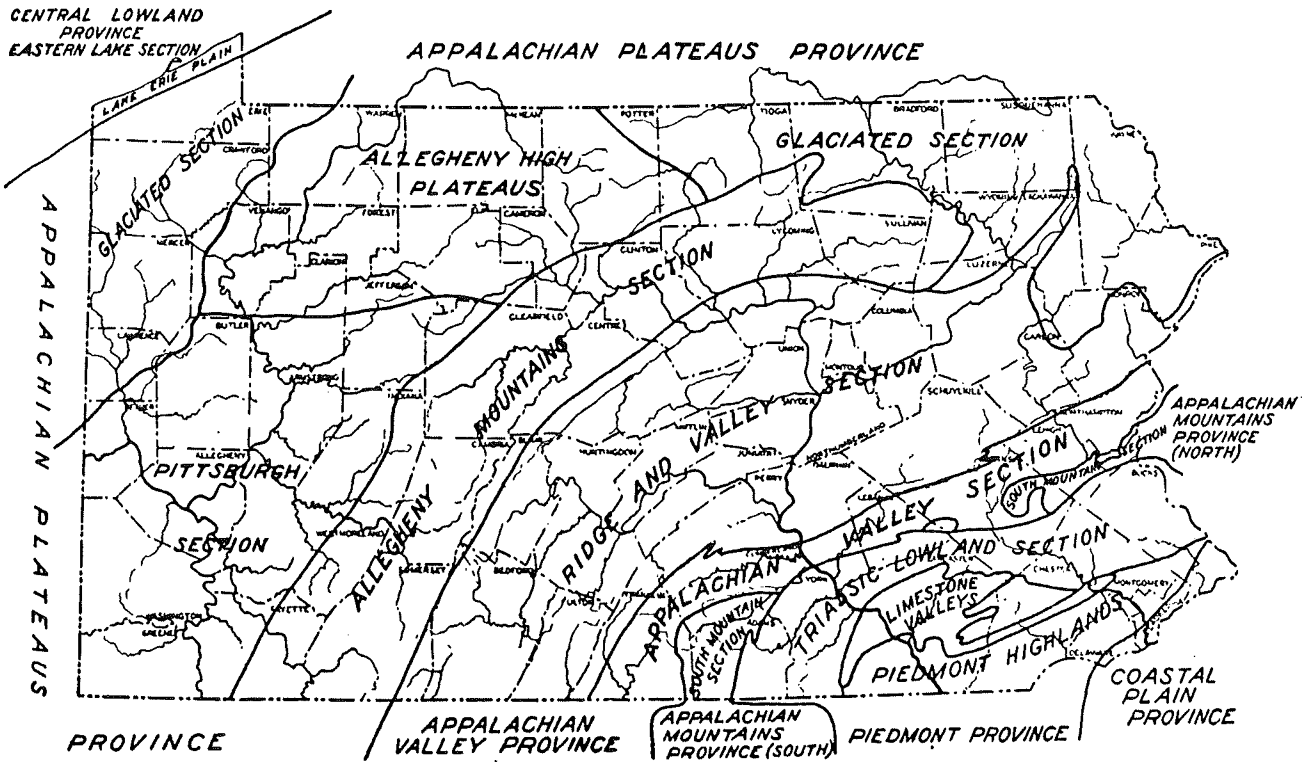

Figure 1. Physiographic province map of Ashley (1933, Figure 2, p. 3).

DEFINITIONS

For practical purposes a physiographic province is a region whose pattern of relief features or landforms differs significantly from that of adjacent regions (Glossary of Geology, 1987, 3rd. ed., p. 502). Each province is characterized by similar topography, structure, and history of development, both tectonic and geomorphic (Godfrey and Cleaves, 1991).

Finding a good definition of the Ridge and Valley Province is not easy. Fenneman (1938, p. 195-278), the standard reference work on physiographic provinces, discusses various aspects and many specifics of the province, but nowhere provides a concise definition. However, the table of Berg and others (1989) can be used to derive the three following definitions:

The Ridge and Valley Province is characterized by alternating long, narrow ridges of low to high relief and broad to narrow valleys which are the product of fluvial erosion of folded and faulted sedimentary rocks of varying lithology and induration. The province is bounded by the crest of the Allegheny Front and the Delaware River escarpments on the west and north and by South Mountain, Mesozoic rocks, and the Reading Prong on the south.

The Appalachian Mountain Section is characterized by alternating long, narrow ridges of moderate to high relief and broad to narrow valleys which are the product of fluvial erosion of folded and faulted sedimentary rocks of varying lithology and induration. The section is bounded by the crest of the Allegheny Front and Delaware River escarpments on the west and north and by the southern foot of Blue Mountain on the southeast.

The Great Valley Section is characterized by a very broad, moderately dissected and karstic valley of low to moderate relief produced by fluvial erosion of folded and faulted shales and sandstones (northwest) and limestones and dolomites (southeast). The section is bounded on the north by the southern foot of Blue Mountain and on the south by South Mountain, Mesozoic rocks, and the Reading Prong.

Some question might be raised as to why the Great Valley Section is part of the Ridge and Valley Province. Indeed, complete separation of this area and its elevation to province level was seriously considered during the preparation of Berg and others (1989), but was rejected because of historic use.

The above provides adequate background information for entry into an examination of the Ridge and Valley Province. More detailed information is included in the field trip road log.

DETAILED LANDSCAPE ANALYSIS

A very recent paper by Godfrey and Cleaves (1991) presents a hierarchial approach to landscape analysis which allows more detailed subdivision than is provided by the traditional province and section. Their 11-fold ranking of landscape units includes the province and section subdivisions of Fenneman (1938) and 7 smaller units which are variably defined following a geomorphic systems approach.

"The geomorphic systems approach considers lithology of the rock units, structural geology, time, geomorphic processes, and their relationships." (Godfrey and Cleaves, 1991, p. 143). Scale is very important in this approach: the larger the unit of landscape, the greater the generality of description and the longer the time frame of the unit. Thus a province may contain great geological diversity and must be considered in terms of geological time, whereas a zone may be geologically very specific and framed in terms of human time. The classification developed by Godfrey and Cleaves emphasises visual identity of landscape units and mapping of boundaries. As with any classification scheme, some artificiality may occur, but this can be controlled by the classifier. The use of such classification is multiple as long as the user is cognizant of the basis and limits of the classification. An example of the classification, as applied to the landscape at Stop 2 is presented in Table 1.

Table 1. **Ranking of landscape units (modified from Godfrey and Cleaves, 1991; Examples are for Pennsylvania.).**

Rank and description	Basis	Example
1. Realm	Magmatic differentiation, plate tectonics; 10^7 km^2	Continental mass
2. Major division	Plate tectonics on a continental or ocean basin scale; 10^6 km^2	Appalachian Highlands
3. Province	Major structural geology unit; large-scale similarity of relief or topographic features; 10^5 km^2	Ridge and Valley
4. Section	One geomorphic system usually dominant; intermediate structural geology unit; 10^4 km^2	Great Valley
5. Region	Tectonic individuality; common lithologic characteristics; 10^3 km^2	Shale Uplands
6. District	Lithology influences deformation style and pattern; lithology/ geomorphic process/landform delicately interrelated; 10^2 km^2	Newburg Uplands
7. Area	Local lithology closely related to land unit; geomorphic processes directly related to lithology and landform; 10^1 km^2	
8. Zone	One geomorphic process may dominate; limited relief and slope parameters; 10^0 km^2	Floodplain Zone
9. Locale	Very limited relief and slope parameters; lower limit for most mapping; 100 m^2	
10. Compartment	Extremely limited parameters and very restricted controls; time span may be very transitory; primarily used in describing superior land unit; 1-100 m^2	
11. Element	$<$ m^2	Boulder

THE FIELD TRIP

The purpose of this field trip is multiple. The primary purpose is to introduce the basic elements of landscape which distinguish the Ridge and Valley Province and its sections. A second purpose is to point out some of the landscape details which can be readily included in a detailed landscape classification. The third purpose is to demonstrate some of the Cenozoic erosional history of the province. The final purpose is to provide participants with an enjoyable and educational day in the field. Have fun!

FIELD TRIP ROAD LOG

MILEAGE INC	MILEAGE CUM	DESCRIPTION
0.0	0.0	**LEAVE** parking lot of Dickinson College geology Department. **TURN RIGHT** onto PA Route 74. **PROCEED STRAIGHT AHEAD** at stop light.
0.1	0.1	**STOP LIGHT. TURN RIGHT** onto PA Route 641 W.
0.6	0.7	**STOP LIGHT. TURN RIGHT** following PA Route 641. Pass through railway underpass and **TURN LEFT** immediately following PA Route 641 W.
3.5	4.2	McAllister Church Road on the right leads to Opossum Lake, part of the 4th Annual HAGS trip (1985). For the next 5 miles the route traverses terrain typical of the Great Valley Section in this area.
3.5	7.7	Bears Crossroads is at curve in the road. Best views of the karst terrain are ahead.
0.4	8.1	High point on terrain just before a barn on the left. **PULL OFF** onto shoulder on right side of road.

STOP 1. This is a good place to view, on both sides of the road, the typical karst topography for the area. We are in the Great Valley Section and, if further subdivision is desired, this is the Carbonate Lowlands Region. The adjacent terrain comprises gently rolling topography with low relief and no integrated drainage (Figure 2). The low knobs are covered with thin residuum and bedrock is close to the surface. Rock outcrops are common on the knolls. The swales have thicker residuum, probably thickened by a combination of greater weathering and colluviation of residuum from the knolls to the swales. Plowed fields usually show moisture differences dependent upon the thickness of the residuum: thick residuum has deeper red brown color with a damp appearance while thin residuum is light brown with a dry appearance. This area lacks sinkholes which are often common in carbonate terrain. If further landscape classification beyond the region level is desired in the Carbonate Lowland Region, the degree of sinkhole development might be a classification factor.

MILEAGE INC	MILEAGE CUM	DESCRIPTION
		LEAVE STOP 1 AND CONTINUE STRAIGHT AHEAD.
1.4	9.5	Here the route enters a curve and proceeds uphill. Bedrock changes from carbonate to shale.
0.5	10.0	Outcrop of Martinsburg shale on left. Road ahead curves left and goes downhill back into carbonate rock. Newville is built on carbonates.
1.7	11.7	Quarry on left in limestone.
0.2	11.9	Cemetary Road intersects from left. Route is again traversing shale bedrock and we are now in the Shale Uplands Region of the Great Valley Section. As we proceed, note the differences between the carbonate and shale terrains: greater relief and better integrated drainage on the shale.
2.1	14.0	Cross over Green Spring Creek. Note the floodplain which is well developed on the shales.
0.9	14.9	Broad area at lower elevation on right is floodplain of Conodoguinet Creek. Colluviated slopes lead to the floodplain.

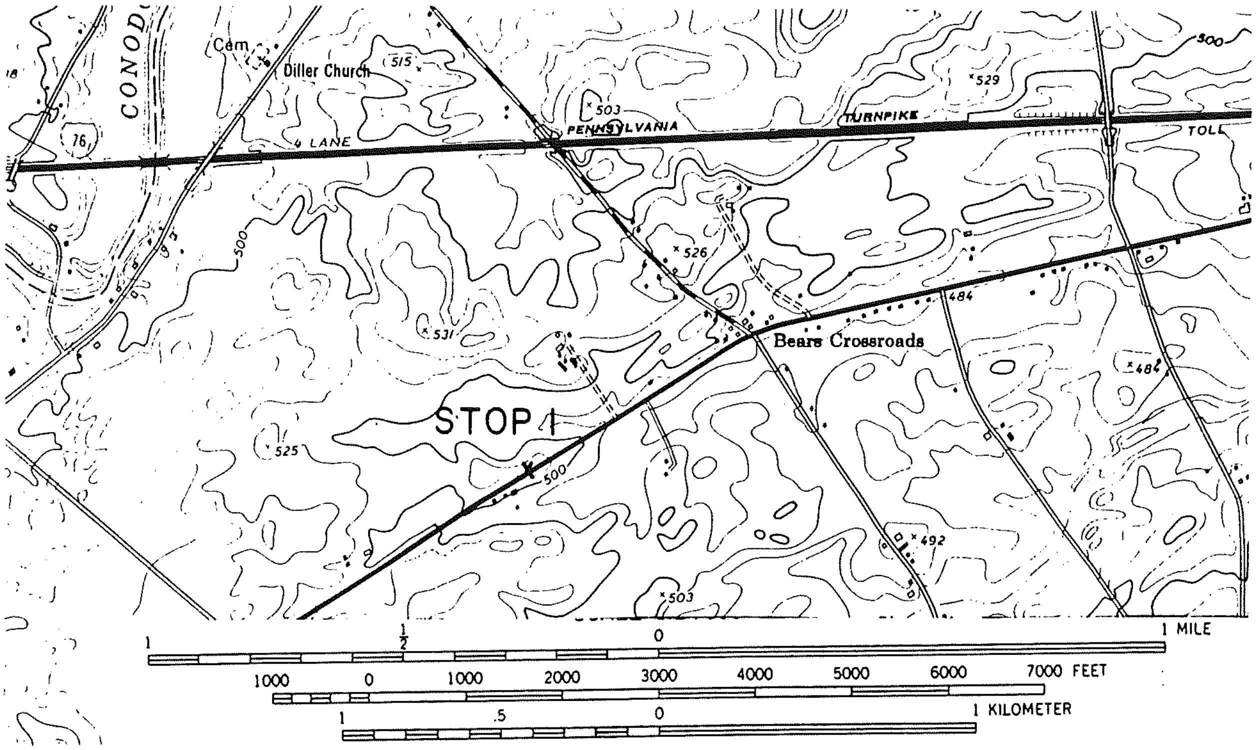

Figure 2. Topography typical of the Carbonate Lowland Region at Stop 1. From Plainfield 7.5-minute quadrangle.

3.0 17.9 Cross Conodoguinet Creek. Note character of the shale terrain during the next few miles. The route repeatedly crosses uplands and small valleys. This is typical for Martinsburg terrain. The streams originate on the slopes of Blue Mountain and flow approximately normal to it for several miles. The small streams eventually join a larger stream which flows parallel to the mountain. This pattern occurs from the Susquehanna River to Chambersburg. In this area the small streams flow at an angle to Blue Mountain rather than normal to it. The reason for this has not been determined.

2.3 20.2 **TURN RIGHT** onto PA Route 696 N at the west side of Newburg. The route will follow the valley of Newburg Run toward Blue Mountain.

1.0 21.2 **TURN LEFT** onto Hill Top Road. Note the valley of Newburg Run. It has a well-developed floodplain, and no evidence of terraces. The sediment exposed in the cutbanks is dominantly fine grained. There are a few pebbles and cobbles of rocks derived from Blue Mountain, but not many and none are very large. In general, the stream gradient is too low and the discharge too small to transport large clasts. However, the material in the cutbanks may be sediment eroded and deposited in post-settlement time and may not be truly representative of natural stream load.

0.25 21.45 **TURN LEFT** onto Shady Road. Note several large boulders ahead in the field on the right.

0.35 21.8 Highest elevation along road traverse of upland. **PULL OFF** onto right road shoulder.

STOP 2. At this location we are in the Great Valley Section, the Shale Uplands Region, the Newburg Uplands District, and the Upland Zone (Table 1) (Figure 3). The few boulders present in the fields represent elements of the landscape (Table 1). The valley of Newburg Run which we followed to get here is the Floodplain Zone and the slopes adjacent to the valley bottom, the Valley Slope Zone (Figure 3). All of these zones could be identified and mapped in each drainage. This is one aspect of landscape description - its classification into specific categories for whatever purpose. There are other approaches.

In the classical approach, that of 50-100 years ago, this upland surface would be called a remnant of the Harrisburg peneplain (Campbell, 1903). This assignment is based on the fact that this elevation, here between 660 and 680 feet is correlative with most other uplands in the area. Thus, the interpretation would be that there is accordance of summits and that these summits are the remains of a former erosion surface. More recent investigators (e.g., Hack, 1960; 1975) have questioned the reality of the peneplain interpretation and suggest instead that the uplands are at the same elevation because the rock is everywhere equally resistant to erosion and has been eroded to the same level. This is possible, but at this location such an explanation does not explain everything.

The few boulders present here and others in the area are derived from the crest or flanks of Blue Mountain. I have discussed my interpretation of this in detail elsewhere (Sevon, 1985; 1989) and offer only a summary here. The boulders were transported across and deposited on a former sloping surface of low relief which existed at a slightly higher elevation. The surface has been dissected to its present topography leaving the boulders as isolated evidence of the existence of the former surface. This situation occurs in the Shale Uplands Region from Lehigh County to Maryland and even farther south. I suggest that the boulders are evidence of the reality of a former Harrisburg peneplain which has now been so dissected that almost no upland surface represents a true remnant of the former surface. The boulders remain because there is no mechanism of transport, other than man, which can move them off of the present upland surface.

In the background to the northwest is Blue Mountain. By definition (Berg and others, 1989), the boundary between the Appalachian Mountain and Great Valley Sections occurs at the foot of the mountain. Where is that? Probably the easiest place to locate it is at the major change in slope between 800 and 900 feet below the crest (Figure 3). That slope change corresponds more or less with the contact between the overlying Juniata-Bald Eagle and the underlying Martinsburg.

		LEAVE STOP 2 AND CONTINUE STRAIGHT AHEAD. Note several large boulders that occur along the road between Stop 2 and 22.2.
0.4	22.2	Outcrop of Martinsburg shale on left.
0.1	22.3	**STOP SIGN. TURN RIGHT** onto PA Route 641 W.
0.6	22.9	Franklin-Cumberland Counties boundary line. Cross over Laughlin Run. This is another topographic low

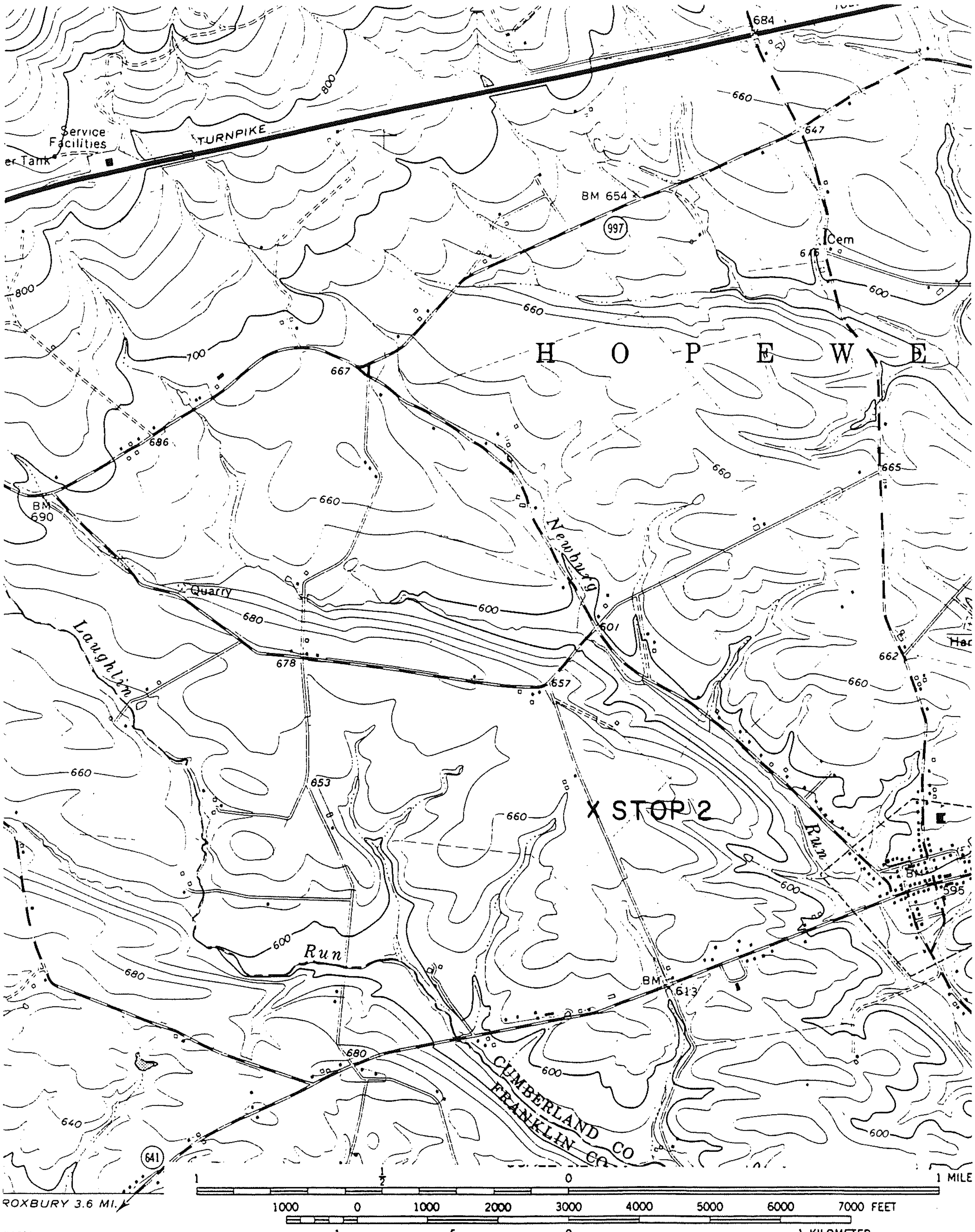

Figure 3. Topography typical of the Shale Uplands Region at Stop 2. From Newburg 7.5-minute quadrangle.

		and a drainage flowing from Blue Mountain. The route will climb up onto another upland and then down into the lowland of Clippinger Run.
1.1	24.0	Clippinger Run. Got the pattern by now?
2.2	26.2	Cross Paxton Run, the next drainage. The uplands are actually narrower than they appear. The route crosses them diagonally.
1.35	27.55	**TURN LEFT** onto PA Route 997 S in the center of Roxbury.
0.05	27.6	From here to 27.9 cross the floodplain of Conodoguinet Creek. Note cobbles in stream bed.
0.6	28.2	**BEAR RIGHT** onto Sandy Mount Road.
0.9	29.1	**TURN RIGHT** onto Tim Road.
0.3	29.4	**PARK ON** right shoulder of road near a small pile of boulders.

STOP 3. The small pile of boulders is only minimal evidence of the material which once covered this area. Note the fence pile in the woods at the crest of the hill ahead. There are also cobbles and pebbles in the fields. These resistant lithologies are derived from the Tuscarora, Juniata, and Bald Eagle Formations which are present within and west of the water gap (Figure 4). The clasts are rounded which indicates water transport. The hypothesis is that Conodoguinet Creek once flowed across this upland and deposited these materials. Since that time the creek has migrated to the northeast and cut down almost 200 feet. The widely-spaced contours to the north and northeast of Stop 3 (Figure 4) define a slip-off slope (SS) which indicates that Conodoguinet Creek has cut down and migrated laterally down that slope with little or no interruption since it was at the 800-foot level.

When did Conodoguinet Creek flow through the area of Stop 3 and deposit all the clasts? I don't know positively and at present there is probably no method for dating the surface. If an erosion rate of 75 ft/ma (minimum) or 124 ft/ma (maximum) (Sevon, 1985, p. 47) is applied and 200 feet of downcutting is assumed, then the surface could have existed as long ago as 2.7 ma or as recently as 1.6 ma. This assumes that the rate of erosion was constant and that the erosion rates are reasonable. This would make the inception of erosion and the downcutting essentially a Pleistocene event which is not unreasonable.

I would also suggest that the boulders here were deposited at the same time as those at Stop 2 and that the two places were at that time part of a continuous surface of low relief. Since the time of boulder deposition, the hilltop at this site has been protected by the capping deposit of boulders and has not been lowered by erosion. The upland at Stop 2 did not have a protective coating of boulders and that area has been much more severely eroded and lowered.

One possible fly in the ointment is the middle Atlantic offshore sediment record (Poag and Sevon, 1989). This record indicates that after a very long period of minimal influx of clastic material a major period of erosion started in the Middle Miocene (about 16 ma) and sent large quantities of clastic

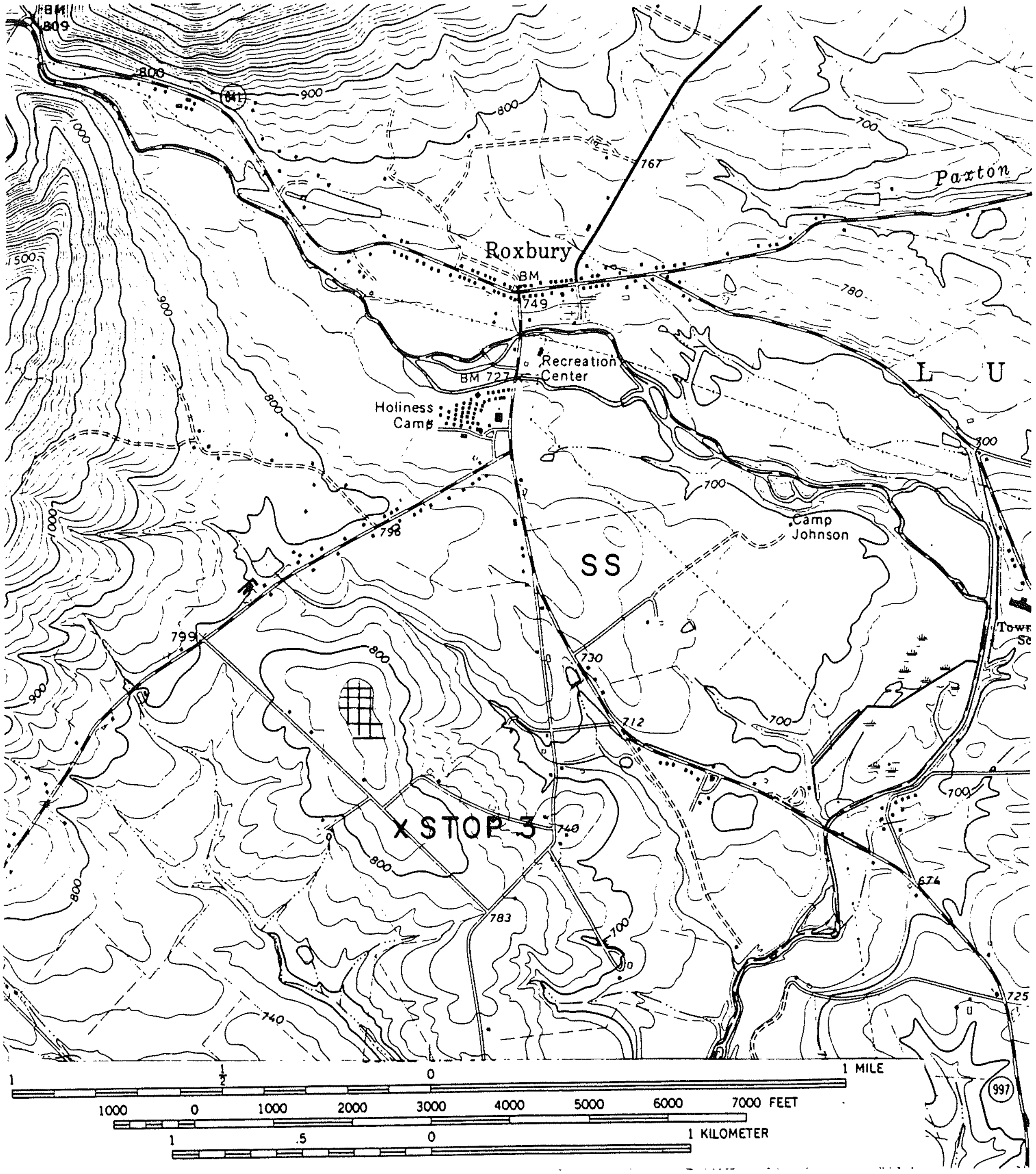

Figure 4. Topography in the area of Roxbury showing slip-off slope of Conodoguinet Creek. Cross-hatched area is boulder-capped upland once traversed by the creek. SS = slip-off slope. From Roxbury 7.5-minute quad.

sediment to the offshore. If the downcutting represented here is related to that event, then the surface is much older. Wherein lies the truth? We don't know. Yet.

After we leave Stop 3 and return to Roxbury, we will head west and begin to traverse the Appalachian Mountain Section of the Ridge and Valley Province. Refresh your memory about the characteristic landscape features: long linear ridges and valleys, various lithologies and degrees of induration, and moderate to high relief. From this stop we again have a view of Blue Mountain to the northwest. Here the major change in slope corresponding to a change in rock lithology is about 400-500 feet below the crest.

LEAVE STOP 3 AND PROCEED STRAIGHT AHEAD.

0.6	30.0	**STOP SIGN. TURN RIGHT.**
0.9	30.9	**STOP SIGN. TURN LEFT** onto PA Route 997 N.
0.3	31.2	**STOP SIGN. TURN LEFT** onto PA Route 641 W.
0.9	32.1	Start of good outcrops on the right of Martinsburg shale. Ahead on the right in the woods are outcrops of Juniata-Bald Eagle sandstones. This water gap and the crest of Blue Mountain for some distance on either side of the gap exposes Juniata-Bald Eagle rather than the usual crest-forming Tuscarora. Why does this situation occur? Possibly because the Juniata-Bald Eagle sandstones are thicker and just as resistant to erosion. We are now travelling through a narrow water gap cut into very resistant rocks by Conodoguinet Creek. The creek has a relatively small catchment area northwest of the gap and one might reflect on the ability of running water to erode well-indurated rock. Of the 7 streams that cut Blue Mountain, only Indiantown Run is smaller. Also note that there is a floodplain in this gap and that the creek is meandering on that surface. None of the other 6 streams do that - most almost completely fill the width of the gap. Any explanation? Could the creek have been larger when it cut the gap to the present level? Possibly. Another problem to consider: why a water gap here?
0.2	32.3	Outcrop on right of Juniata-Bald Eagle sandstone. After that the slope is covered with boulder colluvium.
0.3	32.6	Good outcrop of Tuscarora sandstone on right at sharp curve.
0.4	33.0	Small valley floor on right is filled with large boulders and qualifies as a boulder field.
0.2	33.2	Power line. Note talus on upper slope. Abundant talus, both exposed and vegetation covered, is characteristic of the ridge slopes in this Section. Route is near the center of a plunging syncline which opens to the southwest.
0.7	33.9	Cutbank on right has veneer of sandstone boulders, boulder colluvium, overlying brown shale. Ahead on right at curve is outcrop of Tuscarora sandstone. The route will traverse through gaps cut by Pine Run and cross two en-echelon folds. The first fold is an anticline with Kittatinny Mountain as the southeast limb. The anticline dies out to the southwest and the second fold, a syncline with Timmons Mountain as the northwest limb, dies out to the northeast. The name Timmons Mountain is replaced by Kittatinny Mountain after the anticline

dies out. The pattern of these en-echelon folds is shown in Figure 5. En-echelon folds are common in the Appalachian Mountain Section, but few have a road traversing them as PA Route 641 does here. The folds die out laterally as a result of kink-band structure. The fold geometry and outcrop pattern is an exact reverse of the Cocolamus structure illustrated by Faill (1969, Figure 7, p. 2545) (Figure 6).

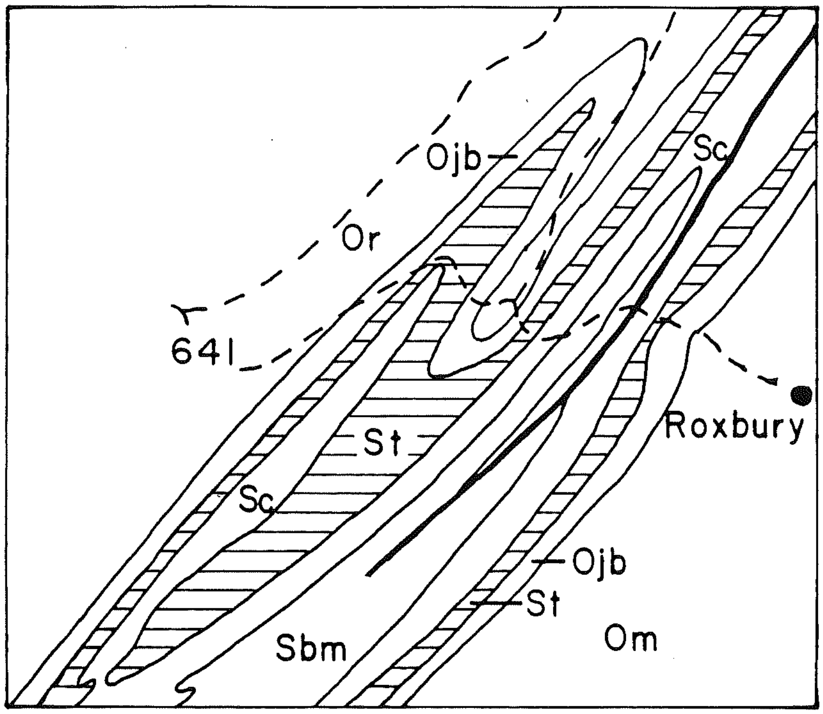

Figure 5. Geology in the area of en-echelon folds along PA Route 641 west of Roxbury. From Berg and others, 1980.

0.3 34.2 **BEAR LEFT** following PA Route 641 W (truck route bears to right). As the route curves left ahead, it is near the center of the first fold, the anticline. The route progresses through a gap cut by Pine Run and, at the base of the climb over Timmons Mountain, the route is in the center of the second fold, the syncline. The truck route goes north around the end of the syncline and does not have a hill climb. On a different subject, if one were to subdivide the area geomorphically according to Godfrey and Cleaves (1991), the following might be the result: Ridge and Valley Province, Appalachian Mountain Section, Kittatinny Mountain Region, Pine Run District, and three zones - Mountain Crest Zone, Mountain Slope Zone, and Valley Bottom Zone. Other logical (or illogical) subdivisions are possible.

0.7 34.9 Power line on the left shows abundant talus.

0.5 35.4 Between here and the crest of the mountain there is abundant talus of Tuscarora sandstone on the right.

0.3 35.7 Crest of Timmons Mountain is typical of most of those in the Section: it is very narrow, rubble

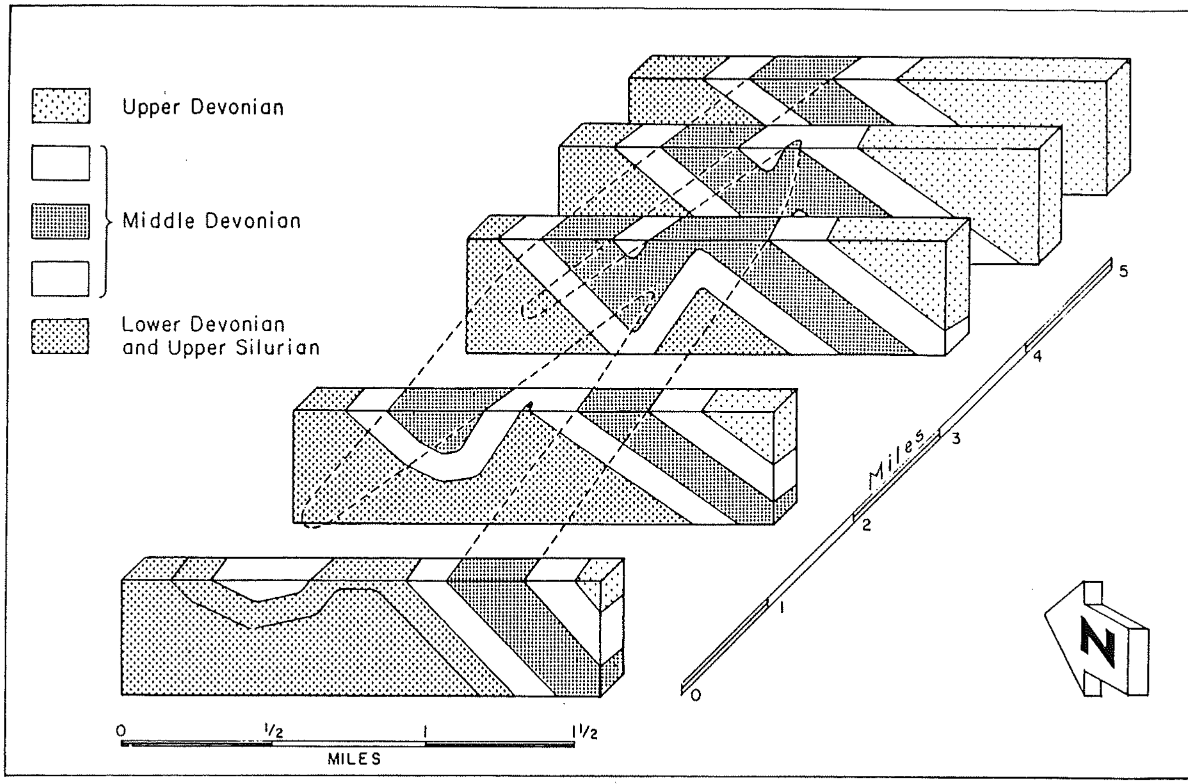

Figure 6. A block diagram of the Cocalamus structure showing fold geometry and outcrop pattern (dashed lines) typical of the Appalachian Mountain Section. From Faill, 1969, Figure 7, p. 2545.

strewn, and lacks substantial undisturbed outcrop.

1.8 37.5 Small hill crest near the base of the steep slope gives a good view across Path Valley. This area is part of the headwaters of West Branch Conococheague Creek which drains into the Potomac River. All other drainage viewed on this trip drains into the Susquehanna River. Path Valley is underlain by several carbonate units. On the opposite side of the valley note the very irregular crest of Tuscarora Mountain, a typical long, linear ridge. Is the irregularity due to faults or fractures?

0.6 38.1 **STOP SIGN. TURN LEFT** following PA Route 641 W. Immediately pass under the Pennsylvania Turnpike.

0.9 39.0 Outcrop of Chambersburg limestone on the right. Note that this area of karst is different from that of the Great Valley at Stop 1 -- it has integrated drainage. However, the rock units are the same. The reason for the difference is open to conjecture.

0.7 39.7 **STOP SIGN. PROCEED STRAIGHT AHEAD** following PA Route 641 W as it crosses PA Route 75 in Spring Run. West of this intersection note the abundance of stone fences and the cobbly nature of the fields. This is a contrast to the carbonate areas of the Great Valley which lack clasts in the soil. The clasts here are not derived from weathering of the carbonates, but are part of overlying colluvium which came from Tuscarora Mountain to the west. The clasts were transported by a gravity-driven mass wasting process, solifluction (?), probably during the Pleistocene.

2.3 42.0 **PULL OFF** into old road area.

STOP 4. On the slope above the center of the curved former roadway is a concentration of sandstone boulders in the trough of a small gully. Note that the slopes adjacent to the gully are basically boulder free. The gully is an area of boulder concentration. Individual boulders, moved by gravity-driven mass-wasting processes, concentrate in the lowest area on the slope and then move farther downslope as a mass.

LEAVE STOP 4 AND PROCEED STRAIGHT AHEAD.

0.7 42.7 Crest of Tuscarora Mountain. Crest is composed of Tuscarora sandstone, but the Juniata-Bald Eagle is very near the crest.

0.4 43.1 Outcrop of Tuscarora sandstone on right. To left is view of valley and linear crest of Shade Mountain. The valley is of moderate width for the Section.

0.5 43.6 Outcrop of talus of Tuscarora sandstone on right. An interesting exercise is to consider how much the crest had to be lowered to produce the talus. I have not tried it here but have elsewhere (Sevon, 1989, p. 38). One needs to calculate an area of talus based on knowledge of the downslope extent of the talus, assume or determine an average thickness, and reduce the thickness by 17-20 percent to account for the void space. Then, if the width of available outcrop is known, the pre-talus height of the crest can be calculated. Such calculation would probably show the crest to have been many 10's of feet higher. The talus was presumably produced during the Pleistocene.

1.6 45.2 Neelyton. The route ahead traverses across a synclinal valley. The margins of the valley expose Middle Devonian Hamilton shales and the center of the valley has Upper Devonian Catskill (not exposed along the route). Although it is not apparent along the route, this area has some of the best trellis drainage (Figure 5) present anywhere in Pennsylvania. This valley, which could be classified as the Neelyton-Dalmatia Valley Region, is a moderately wide valley which separates two Tuscarora-enclosed areas. Stops 5, 6, and 7 are in a comparable region.

1.1 46.3 Outcrop on the left dips to the west. An outcrop at 46.75 dips to the east. The synclinal axis is at about 46.5.

1.8 48.1 **STOP SIGN. TURN RIGHT** onto US Route 522 N. Ahead is Shade Gap which is cut by Shade Creek through Shade Mountain. Most of the material seen within the gap is talus. Shade Mountain is crested by Tuscarora sandstone, but the Juniata is very close to the crest on the west side.

0.6 48.7 On the right is a bridge over Shade Creek which leads to an outcrop of Bald Eagle sandstone.

Figure 7. Map of trellis drainage adjacent to PA Route 641 in the area of Neelyton. Drainage enhanced on Shade Gap 7.5-minute quadrangle.

1.0	49.7	Route now follows along the axis of Locke Valley which is a narrow valley between Shade Mountain on the east and Blacklog Mountain on the west. The center of the valley is underlain by Ordovician carbonates and the lower sides by shale. These units are covered with colluvium derived from the adjacent mountains.
2.6	52.3	Cross Blacklog Creek and enter the water gap in Blacklog Mountain. Sandstones outcropping on both sides of the gap are Juniata-Bald Eagle.
1.3	53.6	**STOP LIGHT. TURN LEFT** in the center of Orbisonia onto PA Route 994 W.
0.4	54.0	**PARK** at East Broad Top Railroad in Rockhill, PA.

STOP 5. At this stop we will board the East Broad Top Railroad at 11:15 am, ride to the turn around, disembark, have picnic lunch at Colgate Grove, and return on a later train. The EBT is the last 3-foot guage line east of the Mississippi River still operating in its original location. It originally hauled coal from the Broadtop coal fields to Mount Union. The railroad operates on Saturday and Sunday, June through October, and may be chartered for weekday runs for large (200) groups. Trains run at 11:15, 1:00, 2:15, and 3:30. A souvenir shop, roundhouse and other items are available for inspection. Also present is the Shade Gap Electric Railway and the Trolley Museum.

		LEAVE STOP 5. CONTINUE STRAIGHT AHEAD on PA Route 994 W.
0.15	54.15	**TURN RIGHT** onto Valley Street. PA Route 994 turns left.
0.25	55.4	Cross Aughwick Creek.
0.1	55.5	**TURN RIGHT** onto unnamed paved road.
0.8	56.3	Note steep slope on the left and the dissected surface across which the road traverses. This is a rock cut terrace (T) and meander of Aughwick Creek when it flowed at this level of about 720 feet (Figure 8).
0.4	56.7	View to the right is of a rock cut terrace at the 720-740-foot level. Rounded cobbles occur in the field.
0.3	57.0	A break in the slope at about 700 feet on the left marks the margin of a terrace level.
0.6	57.6	**BEAR RIGHT** at road fork following along the side of Aughwick Creek on the present floodplain.
1.1	58.7	Pull-off area on right is good place to view floodplain and terraces, but better view is ahead.
0.3	59.0	**PULL OFF** onto narrow shoulder on right.

STOP 6. The level we are on is the present floodplain of Aughwick Creek. In the field is a terrace level less than 20 feet above the floodplain. The cultivated area at higher level is a terrace at about 680 feet.

This reach of Aughwick Creek is properly termed a meandering valley (Leopold and others, 1964, p. 308-317) or an incised meander (Morisawa, 1985, p. 103-104). As an incised meander it is considered ingrown because the valley has an asymmetrical

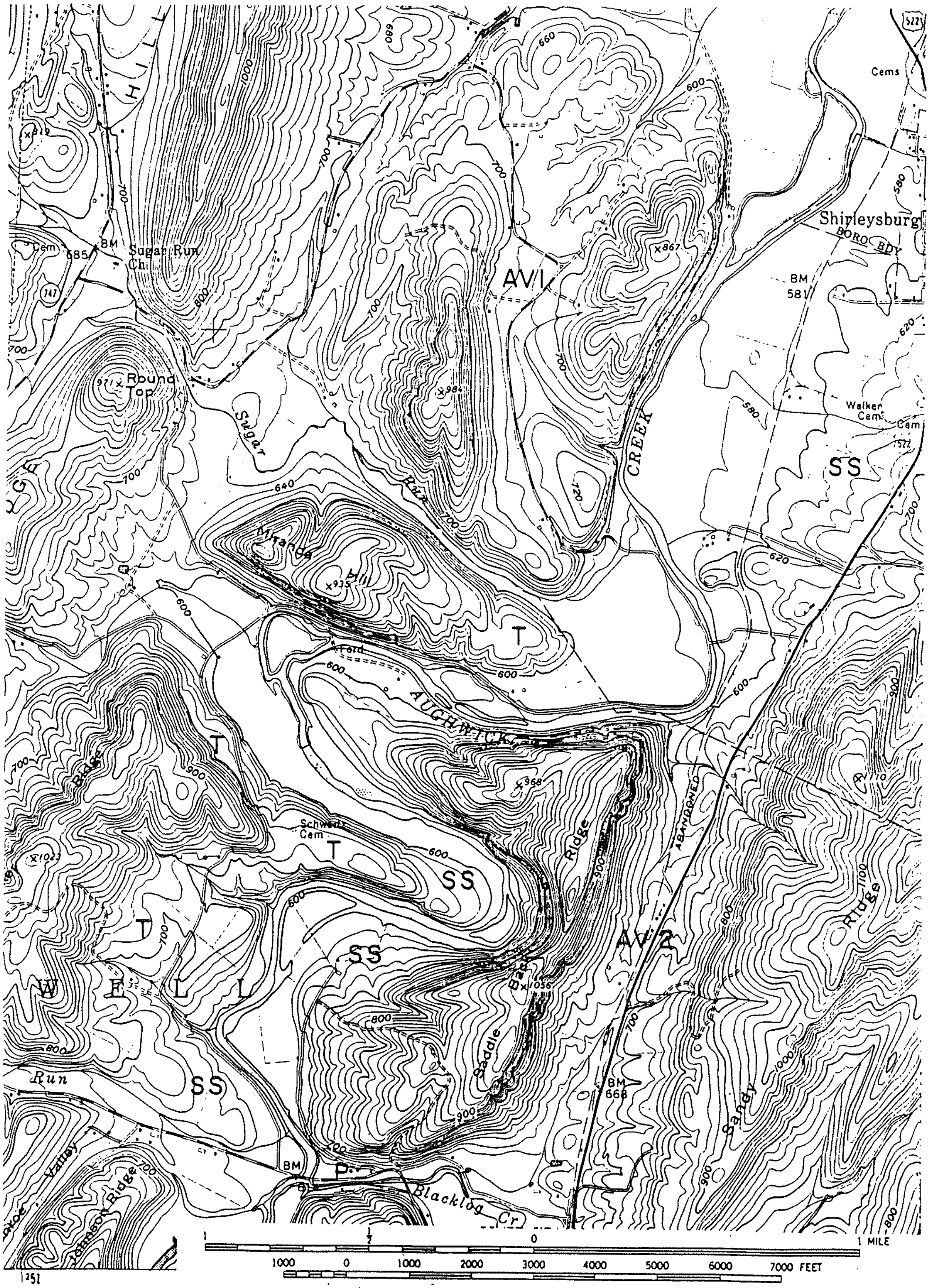

Figure 8. Topography and meanders of Aughwick Creek north of Orbisonia. AV1 and AV2 = abandoned valleys; p = pirating stream; SS = slipe-off slope; T = terrace. From Butler Knob 7.5-minute quadrangle.

profile. This means that the stream has been migrating and cutting laterally at the same time it has been cutting down. The drainage area (approximately 220 sq. mi.) and the meander length (6300 feet) for this meander fit very well into the category of other measured valley meanders (Leopold and others, 1964, Figure 7-48, p. 312). Figure 8 shows the meandering valley, some terrace levels (T), and several slip-off slopes (SS). The slip-off slopes are important clues about the history of the valley.

The simple story is that Aughwick Creek apparently meandered freely with a valley at about the 700-foot level. After downcutting was renewed the stream migrated and cut to its present position. A serious complication occurs south and west of Shirleysburg. A slip-off slope on the east side of the valley south of Shirleysburg indicates that a stream was here when downcutting was renewed. However, fluvial cobbles in the hills immediately west of the present valley and Shirleysburg provide evidence that a stream flowed through what is now an abandoned valley (AV1) at the 680-700-foot level. It is difficult to imagine that Aughwick Creek was in both places at the same time. Exotic meander loops are a possible but not highly probably explanation. I suggest instead that at about the 700-foot level Blacklog Creek flowed through the small valley east of Saddle Back Ridge (AV2), Aughwick Creek flowed through the abandoned valley AV1, and the the two streams joined just north of Shirleysburg. The two streams apparently meandered, cut down, and joined somewhere south of Shirleysburg at which time Aughwick Creek abandoned its former channel. Shortly thereafter, Blacklog Creek was pirated by a small tributary (P) to Aughwick Creek and its channel parallel to Saddle Back Ridge (AV2) was abandoned. This scenario is diagramed in Figure 9.

This explanation is not perfect and has not been proven, but it is possible and some explanation is necessary to account for the few facts. Note that the meander process is extending the meanders normal to the general trend of the stream, but is doing minimal movement of the meanders parallel to the course of the stream.

On another topic, we are certainly in a different geomorphic setting than at previous stops. A landscape classification here could be: Ridge and Valley Province, Appalachian Mountain Section, Sunbury-Warriorsburg Valley Region, Aughwick Creek District, Orbisonia Area, Floodplain Zone, Runk Road Locale. Imaginative perhaps, but it works and each subdivision could be given a reasonable definition. For example, the Sunbury-Warriorsburg Valley Region comprises a wide synclinal valley with moderate relief developed by fluvial erosion primarily on Devonian-age rocks of variable lithology and induration. The valley, which extends from east of Sunbury to the Pennsylvania-Maryland state line and beyond, separates 2 areas enclosed by the Tuscarora Formation. The sides of the valley usually have a well-defined linear ridge crested by Oriskany sandstone.

LEAVE STOP 6 AND PROCEED STRAIGHT AHEAD.

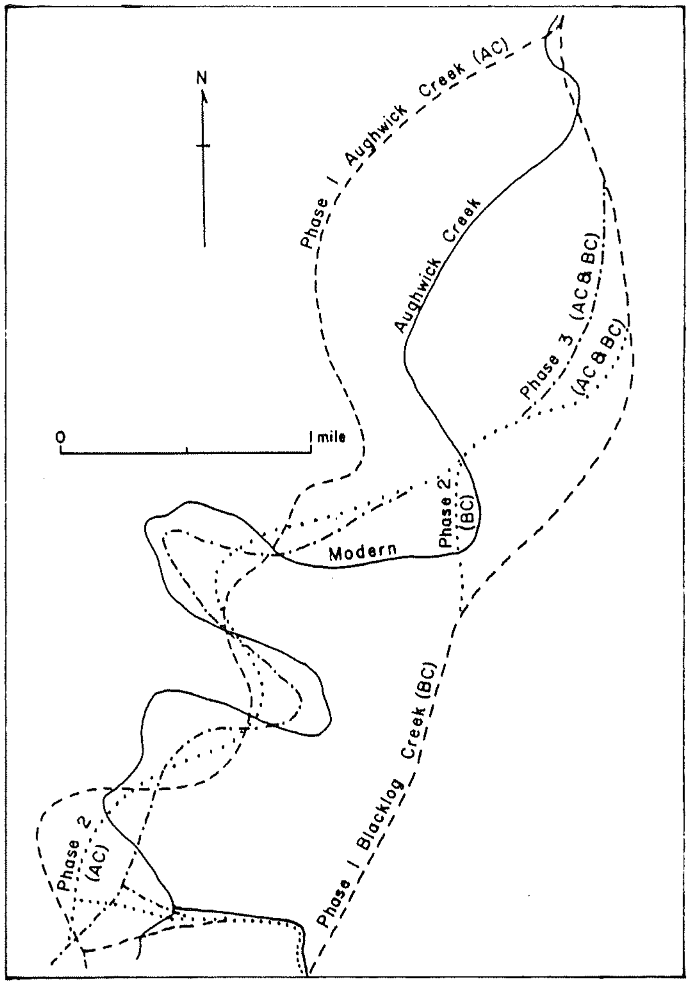

Figure 9. Diagram of interpreted drainaage evolution of Aughwick and Blacklog Creeks in the area between Orbisonia and Shirleysburg.

0.2	59.2	Runk Road bridge. Runk Road goes to US Route 522. **CONTINUE AHEAD** on Gilbo Road.
0.9	60.1	**PULL OFF** onto shoulder of road.

STOP 7. There are a few rounded cobbles on the left side of the road. They indicate that Aughwick Creek once flowed through this valley. See Stop 6 for the explanation.

LEAVE STOP 7 AND PROCEED STRAIGHT AHEAD.

0.7	60.8	Good place to view former valley walls and abandoned channels.
0.7	61.5	**STOP SIGN. TURN RIGHT** onto Keystone Road. Cultivated hilltops ahead are probably terrace remnants and the wooded slopes beyond, the former valley wall.
1.3	62.8	Note the very broad floodplain of Aughwick Creek on the left.
0.5	63.3	**STOP SIGN. TURN RIGHT** onto US Route 522 S.
0.3	63.6	Outcrops of Oriskany sandstone on both sides of the road.
4.7	68.3	**STOP LIGHT** in center of Orbisonia. **CONTINUE STRAIGHT AHEAD** on US Route 522 S.
0.4	68.7	View ahead on left of talus at crest of Blacklog Mountain.

3.1	71.8	View ahead of the serrated ridge of Shade Mountain, a typical long, linear ridge of the Section.
1.9	73.7	**TURN LEFT** onto PA Route 641 E. The turn is on a right curve just east of the water gap and is not highly visible.
4.6	78.3	Talus of Tuscarora sandstone in powerline on left.
0.4	78.7	Outcrop of Tuscarora sandstone on left. View across valley to Shade Mountain on right.
0.4	79.1	Crest of Tuscarora Mountain. View to right across Path Valley. Note outcrops ahead on the left. The red Juniata comes almost to the mountain crest and the lack of Tuscarora talus in places along the mountain side suggests that the Tuscarora is either not always the crest rock or most of the talus produced went down the other side of the mountain.
3.1	82.2	**STOP LIGHT. PROCEED STRAIGHT AHEAD.**
1.6	83.8	**TURN RIGHT** following PA Route 641 E after passing under Pennsylvania Turnpike. Truck route 641 goes straight ahead.
2.4	86.2	Crest of Timmons Mountain. Pull-off area on right provides limited view of Kittatinny Mountain to the east.
1.5	87.7	**STOP SIGN. CONTINUE STRAIGHT AHEAD.**
17.7	105.4	**STOP LIGHT. CONTINUE STRAIGHT AHEAD** in the center of Newville.
1.1	106.5	**BEAR LEFT** onto Creek Road.
0.6	107.4	Floodplain of Conodoguinet Creek on the left.
0.3	107.4	At this curve there is a mapped fault contact between shale and carbonate.
1.0	108.4	Pass over the Pennsylvania Turnpike.
0.3	108.7	Diller Mennonite Church on the left. The slight upland on the right has gravel deposits and is a terrace of Conodoguinet Creek about 40 feet above the present creek.
0.3	109.0	**STOP SIGN. TURN LEFT.**
0.2	109.2	**TURN RIGHT** immediately after crossing Conodoguinet Creek.
1.2	110.4	Field on left has abundant cobbles and is a surface about 30 feet above Conodoguinet Creek. This is a slip-off slope. The crest of the wooded hill on the right just east of Conodoguinet Creek is the site of Stop 8.
0.8	111.2	**TURN RIGHT** onto dirt road.
0.7	111.9	**STOP SIGN. TURN RIGHT** onto Grahams Woods Road. Outcrop of Martinsburg greywacke on left.
0.2	112.1	Cross Conodoguinet Creek.
1.0	113.1	**PULL OFF** onto shoulder on right side of road.

STOP 8. This is a terrace level of Conodoguinet Creek now over 50 feet above the creek. There are a few cobbles and boulders present to prove this. The shape of the landscape suggests that since Conodoguinet Creek was at this level it has gradually cut down and the long straight part of the meander has migrated to the east down the slip-off slope (Figure 10). At the same time the creek counterpart to the west (near 110.4) has done the same thing and is cutting the west base of this terrace remnant. The short, curved part of the meander has migrated very

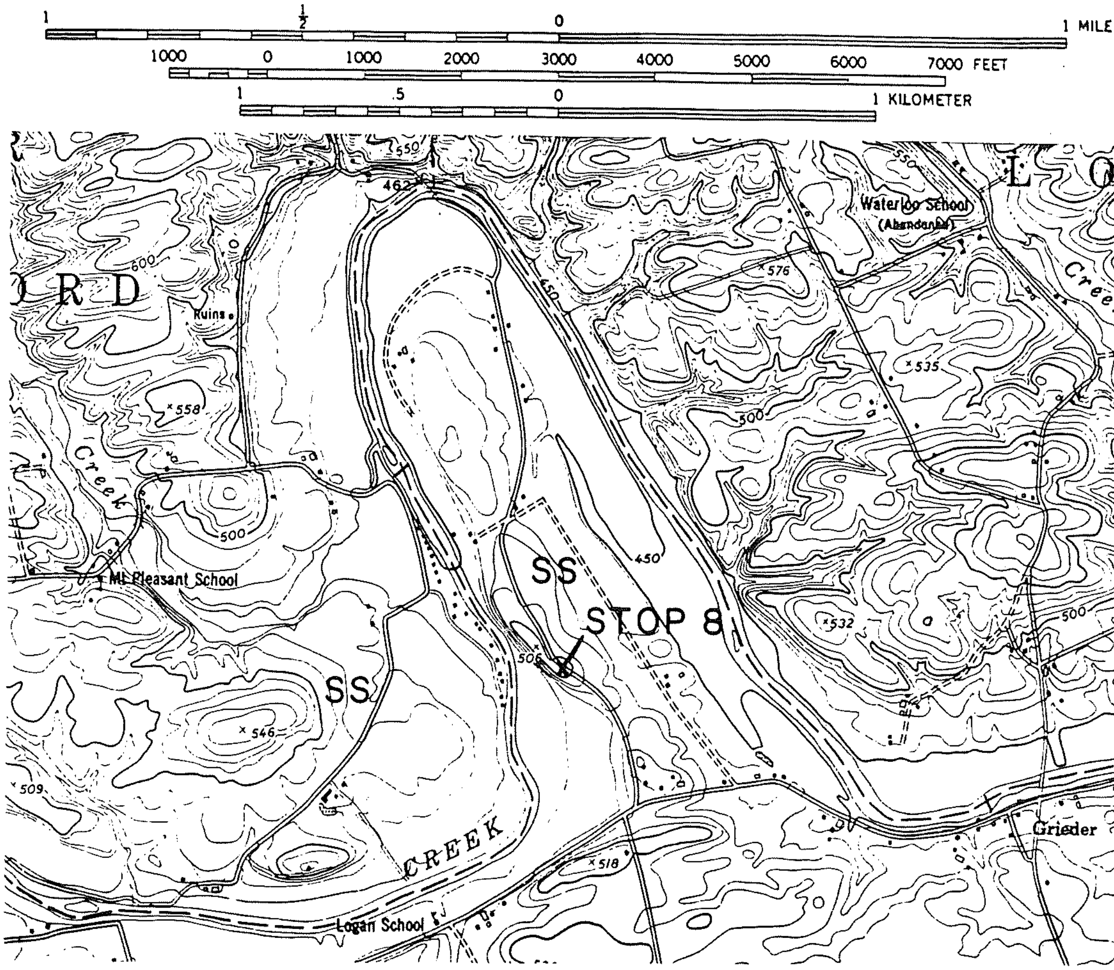

Figure 10. Topography and meander of Conodoguinet Creek at Stop 8. SS = slip-off slope. From Plainfield 7.5-minute quadrangle.

little, while the long, straights have migrated parallel to the general trend of the creek. Compare and contrast this with the meanders of Aughwick Creek (see Stop 6). Also try your luck at classifying this location down to the zone level.

SUMMARY

Is there a common theme for all that we have seen today at Stops 2, 3, 6, 7, and 8? I think there is. In each case we have seen evidence of former drainage at a higher level than today and its relation to erosion to the present base level. These occurrences are in very different areas separated by many miles. Other similar occurrences exist. It is just possible that today we looked at the remains of an old widespread erosion surface which once existed only a little higher than the present surface. Possibly if could even be called the Harrisburg peneplain. When that surface existed and when its dissection commenced are questions which were not answered although both Pleistocene and Middle Miocene are possibilities.

LEAVE STOP 8 AND PROCEED STRAIGHT AHEAD.

0.4 113.5 **STOP SIGN. TURN RIGHT THEN AN IMMEDIATE LEFT.** Note the nice karst topography between here and PA Route 641.

0.9	114.4	**STOP SIGN. TURN LEFT** onto PA Route 641 E.
6.1	120.5	**STOP SIGN. TURN RIGHT, PASS UNDER RAILWAY, AND, AT STOP LIGHT, TURN LEFT** folllowing PA 641.
0.6	121.1	**STOP LIGHT. TURN LEFT** onto PA Route 74 N.
0.2	121.3	**TURN LEFT** into parking lot.
		END OF TRIP. HAVE A SAFE TRIP HOME!!!

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