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The Pocono Formation in Northeastern Pennsylvania

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THE POCONO FORMATION IN NORTHEASTERN PENNSYLVANIA

October 3 and 4, 1969

Host: Pennsylvania Geological Survey

By

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Cover: Recommended type section of Pocono Formation
at Jim Thorpe, Pennsylvania. (Section A,
Appendix C) Scale: 1" = 150'

CONTENTS

	<u>Page</u>
Introduction.....	1
Type section of the Pocono Formation.....	3
Rocks of the Pocono Formation in Northeastern Pennsylvania.....	5
Lithologic Component 1.....	5
Lithologic Component 2.....	15
Lithologic Component 3.....	18
Lithologic Component 4.....	20
Sedimentary History.....	23
Introduction.....	23
Pre-Pocono surface.....	24
Catskill-Pocono transition.....	25
Pocono regression.....	29
End of Pocono sedimentation.....	29
Pocono disappearance.....	31
References cited.....	32
Road log, Friday October 3.....	37
Road log, Saturday October 4.....	45
Appendix A - Review of Pocono Formation name and type locality.....	54
Introduction.....	54
Pocono: The name and the rocks.....	54
Subdivision of the Pocono Formation at Jim Thorpe.....	62
Appendix B - Griswold Gap conglomerate.....	64
Historical speculation.....	66
Appendix C - Measured sections.....	69
Section A - Jim Thorpe.....	70
Section B - Beckville.....	91
Section C - Dunmore.....	109
Section E - Scranton.....	113
Section F - Wildcat Creek.....	123
Section G - Mountain Top.....	125
Section H - Near Drake's Creek.....	128

FIGURES

	<u>Page</u>
Figure 1. Map of the Pocono Formation in northeastern Pennsylvania with locations of important outcrops and field trip stops.....	2
Figure 2. Location map of the recommended type locality of the Pocono Formation.....	4
Figure 3. Correlation of several descriptions of the recommended type locality.....	6
Figure 4. Outcrop of typical tilloid.....	8
Figure 5. Thin section of tilloid.....	9
Figure 6. Thin section of pebbly mudstone.....	9
Figure 7. Pebbles in pebbly mudstone of lithologic component 1....	11
Figure 8. Laminite of lithologic component 1 with 'dropped in' pebble.....	11
Figure 9. Succession of uppermost Catskill and lowermost Pocono rocks at Penn Haven Junction.....	13
Figure 10. Stratigraphic correlation diagram of the basal Pocono rocks in northeastern Pennsylvania.....	14
Figure 11. Planar bedded sandstones.....	17
Figure 12. Rippled surface in planar bedded sandstone.....	17
Figure 13. Load casts at the base of planar bedded sandstone.....	18
Figure 14. Steep, massive foresets in sandstones.....	22
Figure 15. Stratigraphic correlation diagram of the lithologic components of the Pocono Formation in northeastern Pennsylvania.....	26-27
Figure 16. Distribution of probable uppermost Catskill depositional environments and the area of Upper Devonian-Lower Mississippian transgression in northeastern Pennsylvania.....	28
Figure 17. Distribution of Pocono depositional environments at one interval during Pocono regression.....	30
Figure 18. Generalized route map for the field trip.....	36

TABLES

Table 1.....	10
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THE POCONO FORMATION IN NORTHEASTERN PENNSYLVANIA

by

WILLIAM D. SEVON

INTRODUCTION

In this field trip we will examine distinctive aspects of the Pocono Formation in northeastern Pennsylvania in an attempt to convey an impression of each lithologic component in the formation, the origin of some of the components unique to the Upper Paleozoic stratigraphy, and regional facies variations within the formation.

The Pocono Formation in northeastern Pennsylvania can be divided into four lithologic components:

1. A basal tilloid, pebbly mudstone and laminite sequence.
2. A series of well sorted, rippled and planar bedded sandstones.
3. A sequence of massive to thin-bedded sandstones with interbedded siltstones and shales.
4. At the top, conglomerates, cross bedded sandstones, a few siltstones and rare, thin coal beds.

All of these lithologic components will be examined during the course of this field trip. A subaqueous origin for lithologic component 1 indicates an uppermost Catskill-lowermost Pocono marine transgression into northeastern Pennsylvania at least as far south as Jim Thorpe (Fig. 1). A tidal sand flat origin for lithologic component 2 indicates regression following maximum transgression in the lowermost Pocono. Deltaic plain origin of lithologic component 3 and probable fluvial origin for part of lithologic component 4 indicate continued regression.

The recommended type section of the Pocono Formation at Jim Thorpe (Stop I, Fig. 1) is the starting point for comparing its lithologic assembl-

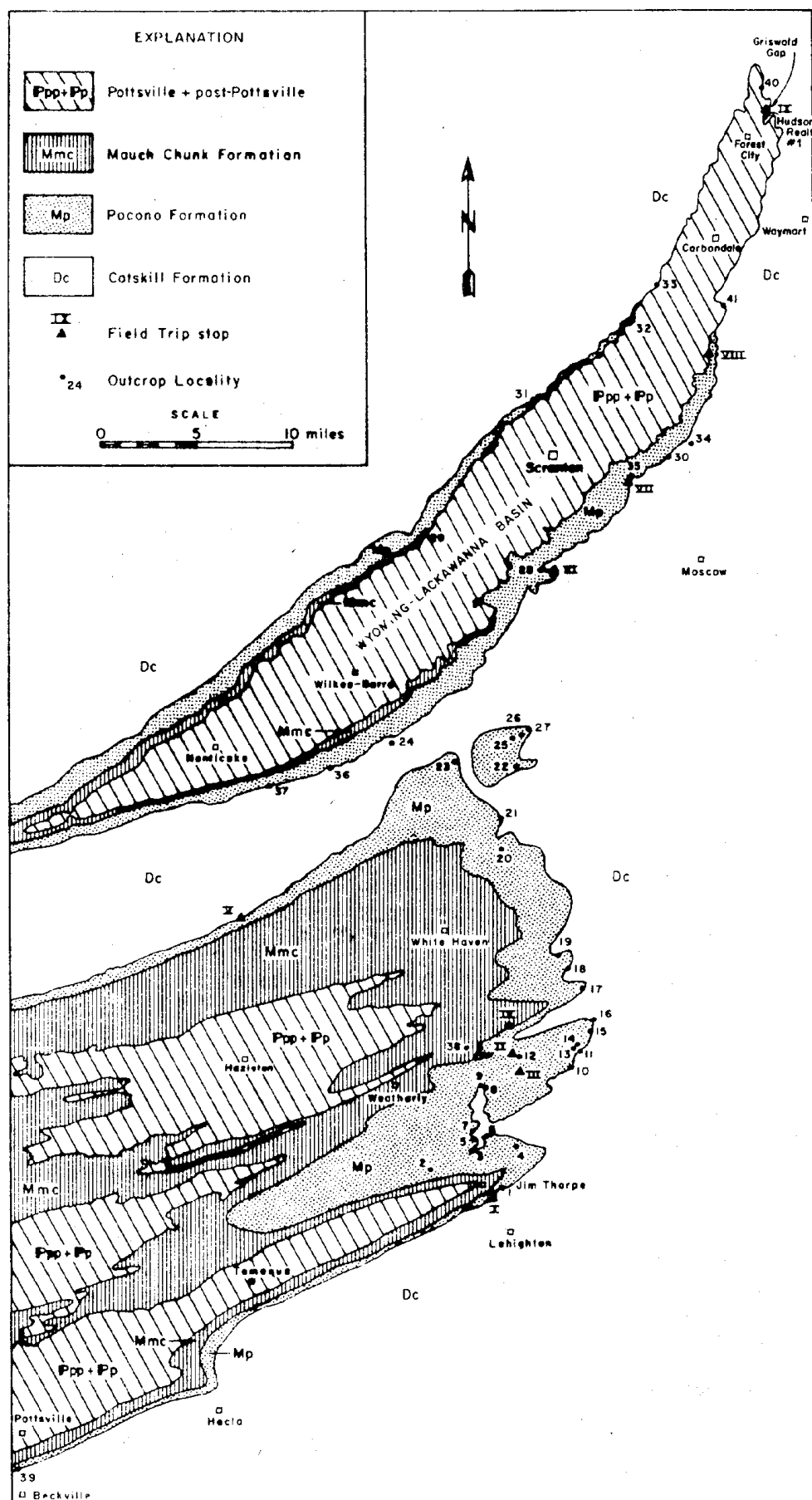


Figure 1. MAP OF THE POCONO FORMATION IN NORTHEASTERN PENNSYLVANIA WITH LOCATIONS OF IMPORTANT OUTCROPS AND FIELD TRIP STOPS.
(Modified from the Geological Map of Pennsylvania (Gray and others, 1960)

age with Pocono assemblages to the north along the Lehigh River and along the margins of the Wyoming-Lackawanna basin (Fig. 1). A sharp, conformable Catskill-Pocono contact at the type locality will be compared with a Catskill-Pocono transition zone at Stop V (Fig. 1) and a sharp erosional (?) contact at Locality 37 (Fig. 1). Northward thinning and facies change of the Pocono occurs between Jim Thorpe and Scranton with further thinning and disappearance of the Pocono northward along the margins of the Wyoming-Lackawanna basin between Scranton and Forest City (Fig. 1).

The present work results from detailed mapping by the writer in the Lehigh, Christmans and Hickory Run 7 1/2' quadrangles (Carbon County) and a regional study of the Pocono Formation in northeastern Pennsylvania during the last four years.

The writer thanks the following people with whom Pocono geology has been discussed during the course of the field work: R. W. Fairbridge, E. C. Dapples, J. D. Glaeser, G. H. Crowl, M. J. Bergen, J. Hollowell, J. Veevers, D. M. Hoskins, P. Wilshusen, and S. Root. The writer also thanks G. H. Wood, S. Root, D. M. Hoskins and J. D. Glaeser for critical comments on the manuscript.

TYPE SECTION OF THE POCONO FORMATION

The recommended type section of the Pocono Formation is located along a railroad cut on the east bank of the Lehigh River at Jim Thorpe (Formerly Mauch Chunk), Carbon County, Pennsylvania (Fig. 2). This locality is recommended as the type section because (1) it contains all the lithologic components of the Pocono Formation in northeastern Pennsylvania and because (2) it appears to be the type section used by the Second Geological Survey of Pennsylvania when the rock sequence was named Pocono (see review in Appendix A). The exposed section (Section A Appendix C) includes the upper beds of the underlying Catskill Formation and terminates at the north end of this continuous exposure in the overlying Mauch Chunk Formation. The base

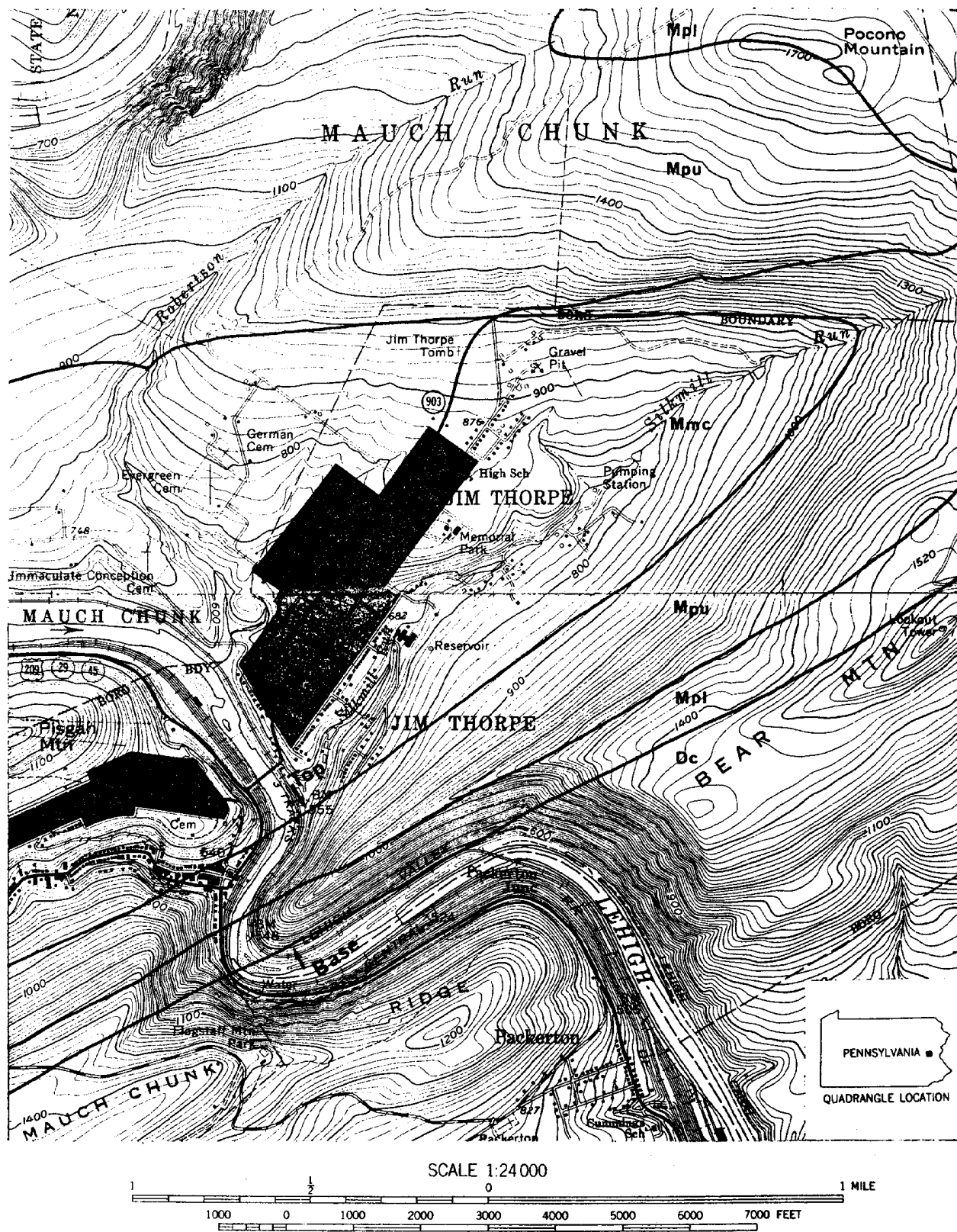


Figure 2. Location map of the recommended type locality of the Pocono Formation (Lehigh 7 1/2' quadrangle) and Pocono Mountain (Christmans 7 1/2' quadrangle) Carbon County, Pennsylvania.

of the type section occurs 169 feet stratigraphically above the west edge of a stone wall which terminates a few yards northeast of a road which passes over the Lehigh Valley Railroad to the Jim Thorpe sewage treatment plant. The outcrop parallels the railroad for over 2,500 feet and ends along an abandoned railroad spur adjacent to a supermarket parking lot. This section has been described in various degrees of detail by Rogers (1858, p. 8), White, (1882, p. 79), Winslow and Hill (1886, p. 1363), Leonard (1953, p. 7-21), Klemic and others (1963, p. 38-40), and the writer (Section A, Appendix C). Summaries of the sections of Rogers, White, Winslow and the writer are collated in Figure 3. Formal and informal stratigraphic subdivision of this section is discussed in Appendix A.

ROCKS OF THE POCONO FORMATION IN NORTHEASTERN PENNSYLVANIA

The Pocono Formation, 1349 feet thick at its type section, is subdivided into four superposed and laterally variable lithologic components. In vertical succession they are: (1) a tilloid, pebbly mudstone and laminite sequence, 156 feet thick, (2) well sorted, rippled and planar bedded sandstones, 42 feet thick, (3) massive to thin-bedded sandstones with interbedded siltstones and shales, 350 feet thick, and (4) conglomerates, cross bedded sandstones, and a few siltstones, 801 feet thick.

Each of these subdivisions will be considered separately in terms of their lithologies, upper and lower contact relations, areal distribution, regional variation and environment of deposition. Particular attention will be given to the lower two subdivisions because they have received no attention from previous workers and because of their importance in sedimentological interpretations of the entire Pocono Formation.

Lithologic Component 1

The lowermost rocks in the Pocono Formation are part of the 'transition

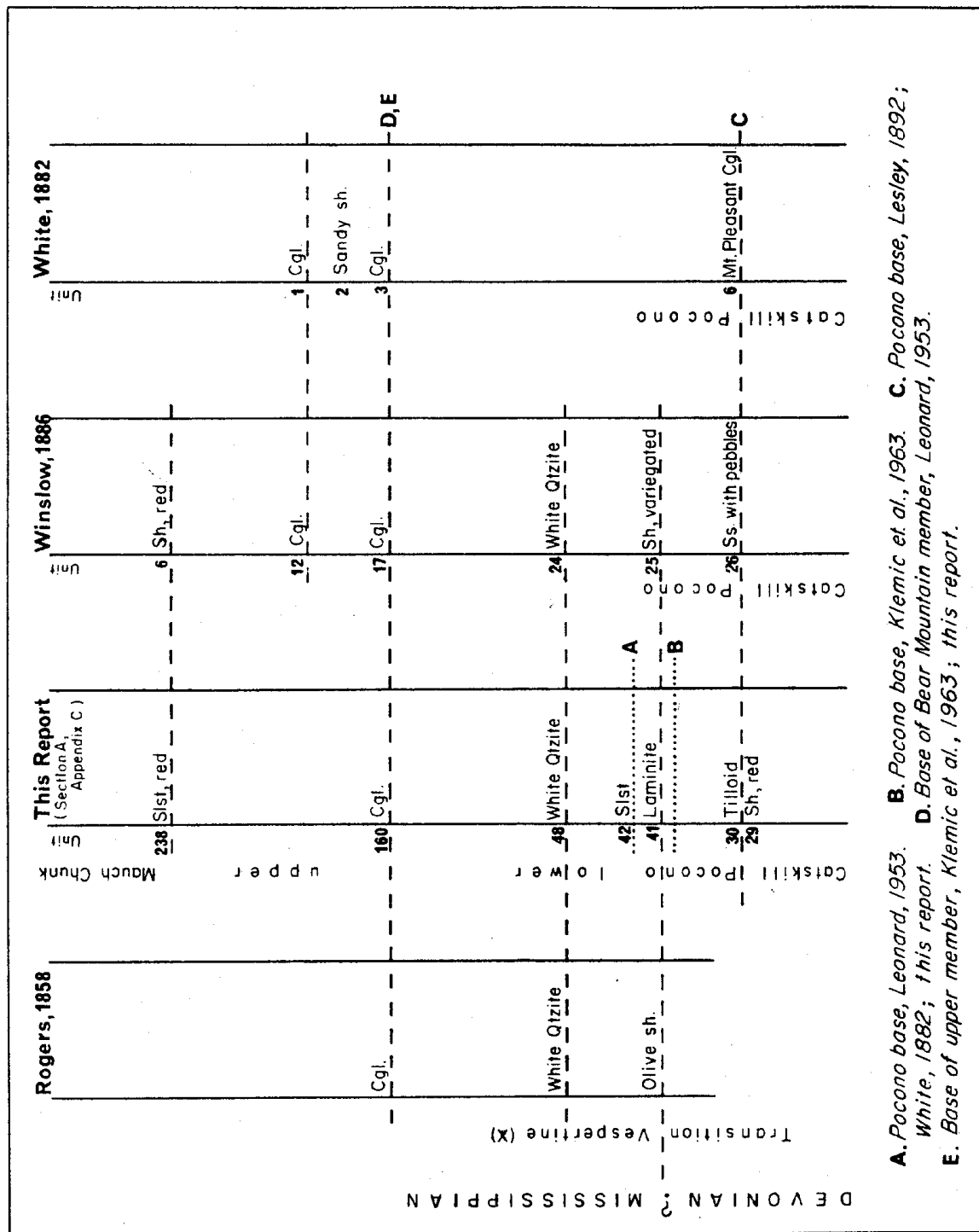


Figure 3. Correlation of several descriptions of the recommended type locality of the Pocono Formation at Jim Thorpe, Pennsylvania.

zone' between the Upper Devonian Catskill Formation and the Lower Mississippian Pocono Formation of both Rogers (1858, v. 2, p. 8) and White (1881, p. 58-59; 1883, p. 49-50). These rocks are Units 30-47 in Section A (Appendix C).

The basal lithology of the Pocono Formation is tilloid, conglomeratic mudstone or tillite-like rock of non-glacial origin (Pettijohn, 1957, p. 265). The tilloid is massive, non-bedded, unsorted rock and in general character resembles a tillite (Fig. 4). The rock contains a complete size range of particles from clay to boulders and in thin sections (Fig. 5) silt and sand grains "float" in a clay matrix. Rounded to well rounded pebbles and cobbles of red quartzite and white quartz up to 4 inches in diameter are common in the tilloid (Fig. 4). Pebbles of slate, sandstone, siltstone, chert, quartz, schist and gneiss occur less frequently (Table 1). A rounded boulder 2 feet in diameter occurs near the middle of the tilloid at Stop I (Fig. 1). At places the tilloid contains thin (less than 1 foot thick) beds of sandstone which have been deformed and reoriented relative to bedding orientation (Stop II, Fig. 1).

The fresh rock ranges in color from dark gray to light olive gray sometimes mottled with grayish red. The rock weathers to a characteristic color between dark yellowish brown and brownish gray. The tilloid usually occurs as a single massive unit, although at some exposures it is interbedded with sandstones (Localities 20, 39 & 7, Fig. 1) and elsewhere tilloid beds are separated by thin (about 1 mm thick) shales (Locality 12, Fig. 1). Where exposed the base of the tilloid has a sharp conformable contact with underlying red shale or gray sandstone of the Catskill Formation.

At Stop II (Fig. 1) the tilloid is overlain by sandstones of lithologic component 2 although more typically the tilloid has a gradational upper con-



Figure 4. Outcrop of typical tilloid at the base of lithologic component 1 (Locality 9, Fig. 1).

tact with an overlying massive and structureless pebbly mudstone which ranges in dominant grain size from clay to coarse-grained silt (Fig. 6). This lithology has no apparent bedding in outcrop, but laminae can be seen in thin sections. Sand grains and rounded pebbles and cobbles up to 3 inches in diameter are scattered throughout the mudstone (Fig. 7). The pebbles and cobbles have the same lithologies as pebbles and cobbles in the underlying tilloid, but they are not as abundant in the mudstone as in the tilloid.

The mudstone is usually light olive gray in color, often with some grayish red or brownish gray mottling. At some locations (e.g., Localities

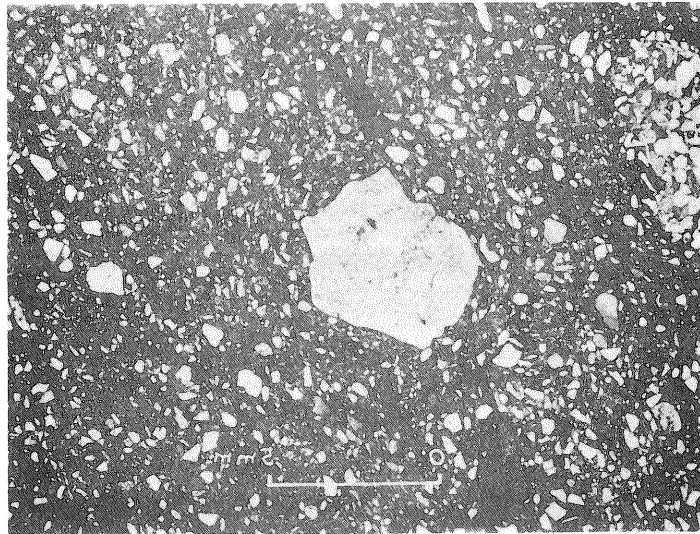


Figure 5. Thin section of tilloid from lithologic component 1 (Locality 9, Fig. 1).

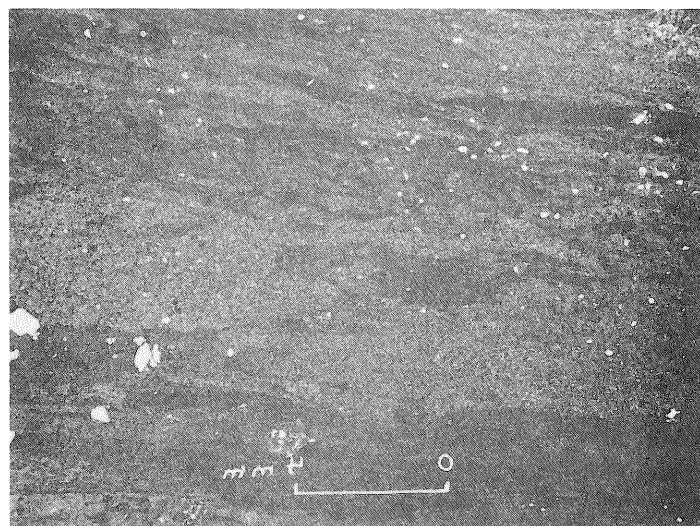


Figure 6. Thin section of pebbly mudstone from lithologic component 1 (Locality 9, Fig. 1).

Count 1				Count 2				Count 3										
Pebble Lithology	Roundness			Pebble Lithology	Roundness			Pebble Lithology	Roundness									
	Broken	Subangular	Subrounded		Well rounded	Long Axis	Inter. Axis		Short Axis	Broken	Subangular	Subrounded	Well rounded	Long Axis	Inter. Axis	Short Axis		
Quartz, white	X			Quartz, white		X		Quartz, white		X		Quartz, white		X		1.4	1.4	?
Quartz, white				Quartz, white				Quartz, white			X	Quartz, white			X	1.4	0.8	?
Quartz, white				Quartz, white				Quartz, white		X		Quartz, white			X	1	0.9	?
Quartz, white		X		Quartz, white				Quartz, white			X	Quartz, white				1.2	0.7	?
Quartz, white		X		Quartz, white				Quartz, white				Quartz, white			X	1.8	1	?
Quartz, white		X		Quartz, clear				Quartz, clear			X	Quartz, white			X	1.8	1.6	?
Quartz, white		X		Quartz, clear				Quartz, clear				Quartz, white			X	1.4	1	?
Quartz, white			X	Quartz, clear				Quartz, clear			X	Quartz, white			X	1.2	0.8	?
Quartz, white			X	Quartzite, white				Quartzite, white			X	Quartz, white			X	1.7	1.2	?
Quartz, white			X	Quartzite, white				Quartzite, white				Quartz, white			X	1.2	0.9	?
Quartz, white			X	Quartzite, white				Quartzite, white			X	Quartz, white			X	1	0.7	?
Quartz, white			X	Chert, red				Chert, red				Quartz, white			X	1.5	0.6	?
Quartzite, red	X			Chert, gray				Chert, gray		X		Quartz, white				1.9	1	?
Quartzite, red			X	Quartzite, red				Quartzite, red			X	Quartz, white			X	1.4	1	?
Quartzite, red			X	Schist, gneissic				Schist, gneissic		X		Quartz, clear			X	1.8	1	?
Quartzite, red			X	Conglomerate				Conglomerate			X	Quartz, clear			X	1.1	0.8	?
Quartzite, red			X	Slate, gray				Slate, gray				Quartz, clear			X	1.2	?	0.5
Siltstone, green			X									Siltstone, gray			X	1.3	0.8	?
Siltstone, green			X									Siltstone, green-gray			X	1.4	1.4	?
Siltstone, green			X									Siltstone, gray			X	3.2	2.8	?
Siltstone, green			X									Siltstone, gray			X	3.5	2.4	?
Siltstone, gray			X									Siltstone, gray			X	6	4	?
Shale, red			X									Slate, gray			X	1.8	1	0.7
Shale, red			X									Slate, gray			X	1	0.8	?
Shale, red			X									Slate, gray			X	3.5	2	?
Shale, red			X									Slate, gray			X	2	0.8	0.7
Shale, red			X									Slate, gray			X	1.7	0.7	?
Shale, red			X									Slate, gray			X	4	4	?
Quartz, smokey			X									Quartzite, red			X	4	4	2
Quartz, smokey			X									Quartzite, red			X	3	3	2.5
Sandstone, green			X									Quartzite, red			X	10	8	6
Sandstone, green			X									Shale, green			X	1.3	1	?
Slate, gray			X									Shale, green-gray			X	9	7	5
Slate, gray			X									Sandstone, gray			X	1	1	?
Chert, green			X									Schist, green			X	9	7.5	1

Table 1. Data from three pebble counts made in tilloid at Penn Haven Junction (Locality 9, Fig. 1).
Data obtained by drawing a 2 foot diameter circle on outcrop face and counting all pebbles with one dimension greater than 1 cm. Center of count 1 was 3 feet above base of tilloid; count 2, 13 feet above base; count 3, 20 feet above base.



Figure 7. Pebbles in pebbly mudstone of lithologic component 1 (Locality 9, Fig. 1). Note variation in orientation of pebbles. Pen is 5 inches long.

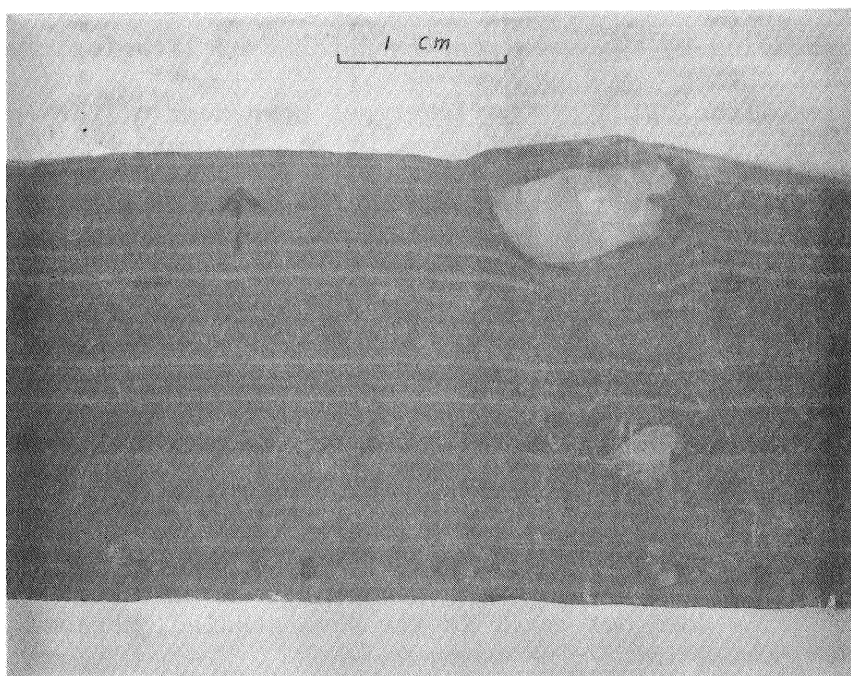


Figure 8. Laminite of lithologic component 1 with 'dropped in' pebble (Stop 1, Fig. 1).

17, 18, 19, 36, Fig. 1) the mudstone contains lenses of siltstone and sandstone which are randomly oriented with respect to bedding because of load-casting and slumping at the time of deposition.

The pebbly mudstone grades upward into a light olive gray laminite which comprises coarse-grained silt or very fine-grained sand laminae alternating with clay laminae. The laminae range from a millimeter to a centimeter in thickness and the coarse-grained laminae have both normal and reverse grading. Many of the coarse grained laminae have medium- to very coarse-grained sand grains and a few pebbles up to 2 inches in diameter scattered along planes of laminae (Fig. 8). The laminae show lateral variation in thickness, but are generally persistent for tens of feet. In some outcrops (e.g., Localities 9 & 18, Fig. 1) the coarse-grained silt laminae become progressively thicker in the upper part of the laminite sequence and are overlain directly without interbedding by the overlying sandstones of lithologic component 2.

The three lithologies of the lowermost component of the Pocono occur at Stop I (Fig. 1) where the gradational character of the contacts is also well exposed. The best exposure of the three lithologies comprising lithologic component 1 occurs at Penn Haven Junction (Locality 9, Fig. 1) which is diagrammatically shown in Figure 9.

The areal distribution and thickness of the tilloid, pebbly mudstone and laminite lithologies are shown in Figure 10. To the east of the sections indicated, erosion has removed all Pocono rocks. To the west, the basal tripartite sequence does not occur in the area studied, presumably because of non-deposition in that area. Note the northward thinning of the tilloid and a northward thickening of the pebbly mudstone. Thickening of the pebbly mudstone is most striking along the southern margin of the Wyoming-Lackawanna

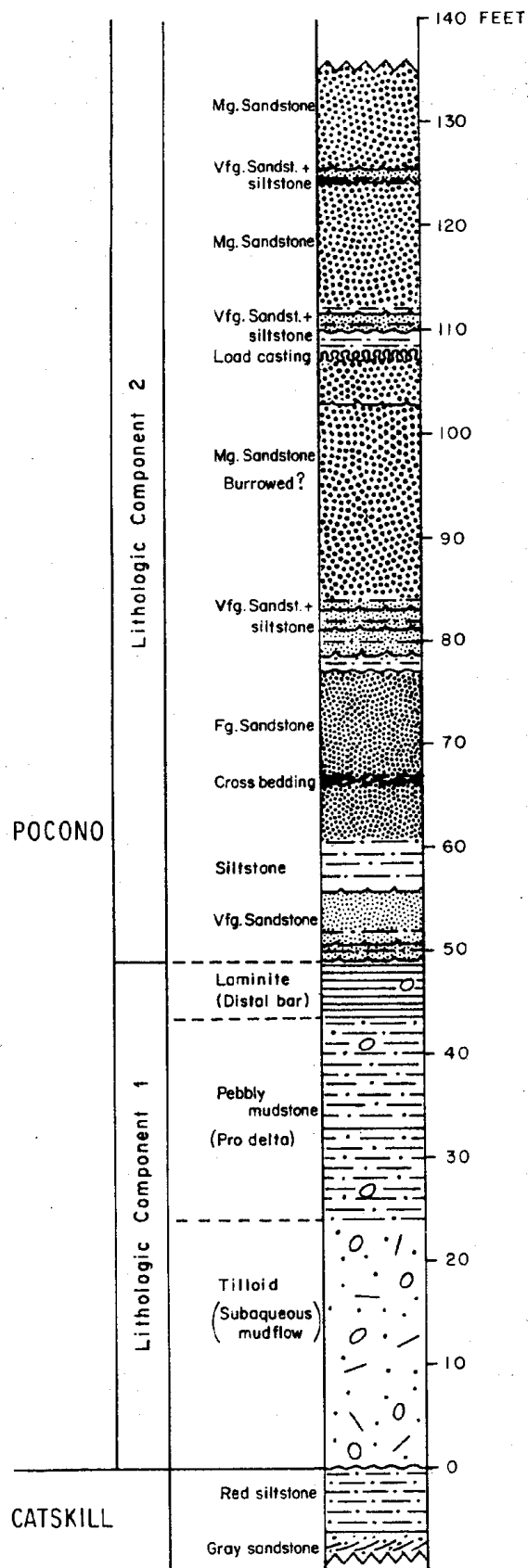


Figure 9. SUCCESSION OF UPPERMOST CATSKILL AND LOWERMOST POCONO ROCKS AT PENN HAVEN JUNCTION, CARBON COUNTY, PA. (Locality 9, Figure 1)

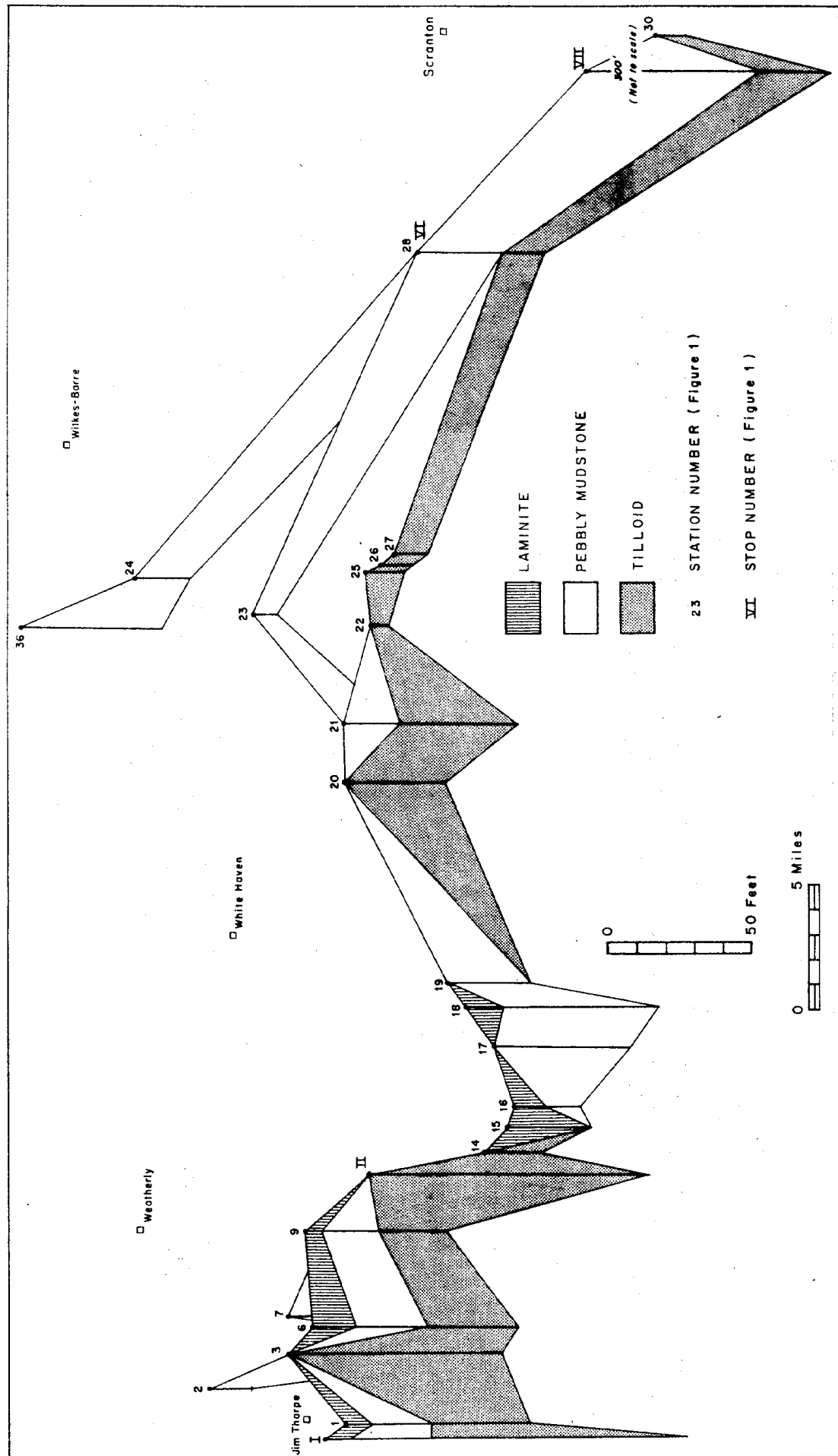


Figure 10. STRATIGRAPHIC CORRELATION DIAGRAM OF THE BASAL POCONO ROCKS IN NORTHEASTERN PENNSYLVANIA.

basin between Locality 36, Stop VII and Stop VIII (Fig. 1). The pebbly mudstone also becomes more shaly and contains fewer clasts in the area of the Wyoming-Lackawanna basin. Although the laminite is seen mainly in the southern part of the area, traces of the lithology occur at Locality 28 and Stop VII (Fig. 1).

The gradational contacts of the tilloid, pebbly mudstone and laminite indicate an environmental association of these lithologies and all the lithologies appear to require a subaqueous environment of deposition. The tilloid most resembles a subaqueous mudflow (Dott, 1963; Schermerhorn and Stanton, 1963), and some of the pebbly mudstone may be a lateral equivalent of the tilloid. However, the fineness of grain size, the poorly developed laminae and the position of the mudstone beneath the laminite suggest either a shelf or prodelta environment of deposition (Coleman and Gagliano, 1965, p. 142-143). The laminite is the product of a higher energy environment than the underlying mudstone and most closely resembles laminated silts and clays deposited in the distal bar part of the deltaic plain (Coleman and Gagliano, 1965, p. 143-144).

Lithologic Component 2

Overlying the basal tripartite sequence of lithologic component 1 at the type section is a 42 foot thick series of well sorted, rippled, and planar bedded sandstones. The sandstone generally is composed of well sorted, fine- to medium-grained, quartz grains with coarse-grained beds at some localities. Conglomeratic beds are rare in this unit in the southern part of the area, but occur frequently on the north side of the Wyoming-Lackawanna basin. Small (1 mm or less) interstitial grains of hematite are often scattered uniformly throughout the unit in the northern part of the area with

the result that the sandstone is a distinctive grayish orange color in the Wyoming-Lackawanna basin area whereas to the south the sandstone is generally white or olive gray in color and weathers very light gray.

Uniformity and continuity of bedding within outcrops (Fig. 11) is the most distinctive feature of this sandstone and is shown at almost every outcrop (e. g., Stops I and II; Localities 12 and 35, Fig. 1). Beds ranging from 1 inch to 2 feet thick are separated by uniform bedding planes which are persistent throughout the length of outcrops up to several hundred feet long (e.g., Localities 12 and 35, Fig. 1). Some beds have symmetrical ripple marks on their upper surfaces (Fig. 12), and a few have vertical animal burrow structures (Locality 9, Fig. 1).

Load casts occur at the base of these sandstones where they overlie shale (Fig. 13). Most load casts are small, but some are up to 2 feet in diameter and occur in a chaotic zone 3 to 4 feet thick. Cross bedding occurs within some planar beds and comprises uniformly oriented (within the same bed) steep planar foresets or sweeping curved foresets with tangential bases. Orientations of cross strata are variable.

The upper contact of the planar bedded sandstones is seldom exposed, but available exposures (e.g., Locality 12, Fig. 1) indicate that the sandstone in the uppermost beds of lithologic component 2 are interbedded with siltstones and shales of the overlying lithology.

The planar bedded sandstones appear to have the same areal distribution as the underlying tripartite sequence, (Fig. 10), but seem to be a more persistent lithology within the general boundaries of that area. The sandstones have a northward thickening from 42 feet at Jim Thorpe (Stop I, Fig. 1; Units 41-48, Section A, Appendix C) to over 150 feet at Scranton (Locality 35, Fig. 1; Unit 15, Section C, Appendix C). The sandstones also show a northeastward thickening from zero thickness at Locality 36 (Fig. 1) to 150

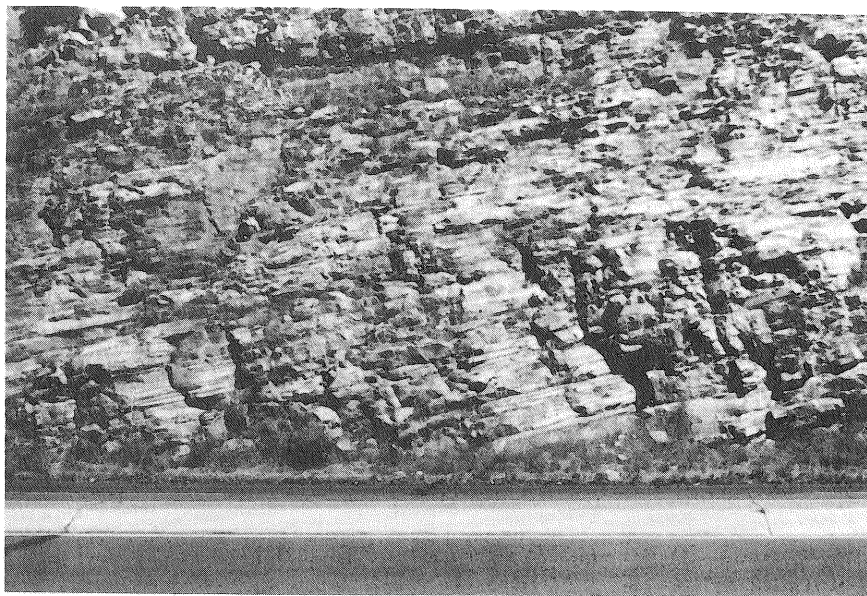


Figure 11. Planar bedded sandstones of lithologic component 2 along route US 611, south of Scranton (Locality 35, Fig. 1).



Figure 12. Rippled surface in planar bedded sandstone of lithologic component 2 (Locality 9, Fig. 1).

feet at Scranton and then a thinning further to the northeast to zero thickness south of Carbondale (Fig. 1). Lithologic component 2 appears to be the main lithology of the Pocono on the north side of the Wyoming-Lackawanna

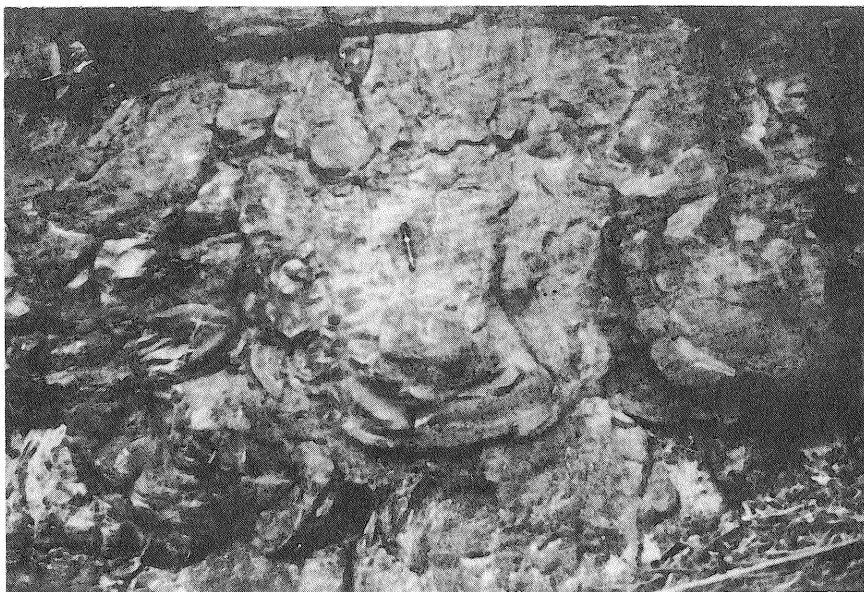


Figure 13. Load casts at the base of planar bedded sandstone of lithologic component 2 (Locality 5, Fig. 1).

basin, but this area has not been examined in detail except in the area north of Scranton (Fig. 1). Rock exposed at Stop VIII and Locality 32 (Fig. 1) suggests that sandstones of lithologic component 2 comprise most if not all of the Pocono rocks between Scranton and the point where the northeastward thinning Pocono Formation disappears (Fig. 1).

The lower sandstones of this component, particularly those with load cast structures, may be distributary mouth bar sediments (Coleman and Gagliano, 1965, p. 144-145), but the bulk of the planar bedded and ripple marked sandstone seems most typical of extensive intertidal-flat sands (Evans, 1965, p. 222-223; Wright, 1967, p. 103-105; Zenkovich, 1967, p. 660-661).

Lithologic Component 3

The sequence of interbedded sandstones, siltstones and shales comprising the next higher part of the Pocono Formation (Stop I, Fig. 1; Units 50-159, Section A, Appendix C) is characterized by bedding uniformity, sharp contacts and a general lack of thick conglomerates. In those places where lithologic

components 1 and 2 do not occur, these rocks overlies Catskill rocks directly. The upper limit of this interval is marked by the occurrence of the first mappable conglomerate in the Pocono sequence.

The sandstones range from very fine- to coarse-grained with fine- to medium-grained sandstones dominating. At the type section about 60 percent of these rocks are fine- to medium-grained sandstones with shale and siltstones comprising less than 10 percent of the unit. Dark gray shale chips and rounded quartz grains up to 1 inch long occur in the lower part of some sandstone beds. Plant debris and muscovite flakes occur on bedding surfaces of some beds. Conglomeratic sandstones are not common in the southern part of the area, but occur in the western and northern parts (e.g., Locality 36, Fig. 1). The sandstones of this interval in the Pocono are often massive, lacking bedding planes and other sedimentary structures. Cross-bedding is occasionally well developed, but generally absent.

The siltstones and shales are mainly thin beds 1 inch or less to 6 feet in thickness. Little is known about the lateral continuity of these beds, but some beds appear to be persistent for several hundreds of feet. The units are dark gray in color and weather to lighter shades of gray. One thick shale-siltstone sequence within this interval is generally deeply weathered, recessed in outcrop and characteristically grayish orange to yellowish brown in color. This lithology occurs at a similar stratigraphic horizon at Stop I (Unit 147, Section A, Appendix C), Stop V (Units 47-49, Section D, Appendix C) and at Locality 39 (Units 56-58, Section B, appendix C). Uniformity within outcrops and variability between outcrops is characteristic of these rocks.

The areal distribution and thickness variations of this interval in

northeastern Pennsylvania are not well known because of the lack of complete exposures and detailed mapping in much of the area. This part of the Pocono apparently thins to the north in contrast to the thickening of the underlying planar bedded sandstones and is only 10 feet thick where last seen northeast of Scranton (Stop VIII, Fig. 1). The upper part of the Pocono section exposed at Roaring Brook along Pennsylvania Route 611 (Locality 35, Fig. 1) is apparently a northern facies equivalent of lithologic component 3 seen at the type section. The rocks at Locality 35 comprise massive sandstones grading upward into siltstones and shale, massive siltstones, limestones and calcareous sandstones. The units appear uniform and persistent within the long outcrop. The limestones are nodular in character and very similar to limestones occurring in the lower Mauch Chunk Formation elsewhere (e.g., Locality 38, Fig. 1) and may represent the Mauch Chunk in this section.

Environments of deposition for this component are not wholly clear, partly because of a lack of study of the rocks and partly because of a lack of distinctive environmental indicators. The general character of the rocks and the presumed position in a deltaic plain environmental succession suggest deposition in interdistributary bays, distributary channels and as crevasse-splay deposits (Coleman and Gagliano, 1965, p. 145-147; Allen, 1965, p. 122-123, 148). Other adjacent deltaic plain environments are probably represented, but have not been recognized.

Lithologic Component 4

The uppermost interval of the Pocono Formation is characterized by a series of conglomerates, cross bedded sandstones, a few siltstones and occasional coal beds. The base is marked by the first massive, regionally mappable conglomerate in the Pocono in northeastern Pennsylvania. The remainder

of the member is dominantly sandstone. At the type section (Stop I Fig. 1) 70 percent of the member is sandstone, 25 percent conglomerate and 5 percent shale or siltstone. Almost all of the sandstones and conglomerates in this interval have a quartzitic texture and appear to be composed mainly of quartz with locally abundant muscovite flakes on bedding surfaces.

The conglomerates are composed almost exclusively of rounded white quartz pebbles as large as 3 inches in diameter, with $\frac{1}{2}$ inch diameter pebbles most common. Some chert, sandstone, quartzite and shale pebbles also occur, but are not abundant. The sand matrix ranges from fine- to coarse-grained and is generally light gray in color. The conglomerate beds are generally massive and structureless, and usually have sharp and irregular basal contacts. Conglomerate beds range from 5 inches to 50 feet in thickness and beds less than 10 feet thick are the norm.

The sandstones are massive and structureless, thinly bedded or cross bedded. The cross bedding ranges from long sweeping wedges with tangential bases to steep, uniformly thick, planar foreset beds (Fig. 14; Stop IV, Fig.1). Many of the sandstones contain scattered quartz pebbles up to 1 inch in diameter and some sandstones contain shale pebbles up to 3 inches long at or near the base of the sandstone. Plant debris and impressions are common on bedding surfaces of sandstones.

The siltstones and shales are thin, dark gray, discontinuous units usually containing abundant plant debris. Little is known about their abundance or lateral relationships. The coal beds are generally less than 6 inches thick and usually appear to be small lenses less than 10 feet in outcrop dimension.

The areal distribution and thickness variation of this interval is not

known because of the lack of detailed mapping in the area of study. The interval is about 800 feet thick at Stop I (Fig. 1) and about 800 feet thick at Locality 37 (Fig. 1). The lithologies of this uppermost component of the Pocono Formation seem consistent throughout the area except along the margin of the Wyoming-Lackawanna basin. Typical conglomerate lithologies are present at Locality 37 and near Stop VI (Fig. 1), but are not present further to the northeast, presumably because of non-deposition.

The upper contact of lithologic component 4 occurs throughout the area at the first occurrence of red siltstone or shale of the Mauch Chunk Formation. The rocks of this component have not been seen in areas where the Mauch Chunk is absent.

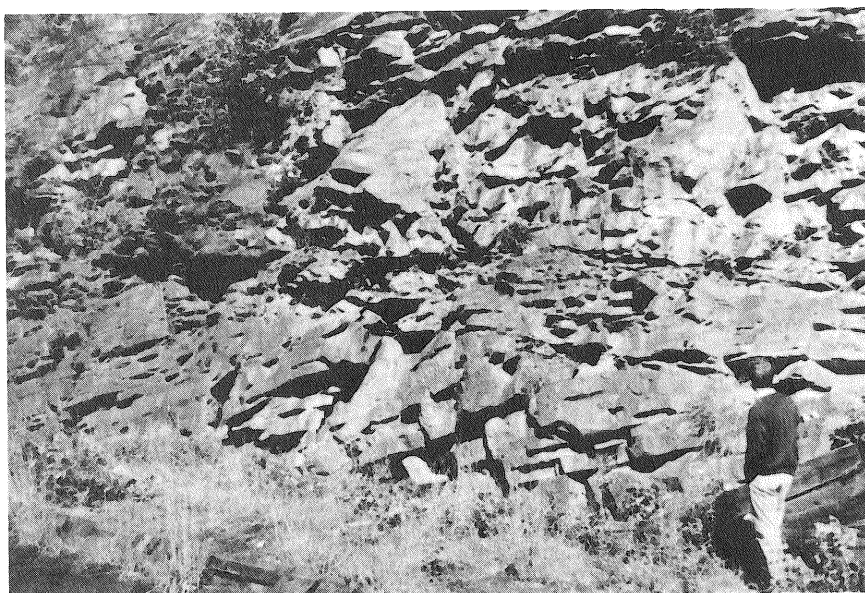


Figure 14. Steep, massive foreset beds in sandstones of the uppermost part of the Pocono Formation (Stop IV, Fig. 1).

Although this part of the Pocono has been separated as a distinctive component because of the presence of conglomerates, much of the component is similar to lithologic component 3 and presumably originated in the same environments. The uppermost part of the component has bedding form and sedimentary structures typical of fluvial deposits (Allen, 1965, p. 108-114; 138-143) and presumably formed in that environment. Most of the Pocono exposed at Locality 37 (Fig. 1) may have originated in the fluvial environment.

SEDIMENTARY HISTORY

Introduction

The sedimentary history of the Pocono Formation in northeastern Pennsylvania is currently in an early phase of reinterpretation following recent recognition (Sevon, 1969; in press) that the basal Pocono rocks (i.e., lithologic component 1) are not fluvial in origin as previously thought (e.g., Pelletier, 1958), but are subaqueous in origin. Study of the Pocono rocks within the context of a deltaic plain model is in progress, but only general aspects of the sedimentary complex have been worked out.

The ascending stratigraphic sequence of the Pocono Formation can be generally assigned to these environments of deposition:

Lithologic Component 1. Shelf (shale at Stop VII, Fig. 1), prodelta (pebbly mudstone), subaqueous mudflow (tilloid) and distal bar (laminite).

Lithologic Component 2. Distributary mouth bar, foreshore and tidal sand flat.

Lithologic Component 3. Interdistributary bay.

Lithologic Component 4.

A. Interdistributary bay and distributary channel.

B. Fluvial.

The distribution and regional variation of the four lithologic components are shown in Figure 15. This diagram shows thickening of components 1 and 2 in the Scranton area, disappearance of component 4 in the northern part of the area, overall thinning of the Pocono to the north and disappearance of the Pocono northeast of Scranton along with a loss of the Mauch Chunk such that Pottsville rocks rest directly upon Catskill lithologies along the northeastern margin of the Wyoming-Lackawanna basin.

The sedimentary model developed here attempts to provide a coherent history for the proposed environments of deposition and the distribution of the sediments formed in these environments.

The sedimentary history of the Pocono may be summarized as follows:

1. Transgression onto a pre-existing Catskill coastal plain accompanied by deposition of interbedded sandstones and shales, tilloid and pebbly mudstone.

2. Regression via development of a deltaic complex accompanied by deposition of laminite (lithologic component 1), planar bedded sandstones (lithologic component 2), interbedded sandstones and shales (lithologic component 3) and fluvial sandstones and conglomerates (lithologic component 4).

3. Change in sediment supply and environmental conditions resulting in cessation of Pocono sedimentation (dominantly sands) and initiation of Mauch Chunk sedimentation (dominantly red muds).

4. Thinning and erosional loss of the Pocono Formation, thinning loss of the Mauch Chunk Formation along the northeastern margin of the Wyoming-Lackawanna basin and overstepping by the Pottsville Formation.

Details of this sedimentary history are discussed below.

Pre-Pocono Surface

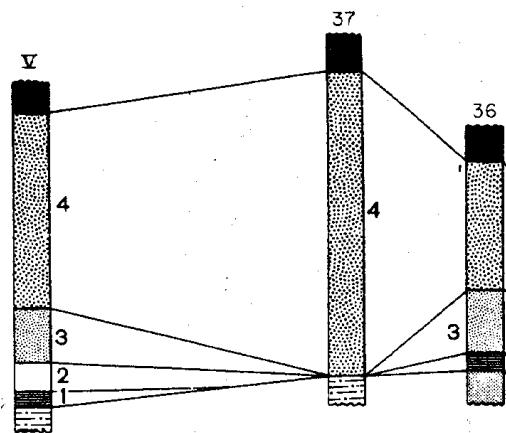
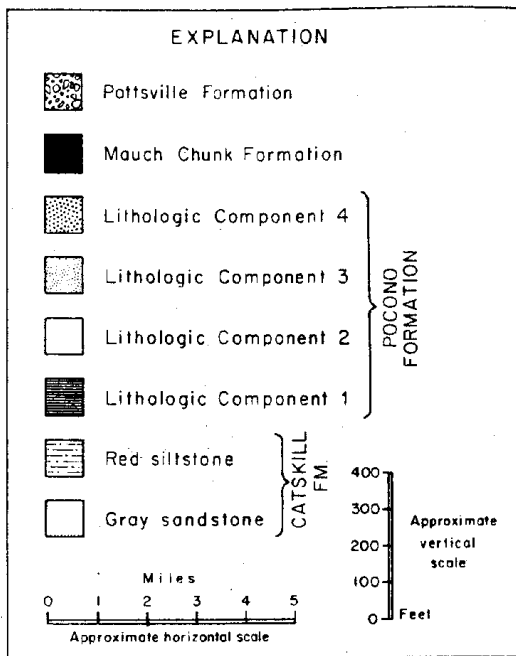
Prior to initiation of Pocono sedimentation, deposition in northeastern

Pennsylvania occurred in a Catskill coastal plain complex (Allen and Friend, 1968). Figure 16 shows the probably northern limit of this coastal plain and the general distribution of depositional environments in latest Catskill time. The distribution of Catskill fluvial systems on this coastal plain is not known, but one system apparently was oriented more or less north-south through the Jim Thorpe area (Fig. 16) as indicated by the distribution of the basal Pocono rocks. Conglomerates and typical alluvial cyclic sediments were deposited by this system in the southern part of the area while sediments thought to be more typical of Catskill marginal marine environments were deposited in the area of the Wyoming-Lackawanna basin.

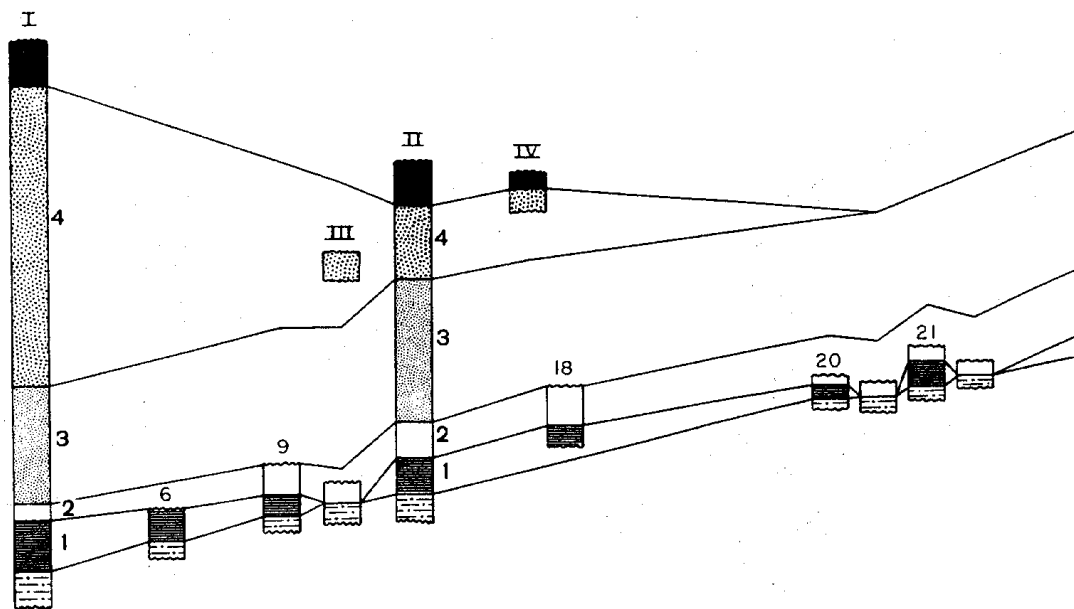
Catskill-Pocono Transition

Catskill sediment supply apparently waned thus failing to keep pace with continuing basin subsidence and allowing a marine transgression onto the coastal plain (Fig. 16). As transgression proceeded southward, some erosion occurred creating surfaces such as that at Stop VI (Fig. 1). Deposition of sandstones and interbedded red shale (e.g., Units 1-29, Section A, Appendix C) occurred in marginal marine environments and comprise a transition zone into the initiation of Pocono sedimentation.

During transgression, either excessive influxes of sediment from the pre-existing fluvial system and/or slump of material built up at the mouth of this fluvial system resulted in sporadic subaqueous mudflows and deposition of tilloid. These mudflows were mainly confined to the channels of the inundated part of the older fluvial system, thus giving rise to the apparent erratic distribution of the tilloid. As transgression proceeded southward, tilloid deposition occurred in areas more proximal to input (e.g., Stop I, Fig. 1) while contemporaneous mudstone and shale deposition occurred in more distal areas (e.g., Stop VII, Fig. 1).



Jim Thorpe



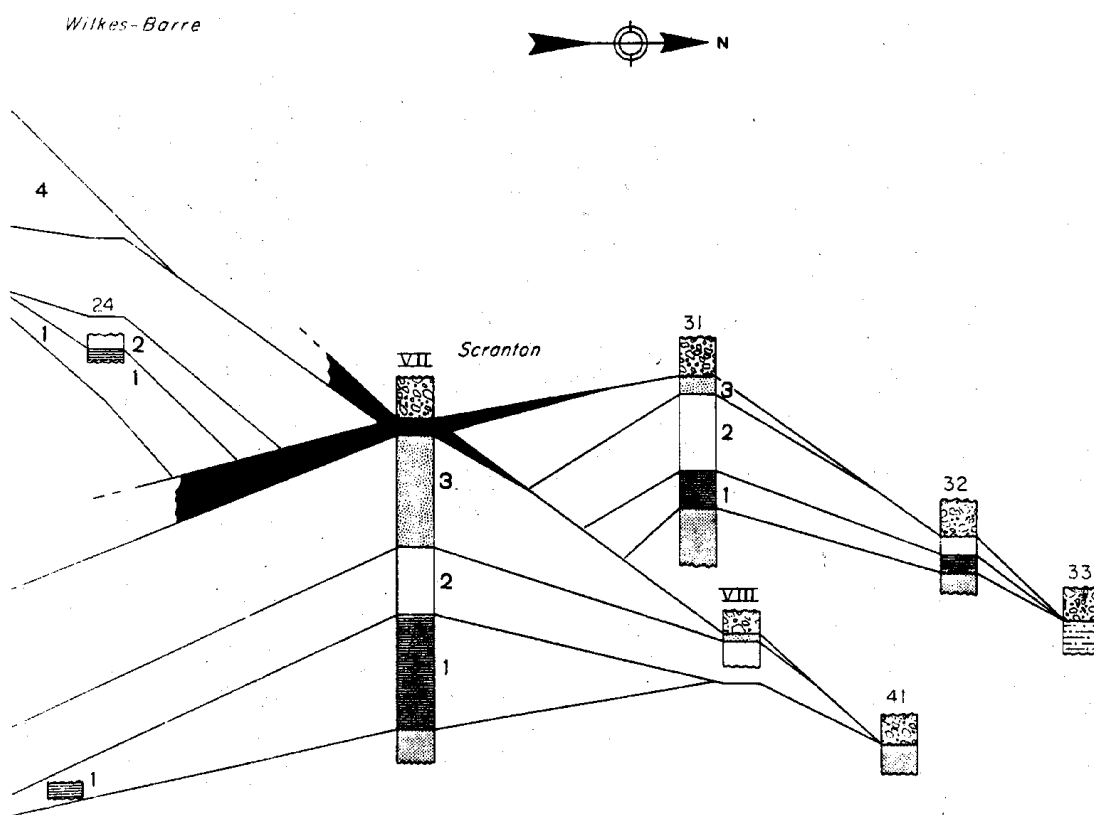
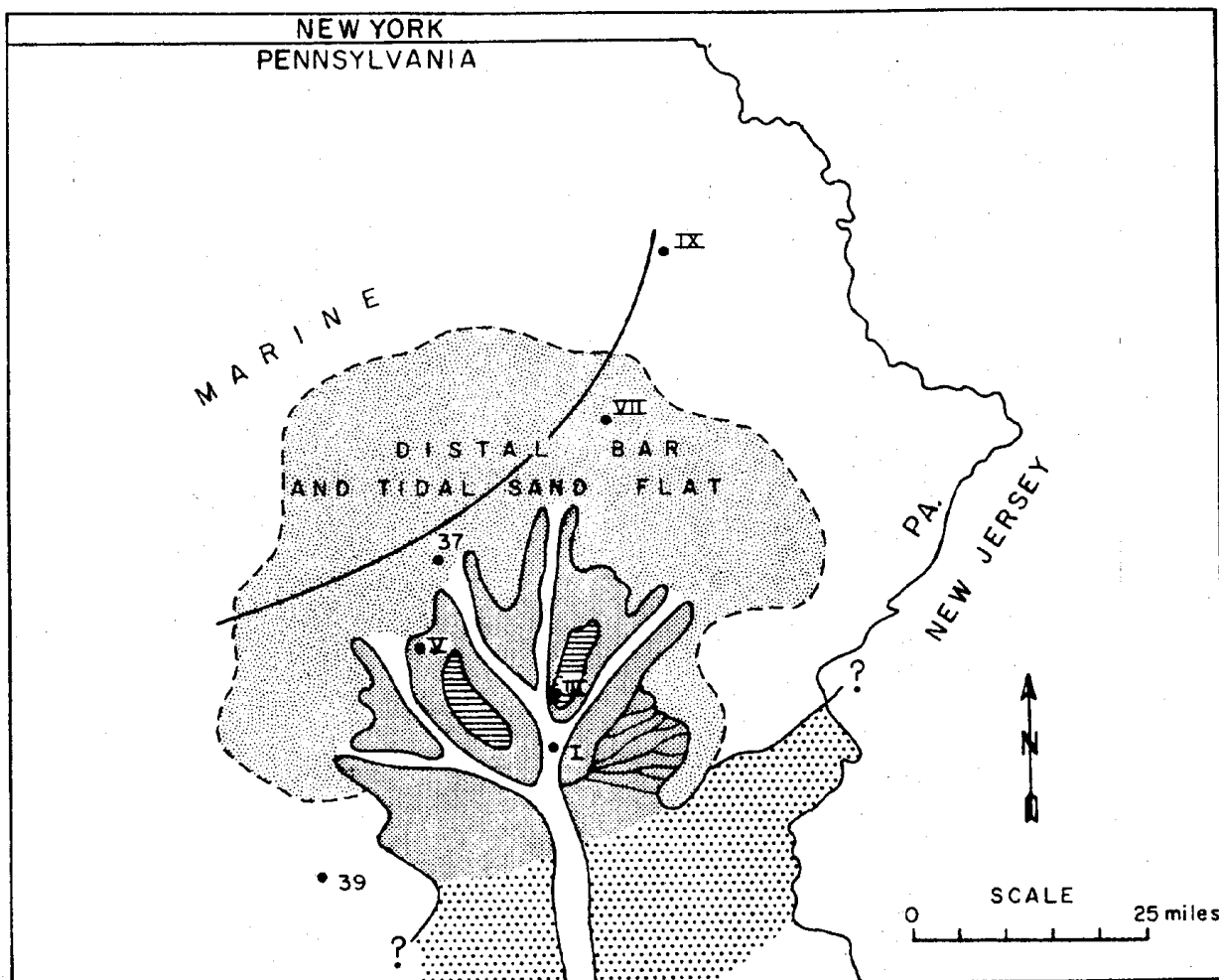
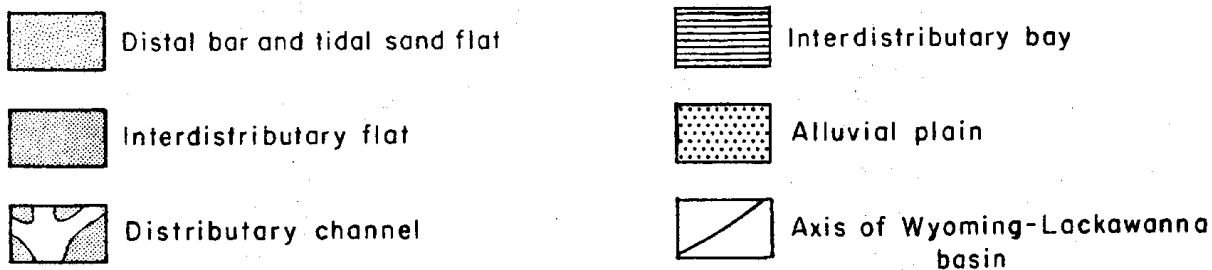


Figure 15. STRATIGRAPHIC CORRELATION DIAGRAM OF THE LITHOLOGIC COMPONENTS OF THE POCONO FORMATION IN NORTHEASTERN PENNSYLVANIA.

(Underlying and overlying rocks are indicated where known)



ENVIRONMENTS OF DEPOSITION



VII Field trip stop

37 Outcrop locality

Figure 16. Distribution of probable uppermost Catskill depositional environments and the area of Upper Devonian-Lower Mississippian transgression in northeastern Pennsylvania.

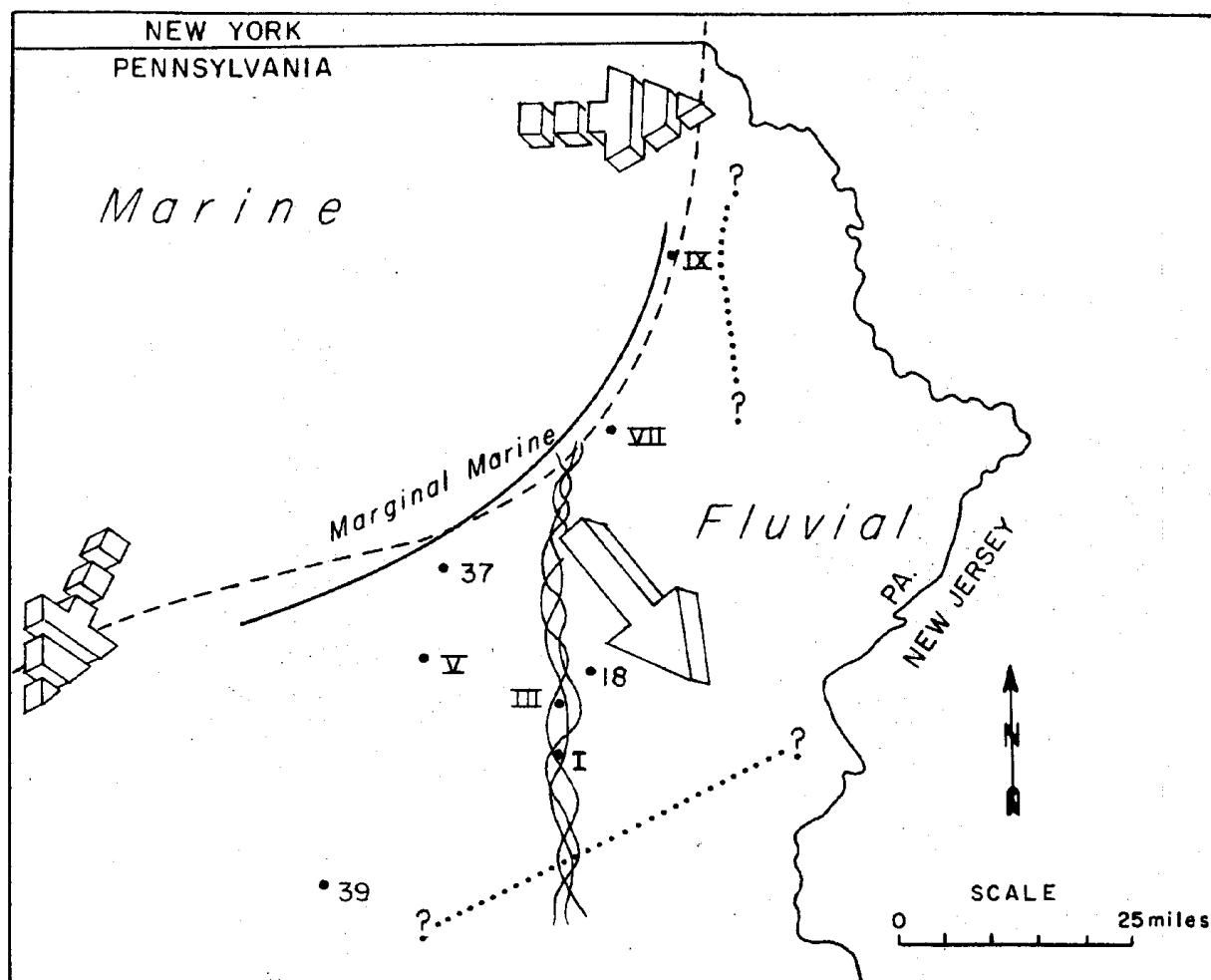
Pocono Regression

Eventually, sediment input exceeded subsidence and removal, and regression occurred with the development of a deltaic plain complex (Fig. 17). A Mississippi delta model is used here (Coleman and Gagliano, 1965) as a basis for interpretation. The vertical sequence of laminite (lithologic component 1), planar bedded sandstones (lithologic component 2) and interbedded sandstones and shales (lithologic component 3) (e.g., Stop I, Fig. 1) shows the progressive changes in depositional environments resulting from lateral delta growth. The laminite was deposited in a deltaic distal bar and is succeeded by distributary bar mouth sands which are in turn succeeded by tidal sand flat sediments. Some interbedded sandstones and siltstones of lithologic component 3 were probably deposited in interdistributary bay environments, but most of this component has not yet been environmentally interpreted.

The regression was culminated by fluvial sedimentation (lithologic component 4) in the southern part of the area (e.g., Stop I and IV, Fig. 1). However, in the northern part of the area (e.g., Localities 28, 30, 34, 35, Fig. 1) Pocono fluvial deposits do not occur. In those places where the Mauch Chunk Formation overlies lithologic component 3 without the presence of lithologic component 4 (e.g., Locality 35, Fig. 1), there is no evidence that lithologic component 4 may have been deposited and then eroded prior to Mauch Chunk sedimentation. Apparently Pocono fluvial sedimentation did not extend northward to the northeastern Wyoming-Lackawanna basin area.

End of Pocono Sedimentation

The end of Pocono sedimentation and the initiation of Mauch Chunk sedimentation is marked by two lithologic changes: (1) a return to red bed sedimentation and (2) a marked decrease in sediment grain size (from fine- and medium-grained sand to silt). These changes are probably related to



• VII- Field Trip Stop

• 37- Outcrop Locality

--- Probable shoreline in uppermost Catskill time

~ Uppermost Catskill fluvial system

... Probable limit of transgression

— Axis of Wyoming-Lackawanna basin

Fluvial— Probable depositional facies in uppermost Catskill time



Direction of upper Devonian-lower Mississippian transgression.



Direction of probable upper Devonian-lower Mississippian transgression

Figure 17. Distribution of Pocono depositional environments at one interval during Pocono regression.

continued decline of activity in the source area and change in environment of deposition to widespread tidal mud flats. The change from Pocono to Mauch Chunk sedimentation appears to be transitional everywhere in northeastern Pennsylvania that the contact zone is seen.

Pocono Disappearance

Northeast of Scranton the Pocono Formation thins rapidly on both sides of the Wyoming-Lackawanna basin as a result of loss of lithologic components 1 and 3 and probable thinning of lithologic component 2 (Fig. 15). Pocono rocks do not occur more than 10 miles northeast of Scranton (Fig. 1) and lithologic component 2 is the only lithology present at the northeastern limit of Pocono occurrence. The amount of thinning northeast from Locality 35 (Fig. 1) is about 80 feet per mile.

The extent of original Pocono occurrence east of the present Wyoming-Lackawanna basin is not known. There is currently no evidence to indicate that the region was a sediment contributing positive area nor is there any evidence to indicate that the region was extensively transgressed during Pocono sedimentation. The most northeastern Pocono rocks are lithologic component 2 which imply deposition marginal to a positive area.

The Pocono-Pottsville contact represents an unconformity everywhere northeast of Scranton, but no detectable angular discordance occurs. The unconformity presumably marks the loss of some Pocono by erosion, but the amount is not known. To the southwest of Scranton, the Mauch Chunk and Pottsville have a transitional contact at Locality 36 (Fig. 1) and may be interbedded even further to the northeast.

The lack of evidence of erosion of Mauch Chunk rocks prior to Pottsville deposition, the lack of angular discordance between the Pocono and Pottsville and the disappearance of the whole Mississippian system along the margins of the Wyoming-Lackawanna basin are parts of one of the most interesting problems of Upper Paleozoic sedimentary history yet to be worked out.

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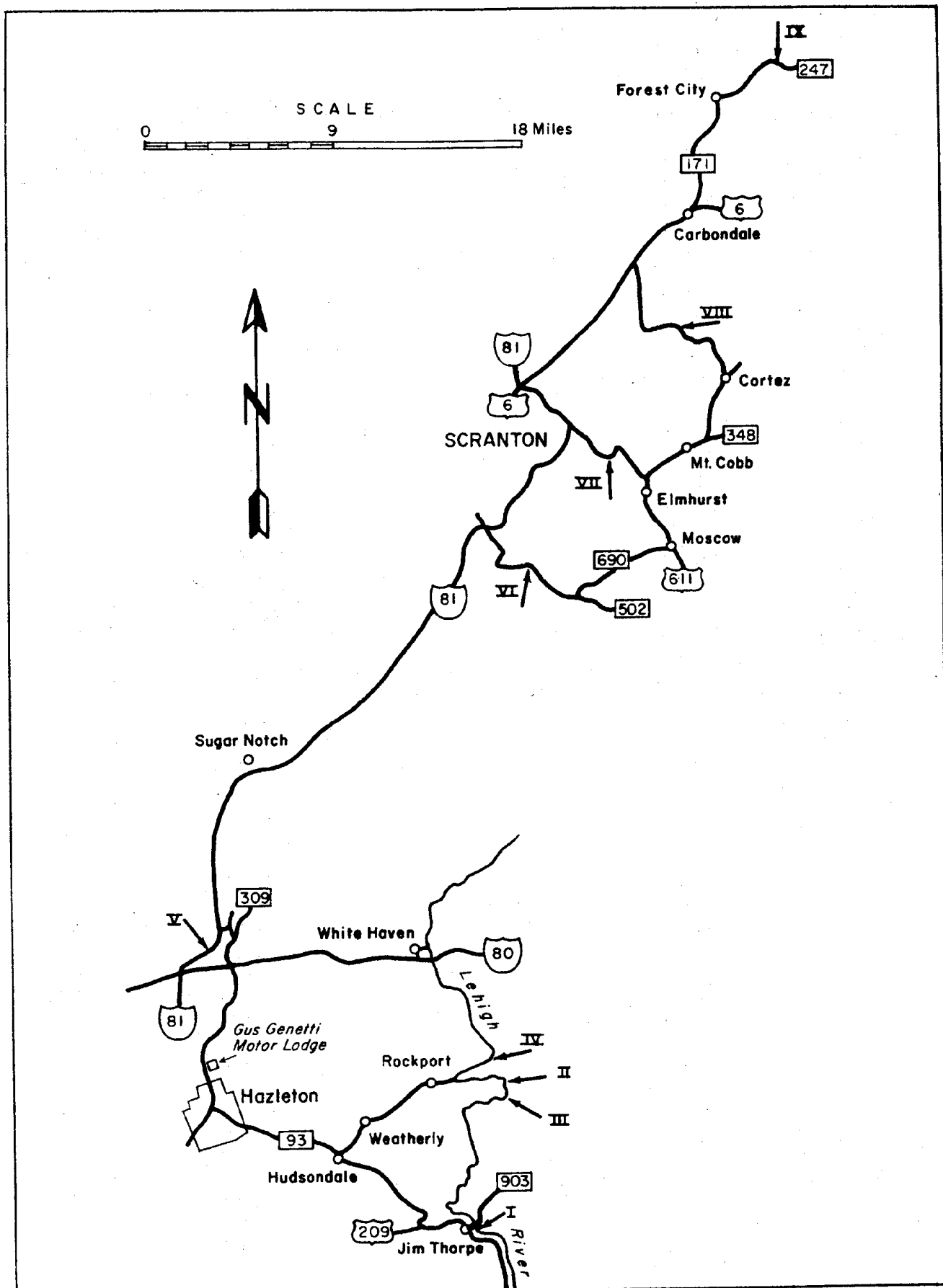


Figure 18. Generalized route map for the field trip.

ROAD LOG

Friday, 3 October, 1969

Departure from Gus Genetti Motor Lodge, Hazelton, Pennsylvania, at 8:00 a.m.

Field trip will follow route shown in Figure 18.

Mileage	Cumulative Mileage	
0.0	0.0	Leave Gus Genetti Motor Lodge parking lot. Turn LEFT onto PA 309S.
2.0	2.0	Turn LEFT on PA 93.
2.7	4.7	Strippings on right in Llewellyn Formation.
0.7	5.4	Borough of Beaver Meadow.
1.7	7.1	Outcrop on left of Pottsville Formation.
1.0	8.1	Village of Hudsondale.
1.05	9.15	Outcrops on both sides in Mauch Chunk Formation.
0.15	9.3	Cross Quakake Creek.
2.2	11.5	Crest of Broad Mountain.
1.5	13.0	Start long section on both sides of Pocono Formation.
0.6	13.6	View ahead of East Jim Thorpe (formerly Mauch Chunk).
1.2	14.8	Turn LEFT on US 209N.
2.0	16.8	Start long strike section in Mauch Chunk-Pottsville transition zone on right. Drifts made during uranium exploration on right at 17.2 miles.
0.55	17.35	Borough of Jim Thorpe.
0.15	17.5	Type locality of Mauch Chunk Formation on right.
0.2	17.7	Turn LEFT onto PA 903N at stop light.
0.1	17.8	Turn RIGHT at east end of bridge over Lehigh River. Bear right through supermarket parking lot to access

road paralleling railroad tracks. Follow road south.
Outcrop on left is Pocono Formation.

0.65 18.45 Cross railroad tracks to parking area. STOP I.

Stop I is the recommended type locality of the Pocono Formation and is described in Section A (Appendix C). The section starts in the upper part of the Catskill Formation and ends in the Mauch Chunk Formation. The following will be discussed at different sites in the section:

1. An Early Mississippian transgression interpreted from the interbedded sandstones and shales of the uppermost Catskill and the tilloid and pebbly mudstone of lithologic component 1.

2. Regression interpreted from the laminite of lithologic component 1 and the planar bedded sandstones of lithologic component 2.

3. The probable environments of deposition of lithologic component 3.

4. The similarity and difference of lithologic components 3 and 4.

Reference will be made to the probable relationship between the Pocono rocks at Stop I and the type locality of the Beckville and Mt. Carbon Members of the Pocono Formation near Beckville (28 miles to the southwest).

Leave parking area and return to US 209S via same route came. Mileage when passing through supermarket parking lot is 18.95.

0.6 19.05 Turn LEFT onto PA 903S. Cross bridge over Lehigh River. Note good view of type locality of Mauch Chunk Formation directly ahead.

0.15 19.2 Turn RIGHT onto US 209S at stop light at west end of bridge.

0.4 19.6 Exposure on left of sandstones and conglomerates and shales of Mauch Chunk-Pottsville transition zone.

Red siltstones of Mauch Chunk occur at both ends of the long exposure.

2.55	22.15	Turn RIGHT onto PA 93N. Redrock Quarry on left is in Mauch Chunk Formation.
1.4	23.55	Cuts on both sides in Pocono Formation.
3.75	27.3	Village of Hudsondale.
0.4	27.4	Cross Quakake Creek. Exposures of Mauch Chunk Formation in cuts immediately north of creek.
0.2	27.6	Turn RIGHT to Weatherly.
1.65	29.25	Borough of Weatherly.
0.55	29.8	Outcrop on left of Mauch Chunk Formation.
0.2	30.0	Turn RIGHT across bridge. Turn RIGHT immediately after crossing bridge and railroad.
0.1	30.1	Turn LEFT onto First Street.
0.4	30.5	Bear LEFT onto Eurana Avenue, then turn RIGHT onto East Main Street.
3.1	33.6	Turn RIGHT to Rockport. Village of Rockport.
0.6	34.2	Road joins from left. CONTINUE straight ahead. Proceed with caution along narrow road with blind curves.
0.5	34.7	Turn RIGHT onto old roadbed of New Jersey Central Railroad. Lehigh River on left. Outcrop on right between here and Stop II is all Pocono formation.
0.7	35.4	To left across Lehigh River is south portal of Rockport Tunnel.
0.1	35.6	To left across Lehigh River is large outcrop of uppermost rocks of the Pocono Formation. Top of slope is capped by conglomerate and overlain by red siltstones

of Mauch Chunk Formation.

1.65 37.25 To left across Lehigh River is mouth of Drakes Creek.
North dipping rocks on south side of creek are in
lower part of the upper member of the Pocono Formation.

0.25 37.5 STOP II.

The uppermost Catskill Formation rocks and the lower two lithologic components of the Pocono occur in this section which is described in Section H (Appendix C). Emphasis is placed on: (1) the change from fining upward cycles to interbedded sandstones and shales in the Catskill rocks, (2) the thick tilloid with included distorted sandstone lenses, (3) the planar bedded sandstones of lithologic component 2, and (4) the relationship of this section to Stop I.

Ripple marks and load casts occur in the recessed zone of the sandstone. To the east across the Lehigh River is a good view of the bedding continuity of lithologic component 2. Also interesting is the fact that the tilloid across the Lehigh is only 16 feet thick and is not present to the south on the other flank of the anticline.

Leave Stop II. CONTINUE straight ahead.

0.35 37.85 Outcrop on right of small anticline involving rocks
of upper Catskill Formation.

0.05 37.9 Outcrop on right of upper Catskill Formation.

0.25 38.15 Base of lithologic component 2 on right overlying Catskill rocks with no occurrence of lithologic component 1.

0.35 38.5 STOP III.

Interbedded sandstones and shales of lithologic component 3 and conglomerates of component 4 occur at this stop. The reason for sepa-

rating lithologic components 3 and 4 will be reviewed and discussion will be devoted to the probable environments of deposition of these rocks.

Buses proceed 0.85 mile to turn around area. Pick up at second part of stop at mileage 38.8. Return via same route came.

0.3	39.1	Top of Stop III.
0.65	39.75	Axis of anticline on left.
0.35	40.1	Base of section of Stop II.
0.2	40.3	Outcrop on left of upper member of Pocono. Fluvial sandstones?
0.05	40.35	Mouth of Drakes Creek across the Lehigh River on right.
1.6	41.95	South portal of Rockport Tunnel across Lehigh River on right.
0.5	42.45	On left is foundation of a water tank used in the days of steam locomotives.
0.3	42.75	Rockport access road enters from left. CONTINUE along the railroad roadbed. Ahead on left is one of the longest exposures of the Mauch Chunk Formation in northeastern Pennsylvania. Over 450 feet of the lowermost part of the formation is exposed. Planar contacts, uniformity of bedding, limestones and lateral continuity are features of the formation well exposed here.
0.2	42.15	Limestone zone in Mauch Chunk on left.
0.2	42.35	Waterfalls on left. Eolian (?) cross bedding exposed on left immediately north of waterfalls.

	42.45	Outcrop on left of deeply etched calcareous Mauch Chunk sandstone.
0.4	42.85	On left are interbedded red siltstones of Mauch Chunk and gray sandstone of Pocono.
0.1	42.95	To right across Lehigh River is north portal of Rockport Tunnel.
0.5	43.45	Outcrop on left of cross bedded Pocono sandstone.
0.7	44.15	On left, about 20 feet above road, are a few cobbles of Illinoian (?) outwash.
0.55	44.7	STOP IV.

Sandstones and some thin, discontinuous shale beds of lithologic component 4 are exposed at this stop. Discussion will center around the environmental interpretation of a series of truncated foreset beds exposed at the base of the outcrop. A fluvial point bar origin is considered.

CONTINUE on the railroad roadbed.

0.1	44.8	On right across Lehigh River is the mouth of Mud Run.
0.1	44.9	On left is cleavage dominated red shale of the Mauch Chunk Formation. Bedding is nearly horizontal.
0.55	45.45	To right is good view up the Lehigh River valley.
0.25	45.7	On left is mouth of Leslie Run.
0.05	45.75	On left is sandstone of uppermost Pocono Formation.
0.15	45.9	Ahead on left bank of river is a view of one of the remnant locks of the Lehigh Canal.
0.25	46.15	On right is a lock of the Lehigh Canal. The lock is constructed of Pocono sandstone and conglomerate and is part of that portion of the Lehigh Canal between Jim Thorpe and its terminus at White Haven which was completed in 1840 and partly destroyed by flood in 1841. Rebuilt, the canal served to transport coal

downstream until it was again destroyed by flood in 1862 and never rebuilt.

1.1	47.25	Bridge over Sand Run.
0.15	47.4	On left is complex of discontinuous beds and cross beds in sandstones of the upper member of the Pocono.
0.15	47.55	On right is lock of Lehigh Canal.
0.4	47.95	On left is cross bedded sandstone of the Mauch Chunk.
0.35	48.3	Pass between piers of old railroad bridge.
0.6	48.9	On left is Mauch Chunk Formation. On right across Lehigh River is Wisconsin kame deposit. To right is good view up the Lehigh River valley.
0.3	49.2	On left is Pocono Formation overlain by Wisconsin till.
0.15	49.35	On left are cross bedded and channeled sandstones of the upper member of the Pocono Formation.
0.15	49.5	STOP at road intersection. PROCEED STRAIGHT AHEAD.
0.2	49.7	On left is cross bedded sandstone of Mauch Chunk.
0.15	49.85	On left is Mauch Chunk Formation.
0.45	50.3	On left is Mauch Chunk Formation.
0.35	50.65	Pass under railroad bridge. Outcrop on left ahead is Mauch Chunk Formation.
0.15	50.8	Pass under US Interstate 80.
0.4	51.2	STOP at road intersection in White Haven. Turn LEFT onto PA 940W.
0.2	51.4	Turn LEFT on PA 940W.
0.3	51.7	Bear RIGHT on to US Interstate 80W. Bedrock in area is Mauch Chunk.

5.0	56.7	On left is Mauch chunk Formation.
0.3	57.0	On right is Mauch Chunk Formation.
3.1	60.1	Cuts on both sides in Mauch Chunk Formation.
3.9	64.0	Cuts on both sides in Pocono Formation.
0.2	64.2	Bear RIGHT onto US Interstate 81N (to Wilkes-Barre).
1.5	65.7	Top of Pocono section of Stop V.
0.45	66.15	STOP V. Park in pull-off area on left side of road.

The uppermost Catskill Formation and all components of the Pocono Formation are exposed here and described in Section D (Appendix C). Emphasis will be on: (1) the transition between Catskill and Pocono rocks, (2) the identification of the four lithologic components of the Pocono, and (3) the relationship of these rocks to those at Stop I.

CONTINUE north on US Interstate 81.

0.45	66.6	Outcrop of Catskill Formation on right.
0.4	67.0	Outcrops of Catskill Formation on both sides.
0.7	67.7	EXIT on Exit 42 to Dorrance.
0.2	67.9	Turn RIGHT at stop sign.
0.2	68.1	Turn RIGHT to PA 309 at stop sign.
0.7	68.8	Turn RIGHT onto PA 309S at stop sign.
1.5	70.3	Pass under US Interstate 80.
1.5	71.8	Outcrop of Wisconsin drift on left.
0.6	72.4	Outcrop of Mauch Chunk Formation on right.
2.1	74.5	Outcrop on left on Mauch Chunk-Pottsville transition zone.
0.8	75.3	Strippings on left in Llewellyn Formation.
0.75	76.05	Turn LEFT into Gus Genetti Motor Lodge parking lot.

End of First Day.

ROAD LOG

Saturday, 4 October, 1969

Departure from Gus Genetti Motor Lodge, Hazelton, Pennsylvania, at 8:00 a.m.

Field trip will follow route shown in Figure 18.

Mileage	Cumulative Mileage	
0.0	0.0	Leave Gus Genetti Motor Lodge parking lot. Turn RIGHT onto PA 309N.
0.7	0.7	Strip mines on right in Llewellyn Formation.
0.35	1.05	Outcrop on right is top of Mauch Chunk-Pottsville transition zone.
2.45	3.5	Cuts on both sides in Mauch Chunk Formation.
0.7	4.2	Outcrop of Wisconsin glacial till on right.
1.6	5.8	Turn LEFT onto US Interstate 80W (to Bloomsburg).
2.2	8.0	Cut in Pocono Formation.
0.1	8.1	Bear RIGHT onto US Interstate 81N (to Wilkes-Barre).
1.5	9.6	Top of Pocono section of Stop V.
0.4	10.0	Pull-off area on left side of road for Stop V.
0.4	10.4	Series of roadcuts on right are in undifferentiated Catskill Formation.
2.1	12.5	Cuts on both sides in Catskill Formation.
0.35	12.85	Rest area on right.
5.0	17.85	Start of long section of undifferentiated upper Catskill Formation through crest of Penobscot Mountain.
0.55	18.4	Base of Pocono Formation on right. The base of the Pocono here is sharp and well defined and a contrast to the base at Stop V. The rocks comprising the

Pocono are all part of lithologic component 4 and probably represent only fluvial deposits. The very extensive bedding plane is interesting because of its size, irregularity and the shale filled pockets which occur on the upper surface. The undercut toe at the west end of this outcrop holds considerable promise for future mass wasting problems.

1.5	19.9	Exposure on left of Mauch Chunk Formation.
0.35	20.25	Top of Mauch Chunk-Pottsville transition zone on right. Wyoming-Lackawanna basin ahead on left.
15.1	35.35	Lackawanna County Line.
0.65	36.0	Bear LEFT onto Exit 50 (to Moosic).
0.2	36.2	Bear RIGHT to PA 502.
0.8	37.0	Cross railroad track.
0.1	37.1	Turn LEFT onto PA 502E.
1.3	38.4	Roadcut on left in Pottsville Formation.
0.4	38.8	Luzerne County line.
1.4	40.2	Lackawanna County line.
0.1	40.3	Exposure on right of Pocono Formation.
0.4	40.7	Exposure on right of tilloid and laminite at base of Pocono Formation.
1.0	41.7	STOP VI. Park on left side of road in large pull-off.

In this exposure laminated and shaly lower Pocono rocks rest with local angular discordance on Catskill sandstones and shales. The sedimentological interpretation is that the Catskill rocks were cut during transgression and that the Pocono rocks represent offshore deposits of lithologic component 1. Arguments favoring a structural interpretation will be entertained.

CONTINUE on PA 502S.

0.8	42.5	Exposure on right is in Catskill Formation.
1.1	43.6	End of Nesbitt Reservoir.
0.75	44.35	Village of Springbrook.
1.15	45.5	Turn LEFT onto PA 690E.
0.2	45.7	Roadcut in Catskill Formation.
1.1	46.8	Exposure on left of Wisconsin till.
2.0	48.8	Junction with PA 307. CONTINUE straight ahead on PA 690E.
2.7	51.5	Turn LEFT onto US 611N at blinking light in Moscow.
2.0	53.5	Village of Elmhurst.
0.8	54.3	Turn LEFT at north end of Elmhurst just before bridge over Roaring Brook. Do not make a sharp left, but virtually straight ahead. Road proceeds past Elmhurst post office.
0.2	54.5	CONTINUE straight ahead where road turns left just past Elmhurst post office.
0.1	54.6	Old railway station on left.
0.15	54.75	Bear LEFT following paved road up hill.
1.35	56.1	Pass under telephone cable.
0.35	56.45	Pass under telephone cable.
0.55	57.0	Turn RIGHT down narrow gravel road.
0.8	57.8	STOP VII. Buses turn around and park in fields to right. Outcrop for stop is 0.5 mile further along road to left.

Shale exposed in the Nay Aug quarry is part of lithologic component 1 of

the Pocono Formation. Of particular interest in the quarry are the well developed scour and ripple structures on the interbedded siltstones. Measurements of these structures on 9 beds gave the following averages:

Ripple marks: orientation of crest - N 80 W, wave length - 10.38 cm, amplitude 0.86 cm, current orientation - toward N 10 E; Scour marks: orientation of elongation - N 17 E. Tilloid occurs in the bed of Roaring Brook below the shale and the shale can be traced upward into the overlying sandstones of lithologic component 2. Emphasis here will be on a probable shelf or prodelta environment of deposition for the shale and its significance in the sedimentary history of the Pocono Formation. The upper part of the Pocono section exposed across the brook on US 611 will be discussed also.

Shales in this quarry were used for brick in the Nay Aug Brick Company. Less shaly material from this stratigraphic interval elsewhere in northeastern Pennsylvania is frequently quarried for use as road metal.

Return to US 611 by same route came.

0.8	58.6	Turn LEFT onto paved road.
2.2	60.8	Bear RIGHT at intersection.
0.25	61.05	STRAIGHT ahead at stop sign. Elmhurst post office on right.
0.2	61.25	Turn LEFT onto US 611 N at stop sign.
0.95	62.2	Outcrop on right of Wisconsin drift.
0.3	62.5	Outcrop on right of Catskill Formation.
0.75	63.25	Outcrop on right of Catskill Formation.
0.15	63.4	Outcrop on right of Wisconsin drift. View ahead of cliff formed of sandstones of lithologic component 2.
1.0	64.4	Red Catskill rock on right.

0.2	64.6	Tilloid of lithologic component 1 on right.
1.0	65.6	Base of section of lithologic component 2. This section is described in Section C (Appendix C). The thick sequence of planar bedded sandstones is correlated with similar sandstones at Stops I and II and with rocks on the north side of the basin (Section E, Appendix C).
0.4	66.0	Small outcrop on right of conglomerate occurring in center of Pocono Formation in this section.
0.1	66.1	Base of section of upper part of Pocono Formation. Rocks are uniform sandstones and shales with limestones near top which are probably Mauch Chunk equivalent.
0.2	66.3	Basal Pottsville conglomerate.
0.25	66.55	Bear RIGHT onto Tighe St. exit.
0.1	66.65	Continue bearing RIGHT.
0.15	66.8	Turn LEFT to US 611S at stop sign.
0.15	66.95	Bear LEFT to US 611S at road fork.
0.2	67.15	Join US 611S.
0.4	67.55	Lithologic component 2 on left.
1.85	69.4	Roaring Brook Township.
1.25	70.65	Turn LEFT onto PA 348E (to Mt. Cobb).
2.0	72.65	Village of Mt. Cobb.
0.7	73.35	Borrow pit on left in Catskill Formation.
0.85	74.2	Turn LEFT onto road to Cortez.
2.7	76.9	Village of Cortez.

0.8	77.7	Bear LEFT (straight ahead) at road fork.
0.65	78.35	Turn LEFT at intersection.
0.95	79.3	Outcrop of red Catskill on both sides.
1.35	80.65	Pass under power line.
0.1	80.75	Pass under power line.
0.4	81.15	STOP VIII. Park along right side of road. Quarry is on left side.

Planar bedded sandstones of lithologic component 2 are well exposed in this quarry. Small scale cross bedding, lithologic and bedding uniformity, and the upper contact are features of particular interest. The sandstone is overlain by dark gray shale of lithologic component 3 which is in turn overlain by sandstone and conglomerate of the Pottsville Formation.

Discussion will emphasize the northward thinning of the Pocono Formation.

CONTINUE straight ahead along road.

1.8	82.95	Turn LEFT at road fork.
0.15	83.1	Turn RIGHT at stop sign.
0.25	83.35	Turn RIGHT after crossing bridge in Archbald.
0.6	83.95	Outcrop on left in Llewelyn Formation.
0.8	84.75	Borough of Jermyrn.
0.6	85.35	Bear RIGHT at intersection.
0.7	86.05	Turn LEFT onto PA 107.
0.35	86.4	Turn RIGHT to US 6E.
0.15	86.55	Turn RIGHT onto US 6E.
3.45	90.0	Turn LEFT on US 6E.
0.45	90.45	Turn LEFT on US 6E.
0.1	90.55	Turn LEFT onto PA 17IN.
4.35	94.9	Borough of Vandling.

1.35	96.25	Borough of Forest City.
0.3	96.55	Turn RIGHT onto PA 247N.
0.55	97.1	Turn LEFT on PA 247N.
0.45	98.05	Bear RIGHT on PA 247N at road fork.
0.35	98.4	Boulder of Pottsville (Griswold Gap conglomerate) on left.
0.25	98.65	STOP IX. Outcrop is north of road about 100 yards.

This is the type locality of the Griswold Gap conglomerate which I. C. White placed at the base of the Pocono (see discussion in Appendix B). The conglomerate is actually the base of the Pottsville Formation and rests on gray Catskill sandstone with no intervening Pocono.

Discussion will synthesize the sedimentary history of the Pocono Formation in northeastern Pennsylvania as interpreted from the rocks seen on the field trip.

TURN AROUND and return via same route came.

0.25	98.9	Boulder of Pottsville (Griswold Gap conglomerate) on right.
1.3	100.2	Turn RIGHT on PA 247S.
0.35	100.55	Borough of Forest City.
0.2	100.75	Turn LEFT on PA 171S at stop sign.
0.4	101.15	Borough of Vandling.
1.7	102.85	Village of Simpson.
3.95	106.8	Turn RIGHT on US 6W.
0.1	106.9	Turn RIGHT on US 6W.
0.55	107.35	Turn RIGHT on US 6W at 8th Ave.
2.2	109.55	Borough of Mayfield
1.55	111.1	Borough of Archbald.

3.45	114.55	Borough of Blakesly.
1.8	116.35	Borough of Dickson City.
2.5	118.85	Bear RIGHT to US Interstate 81S (to Wilkes-Barre).
0.3	119.15	Join US Interstate 81S.
3.7	122.85	Bear RIGHT on US Interstate 81S (to Wilkes-Barre).
4.1	126.95	Outcrop of Pocono Formation on right.
0.4	127.35	Outcrops of Pottsville Formation on both sides.
4.0	131.35	Luzerne County line.
14.9	146.25	Basal Pottsville on right.
0.3	146.55	Outcrop of Mauch Chunk on right.
1.7	148.25	Lower Pocono rocks on left.
0.6	148.85	Basal Pocono rocks on left. Cuts on both sides in undifferentiated Catskill Formation.
2.8	151.65	Rest area.
1.0	152.65	Cuts in Catskill Formation.
1.5	154.15	Cuts in Catskill Formation
1.6	155.75	Cut on left in Catskill Formation.
1.2	156.95	Basal Pocono rocks.
1.9	158.85	Exit RIGHT onto US Interstate 80E (to Stroudsburg).
0.9	159.75	Cuts in Pocono Formation.
2.1	161.85	Exit RIGHT at Exit 39 to PA 309S (to Hazelton).
0.2	162.05	Turn RIGHT onto PA 309S.
1.5	163.55	Outcrop of wisconsin till on left.
0.6	164.15	Cuts on both sides in Mauch Chunk Formation.
2.1	166.25	On left, Mauch Chunk-Pottsville transition zone.
0.5	166.75	Top of hill capped by Pottsville.
0.25	167.0	Strip mines on left in Llewelyn Formation.

0.8

167.8

Turn LEFT into Gus Genetti Motor Lodge parking lot.

END OF FIELD TRIP

APPENDIX A

Review of the Pocono Formation name and type locality.

Introduction

As recently as 1966, Moody commented:

"It is difficult enough to accomodate such views as (a) there is no Pocono Formation in the Pocono Mountains (geologic map of Pennsylvania, scale 1:250,000, 1960) . . . And when it is realized that the Pocono Mountains, originally mapped as consisting of the Pocono Formation, are now shown as being composed of the Catskill Formation, . . . one's confusion increases."

Thus, the meaning of the term Pocono is not yet clear. A number of people have discussed the Pocono 'problem' (see summaries in Wilmarth, 1938, p. 1687-89; Leonard, 1953, p. 7-9; Read, 1955, p. 4-7; Swartz, 1965, p. 19-21; Wood and others, 1969, p. 59), but the problem has never been adequately reviewed.

The following discussion shows that the name Pocono was applied to an unmistakable sequence of rock strata in northeastern Pennsylvania and that the Lehigh River section at Jim Thorpe is properly the type locality.

Pocono: The Name And The Rocks

Rogers (1836), in his summary of the first year of the First Geological survey of Pennsylvania, presented a description of 13 superposed distinct stratigraphic units which he recognized as the main body of Paleozoic rocks in the state. This sequence was:

XIII Coal measures.

XII Siliceous conglomerate.

XI Red shale.

X White & grey sandstone & conglomerate.

IX Red shales & red, buff & grey sandstones.

VIII Olive coloured slate & sandstone.

VII Coarse white sandstone.

etc.

In 1838 Rogers (p. 63-64) described one of the units as:

". . . Formation No. X, which I now proceed to describe.

The lower portion of the mass includes white and grey siliceous sandstones, with interstratified beds of dark bluish and greenish slates, sometimes resembling the shales contiguous to coal, by having occasionally sufficient carbonaceous matter in their composition to ignite, when highly heated.

The middle and upper strata are alterations of coarse siliceous conglomerates, and grey, bluish grey, yellowish and white sandstones, including, in some districts, thin layers of olive colored and black slates."

It should be noted that the 1838 report of Rogers dealt only with northeastern Pennsylvania and that the above description most closely coincides with rocks exposed along the Lehigh River at Jim Thorpe (Stop I, Fig. 1).

Rogers' numbering system became firmly established in the literature of the First and Second Geological Surveys of Pennsylvania, but he (1844, p. 147) also assigned names to these rock units. He reported his first name assignments as follows:

"The Ponent Series includes all the rocks between the base of the Catskill red sandstone and the top of the overlying conglomerate. (formation X, of the Pennsylvania and Virginia annual reports.) It usually embraces but two formations, the Ponent red sandstone and the Ponent conglomerate, though the former of these requires

for some districts a triple subdivision.

The Vespertine Series comprehends the interesting formations above the horizon of the Ponent conglomerate, and below that at the base of the great conglomerate under the coal measures. In Pennsylvania it is composed of the thick red shale deposit of the coal regions,"

Rogers numbers only one unit in this description, but it appears that his lower Ponent is unit IX of his 1836 classification and his Vespertine is unit XI.

Sometime between 1844 and 1858, Rogers revised his nomenclature and separated the Ponent into two parts assigning the name Vespertine to the former upper Ponent and introducing the name Umbral for the former Vespertine. In his compilation report of 1858 Rogers (v. 1, p. 108) defined unit X as follows:

"Vespertine Conglomerate and Sandstone. - White, grey, and yellowish sandstone, alternating with coarse siliceous conglomerates, and dark-blue and olive-coloured slates. It frequently contains beds of black carbonaceous slate, with one or more thin seams of coal. The only organic remains are fragments of coal plants;"

He places the Vespertine between the red Ponent (below) and the red Umbral (above).

However, the names established by Rogers did not meet with general acceptance and were replaced with geographic names by Lesley, State Geologist of the Second Geological Survey of Pennsylvania. The first official statement concerning a geographic name for the Vespertine occurs in the work of Platt and Platt published in 1877 (p. xxvi):

"In the above scheme four new names have been placed (proposed by the

present State Geologist of Pennsylvania) viz:

Pottsville Conglomerate, for Rogers' "Seral," No. XII.

Mauch Chunk Red Shale, for Rogers' "Umbral," No. IX.

Kenawha Coal Measures, for Fontain's "New River" series.

Pocono Sandstone, for Rogers' "Vespertine," No. X.

This is done in order to get geographical names for the formations.

If No. IX be properly called the Catskill Formation because it forms the mass of mountains between the Hudson river and the Delaware, it is perfectly proper that the Gray Sandstone Formation, No. X, next above it should be called the Pocono Formation, for it forms the mass of the great mountain plateau between the Delaware and Lehigh rivers. And both these great formations attain their greatest development in the mountains thus named."

It has been suggested by some writers (e.g., Wood, and others, 1969, p. 59) that the first official use of the name Pocono occurs in Lesley's description of the Boyd's Hill well at Pittsburgh (Lesley, 1876, p. 221-27). Trexler (1964, p. 159) suggests that this is the type locality of the formation. However, a slight discrepancy occurs in the chronology of the first useage of the term Pocono. Both of the above references (Platt and Platt, 1877; Lesley, 1876) were transmitted to the State Printer, December 31, 1875. Since the Pocono terminology in the Platt and Platt reference occurs in the preface, it is probable that such useage was included at the time of transmittal. It also appears that the report was complete at the time of transmittal.

However, Lesley's statement (Lesley, 1876, p. 217) "The well is about 2,300 feet deep in January, 1877, having been begun early in 1876." indicates

that the publication dated 1876 could not have appeared before 1877. This fact is further established in the same report (p. 214) which cites data transmitted on February 6, 1877. Therefore, the writer argues that by virtue of contemporaneity the Pocono definition in Platt and Platt is the first official assignment of the term Pocono and that the useage in Boyd's Hill well is merely a later application of the terminology.

The reason for the selection of the name Pocono is clearly stated by Lesley in 1882 (White, 1882, p. xiii-xv):

"The front edge or south wall of the plateau in Carbon and Monroe counties has always been called the Pocono mountain; ending eastward in the Pocono Knob, back of Stroudsburg; but spreading northward and northeastward, around the heads of Brodhead's creek, as far as the High Knobs in Pike county.

On the geological map of Pennsylvania which I made in 1841 (published by Prof. Rogers in 1858) it will be noticed that I spread the color of No. X over most of the plateau from the from edge of the wall of the Pocono mountain northward far into Pike and Wayne counties, and confined the color of No. IX to the steep face of the mountain (southwards) and its foot hills. But the principal valleys of the plateau are represented as cutting down into X; and the country bordering the Delaware gorge is capped with X between the streams.

In naming Nos. IX, X, XI, and XII geographically (from east to west) Catskill, Pocono, Mauch Chunk and Pottsville, I took for granted that, as the Catskill mountains were characterized by the great red formation IX, so the Pocono plateau was characterized by the great grey formation X.*"

Lesley follows these paragraphs with five more which clearly state why the application of the name Pocono was not correct:

"But in point of fact, of the conglomerates which form the two crests of the Second mountain west of the Lehigh, colored the one IX and the other X, only the lower (IX) appears in the Pocono mountain; the other (1,500' above it) has been eroded from the plateau. Half way between them (on the Lehigh) runs the edge of a thinner conglomerate, where the First Survey placed the dividing line between IX and X, splitting the Second mountain midway between its two crests.

This middle conglomerate is the Mt. Pleasant conglomerate of Mr. White's reports, and is the rock which he adopted in Wayne county in 1880 as the basal rock of X.

The conglomerate in IX which makes the south crest of the Second mountain at Mauch Chunk he recognizes as his Cherry Ridge conglomerate, 700' down from the top of the Catskill Formation. Now, it is precisely this conglomerate which makes the cornice or top edge of the Pocono plateau.

Therefore, to find any Pocono on the Pocono plateau, one must go a number of miles to the north of the front edge of the plateau, where ridges of the lowest Pocono rock, the Mt. Pleasant conglomerate, remain uneroded.

The real reasons why the Pocono (X) color was spread over the whole plateau on my map of 1841 (1858) were 1. the impossibility at the time of determining any special limit between IX and X in wilderness country of the "Shades of Death," or "the Great Beech Woods;" and 2. the desirability of distinguishing the plateau from the low lands, topographically and geologically. This could

only be done by using the strongly contrasted grey and red colors assigned to X and IX."

The following conclusions are drawn from the above discussion:

1. Both the First and Second Geological Surveys of Pennsylvania recognized a gray colored sequence of rocks which occurs between two red units.
2. The First Survey applied the terms X and Vespertine to this gray colored unit.
3. The Second Survey applied the same names to the same rock units until Lesley substituted the geographic name Pocono for the name Vespertine.
4. The substitution of the name Pocono for Vespertine was not appropriate because the bulk of the Pocono plateau, from whence the name came, is not underlain by Vespertine rocks.
5. This error in name selection resulted from an inadequate knowledge of the areal geology of the region.

It is the writers opinion that the literature is sufficiently clear with regard to the rock units involved and the intentions of Lesley so that there is no question as to which rocks the term Pocono was applied. There then remains the matter of a type locality.

Rogers did not establish type localities or even type areas for any of the units he defined. However, he clearly recognized the eastern outcrop belt of the Vespertine as being more typical. This is indicated by such statements as:

"We thus behold it in its maximum thickness, coarsest texture, and most miscellaneous composition in its Eastern outcrops, and can trace it to the N. W., gradually altering its type to that of a more strictly aqueous deposit of fine sediments." (Rogers, 1858, v.1, p. 301).

"The materials of the Vespertine rocks, their lessening gradation in size going W., the direction of their bedding, and sundry other phenomena, all concur to suggest that the deposit was chiefly derived by currents and paroxysmal movements of the waters from the E. and N. E., " (Rogers, 1858, v. 2, p 794).

Of the three Vespertine sections presented by Rogers in 1858, the one at Jim Thorpe (then Mauch Chunk) (Stop II, Fig. 1) is probably the best. Further evidence of Rogers' regard for this section is given in his Second Annual Report (Rogers, 1838, p. 14-15):

"A very extensive section has been begun, but not completed, on the Lehigh, commencing in the neighborhood of Mauch Chunk, with the conglomerate formation, which lies immediately below the coal measures, and embracing all the several groups of strata, so admirably exposed along the river, from that point to the southern side of the bold notch, by which the Lehigh passes through the Kittatinny mountain into the valley to the south. From this line alone, much useful knowledge will be derived. The measurements and the specimens there collected, will show the dimensions and composition in this section of the State, of all the strata, composing no less than nine out of the whole thirteen formations, which constitute the Appalachian region of Pennsylvania."

The writer concludes from the above that although the First Geological Survey of Pennsylvania did not specifically designate a type locality for unit No. X, it was the Lehigh River section which was considered most typical of unit No. X.

This section was also held in high regard by the Second Geological

Survey of Pennsylvania as is indicated by Chance (1880, p. 82):

"*Prior to making any examination on the Susquehanna river, I was directed by the State Geologist to study the exposures of Devonian and subcarboniferous rocks in the Alleghany mountain at Altoona and Snow Shoe, and to collate any facts thus obtained, with my reconnaissance sections on the Lehigh and Schuylkill rivers, where the typical development of No. X, No. XI and No. XII occurs."

The above statement indicates that the Lehigh River section was considered the equivalent of the Pocono type locality by the Second Geological survey of Pennsylvania rather than the Boyd's Hill well as suggested by Trexler (1964, p. 159) or the Moosic Mountains as suggested by Willard (1936, p. 596-598). The Lehigh River section at Jim Thorpe has been called the Pocono type locality by Leonard (1953) and Read (1955) and apparently was considered the type locality by Klemic and others (1963).

Although the name Pocono was originally derived by Lesley from the general term 'Pocono mountains,' the name at the recommended type locality is derived from Pocono Mountain which occurs 3 miles to the north (Fig. 2). Pocono Mountain is upheld by the basal conglomerate of the upper member of the Pocono Formation and these rocks can be traced directly into the type locality.

Subdivision of the Pocono Formation at Jim Thorpe

The Pocono Formation at the recommended type locality is readily subdivided into a lower nonconglomeratic sequence (Units 30-159, Section A, Appendix C) and an upper conglomeratic sequence (Units 160-237, Section A, Appendix C). Leonard (1953, p. 21) ascribed the names Silkmill Run Member and Bear Mountain Member to these lower and upper parts respectively, but Klemic and others (1953, p. 37) considered the names inappropriate because neither

name is geographically related to the rocks. The writer concurs with Klemic and others for the same reasons.

Klemic and others (1953, p. 37-43) used the informal names lower and upper member for the Pocono subdivisions at the type locality and mapped these members for several miles to the north of the type locality. The writer has followed Klemic and others in using the informal names lower and upper for the two Pocono subdivisions at the type locality and in the areas he has mapped to the north (Christmans and Hickory Run 7½' quadrangles).

Informal member names for the Pocono formation are retained in the study area because an adequate study has not yet been made of the relationship between the type locality of the Pocono Formation at Jim Thorpe and the type locality of the Beckville and Mt. Carbon Members of the Pocono Formation (Trexler and others, 1962) near Beckville, Pennsylvania (Fig. 1), 28 miles to the southwest. Examination of the rocks at the Beckville locality indicates that the Spechty Kopf Member of the Catskill Formation exposed at the base of the section (Units 1-29, Section B, Appendix C) are lithologically similar to the lowermost Pocono rocks at Jim Thorpe (Units 30-40, Section A, Appendix C) and that, except for the presence of conglomerates in the Beckville Member, the Beckville and Mt. Carbon members are lithologically similar to the lower and upper members respectively at Jim Thorpe. Reconnaissance of these units east from Beckville indicates that the Spechty Kopf is not continuous to Jim Thorpe and that the middle conglomerate of the Beckville Member (Units 59-63, Section B, Appendix C) is traceable into the basal conglomerate of the upper member of the Jim Thorpe section (Unit 160, Section A, Appendix C). However, the certainty of these relationships and the geologic reasons for them have not yet been established.

APPENDIX B

Griswold Gap Conglomerate

During the course of his comprehensive study of the geology of northeastern Pennsylvania, I. C. White (1881, p. 57) defined a conglomerate as follows:

"The 35' Griswold Gap Conglomerate (12) is a remarkable horizon.

In the whole 800' to 850' interval between it and the Bottom Conglomerate of XII, our section of Mauch Chunk and Pocono rocks has not exhibited a deposit in which the quartz pebbles are numerous, large or persistent enough to warrant the name of a conglomerate. but at this horizon lies a true conglomerate, so solid and massive as to make the crest of the Moosic mountain.

In the notches of this crest the rock can be studied all along the western border of Wayne county, and it has two fine sloping outcrops on the opposite side of Griswold's gap, just east of Forest City, on the road to White Oak pond."

Although some question has been raised about the exact location of Griswold Gap since it appears on no known map and White's own description of its location is not entirely clear, the exact location of the gap has been ascertained from local residents of the area as well as from legal records at the Wayne County Court House (Wayne County Court of Quarter Sessions). Griswold Gap is the northernmost gap through the Moosic Mountains in Clinton Township, Wayne County, and is today traversed by Pennsylvania Route 247 which passes from Curtis Valley School (on the east) through the gap to Forest City (on the west) (Fig. 1).

White further states that (p. 57):

"Its pebbles, very white, are somewhat angular and flattish rather than ovoid, vary in size from $\frac{1}{2}$ " to 2", and rest in a rather coarse, brownish-gray matrix weathering whitish."

and (p. 177):

"I regard it as certainly a member of the Pocono series;"

However, White was not certain as to the position of the Griswold Gap conglomerate within the Pocono. Initially (1881, p. 56-59) he designated the Griswold Gap conglomerate as the base of the Pocono Formation, but later (1882, p. 89) he considered the Mount Pleasant conglomerate as the basal member of the Pocono. In 1883 (p. 49-50) he reverted to his original position that the Griswold Gap marked the base of the Pocono and the top of a Pocono-Catskill transition zone.

Recently, Trexler and others (1962, p. 36-39) as well as Wood and others (1969, p. 60-61) correlated the basal conglomerate of their Beckville Member of the Pocono Formation near Beckville, Pennsylvania (75 miles to the southwest), with the Griswold Gap conglomerate, and Kehn and others (1966, p. 26-27) assigned the name to a member of the Pocono rocks mapped by themselves.

In contrast to this Willard (1946, p. 787) and Leonard (1953, p. 120-122) have suggested that on the basis of lithologic similarity the Griswold Gap conglomerate is actually the base of the Pottsville Formation.

The situation is clearly expressed by Leonard (1953) in the following statement (p. 120-121):

"... the Pocono beds ... show the same tendency toward eastward thinning, and finally disappear in the extreme northeastern area at Griswald's (sic) Gap near Forest City. There are conglomerate beds at this locality that were named Griswald's (sic) Gap conglomerate by I. C. White in 1882, and considered by him to be part of the Pocono; there

is much evidence, however, that the conglomerates are Pottsville and not Pocono in age. This view is followed because the only massive and coarse conglomerates persisting that far east in the coal basin are of Pottsville age; the Pocono pebble beds become less numerous thinner and finer textured eastward. Furthermore, the beds are of a "dead-white" color peculiar to the Pottsville, whereas the Pocono conglomerates are of a characteristic grayish color when fresh, and when weathered, are tinged by minutely disseminated iron oxide. Finally, on the basis of a brief reconnaissance, the writer believes that the "Griswald" (sic) can be physically traced northward into the coal basin itself where it closely underlies the coal measure."

During the spring of 1969 the writer traced the Griswold Gap conglomerate from Griswold Gap south along both sides of the Wyoming-Lackawanna basin to Roaring Brook (south side of basin) and Leggetts Creek (north side of basin) (Fig. 1). This work indicates that the Griswold Gap conglomerate can be traced directly into the basal Pottsville conglomerate which overlies the Pocono at both Roaring Brook and Leggetts Creek. The mapped trace of this conglomerate is shown on Figure 1 as the base of the Pottsville Formation and does not differ significantly from the Pottsville-Pocono contact shown on the Geological Map of Pennsylvania (Gray and others, 1960).

Since the Griswold Gap conglomerate is not part of the Pocono Formation as thought by I. C. White, the writer recommends that the name Griswold Gap be abandoned because of the priority of the name Pottsville (Platt and Platt, 1877, p. xxvi).

Historical Speculation

Today it is probably not possible to establish with certainty why

I. C. White identified the Pottsville Formation at Griswold Gap as basal Pocono. The geologic map accompanying White's Susquehanna and Wayne County report (1881) is not sufficiently detailed, nor is the base sufficiently accurate, to allow precise definition of his basal Pottsville contact. The map does indicate that he everywhere mapped as Pocono the rocks forming the mountain crests surrounding the basin, even those rocks which are red shales. Discussions of the Pocono in White's report on the Susquehanna River region (1883) indicate that he did not identify the Pottsville in that area as Griswold Gap conglomerate, but rather applied the name Griswold Gap to rocks which bear little resemblance to those he originally described at Griswold Gap.

The writer suggests that the misidentification arose from what was, to White, a stratigraphic necessity. White did his field work on Susquehanna and Wayne Counties between mid-June and September 20, 1880, of which time the last three weeks were spent tracing rocks westward from the area. Apparently White had not worked in northeastern Pennsylvania prior to 1880 although he had considerable experience in equivalent rocks in western Pennsylvania. During his short field season, White not only accomplished the geology of two counties, he also established a stratigraphic succession and terminology for the entire Catskill which have been used and misused ever since. Working rapidly in country which, at that time, must have been only partly accessible and lacking in artificial outcrops, and also working with a hypothesis of a uniform stratigraphic succession of red Catskill, gray Pocono, red Mauch Chunk and gray Pottsville rocks, White failed to detect the disappearance of the Pocono at the northern end of the basin. A reluctance to 'lose' a stratigraphic unit is indicated in his report (1883, p. 55-56) by his admission that there are no recognizable Mauch Chunk rocks in the mapped area and that most of those considered Mauch Chunk are typical Pocono lithologies. He did not,

however, abandon the unit, but rather placed it on the map completely around the Wyoming-Lackawanna basin.

With this in mind, it is understandable that White would consider the gray Catskill sandstones forming the crest of the Moosic Mountains between Scranton and Forest City to be Pocono since they contain no red rocks and overlie known red units. Consequently, in the Griswold Gap area where the gray Catskill sandstones are very thin and the Pottsville conglomerate is underlain within a short stratigraphic interval by red shales, White concluded that the Pottsville conglomerate was basal Pocono. In what was probably abundantly vegetated landscape, without the aid of aerial photographs and lacking an apparent necessity to do so, White apparently did not trace the very persistent Pottsville conglomerate to the south and discover its true stratigraphic position.

APPENDIX C

STRATIGRAPHIC DESCRIPTIONS

Following is a key to abbreviations used in stratigraphic descriptions.

bk	-	black	mod	-	moderate
bl	-	blue	o	-	orange
bn	-	brown	ol	-	olive
c	-	clay	pk	-	pink
cg	-	coarse grained	pur	-	purple
cgl	-	conglomerate	qtz	-	quartz
cglic	-	conglomeratic	qtzic	-	quartzitic
cs	-	claystone	rd	-	red
diam	-	diameter	s	-	sand
dk	-	dark	sh	-	shale
fg	-	fine grained	slst	-	siltstone
gn	-	green	slt	-	silt
gy	-	gray	ss	-	sandstone
lgt	-	light	v	-	very
ls	-	limestone	vcg	-	very coarse grained
md	-	medium	vfg	-	very fine grained
mg	-	medium grained	yel	-	yellow

SECTION A

Stratigraphic description of the Pocono Formation at the recommended type locality, Jim Thorpe, Pennsylvania. The section occurs along a railroad cut on the east bank of the Lehigh River. The base is placed at the southwest edge of a stone retaining wall located a few yards northeast of a road which passes over the Lehigh Valley Railroad to the Jim Thorpe sewage treatment plant. The section parallels the railroad for over 2,500 feet and ends along an abandoned railroad spur adjacent to a supermarket parking lot.

Unit	Lithologic Description	Thickness	
		(Ft)	(In)
MAUCH CHUNK FORMATION			
260	Slst, vcg, gy rd (5Y 4/2), massive, breaks down into 1/8-1/4" thick irregular plates, upper part is covered.	2	6
259	Slst, mg-cg, gy rd (5R 4/2), massive, hackly weathered pieces, upper contact is gradational.		9
258	Slst, fg-mg, ol gy (5Y 4/1), mottled with gy rd (5R 4/2) to dusky rd (5R 3/4) along joints and some bedding planes, irregularly hackly weathered plates, dominantly rd at 2 1/2-3', gradational upper contact.	8	
257	Slst, fg, ol gy (5Y 5/2), occasional trace of rd, hackly weathered color slightly lighter gn, gradational upper contact.	1	10
256	Slst, fg, gn gy (5GY 5/1), massive, hackly weathered pieces, weathered color slightly lighter gn, gradational upper contact.	1	5
255	Slst, cg, color between mod yel bn (10YR 5/4) and dusky yel (5Y 6/4), massive with some suggestion of bedding planes, hackly weathered pieces, gradational upper contact.	6	
254	Ss, vfg, color between, mod yel bn (10YR 5/4) and dusky yel (5Y 6/4), massive, structureless, well-indurated, basal 1-1 1/2' is fg ss, well sorted qtz ss, breaks down to hackly blocks, abundant fg mica flakes, gradational upper contact: Uppermost Pocono ss lithology.	11	
253	Ss, mg, color near yel gy (5Y 7/2), bedding not well-defined but some beds 1-6" thick, well sorted subangular qtz ss with some c matrix (decomposed feldspar?), small amount of vfg-fg muscovite flakes and 1% mg biotite flakes, gradational upper contact.	7	6

Unit	Description	Thickness	
		(Ft)	(In)
252	Ss, massive unit with color near yel gy (5Y 7/2), internal subdivision is: 7'6" Ss, mg, qtz ss, with occasional pebbles to 1/4" diam scattered at random, some of sand may be cg. 1/4-2" Pebble zone, rounded qtz pebbles along well-defined plane, 1" max, 1/4" ave. 10" Ss, fg-mg, qtz s, no pebbles, sharp upper contact.	8	4
251	Covered interval	1	6
250	Slst, mg-cg, color near gy or (10YR 7/4), massive, breaks into small hackly pieces.	2	2
249	Slst, vcg, near gy or (10YR 7/4), upper contact a sharp bedding plane.		2
248	Ss, vfg-fg, lgt ol gy (5Y 6/1) with slight rd bn appearance, qtz ss, some muscovite flakes to vcg, some dark grains, upper contact sharp bedding plane.		5
247	Slst, vcg, near gy or (10YR 7/4), irregular sharp upper contact.		9
246	Ss, vfg-fg, lgt ol gy (5Y 6/1) with slight rd appearance, some muscovite flakes to vcg, some dark grains, sharp upper contact.		4
245	Ss, vfg with vcg silt, lgt ol gy (5Y 6/1) with rd appearance, well bedded with 1/8 - 1/4 ", some fg mica flakes, disintegrates easily, sharp upper contact.	2	
244	Ss, fg, lgt ol gy (5Y 6/1) with slight rd appearance, massive, well indurated, joints normal to bedding, mica flakes to mg, sharp upper contact.	2	
243	Ss, as 245		10
242	Ss, fg (basal 3' of unit is gradational from mg to fg), lgt ol gy (5Y 6/1) with slight rd appearance, massive well indurated, mica flakes to mg, sharp upper contact, basal surface is knobbly and may be small load casts.	6	6

Unit	Description	Thickness	
		(Ft)	(In)
241	Slst, fg, between gn gy (5GY 6/1) & (5G 6/1), cleavage dominated, weak zone, disintegrates into hackly pieces, sharp upper contact.	2	7
240	Slst, fg, gy rd (5R 4/2), cleavage dominated, disintegrates into hackly pieces, zone 1½-2' above the base nearly Qtzic, gradational upper contact.	12	
239	Slst, cg, gy rd (5R 4/2) to dusky rd (5R 3/4), vfg mica flakes, numerous bedding planes, disintegrates into hackly plates which parallel bedding, gradational upper contact.	12	5
238	Ss, vfg, gy rd pr (5RP 4/2), v hard and well indurated, some mica flakes, some mottling in lower ½, abrupt gradational upper contact.	2	
	Total thickness of Mauch Chunk Formation	93	0
POCONO FORMATION (upper member)			
237	Ss, fg, near pale bn (5YR 5/2) or pale yel bn (10YR 4/2) with slight gy appearance, Qtzic, massive, some conchoidal parting, some mica flakes, gradational upper contact.	19	6
236	Covered interval. Top of covered interval is at north edge of stone foundation structure which probably upheld a water tank at one time. Base of the covered interval is at the top of the last well exposed ss to the south of the stone foundation.	266	
235	Ss, mg, lgt gy (N7), Qtzic, massive, some small spots of c, 95%+ Qtz, few dark grains, ss may be cg in part,	6	6
234	Ss, mg, lgt gy (N7), Qtzic, contains medium gy (N4) sh chips to 1½" diameter and 1/8" thick and rounded Qtz pebbles to ½" diameter, some cg to vfg muscovite flakes, sh chips may be a disrupted clay layer, gradational upper contact (part of same unit as 235).		2

Unit	Description	Thickness	
		(Ft)	(In)
233	Ss, mg, lt gy (N7), qtzic, cg-vcg muscovite flakes abundant, possible planar cross bed at top, plant fossil molds on some surfaces, small $\frac{1}{4}$ - $\frac{1}{2}$ " pyritic nodules, sharp upper contact.	8	6
232	Ss, as 233 but with definite beds $\frac{1}{2}$ -1" thick.		5
231	Ss, as 233 but massive.	1	4
230	Ss, fg, lgt gy (N7), contains scattered coarser s grains and rounded qtz pebbles to $\frac{1}{2}$ " diam and md gy (N4) shale chips to 1 $\frac{1}{2}$ " diam sharp upper contact.		6
229	Sh, lgt ol gy (5Y 5/2), irregular, slickensided, laterally discontinuous, sharp contacts.		2
228	Ss, as 230 but with more sh chips, sharp upper contact.		1
227	Ss, as 233 rapidly gradational upper contact.	7	
226	Ss, as 230 but with only rare qtz pebbles, lateral variation in thickness from 3 to 10", sharp upper contact.		10
225	Ss, as 233 sharp upper contact.	10	
224	Ss, mg-vcg, angular to subrounded qtz grains with some pebbles to $\frac{1}{4}$ " diameter set in a matrix of hard black clayey material, some mica flakes, some dk gy (N3) sh chips, some irregular bedding planes, sharp upper contact.		3
223	Ss, mg, lgt gy (N7), qtzic, massive, some hairline dk gy (N3) sh planes and rare sh chips parallel to bedding, numerous rounded qtz pebbles to $\frac{1}{4}$ " diam in basal 2', sharp upper contact.	12	
222	Ss, mg, lgt gy (N7), qtzic, massive scattered planes with sh chips, gradational upper contact.	27	
221	Ss, mg-vcg, lgt gy (N7), qtzic, scattered subangular qtz pebbles to $\frac{1}{4}$ " diam, gradational upper contact.		10
220	Ss, as 222 but partially covered, gradational upper contact.	10	

Unit	Description	Thickness	
		(Ft)	(In)
219	Cgl, pebbles to $\frac{1}{2}$ " diam in matrix of mg-vcg qtz s, some bk to dk gy (N3) sh chips, no bedding, poorly sorted, sharp upper contact.	3	
218	Ss, cg grading to mg in upper 1/3, lgt gy (N7), qtzic, may be cross bedded, breaks into slabs 2-3" thick, sharp upper contact.	16	
217	Cgl, 1/8- $\frac{1}{4}$ " pebbles compose 50%+ of cgl with some matrix is fg-mg s, massive, qtzic, no bedding but some parting parallel to bedding, orientation of long pebble axes parallel to bedding, gradational upper contact.	4	6
216	Ss, mg, lgt gy (N7), qtzic, partially covered in lower 5', sharp upper contact.	13	
215	Ss, mg, lgt gy (N7), qtzic, massive, upper surface has abundant md gy (N5) sh chips to 5" diam but generally 2" or less in diam, random qtz pebbles to $\frac{1}{2}$ " diam, rare sh chips throughout and a plane of sh chips 3' 6" above base, sharp upper contact.	16	6
214	Cgl, rounded qtz pebbles to $\frac{3}{4}$ " diam which average $\frac{1}{4}$ - $\frac{1}{2}$ " diam and compose 25-50% of the cgl, matrix is cg-vcg qtz s, scattered sh chips to 3" diam, sharp upper contact.		10
213	Ss, mg-cg, lgt gy (N7), qtzic, massive, few scattered rounded qtz pebbles to $\frac{1}{4}$ " diam, sharp upper contact.	2	6
212	Cgl, rounded qtz pebbles averaging $\frac{1}{4}$ " diam compose 25% of cgl, mg qtz ss matrix, lgt gy (N7) to very lgt gy (N8), qtzic, no bedding, poor sorting, gradational upper contact.	2	
211	Ss, mg, medium lgt gy (N6), qtzic, some scattered vcg qtz grains, bedding indicated by very fine dk lines (mineral concentrate?), suggestion of large cross bed, occasional sh chips to 6" diam in lower $\frac{1}{2}$ and a nearly continuous sh chip horizon at 7' 6" above base, sharp upper contact.	14	6
210	Cgl, lgt gy (N7) stained rd bn (10R 3/4), in part qtz pebbles to $\frac{1}{2}$ " diam averaging $\frac{1}{4}$ " diam, matrix is mg qtz s, qtzic, no bedding evident, poor sorting, sharp upper contact.	3	6

Unit	Description	Thickness	
		(Ft)	(In)
209	Ss, fg-mg, lgt gy (N7), qtzic, some scattered rounded qtz pebbles to $\frac{1}{4}$ " diam, long planar cross beds 1-2" thick taper to zero thickness, upper contact sharp and irregular.	2	6
208	Ss, mg with up to 10% rounded qtz pebbles to $\frac{1}{4}$ " diam randomly scattered, qtzic, sharp upper contact.		7
207	Ss, mg, lgt gy (N7), massive, qtzic, some scattered qtz pebbles to $\frac{1}{4}$ " diam, sharp and irregular upper contact.	3	
206	Ss, cg-vcg, lgt gy (N7), massive, qtzic, up to 10% qtz pebbles to $\frac{1}{4}$ " diam, sharp upper contact.	4	9
205	Ss, fg, lgt gy (N7), bn weathered color, massive, may be laterally discontinuous, sharp upper contact.		10
204	Cgl, over 25% pebbles averaging $\frac{1}{4}$ " diam with max $\frac{1}{2}$ " diam, mg-cg s matrix, lgt gy (N7), qtzic, pebbles rounded to subangular, sharp upper contact.	3	6
203	Ss, mg-cg, very lgt gy (N8), qtzic, some bedding planes, sharp upper contact.	8	
202	Cgl, as 204.		5
201	Ss, as 203.	2	6
200	Ss, mg-cg, lgt gy (N7), qtzic, up to 10% pebbles to $\frac{1}{4}$ " diam, some md dk gy (N4) sh chips to 2" diam, some irregular planes present, upper $\frac{1}{2}$ mainly covered, gradational upper contact.	20	
199	Cgl, pebbles averaging $\frac{1}{4}$ - $\frac{1}{2}$ " diam with max of 1" diam, cg-vcg ss matrix, some sh chips to 5" diam, massive, no bedding, poorly sorted, sharp upper contact.	2	
198	Ss, mg-cg, lgt gy (N7), qtzic, gradational upper contact.	2	
197	Cgl, as 199, sharp upper contact.	2	
196	Ss, as 198, with some cross bed planes at base, sharp upper contact.	1	4

Unit	Description	Thickness	
		(Ft)	(In)
195	Cgl, as 199, gradational upper contact.	2	
194	Ss, vfg-fg, md dk gy (N4), moderately well indurated, some mica flakes, cross beds with 1/16-1/8" thick beds, sharp upper contact.	2	
193	Ss, fg-mg, lgt gy (N7), massive, qtzic, plant fossil molds on bedding planes, cross bed topsets, gradational upper contact.	4	
192	Cgl, pebbles vary from 15-50% , pebbles average 1/4" diam, max 1/2" diam rounded to subangular, fg-mg ss matrix, qtzic, sharp upper contact.	4	6
191	Ss, fg-mg, lgt gy (N7), qtzic, thinly bedded in part, gradational upper contact.	10	
190	Cgl, pebbles averaging 1/2" diam with max 2 1/2" diam, pebbles are rounded qtz, mg-cg ss matrix, qtzic, pebbles are partially aligned with axes parallel to bedding and defined pebble beds; laterally irregular in thickness and in places includes part of the overlying bed, massive, sharp upper contact.	4	
189	Ss, as 191, sharp upper contact		10
188	Cgl, rounded qtz pebbles to 2 1/2" diam with average 1/2-1" diam, mg-cg ss matrix, massive, structureless, irregularly defined ss beds occur in the upper 15', sharp upper contact.	50	
187	Ss, fg md lgt gy (N5), massive, qtzic, some sh chips to 4" diam randomly scattered, some fossil plant molds on some bedding planes, structureless, very uniform appearance, sharp irregular upper contact.	28	
186	Ss, fg, md lgt gy (N5), massive, qtzic, some sh chips which are sufficiently abundant, well oriented and large to suggest a disruption of of an original clay shale deposit, sh chips lacking in central 1', sharp upper contact.	23	6
185	Ss, as 187, with rare qtz pebbles to 1/4" diam, sharp upper contact.	11	
184	Cgl, lgt gy (N7), pebbles to 1/2" diam average 1/4" diam, mg ss matrix is 25-50% of whole, qtzic, sharp upper contact.	1	

Unit	Description	Thickness	
		(Ft)	(In)
183	Ss, fg, md lgt gy (N6), clayey matrix, vcg mica flakes, massive but breaks into beds, gradational upper contact.	7	
182	Sh, gy bk (N2) to bk (N1), clayey, thin bedded very crushed and distorted, upper contact obscure but apparently sharp.	5	
181	Ss, mg, v lt gy (N8), qtzic, laterally has cgl zones to 6" thick, lower 2' are cross bedded and rest on an irregular surface, sharp upper contact.	8	
180	Cgl, 25-50% pebbles averaging $\frac{1}{2}$ -1" diam, some pebbles are elongate to 2" long while others are more nearly spherical and near 1" diam, pebbles are rounded to subrounded, mg ss matrix, massive, qtzic, structureless, some cavities filled with qtz crystals to $\frac{3}{4}$ " long and $\frac{1}{4}$ " diam, sharp irregular upper contact.	21	6
179	Ss, mg, v lgt gy (N8), qtzic, massive, structureless, some rd stain in parts, well sorted, sharp irregular upper contact.	5	6
178	Ss, vcg, v lgt gy (N8), fair sorting, sharp upper contact.	2	
177	Ss, as 179, sharp upper contact.		8
176	Cgl, over 50% pebbles averaging $\frac{1}{4}$ - $\frac{1}{2}$ " diam with max 1" diam, massive, structureless, qtzic, sharp irregular upper contact.	7	
175	Slst, mg-cg, some mg qtz grains, bn color, discontinuous, irregular upper contact.		2
174	Cgl, as 176, irregular thickness varies from 6-12", sharp upper contact.	1	
173	Ss, mg, md gy (N5), moderately indurated, dk gy (N3), sh chips to $2\frac{1}{2}$ " diam with average less than lower 2" has 15-25% qtz pebbles $\frac{1}{4}$ - $\frac{1}{2}$ " diam, sharp upper contact.		6
172	Ss, mg, md gy (N5), moderately well indurated, may intertongue laterally with cgl, gradational upper contact.	2	3
171	Ss, cg, lgt gy (N7), moderately well indurated to qtzic some scattered $\frac{1}{4}$ " diam qtz pebbles, some rd iron stain, sharp upper contact.	5	

Unit	Description	Thickness	
		(Ft)	(In)
170	Sh, bk, thin weak zone of fg slst at base grades up into sh with intermixed mg ss stringers and zones of pure c sh, some suggestion of plant impressions, unit is crushed and weathered, underlying ss surface has holes which may represent areas from which sh has been weathered, sharp upper contact.	6	
169	Ss, mg, qtz grains set in fg matrix, md dk gy (N4) to dk gy (N3), qtzic, occasional sh chips, sharp upper contact with irregular holes on upper surface probably representing holes from which overlying sh was weathered.	7	
168	Slst, mg-cg, dk gy (N3), massive, structureless, impression of log at least 7' long on bedding plane gradational upper contact, thickness varies 4 to 9".		9
167	Ss, mg, lgt gy (N7), massive, qtzic, discontinuous ss (as 168) 2' from top, sharp upper contact.	17	6
166	Ss, mg-cg, lgt gy (N7), with 10-20% qtz pebbles averaging 1/8-1/4" diam, qtzic, some intermixed slst, sharp irregular upper contact.	2	
165	Ss, as 167, with cross bedding shown by dark lines on fresh surfaces, overall appearance is massive, sharp irregular upper contact.	9	
164	Slst, mg, dk gy (N3), 1/8-1/4" thick beds, conchoidal weathering masses, discontinuous ss layer 2' above base varies from 0-2' thick, sharp irregular upper contact.	15	
163	Ss, mg, md dk gy (N4), to md gy (N5), qtzic, scattered rounded qtz pebbles to 1/4" diam in basal 2", cg mica flakes in upper 10', structureless for most part but some bedding in upper 10', sharp irregular upper contact.	32	
162	Sh, bk, 1/16-1/8" beds, sharp upper contact.	1	8
161	Ss, mg, lgt gy (N7), qtzic, grades from vcg ss at base to mg ss 2' above base, top of 6" thick zone of mixed ss and sh at 9" below top, sharp upper contact.	6	
160	Cgl, 25-50% rounded qtz pebbles averaging 1/4-1/2" diam with max 2" diam, mg-cg ss matrix, 7' above base	17	

Unit	Description	Thickness	
		(Ft)	(In)
	is discontinuous zone of slst and pebble free ss sharp upper contact.		
	Total thickness of upper member of the Pocono Formation	801	2
POCONO FORMATION (lower member)			
159	Slst, fg, lgt ol gy (5Y 5/2), basal 6" fines upward from vcg slst, hackly breakup, irregular sharp upper contact.	4	
158	Ss, mg, md gy (N5), poorly sorted, qtzic, sharp upper contact.		7
157	Ss, vfg, lgt gy (N7), qtzic, ¼"-1" beds, sharp contact.	1	10
156	Ss, as 158 but with basal 1" containing rounded ¼" diam qtz pebbles, sharp upper contact.	1	2
155	Ss, as 157, sharp upper contact.	1	6
154	Ss, as 158, but with some ¼" qtz pebbles scattered throughout, sharp upper contact.	11	
153	Slst, cg, between gy o (10YR 7/4) and mod yel bn (10YR 5/4), massive, structureless, hackly weathering pieces, sharp upper contact.	8	
152	Ss, vfg, lgt ol gy (5Y 5/2), fg-mg mica flakes abundant, sharp upper contact.	3	
151	Slst, as 153, sharp upper contact.	2	6
150	Ss, as 152, sharp upper contact.	1	4
149	Slst, as 153, sharp upper contact.	1	8
148	Ss, as 152, sharp upper contact.	4	6
147	Slst, as 153, sharp upper contact.	31	
146	Ss, fg, md gy (N5), qtzic, definite beds, sharp upper contact.	1	2
145	Slst, as 153, basal 1½' may be slightly coarser than rest, sharp upper contact.	6	6

Unit	Description	Thickness	
		(Ft)	(In)
144	Slst, cg, md dk gy (N4), massive at top, bedded in 2-3" beds at base, gradational upper contact.	2	
143	Ss, vfg, md dk gy (N4), qtzic, bedded with some cross bedding shown by dark lines, sharp upper contact.	1	
142	Slst, mg-cg, md dk gy (N4), may be laterally discontinuous, mg mica flakes, shaly nature, sharp upper contact.		5
141	Ss, fg, may have some mg in lower part, md gy (N5), qtzic, massive, sharp upper contact.	21	10
140	Ss, fg, md dk gy (N4), to md gy (N5), abundant cg-vcg mica flakes on bedding planes, large thin tabular cross bed sheets $\frac{1}{2}$ '-1" thick with low inclinations, very well indurated, sharp upper contact.	4	
139	Ss, fg-mg, md dk gy (N4), qtzic, massive, cross bed sheets 2-6" thick, sharp bedding planes, cg mica flakes on some bedding planes, sharp upper contact.	15	
138	Sh, mixed dk gy (N3) c sh and cg ss, sh seems to occur in thin layers, ss is moderately to poorly indurated, sharp upper contact.	1	2
137	Ss, fg becoming mg in upper 6", md dk gy (N4), qtzic, sharp upper contact.	2	2
136	Slst, cg-vcg, md dk gy (N4), mica flakes, laterally discontinuous, thin bedded and platy, sharp upper contact.		1
135	Ss, as 137, sharp upper contact.	2	5
134	Slst, fg-mg, near gn gy (5GY 6/1), stained with metallic color near gy bl (5PB 4/2), weathered surface is knobbly and iron stained, very disrupted appearance, sharp upper contact.	2	
133	Ss, vfg, md dk gy (N4), well indurated, abundant mg mica flakes, upper 6" has $\frac{1}{2}$ -1" beds, lower part is massive, sharp upper contact.	2	
132	Slst, cg, md dk gy (N4), hard, brittle, very homogeneous, sharp upper contact.		5

Unit	Description	Thickness	
		(Ft)	(In)
131	Ss, mg with some fg in middle 1/3, md gy (N5), qtzic, large tabular cross bed sheets, sharp upper contact.	17	
130	Sh, bk (N1), platy, laterally discontinuous, very disrupted, irregular sharp upper contact.		2
129	Ss, vfg, md dk gy (N4), qtzic, massive, very faint suggestion of bedding, some bedding planes marked by vcg mica flakes, irregular upper contact.	6	6
128	Slst, cg, dk gy (N3), hackly breakup, some inter-laminated fg ss but mainly slst, irregular sharp upper contact.	1	
127	Ss, mg, md dk gy (N4), to md gy (N5), qtzic, massive, few scattered 1/8-1/4" shale chips in upper 6", some breakup into thick (6" +) beds, some suggestion of cross bedding in central 1/3, irregular sharp upper contact.	19	6
126	Ss, vfg, dk gy (N3), 1-2" beds, qtzic, sharp upper contact.	3	2
125	Ss-sh, zone of mixed mg ss and bk sh in thin layers and sh chips, irregular and disrupted zone, sharp upper contact.		8
124	Ss, fg-mg, md dk gy (N4), qtzic, 1/8-1/4" sh chips scattered throughout along bedding planes, sharp upper contact.		4
123	Slst, cg-vcg, dk gy (N3), laminated, mica flakes, hard, sharp upper contact.		2
122	Ss, as 124, sharp upper contact.		1½
121	Slst, as 123, sharp upper contact.		9
120	Ss, fg, md dk gy (N4), well indurated, some cg mica flakes on bedding planes, sharp upper contact.	1	8
119	Ss-sh, as 125, sharp upper contact.		10
118	Ss, as 120, sharp upper contact.	8	
117	Ss, mg, md dk gy (N4), massive, qtzic, upper	3	4

Unit	Description	Thickness	
		(Ft)	(In)
	1" is cg with 1/8-1/4" sh chips, sharp upper contact.		
116	Slst, mg, md dk gy (N4), hard, homogeneous, slightly brittle, sharp hackly breakup pieces, sharp upper contact.	4	
115	Ss, mg, md lgt gy (N6), mod well indurated, abundant cg mica flakes, hairline dk laminae indicate bedding, sharp upper contact.	2	
114	Slst, fg-mg, md gy (N5) to lgt ol gy (5Y 5/2), platy, disrupted, upper contact gradational.		8
113	Ss, fg, md gy (N5), well indurated, bedded, gradational upper contact.		7
112	Slst, vcg, md dk gy (N4), bedded, some fg mica flakes gradational upper contact.	1	9
111	Ss, mg, md gy (N5), qtzic, massive, some mg mica flakes, sharp upper contact.	10	
110	Slst, cg-vcg, md dk gy (N4) massive, breaks into 1/8-1/4" beds, slightly brittle, sharp upper contact.	4	
109	Ss, vfg, md dk gy (N4), qtzic, massive, some bedding shown by hairline dk lines, sharp upper contact.	18	
108	Slst, fg, md dk gy (N4), massive, qtzic, becomes coarser upwards in upper 1/2 and is cg in upper 1', sharp upper contact.	8	
107	Fault plane, crush zone of dark slst.		3
106	Ss, mg-cg, md lgt gy (N6), qtzic, faulted surface is very irregular, thickness may be less than indicated since laterally there is some wedging of this unit and considerable irregularity.	6	
105	Slst, vcg, md dk gy (N4), laminated, dk color bands show laminae less than 1 mm apart, some 2-6" mg-cg ss layers along lateral extension may be faulted into position, sharp upper contact.	2	
104	Ss, fg-mg, md dk gy (N5), qtzic, massive, lower surface is irregular with possible load casts, sharp upper contact.	3	6

Unit	Description	Thickness	
		(Ft)	(In)
103	Slst, mg, md dk, gy (N4), massive, sharp upper contact.	2	
102	Ss, mg with some cg, md gy (N5), qtzic, scattered shale chips, lateral variation in thickness (1-4"), sharp upper contact.		4
101	Ss, mg, md gy (N5), qtzic, massive, gradational upper contact.	8	9
100	Ss, mg, md dk gy (N4), qtzic, sh chips to 1/4" diam mixed irregularly throughout, sharp upper contact.		5
99	Ss, as 101, upper contact gradational.		10
98	Ss, as 100, gradational upper contact.		4
97	Ss, fg, md dk gy (N4), qtzic, gradational upper contact.	1	4
96	Ss, cg, some vcg and rare pebbles to 1/8" diam of qtz, some sh chips to 1/4", gradational upper contact.		4
95	Ss, as 97, with laminae indicated by color lines, gradational upper contact.		5
94	Ss, as 96, with numerous sh chips to 1/4" diam which weather with iron stain, gradational upper contact.		5
93	Ss, vfg, md dk gy (N4), qtzic, gradational upper contact.		5
92	Ss, vfg, md dk gy (N4), rounded qtz pebbles to 3/4" and rounded dk gy (N3) sh pebbles with iron stained rims to 1" diam, gradational upper contact.		3
91	Ss, as 93, gradational upper contact.		2
90	Ss, as 92, laterally this unit and unit 92 may become one with no central ss, weathered shale chips leave moderate bn pits on rock gradational upper contact.		8

Unit	Description	Thickness	
		(Ft)	(In)
89	Ss, fg, md gy (N5), qtzic, 1-6" beds, loadcasts on lower surface, gradational gradational upper contact.	7	6
88	Slst, mg, md dk gy (N4), massive, cleavage dominated, gradational upper contact.	1	
87	Ss, vfg, md dk gy (N4), qtzic, massive, several 1½" diam weathered pyrite nodules, gradational upper contact.	1	4
86	Slst, as 88, sharp upper contact.	4	
85	Ss, as 87, sharp upper contact.		5
84	Slst, as 88, this unit grades upward from underlying unit and although the contact is distinctive it is really one continuous graded bed, sharp upper contact.		6
83	Ss, as 87, gradational upper contact.		8
82	Ss, as 87, with slst in upper ½", sharp upper contact.		2½
81	Ss, as 82, sharp upper contact.		5
80	Ss, as 87, sharp upper contact.		9
79	Ss, as 87, with upper 1" slst as 88, sharp upper contact.		3
78	Ss, as 79, sharp upper contact.		5
77	Ss, as 79, upper ½" slst, sharp upper contact.		3½
76	Ss, as 77, sharp upper contact.		4½
75	Ss, as 77, sharp upper contact.		4
74	Ss & slst, ss (as 87) 1½" thick grades up into slst (as 88), sharp upper contact.		4½
73	Slst, as 88, seems nearly gradational from lower unit and into upper unit and is typical of the slst beds in this part of the section, the basal contact is the sharpest in appearance and the slst is marked by acute angled cleavage, sharp upper contact.		2
72	Ss, as 87, sharp upper contact.	1	8

Unit	Description	Thickness	
		(Ft)	(In)
71	Slst, as 88, sharp upper contact.		10
70	Ss, as 87, sharp upper contact.		8
69	Slst, as 88, sharp upper contact.		2
68	Ss, as 87, sharp upper contact.	1	7
67	Slst, as 88, sharp upper contact.		1
66	Ss, as 87, gradational upper contact.		7
65	Slst, as 88, parting of slst, sharp contacts.		1/4
64	Ss, as 87, sharp upper contact.	1	4
63	Slst, as 88, parting of slst which varies in thickness laterally, sharp contacts.		1/4
62	Ss, as 87, sharp upper contact.		11
61	Slst, as 88, parting of slst which laterally thickens and thins, sharp contacts.		1
60	Ss, as 87, sharp contact.	2	
59	Slst, as 88, sharp contacts.		1/2
58	Ss, fg, md dk gy (N4), qtzic, structureless, sharp upper contact.	3	1
57	Slst, fg-mg, dk gy (N3), platy, sharp upper contact. gradational lower contact.		1
56	Ss, as 58, gradational upper contact.	1	10
55	Slst, as 57, sharp upper contact.		2
54	Ss, as 58, gradational upper contact.		5
53	Slst, as 57, sharp upper contact.		2 1/2
52	Ss, as 58, sharp upper contact.	5	7
51	Ss, mg-cg, lgt gy (N7), sh chips to 1/4" diam, moderate induration, sharp upper contact.		4
50	Ss, as 58, massive in appearance but breaks into beds 1' to 2' thick, uniform texture, sharp upper contact.	24	

Unit	Description	Thickness	
		(Ft)	(In)
49	Covered interval, behind stone retaining wall, no crop above wall, probably same as 50 or possibly some of 50 and 48.	10	
48	Ss, mg, white, very pure qtz, extremely hard, bedding shown by sharply defined partings which give rise to beds varying from 1" to 10" thick with an average thickness of about 5". Some beds are undulatory near base and may be ripple marked, at the base is a small wedge of qtz which repeats about 4' of section at the road level, but is not present 6' above the road, upper contact is not exposed and lower contact is involved in faulting of obscure nature. The sequence from here down to unit 38 is somewhat confused and may repeat some section.	33	
47	Ss, c to mg, poorly sorted, v lgt gy (N8), hard, prominent cleavage, may be weathered portion of underlying unit.	1	7
46	Ss, c to mg, poorly sorted, lgt o gy (5Y 5/2), hard, some of qtz grains are rounded, s comprises $\frac{1}{4}$ - $\frac{1}{2}$ of rock, upper contact may be fracture only.	3	3
45	Slst, poorly sorted c to vfg s, lgt o gy (5Y 5/2), upper contact may be bedding plane, fracture or small fault plane.		9
44	Slst, cg, v lgt gy (N8), hard, few random mg qtz grains, bedding plane upper contact.		7
43	Slst, cg, mod rd bn (10R 4/6), with $\frac{1}{4}$ fg-mg qtz grains which are angular to rounded, bedding plane upper contact.		8
42	Slst, cg, v lgt gy (N8), some vfg-mg scattered qtz grains, may be a repeat of 47, sharp upper contact.		6
41	Slst, cg, lgt o gy (5Y 6/1), some vfg-mg qtz grains scattered throughout, gradational upper contact.	1	8
40	Laminite, fg-mg, finely laminated with laminae $\frac{1}{2}$ -1 mm thick showing color alteration of lgt ol gy (5Y 4/2), some of lighter laminae are composed of cg-vcg slst and some laminae have a single grain thick-	7	6

Unit	Description	Thickness	
		(Ft)	(In)
	ness of sand grains varying from vfg to mg, qtz grains varying from 1/8" to 1/2" diam appear to have been dropped onto some of the bedding planes and in some cases have distorted and even disrupted the underlying laminae; bedding surfaces sometimes show well developed lineations suggestive of current scour marks and all show a general east-west orientation; some laminae have been distorted; these laminae resemble varves, the unit has gradational upper and lower contacts.		
39	Sh, c, gn gy (5GY 6/1), the upper 2' resembles Unit 40 but well developed cleavage obscures any laminae in the lower 8' (if any are present), qtz pebbles are numerous and are rounded and attain sizes to 2 1/2" diam, would appear that this unit is structureless in the lower part and grades into the overlying lithology, gradational upper contact.	10	
38	Fault zone, crushed shale.		6
37	Sh, gn gy (5G 6/1), bedding defined by parting, upper contact is fault plane.	1	
36	Sh, gy rd (5R 4/2), bedding defined by parting, 1-4 mm beds, rare pebbles and s grains, obscure upper contact, base is a fault.	4	8
35	Sh as 37, sharp upper contact.	2	6
34	Sh, as 36, gradational upper contact.	5	
33	Mudstone, cg, bn gy (5YR 4/1) to md dk gy (N4), hard, homogeneous, no bedding, massive, randomly scattered qtz grains and pebbles to 3" diam, pebbles are rounded, gradational upper contact.	33	
32	Mudstone, as 33, with slightly more sh character than 33, gradational upper contact.	2	
31	Tilloid, mg-cg, gy rd (5R 4/2), slight sh texture, abundant qtz grains and pebbles scattered throughout, very poorly sorted throughout, lower part contains more coarse material than upper part and has less sh character, gradational upper contact.	9	
30	Tilloid, c to vcg, mottled gy rd (5R 4/2), to md dk gy (N5) slight gn appearance, scattered rounded qtz pebbles to 2" diam, poorly sorted, s is over 50% of rock, uniform over entire thickness, a 2'	81	

Unit	Description	Thickness	
		(Ft)	(In)
	diam fg well sorted rounded ss boulder occurs 51' above the base 7' above the road, lower $\frac{1}{2}$ varies slightly in color and may have a slightly higher pebble quantity than the upper $\frac{1}{2}$, gradational upper contact.		
	Total thickness of lower member of Pocono Formation	547	3
CATSKILL FORMATION			
Bear Mountain Member			
29	Sh, silty, gy rd (10R 4/2), has some pebbles to $\frac{1}{4}$ " diam, sharp upper contact.	2	
28	Slst, mg-cg, gy rd (10R 4/2) mottled with gn gy (5GY 6/1), massive, has randomly scattered mg-vcg qtz grains and some pebbles to $1\frac{1}{2}$ " diam, gradational upper contact.	5	
27	Ss, vfg with some grains to cg, lgt ol gy (5Y 5/2) poorly sorted, rounded qtz pebbles to 1" diam, gradational upper contact.	4	6
26	Sh, as 29, gradational upper contact.	2	6
25	Slst, as 28, gradational upper contact.	2	
24	Ss, c to vcg with average mg, lgt ol gy (5Y 5/2), poorly sorted, rounded pebbles to 3" diam, massive, qtzic, gradational upper contact.	27	
23	Ss, mg-cg qtz grains in clayey matrix, gy rd (5R 4/2), some zones have over 50% matrix, some small cross beds, some zones with pebbles to $\frac{1}{2}$ " diam, basal 6" has numerous qtz pebbles, sharp upper contact.	4	3
22	Ss, fg-mg, gy rd (5R 4/2), qtzic, massive, gradational upper contact.	7	6
21	Ss, vfg, gy rd (5R 4/2), qtzic, bedded, grades into slst with scattered mg s grains in upper 6", sharp upper contact.	1	6
20	Ss, mg-cg, gy rd (5R 4/2), qtzic, massive sharp upper contact.	8	
19	Ss, cg, gy rd (5R 4/2), clayey matrix, pebbles to $\frac{1}{2}$ " qtzic, massive, upper 6" becomes fg, few pebbles to	14	

Unit	Description	Thickness	
		(Ft)	(In)
	1½" diam, sharp upper contact.		
18	Ss, fg, lgt ol gy (5Y 6/1), Qtzic, massive, sharp upper contact.	3	
17	Slst, cg, lgt ol gy (5Y 6/1), thin bedded, moderately well indurated, sharp upper contact.		10
16	Ss, fg-mg, lgt gy (N7), faint suggestion of gn gy (5GY 6/1), Qtzic, massive, some parallel beds indicated by color laminae, sharp upper contact.	17	6
15	Sh, lgt ol gy (5Y 5/2), cleavage dominated, sharp upper contact.		6
14	Slst, fg, gy rd (5R 4/2), cleavage dominated, faint trace of bedding, hackly breakup, gradational upper contact.	11	
13	Slst, cg-vcg, gy rd (5R 4/2), 1-3" beds, gradational upper contact.	7	6
12	Ss, vfg, lgt ol gy (5Y 6/1) to gn gy (5GY 6/1), massive, Qtzic, sharp upper contact.	1	3
11	Ss, vfg, lgt ol gy (5Y 6/1) with some rd mottling, blocky to hackly to cleavage dominated, sharp upper contact.	4	6
10	Slst, fg, gy rd (5R 4/2), cleavage dominated, gradational upper contact.	11	
9	Ss, vfg, grayish red (5R 4/2), massive, parallel bedding laminae, Qtzic, gradational upper contact.	5	
8	Slst, cg, gy rd (5R 4/2), Qtzic, parallel laminae, gradational upper contact.		3
7	Ss, as 9, gradational upper contact.		2 1/2
6	Slst, as 8, gradational upper contact.		2
5	Ss, as 9, gradational upper contact.	6	
4	Slst, as 8, gradational upper contact.		5
3	Ss, fg, gy rd (5R 4/2), small concentrations of mg s in clayey matrix, cleavage dominated, gradational upper contact.	2	

Unit	Description	Thickness	
		(Ft)	(In)
2	Slst, fg, gy rd (5R 4/2), small concentrations of mg s in clayey matrix, cleavage dominated, grad- ational upper contact.	2	
1	Ss, cg, gy rd (5R 4/2), Qtzic, massive, base behind stone wall.	2+	
	Total thickness of Bear Mountain Member of Catskill Formation	169	4½

SECTION B

Stratigraphic description of the Mt. Carbon (upper) and Beckville (lower) Members of the Pocono Formation and the Spechty Kopf Member of the Catskill Formation at the type locality of the Pocono members north of Beckville, Pennsylvania. Described section starts near the paved road fork 1 mile north of Beckville on the east side of the road immediately north of a gully recess.

Unit	Lithologic Description	Thickness	
		(Ft)	(In)
MAUCH CHUNK FORMATION			
192	Sh, gy rd (5R 4/2), thin parallel-sided beds, breaks into plates, upper contact lost in cover, end of rock exposure, 100-200' of cover in remainder of cut has mixed rd and non rd float, may be contaminated by colluvium.	8	0
191	Slst, fg, between lgt ol gy (5Y 5/2) and dusky yel (5Y 6/4), massive, breaks up into sharp cornered blocks in lower part and plates in upper part, upper 1' is sh, gradational upper contact.	11	0
190	Ss, fg, ol gy (5Y 5/2), massive, gradational upper contact.	4	0
189	Slst, as 191, sharp upper contact.	4	6
188	Ss, mg, ol gy (5Y 5/2), massive, moderately indurated, gradational upper contact.	2	0
187	Sh, dk rd bn (10R 3/4), breaks up into thin parallel-sided flakes, massive with some suggestion of parallel-sided bedding, sharp upper contact.	4	0
186	Slst, mg-cg, gy rd (5R 4/2), grades up into sh, parallel-sided beds, poorly defined bedding, micaceous, breaks up into small thin flakes, gradational upper contact.	4	0
185	Covered interval, ss float.	6	0
184	Slst, cg at base grades up into fg, dk rd bn (10R 3/4) to grayish rd (5R 4/2), dk bn is fresher color, irregular parting along parallel-sided beds, poor outcrop, upper contact lost in cover.	6	0
Total thickness of Mauch Chunk Formation		54	6

Unit	Description	Thickness	
		(Ft)	(In)
POCONO FORMATION			
Mount Carbon Member			
183	Covered interval, traces of rd sh 40' above base	54	0
182	Ss, mg, massive, structureless, qtzic, upper contact lost in cover.	16	0
181	Covered interval, probably slst.	8	0
180	Ss, cg-vcg, massive, structureless, qtzic, upper contact lost in cover.	6	0
179	Covered interval.	25	0
178	Ss, mg, qtzic, massive, apparently structureless, upper contact lost in cover.	9	0
177	Covered interval.	20	0
176	Ss, cg, scattered qtz pebbles up to $\frac{1}{2}$ " diam, massive, qtzic, upper contact lost in cover.	3	0
175	Ss, mg, hard, qtzic, massive, sharp upper contact.	2	0
174	Ss, cglatic, mg-cg with 25% + white qtz pebbles generally less than $\frac{1}{4}$ " diam., massive structureless, some sh chips up to 1" long, sharp upper contact.	2	0
173	Ss, cg, occasional scattered pebbles up to 1" diam., massive, partially covered, upper contact probably gradational.	11	0
172	Covered interval.	12	0
171	Ss, cglatic, mg-cg with white qtz pebbles $\frac{1}{4}$ - $\frac{1}{2}$ " diam occurring as scattered pebbles and in discontinuous bands, massive, qtzic, crossbedding in upper $1\frac{1}{2}$ ', upper contact lost in cover.	10	0
170	Covered interval.	20	0
169	Ss, cg, massive, qtzic, scattered pebbles up to 1" diam in lower 3', upper contact lost in cover.	11	0
168	Covered interval.	14	0
167	Ss, mg-cg, hard, qtzic, parallel-sided beds, probably cross-bedded, upper contact lost in cover.	3	3

Unit	Description	Thickness	
		(Ft)	(In)
166	Covered interval.	12	0
165	Ss, mg, qtzic, cross bedded, upper contact lost in cover.	5	0
164	Cgl, 1/8-1/4" diam pebbles make up to 75% of rock in lower part, upper part has mainly 1/8" diam pebbles, grades up into ss at top, cg s matrix, upper half contains sh chips up to 1" diam, contains considerable feldspar which is weathering to c, gradational upper contact.	2	2
163	Ss, mg-cg, massive, qtzic, sharp upper contact.	2	8
162	Covered interval.	12	0
161	Ss, mg, qtzic, massive cross bedded, bedding indicated by color variation and weathering, upper contact lost in cover.	26	0
160	Covered interval, probably same as unit 130.	13	0
159	Ss, mg, hard, qtzic, cross bedded, sweeping cross beds with tangential bases, mica flakes on bedding planes, upper half massive, bedding generally poorly defined, upper contact lost in cover.	42	0
158	Ss, cg, massive, hard, qtzic, cross bedded, color bands indicate laminations, some mica on bedding planes, cross beds are sweeping with tangential bases, sharp smooth planar upper contact, uppermost 1" is platy, highly micaceous fg-mg ss with abundant organic debris.	24	0
157	Ss, mg-cg, mixed with slst, cg, dk gy (N3), laterally the slst may be replaced by ss, top marked by md dk gy (N4) fissile sh which is laterally discontinuous, sharp irregular upper contact.	3	0
156	Ss, mg-cg, cross bedded, color banding, sharp irregular upper contact.	5	0
155	Sh, md dk gy (N4), laterally discontinuous, contains organic fragments.	0	2
154	Ss, cg, qtzic, scattered pebbles up to 1" diam in lowermost 2' irregular sub-parallel bedding, sharp irregular upper contact.	15	0

Unit	Description	Thickness	
		(Ft)	(In)
153	Ss, cg, contains a few $\frac{1}{4}$ - $\frac{1}{2}$ " diam pebbles in basal 1', massive in lower part, crossbedded in upper part, cross beds are broad sweeping beds up to 2" thick, mica flakes concentrated on bedding planes, becomes mg in upper 4', grades into fg ss and very thin platy beds ($\frac{1}{8}$ - $\frac{1}{4}$ " thick) in uppermost 5", sharp upper contact.	17	0
152	Ss, cg, irregularly bedded, laterally discontinuous, coal 1" thick at top.	4	9
151	Sh, bk, grades upward in upper 2' into dk gy (N3) fg slst, may have thin coal at top but outcrop too poor to tell, laterally becomes separated by wedge of mg-cg, massive, structureless ss, sharp upper contact.	6	0
150	Ss, cg, pebbles up to $\frac{1}{2}$ ' diam, massive, may have bedding but appears structureless, hard, qtzic, sharp upper contact.	1	5
149	Ss, mg, massive, parallel-sided bedding poorly displayed in lower part, becomes platy in upper 1", mica flakes on bedding planes, sharp upper contact.	2	0
148	Slst, cg, dk gy (N3), blocky, mixed with mg, hard, qtzic ss, slst appears laterally discontinuous, ss contains slst chips, outcrop poor, upper contact may be gradational.	1	4
147	Ss, mg, hard, cross bedded in part, cglatic with 15-20% pebbles $\frac{1}{4}$ - $\frac{1}{2}$ " diam, massive, sharp upper contact.	8	0
146	Cgl, cg-vcg ss matrix, up to 40% pebbles $\frac{1}{4}$ - $\frac{1}{2}$ " diam, sharp upper contact.	2	2
145	Ss, fg-mg, cross bedded with very flat sweeping beds $\frac{1}{4}$ -2" thick, much organic material concentrated on bedding planes, pyrite nodules up to $\frac{1}{2}$ " diam scattered throughout, weathered surface highly stained with rust colors, sharp upper contact, laterally may be cut out by mg ss lacking organic material.	3	7
144	Ss, mg, massive, qtzic, 15-20% pebbles in upper $\frac{1}{2}$, pebbles $\frac{1}{4}$ - $\frac{1}{2}$ " diam, sharp upper contact is very planar.	1	0

Unit	Description	Thickness	
		(Ft)	(In)
143	Cgl, cg ss matrix, up to 40% qtz pebbles which are variably distributed and more abundant in upper $\frac{1}{2}$, pebbles generally $\frac{1}{4}$ - $\frac{1}{2}$ " diam, laterally discontinuous, $\frac{1}{4}$ - $\frac{1}{2}$ " thick coal at top sharp and irregular upper contact.	3	4
142	Ss, mg, hard, qtzic, massive, gradational upper contact.	1	8
141	Ss, mg-cg, qtzic, hard, md gy (N5), cross bedded, grades into fg ss in upper 3", platy beds $1/8$ - $1/4$ " thick sharp planar upper contact.	2	8
140	Cgl, cg-vcg ss matrix, 25-40% qtz pebbles $\frac{1}{4}$ - $\frac{1}{2}$ " diam, 1" thick discontinuous coal bed in center and also at top, hard, qtzic, massive, structureless, sharp upper contact.	2	0
139	Ss, cg, hard, qtzic, uppermost 1" becomes mg, platy beds, scattered organic material, sharp and irregular upper contact.	0	6
138	Cgl, mg-cg, ss matrix, 40% + qtz pebbles, pebbles up to 1" diam average $\frac{1}{2}$ " diam, massive, structureless, laterally variable in thickness, sharp and irregular upper contact.	1	4
137	Ss, mg, central part contains numerous qtz pebbles $\frac{1}{4}$ - $\frac{1}{2}$ " diam, cross bedded, composed of several 3-4" thick beds which may be laterally discontinuous, hard, qtzic, smooth but irregular upper contact.	1	8
136	Ss, mg-cg, contains 5-25% white qtz pebbles up to $\frac{1}{2}$ " diam concentrated in zones, some pebbles scattered throughout, hard, qtzic, smooth but irregular upper contact.	5	0
135	Cgl, mg-cg ss matrix, 50-75% white qtz pebbles with $\frac{1}{4}$ - $\frac{1}{2}$ " diam the dominant size, nearly white in color, qtzic, 1' above base is coal with maximum thickness of 4"; coal has irregular shape, is 4' long and completely enclosed by cgl; whole unit is massive and structureless, sharp and irregular upper contact.	12	0
134	Ss, mg, parallel-sided beds may be related to cross bedding, may thin laterally, sharp upper contact with relief of 1-2'.	3	0

Unit	Description	Thickness	
		(Ft)	(In)
133	Cgl, mg-cg ss matrix, 10-50% white qtz pebbles, laterally becomes dominantly ss, thickness variable and dependent upon channeling by overlying unit, sharp upper contact.	4	0
132	Ss, mg, md gy (N5), qtzic, cross bedded, sharp upper contact.	2	0
131	Cgl, over 50% white qtz pebbles up to 1" diam averaging $\frac{1}{4}$ " diam, qtzic, massive, structureless, sharp upper contact.	2	0
130	Ss, fg, massive, laterally interbedded with tongues of underlying cgl, sharp upper contact.	0	10
129	Cgl, as unit 102, sharp upper contact.	6	0
128	Sh, gy bk (N2), upslope sh thickens to 1'6" as result of fill into underlying scour channel, locally the sh is overlain by maximum of 2 $\frac{1}{2}$ ' of vcg ss with pebbles to 1/8" diam, ss has parallel-sided beds and is lense which is not laterally persistent, sharp upper contact.	1	0
127	Ss, mg-cg, cross bedded, contains scattered pebbles to $\frac{1}{4}$ " diam, sharp upper contact.	3	0
126	Cgl, mg-cg ss matrix, 30-50% pebbles up to $\frac{1}{2}$ " diam, qtzic, massive, cross bedded, sharp upper contact.	1	7
125	Ss, mg, cross bedded, cross beds have sweeping tangential bases and truncated tops, sharp upper contact.	0	3
124	Ss, cg-vcg, scattered qtz pebbles up to $\frac{1}{2}$ " diam v lgt gy (N8), qtzic, massive, some cross bedding indicated by color banding, sharp upper contact.	1	4
123	Ss, as unit 125, sharp upper contact.	1	2
122	Ss, as unit 124, sharp upper contact.	2	0
121	Ss, as unit 125, sharp upper contact.	4	0
120	Cgl, 10-50% qtz pebbles averaging $\frac{1}{4}$ " diam, qtzic, massive, structureless with beds 1-1 $\frac{1}{2}$ ' thick,	4	0

Unit	Description	Thickness	
		(Ft)	(In)
	sharp upper contact.		
119	Ss, mg-cg, contains a few 1/8" (or less) thick carbonaceous slst beds, irregularly bedded, some cglatic layers in lower 1/2 with pebbles up to 1/2" diam, sharp irregular upper contact, in places separated from overlying unit by 1/4" thick dk gy sh.	3	6
118	Ss, mg, qtzic, micaceous, massive, cross bedded, sharp upper contact.	6	0
	Total thickness of Mount Carbon Member of the Pocono Formation	510	4
Beckville Member			
117	Sh, dk gy (N3), some interbedded mg ss, sh may be laterally discontinuous, abundant carbonaceous material, sharp upper contact.	3	2
116	Ss, fg-mg, parallel-sided beds 1-4" thick, becomes mg ss and massive in upper 3 1/2', sharp upper contact.	7	6
115	Slst, cg, dk gy (N3), some vfg ss beds, parallel-sided beds 1/8-1" thick, scattered pyrite nodules, abundant rusty iron stain on weathered surface, sharp upper contact.	3	3
114	Ss, fg, parallel-sided beds 1-3 mm thick in lower 7", grades up into mg ss, massive in appearance, sharp upper contact, scattered pyrite nodules in lower 5".	2	6
113	Ss, fg, parallel-sided beds 1-3 mm thick in lower 7", grades up into mg ss, cross bedded but massive in appearance, sharp upper contact.	4	2
112	Ss, mg, massive, structureless, sharp upper contact, pyrite nodules in upper 1".	1	10
111	Ss, fg, thinly bedded, scattered carbonaceous material, 0 recesses upon weathering, sharp upper contact.	0	2
110	Ss, mg, massive, cross bedded, qtzic, sharp upper contact.	8	7

Unit	Description	Thickness	
		(Ft)	(In)
109	Sh, dk gy (N3), with interbedded mg, qtzic ss, ss is irregularly shaped and discontinuous, sharp irregular upper contact.	4	6
108	Ss, mg-cg, massive, may be cross bedded, 1" diam pyrite nodule 5'6" above base, near base of slope a 3" thick coal bed occurs diagonally across unit for 5' and is 2' below top at one end and 6" below top at other end, sharp upper contact.	9	6
107	Ss, cg, occasional qtz pebbles and sh chips, numerous irregular sh planes between ss beds $\frac{1}{2}$ -1" thick, very irregular appearing, sharp upper contact.	2	0
106	Coal, fissile, laterally discontinuous, irregular sharp upper contact.	0	3
105	Ss, cg, zone between 2' and 3 $\frac{1}{2}$ ' above base contains numerous scattered sh chips up to 3" diam but generally less than 1", massive with cross bedding indicated by color lines, sharp irregular upper contact.	12	3
104	Slst, cg, md dk gy (N4), fissile, laterally variable in thickness and probably discontinuous sharp upper contact.	0	3
103	Ss, mg-cg, contains some sh chips in upper 6", massive becoming cross bedded in upper 2', sharp upper contact.	6	0
102	Sh, dk gy (N3), fissile, sharp irregular upper contact.	2	6
101	Ss, cg, massive, becomes mg and cross bedded in upper $\frac{1}{2}$, sharp upper contact.	6	6
100	Sh, dk gy (N3), abundant organic material in places, downslope a mg ss tongue joins with Unit 70 and comprises 2'5" of the total thickness, up slope the ss tongue pinches out entirely, most of the organic material is upslope beyond the end of the ss tongue, sharp upper contact.	3	0
99	Ss, mg, cross bedded, sharp upper contact.	12	0
98	Sh, dk gy (N3), platy to fissile, probably laterally discontinuous, sharp planar upper contact.	2	0

Unit	Description	Thickness	
		(Ft)	(In)
97	Ss, mg, hard, qtzic, md dk gy (N4), zone between 3-4' above base contains a few dk gy sh chips and white qtz pebbles and is steeply cross bedded sharp upper contact.	17	3
96	Slst, fg, dk gy (N3), fissile, micaceous, some organic material concentrated on bedding planes, sharp upper contact.	0	10
95	Ss, mg, massive, qtzic, parallel-sided laminae related to cross bedding, cross beds are tangential at base but tops are indistinct, lower 5'9" apparently lacks cross bedding, sharp upper contact.	21	9
94	Ss, cg, massive, laterally this unit thickens at expense of underlying unit while in opposite direction the bed is cut out entirely by the overlying unit, sharp upper contact is in places a mixed zone and appears gradational, upper part of the unit contains scattered dk gy sh chips and white qtz pebbles.	4	0
93	Ss, vfg-fg, parallel-sided beds 1-3 mm thick, md dk gy (N4), recesses upon weathering, lower 2" is mg-cg ss with abundant dk gy sh chips up to 1" diam, very hard qtzic bed, sharp upper contact.	0	11
92	Ss, mg, massive with trace of irregular sub-parallel beds, scattered dk gy sh chips up to 2" diam throughout but mainly in lower 6", sharp upper contact.	3	0
91	Sh, dk gy (N3), irregularly interbedded fg ss beds up to 1" thick, unit has chaotic appearance, sharp upper contact.	1	3
90	Ss, mg parallel-sided beds indicated by parting and color bands, abundant mica flakes along parting planes, appears more massive in upper 3', sharp upper contact.	13	0
89	Ss, fg, parallel-sided beds and cross beds, numerous $\frac{1}{4}$ -1" thick beds, sharp upper contact.	3	6
88	Ss, mg, massive, qtzic, sharp upper contact.	5	3
87	Slst, fg, dk gy (N3), micaceous, sharp contact.	2	6
86	Ss, mg, qtzic, massive, apparently structureless, sharp upper contact.	6	0

Unit	Description	Thickness	
		(ft)	(In)
85	Slst, fg, dk gy (N3), fissile, micaceous, parallel-sided beds indicated by interbedding with coarser grained lighter colored beds, sharp upper contact.	8	0
84	Ss, mg, massive, structureless, qtzic, sharp upper contact.	4	7
83	Sh, dk gy (N3), scattered carbonaceous fragments, fissile, silty, sharp upper contact.	1	0
82	Ss, mg, massive, may contain parallel-sided beds and cross beds, lower few feet are cg, central part is covered, sharp upper contact.	26	0
81	Slst, mg, dk gy (N3), hard, parallel laminations indicated by color banding, sharp upper contact.	0	8
80	Ss, mg, well indurated, recesses upon weathering, cross bedded with sweeping tangential base, cross beds, sharp upper contact.	1	1
79	Ss, mg, qtzic, massive, may be cross bedded, sharp upper contact.	6	0
78	Slst, fg, ol bk (5Y 2/1), parallel-sided beds, sharp upper contact.	6	0
77	Ss, mg-cg, qtzic, massive, irregularly shaped beds, sharp upper contact.	4	3
76	Ss, cg, qtzic, contains irregularly interbedded dk gy sh, sh is thin and laterally discontinuous, upper 2' of ss contains abundant sh chips up to 2" diam, gradational upper contact.	3	6
75	Ss, mg-cg, massive, irregular parallel-sided beds and cross beds, base defined by recessed platy tangential cross beds, a pyritic zone 1½" thick and 12" long occurs 5'6" above base, sharp upper contact.	9	0
74	Ss, mg, massive, scattered ¼" diam qtz pebbles in upper 1", sharp upper contact.	0	9
73	Ss, vfg-fg, platy, beds 1/8" thick or less, micaceous, some organic material, recessed zone, sharp upper contact.	0	3

Unit	Description	Thickness	
		(Ft)	(In)
72	Ss, mg, massive, parallel-sided beds, lower 2" is cross bedded and highly micaceous fg ss, cross beds have tangential bases and are 1/8-1/4" thick, platy beds developed by weathering, gradational upper contact.	2	3
71	Ss, mg, qtzic, massive, sharp upper contact.	1	2
70	Slst, dk gy (N3), micaceous, sandy with vfg s grains, gradational upper contact.	0	2
69	Ss, mg, qtzic, massive, parallel-sided beds, sharp upper contact.	2	9
68	Sh, 1/2-2" thick, bk, very fissile, deeply recessed by weathering, sharp upper contact.	0	2
67	Cgl, 1/8-1/2" diam qtz pebbles, mg ss matrix, may not be laterally persistent, sharp upper contact.	0	4
66	Ss, mg, ol gy, hard, qtzic, micaceous, parallel-sided beds 1-3" thick with parallel laminae indicated by color banding, some planes of pyrite nodules up to 2" diameter, some cross bedding in upper 2', sharp upper contact.	18	0
65	Ss, mg-vcg, 10-20% white qtz pebbles 1/4-1/2" diam, massive, qtzic, irregular sub-parallel beds in upper 1', upper 4" very cglatic with up to 50% pebbles, pebbles up to 1 1/2" diam, sharp upper contact may really be gradational.	3	6
64	Slst, fg, dk gy (N3), few scattered organic fragments, numerous mica flakes, sharp upper contact.	0	6
63	Ss, cg-vcg, cglatic with scattered pebbles 1/8-1" diam, massive, scoured basal surface, cross bedded in lower 2", main mass of rock structureless, sharp upper contact.	2	6
62	Cgl, 10-50% white qtz pebbles up to 1" diam averaging 1/4-1/2" diam, basal 2' contains fewest pebbles, cg-vcg ss matrix, massive, some conglomerate beds 1-2' thick grade upward into ss without pebbles, upper contact sharp and irregular, laterally a sh occurs at contact and contains abundant organic material, cover obscures overall relationship of sh.	12	0

Unit	Description	Thickness	
		(Ft)	(In)
61	Ss, mg-cg, hard, Qtzic, massive, probably cross bedded sharp upper contact.	3	2
60	Cgl, cg-vcg ss matrix, 25-50% Qtz pebbles up to $\frac{1}{2}$ " diam averaging $\frac{1}{4}$ " or less, Qtzic, very hard, scattered sh chips in center of unit, massive, gradational upper contact (?).	6	0
59	Ss, cg-vcg, cglatic with pebbles $\frac{1}{4}$ " diam or less, Qtzic, md lgt gy (N6), probably cross bedded, pebble content varies from 0 to 25%, upper contact may be gradational.	10	0
58	Sh, between lgt ol gy (5Y 6/1) and dusky yel (5Y 6/4), massive, structureless, upper 2/3 is mainly covered but float suggests lithology same, upper contact is sharp and marks end of large recessed zone.	34	0
57	Slst, fg-mg, lgt ol gy (5Y 5/2), massive, well indurated, structureless, sharp upper contact, stands out in center of recess zone.	0	7
56	Sh, silty, between lgt ol gy (5Y 6/1), and dusky yel (5Y 6/4), massive, blocky in weathering character, forms lower part of large recessed zone, partially covered, upper 5' contains abundance of small holes 0.1-0.2 mm in diam, holes internally coated with lgt bn (5YR 5/6) iron stain, upper contact gradational.	15	0
55	Ss, vfg, lgt ol gy (5Y 6/1), massive, separated from Unit 25 by $\frac{1}{4}$ - $\frac{1}{2}$ " thick fg slst bed which grades up into ss, sharp upper contact.	0	8
54	Slst, cg, lgt ol gy (5Y 6/1), grades up into vfg ss in upper 2", massive, gradational upper contact.	0	6
53	Ss, mg, fg ss at base grades up within 3' into mg, massive, scattered Qtz pebbles to $\frac{1}{2}$ " diam, cross bedding indicated by laminae and fracturing, gradational upper contact.	15	0
52	Sh, md dk gy (N4), deep recess, may be laterally discontinuous, sharp upper contact.	0	1
51	Ss, fg-mg, md lgt gy, massive, structureless, sharp upper contact.	1	1
50	Slst, md dk gy (N4), slightly fissile, sharp upper contact.	0	8

Unit	Description	Thickness	
		(ft)	(In)
49	Ss, mg, md dk gy (N4), hard, qtzic, 3-4" thick parallel-sided beds, 32' above base are 2 sh chip zones 1-2" thick occurring on cross bed planes, some qtz pebbles up to ½" diam occur along these planes, sharp upper contact.	47	0
48	Ss, mg, sh chips, bed is laterally discontinuous, slightly recessed zone, sharp upper contact.	1	0
47	Ss, mg, massive, md lgt gy (N6), hard, qtzic, few sh chips near base and some unusual bedding plane structures which look like filling of log impressions, gradational upper contact.	17	0
46	Sh, md dk gy (N4), fissile, distorted, laterally discontinuous, sharp upper contact.	1	1
45	Ss, cg, lgt ol gy (5Y 6/1), very hard, qtzic, massive, lower 1' contains occasional sh chips up to 4" long and 1½" thick, some qtz pebbles up to ½" diam, some cross bedding, 2' below top is discontinuous md dk gy sh 0-4" thick which seems distorted by overlying ss, sharp upper contact.	8	0
44	Ss, mg-cg, abundant sh chips up to 2" diam, laterally unit is cross bedded and lacks sh chips, sharp upper contact.	2	6
43	Ss, mg, lgt ol gy (5Y 6/1), hard, qtzic, lower 12' are massive, upper 8' are irregularly bedded and possibly cross bedded, gradational upper contact.	20	8
42	Slst, cg, dk gy, fissile, abundant carbonaceous material and mica flakes, parallel-sided beds 1/8" thick or less, sharp upper contact.	0	7
41	Ss, mg, md gy, massive with suggestion of sweeping cross beds in lower, bedding plane concentrations of ¼-½" diam sh chips occur at 6", 1'8" and 8' 4" above the base, the chip zones appear laterally discontinuous, sharp upper contact.	15	0
40	Slst, mg, ol gy (5Y 3/2), base is fg ss which grades up into slst, fissile in breakup, massive in outcrop, upper ½ has carbonaceous material and mica flakes on bedding planes, sharp upper contact.	4	2

Unit	Description	Thickness	
		(Ft)	(In)
39	Ss, fg, lgt ol gy (5Y 5/2), hard, qtzic, parallel-sided laminae, mg-vcg mica flakes on bedding surfaces, upper 5" has scattered pyrite nodules up to 1" diam aligned along plane, sharp upper contact.	9	6
38	Slst, cg, md gy, fissile, some carbonaceous material, deeply weathered, sharp upper contact.	0	5
37	Ss, mg, md gy, massive, qtzic, 1" diam pyrite nodule 6" above base, scattered sh chips 1' above base, sharp upper contact.	3	0
36	Sh, bk, deeply recessed, may be laterally discontinuous, upslope about 15' only 8" of sh with abundant carbonaceous material lies between ss beds, sharp upper contact.	1	4
35	Ss, sequence as follows: top Ss, mg, md gy, massive, wedges out laterally, sharp upper contact. 1' 4" Ss, vfg, md gy (N5), parallel-sided beds, carbonaceous material scattered mainly in lower part, sharp upper contact. 1' 7" Ss, mg, few pebbles to 1½" diam in central part, massive sharp upper contact, md gy (N5). 0' 5" Ss, vfg, md gy (N5), micaceous and carbonaceous, parallel-sided beds, sharp upper contact. 0' 4"	3	8
34	Cgl, cg ss matrix, pebbles to 2" diam averaging ½-1" diam, pebbles less than 15% of rock, massive, qtzic, very hard, one ironstone concretion 1" diam, several limonitic pellets up to ¼" long and 1/8" diam, sharp upper contact.	2	0
33	Ss, mg, lgt gy, qtzic, very hard, massive, breaks up into parallel-sided pieces several inches thick; 4' 6" above base is 5" thick zone with some ol gy sh chips, may have sh parting at top of zone; 7' 7" above base is pebble layer 1 pebble thick and pebbles to 1½" diam; 10' 6" above base is 2-4" thick cgl with ½-1½" diam pebbles and sh chips over 4" long, unit has basal scoured contact with underlying unit; upper 2' 6" has few scattered pebbles up to 2" diam, sharp upper contact.	13	0

Unit	Description	Thickness	
		(Ft)	(In)
32	Cgl, cg-vcg ss matrix, most pebbles 1/8-1/4" diam pebbles common, massive, some separation of ss and cgl layers but rather obscure, sharp upper contact.	2	8
31	Sh, ol gy (5Y 4/1), massive, breaks into fissile plates, mg-cg mica flakes common on bedding-parallel partings, laterally discontinuous, sharp planar upper contact.	0	9
30	Cgl, cg-vcg ss matrix, white qtz pebble up to 2" diam averaging 1/4-1/2" diameter, qtzic, some zones with no pebbles, base is very irregular and either scoured or loaded into underlying unit laterally thins and may be discontinuous, sharp planar upper contact.	1	11
	Total thickness of Beckville Member of the Pocono Formation	522	7

CATSKILL FORMATION

Spechty Kopf member

29	Slst, mg-cg, qtzic, lgt ol gy (5Y 6/2), structureless in lower part with some poorly defined cs beds, 22' above base are some vfg-mg ss beds with load cast structures on bases and symmetrical ripple marks on upper surfaces, sharp upper contact.	54	0
28	Sh, dk yel bn (10YR 4/2), structureless in lower part; 10' above base is lense of fg, lgt ol gy (5Y 6/2) qtzic ss with 1-2" thick parallel-sided beds, lense is 5' thick and 10-15' long; 20' above base is similar ss lense 3' long and over 20' long; upper 60' has scattered pebbles and qtz grains of s size; 56' above base are some laterally discontinuous, small lenses of mg-cg slst with load cast appearance; sharp upper contact.	84	0
27	Claystone, lgt ol bn (5Y 4/6), parallel laminae 1 mm or less thick, numerous dropped in pebbles up to 1" diam, abundant s grains along laminae planes; 6' above base is cs, non-laminated, pale bn (5YR 5/2), with a few pebbles and s grains; 12' above base grades back into laminated cs with pebbles up to 4" diam and s grains; 16' above base	20	0

Unit	Description	Thickness	
		(Ft)	(In)
	grades into cs, non-laminated with few s grains and no pebbles; 20' above base is top of laterally discontinuous zone of lenses of slst, mg-cg, lgt ol gy (5Y 5/2), smooth margins, 4' maximum thickness, 6' maximum length; gradational upper contact.		
26	Mudstone, c to cg s, pebbles, lgt ol gy (5Y 6/2), irregularly bedded, poorly sorted, sharp contacts.		10
25	Tilloid, c to cg s with 50% + c, unsorted, lgt ol gy (5Y 6/2), uniform, massive, numerous pebbles weathering tendency toward exfoliation spalls; 14' above base is lense of ss, 3' maximum thickness and 8' long, sharp contacts.	45	0
24	Ss, fg-mg, qtzic, lgt ol gy (5Y 5/2), massive, irregularly bedded, sharp upper contact.	2	0
23	Ss, mg-cg, numerous pebbles to 1/4" diam sometimes concentrated in distinct beds-particularly at base of individual beds, qtzic, irregular parallel-sided beds 4" to 1' 6" thick, sharp upper contact.		
22	Tilloid, c to pebbles, unsorted, ol gy (5Y 4/2), seems deficient in s size material, massive, 4' above base is zone up to 2' thick of interfingering lgt ol gy (5Y 6/2) cs, occasional pebbles, sharp upper contact.	8	6
21	Cgl, 25% qtz pebbles 1/4-1/2" diam in mg-cg ss matrix, sharp upper contact.	1	4
20	Tilloid, c to pebbles, unsorted, massive, ol gy (5Y 4/2), sharp upper contact.	2	0
19	Ss, vfg-fg, qtzic, lgt ol gy (5Y 5/2), sharp upper contact.		11
18	Tilloid, c to pebbles, unsorted, massive, ol gy (5Y 4/2), sharp upper contact.	4	0
17	Ss, mg, some pebbles to 1/4" diam, comprises 4 beds slightly cglatic at base grading upward into ss, sharp upper contact.		11
16	Ss, c (?) to pebbles, dominantly mg, qtzic, obscure bedding, sharp upper contact.	7	0

Unit	Description	Thickness	
		(Ft)	(In)
15	Ss, mg, qtzic, lgt ol gy (5Y 5/2), occasional pebbles to ¼" diam, crude parallel-sided bedding with beds 1-2" thick, sharp upper contact.	2	3
14	Tilloid, c to pebbles, unsorted, md dk gy (N4) massive, sharp upper contact.	4	3
13	Ss, mg, qtzic, lgt ol gy (5Y 5/2), occasional pebbles to ¼" diam, crude parallel bedding, sharp contacts.	1	6
12	Tilloid, c to pebbles, unsorted, ol gy (5Y 4/2), massive, weathers by spall, sharp upper contact.	12	0
11	Cgl, 25% pebbles to ¼" diam in slst to mg ss matrix, cgl is 6" to 1' thick then grades upward into overlying unit.	2	0
10	Ss, mg, qtzic, ol gy (5Y 4/2) basal 3" laterally contains concentration of pebbles to ¼" diam, irregularly bedded, sharp upper contact.	3	0
9	Tilloid, c to pebbles, lgt ol gy (5y 5/2), dominantly fg-mg s with c coating on grains, massive; 3' above base is 5" thick vfg-fg ss lense; sharp upper contact.	7	0
8	Slst, cg, ol gy (5Y 5/2), hard, massive, weathers to gy rd, contains contorted ss layer with pebbles to ¼" diam, upper 6" is fg slst and is leached, sharp upper contact.	7	0
7	Sh, gy rd (5R 4/2), disintegrates into hackly pieces, contains some slst, mg-cg, mod yel bn (10YR 6/4) in obscure bedding relationship, sharp irregular upper contact.	8	0
6	Ss, mg, qtzic, ol gy (5Y 4/2), parallel beds 2-9" thick sharp upper contact.	6	0
5	Ss, mg, lgt gy to white, poorly defined laminae, qtzic, above 14' above base contains numerous sh chips and occasional rounded qtz pebbles to ¼" diam, upper 6" grades into slst, sharp irregular upper contact.	21	0
4	Slst, mg, gy rd (5R 4/2), massive, upper 6" leached to gy o (10YR 7/4), sharp irregular upper contact.	3	0
3	Ss, vfg, lgt ol gy (5Y 5/2), massive, abundant fg muscovite flakes, gradational upper contact.	6	0

Unit	Description	Thickness	
		(Ft)	(In)
2	Slst, mg-cg, lgt ol gy (5Y 5/2), massive, gradational upper contact.	2	0
1	Ss, vfg, lgt ol gy (5Y 5/2), massive, abundant fg muscovite flakes, gradational upper contact.	10	0
	Total thickness of Spechty Kopf Member of the Cat-skill Formation	329	1
	Base of section lost in float in gulley recess.		

SECTION C

Stratigraphic description of Pocono Formation occurring along east side of Route US 611 south of Dunmore, Lackawanna County, Pennsylvania. Top of section at prominent basal conglomerate of Pottsville Formation. Base of described section at pull-off on east side of road were cliff forming sandstones intersect road.

Unit	Lithologic Description	Thickness	
		(Ft)	(In)
POTTSVILLE FORMATION			
37	Cgl, white, pebbles to 1½" diam of qtz, massive, qtzitic, 10' above base is lense of bk sh.	25+	0
POCONO FORMATION			
36	Ss, mg, lgt gy, qtzitic, massive, upper part locally an alternation of fg ss and sh, sharp upper contact.	10	0
35	Ss, fg, md lgt gy (N6), weathers with reddish tint, calcareous, parts of upper ½ contain more calcite than s, very nodular appearance in upper part, well developed etched surfaces, sharp upper contact.	6±	0
34	Ls, gy bk (N2), massive, blocky, criss-crossed with veins of calcite, some weathering color of gy o pk (5YR 7/2), ss dikes with vcg s following definite vertical planes, sharp upper contact.	5	0
33	Sh, near pale yel bn (10YR 6/2), weathers between lgt ol gy (5Y 6/1) and gn gy (5GY 6/1), calcareous, hard brittle, numerous small (less than 1'.8") ls pellets, parts of unit are pure ls, gradational upper contact.	6	0
32	Sh, ol gy (5Y 5/2), weathered surface near dusky yel (5Y 6/2), gradational upper contact.	1	6
31	Sh, ol gy (5Y 5/2), abundant holes less than 1 mm diam filled with ls which weathers leaving hole, ls mainly in lower 9" weathers near gn gy (10Y 4/2), gradational (?) upper contact.	1	3
30	Ls, crystalline, hard, pale rd (5R 6/2), weathers v lgt gy (N8), occurs as irregular masses in sh similar to Unit 29, suggestion of vertical ls masses with greater concentration near top, lateral persistence with variable thickness, sharp upper contact.		9
29	Sh, ol gy (5Y 4/1), hard, brittle, gradational upper	2	0

Unit	Description	Thickness	
		(Ft)	(In)
	contact.		
28	Slst, cg, md gy (N5), hard, brittle, parallel laminae (?), iron pellets up to 1 mm diam are gy rd (5R 4/2) and concentrated along planes, fewer pellets in upper 4', gradational upper contact.	10	0
27	Slst, fg, md gy (N5), hard, brittle, lower 2' has darker color and plant fragments, 10-14' above base are several zones with irregular beds of rd bn iron pellets and disseminated iron, sharp upper contact.	16	0
26	Sh, bk, sharply gradational upper contact.		6
25	Ss, mg-cg, lgt ol gy (5Y 6/1), qtzitic, massive, irregular base is load casted or rests on irregular eroded surface, locally base has up to 1' of cgl with pebbles to 1" diam about 16' above base at north end of culvert is thin laterally discontinuous ol gy silty sh 1-2" thick, becomes fg-vfg in upper 10', sharply gradational upper contact.	36	0
24	Sh, lgt gy (N7) in lower part becoming dk gy (N3) in upper 1', silty in part, brittle, sharp upper contact.	8	0
23	Ss, mg, between lgt ol gy (5Y 6/1) and gn gy (5GY 6/1), abundant bn bk (5YR 2/1) iron pellets 1 mm diam which weather moderate bn (5YR 4/4) and leave pitted surface; hard, massive, gradational upper contact.	4	0
22	Ss, mg, lgt gy, qtzitic, massive unit with parallel-sided beds, cross bedding, local sh chips, 1/8" diam pebbles, gradational upper contact.	20	0
21	Sh, silty, gy bk (N2), may contain organic debris, sharp upper contact.	1	2
20	Ss, mg, md gy (N5), highly micaceous, platy beds, grades upward into fg then vfg, becomes massive in upper 1/2, gradational (?) upper contact	12	0
19	Ss, cg, white, qtzitic, hard, cross bedded, micaceous, sharp upper contact. Base in cover at Tique St. Exit sign.	16	0

Covered interval of approximately 200' of stratigraphic

Unit	Description	Thickness	
		(Ft)	(In)
	interval. Small road side exposure at culvert near middle of covered interval shows the following section:		
18	Cgl, 50% + rounded qtz pebbles up to 1" diam in mg-cg ss matrix, grades upward in upper ½ into ss with less than 10% pebbles, lost in cover.	7	0
17	Ss, mg-cg, gy, micaceous, massive, lacks good bedding, hard, sharp irregular upper contact.	2	0
16	Cgl, 50% + rounded white qtz pebbles up to 1" diam, md gy color, sharp upper contact, base lost in cover.	7	0
	Covered interval. Large thickness of Unit 15 measured up slope not along road.		
15	Ss, mg, ol gy (5Y 5/2) weathers gy o (10YR 7/4), qtzitic, massive, thick beds, base of ss as seen from across river appears to be forset beds 1-2' thick; ss is well sorted, occasional symmetrically rippled surfaces, internal color bands show both parallel laminae and cross bedding; top of forset zone is about 65' above base and gives way to uniform parallel-sided beds, at road level this zone has a thin sh up to 6" thick, upper contact lost in cover.	152+	0
14	Ss, fg, olive gy (5Y 5/2), qtzitic, parallel-sided beds from 1 mm to several cm thick, sharp upper contact.	5	3
13	Ss, fg, ol gy (5Y 5/2), load casting at base, massive in upper part, qtzitic, sharp upper contact.	1	2
12	Ss, vfg, ol gy (5Y 5/2), laminated in 2 mm to 1 cm thick beds, sharp and irregular upper contact.		7
11	Ss, fg, ol gy (Y 5/2), qtzitic, chaotic interior, sharp upper contact.	1	8
10	Laminite, as 8.	1	6
9	Ss, fg, ol gy (5Y 5/2), qtzitic, sharp upper contact.		3
8	Laminite, as 4 but with ss laminae up to 3 cm thick and sh content small, sharp upper contact.	2	2
7	Ss, vfg, ol gy (5Y 4/2), qtzitiz, sharp upper contact.		3

Unit	Description	Thickness	
		(Ft)	(In)
6	Laminite, as 4	1	6
5	Slst, cg, ol gy (5Y 4/2), qtzitic, sharp upper contact.		3
4	Laminite, lgt ol gy (5Y 5/2), laminae of vfg-fg ss and sh, occasional pebble to ¼" diam, laminae 1 mm to several mm thick, ss dominates, sharp upper contact.	3	8
3	Ss, fg, v lgt gy (N7) to lgt gy (N6), qtzitic, massive, laterally thins to 1' 6", sharp upper contact.	2	0
2	Slst, fg, lgt ol gy (5Y 5/2), very planar beds, some sh interbeds, laminae 1 mm or less thick with occasional slst bed up to 2-3 cm thick; 2'6" above base is vfg ss lense with load casting at base; becomes silty sh in upper ½ and sh in upper 1', sharp upper contact.	8	0
1	Sh, lgt ol gy (5Y 5/2), massive, breaks into small plates, base lost in cover, sharp upper contact. This sh is presumably continuous downward to tilloid exposed in Roaring Brook. Total sh thickness calculated at 300' ± 50'. Sh exposed in quarry across Roaring Brook to west has numerous sandstone beds discussed at Stops VII. Tilloid is estimated at 25' ± thick.	6	0
Total thickness of Pocono Formation		650±	

SECTION D

Stratigraphic description of uppermost Catskill Formation and Pocono Formation on crest of Nescopeck Mountain. Rocks exposed on west side of north-bound lane of US Interstate 81. Description starts at base of good outcrop of red Catskill. Contact between Catskill and Pocono is arbitrary.

Unit	Lithologic Description	Thickness	
		(Ft)	(In)
POCONO FORMATION			
58	Ss, as 56, with cgl zones, lost in cover, top of section.	20+	0
57	Cgl, vcg ss matrix, 50% + white qtz pebbles $\frac{1}{4}$ - $\frac{1}{2}$ " diam qtzitic, md lgt gy (N6), locally has basal coal lenses, sharp upper contact.	5	0
56	Ss, mg-vcg, v lgt gy to white, poorly defined bedding, coaly material mixed at base, base marked locally by up to 1' of cgl with $\frac{1}{4}$ - $\frac{1}{2}$ " white qtz pebbles, 20' above base is isolated bk sh, 42' above base is thin bk coal, sharp upper contact.	50+	0
55	Covered interval, probably similar to 54, sharp upper contact marked by coal and bk sh.	5+	0
54	Sh, ol gy (5Y 3/2), abundant scattered lgt bn (5YR 6/4) spots, silty at base becoming entirely c in upper $\frac{1}{2}$, spots weather to holes, weak zone, upper contact lost in cover.	8	0
53	Sh, gy bk (N2), massive, deeply weathered, sharp upper contact.		4
52	Slst, fg, bn gy (5YR 4/1), massive, shaly, abundant plant debris, gradational upper contact.	8	0
51	Sh, gy bk (N2), platy, abundant plant fragments, sharp upper contact.	2	0
50	Ss, fg-mg, md gy (N5), massive, bedding poorly defined, structureless (?), cgl with $\frac{1}{4}$ - $\frac{1}{2}$ " qtz pebbles and some to 1" diam occurs 8' 6" above base and at top, middle cgl about 6" thick and overlain by 1-2' platy slst, sharp upper contact.	21	0
49	Sh, as 47, sharp upper contact at north end of culvert,	12	0
48	Slst, cg, ol gy (5Y 4/2), two 4" thick hard beds	1	0

Unit	Description	Thickness	
		(Ft)	(In)
	separated by 4" sh, sharp upper contact.		
47	Sh, weathered color is gy o (10YR 7/4), contains small $\frac{1}{4}$ mm or less holes colored lgt bn (5YR 5/6), very clayey, deeply weathered, massive, may have parallel laminations, sharp upper contact.	20	0
46	Ss, mg, md gy (N5), weathers bn, parallel-sided beds 2"-1' thick, sharp upper contact.	84	0
45	Ss, vfg with some cg slst, thin platy beds, parallel-sided beds, plant debris and mica create good parting planes, grades up into md dk gy (N4) slst at top which is deeply leached, sharp upper contact. At road level units here are involved in small fold which brings 44 up in small anticline and overlying beds have some wedging. Pick up of sequence is at presumed top of 45 and is about 46' horizontally south of base of 45.	12+	0
44	Cgl, vcg ss matrix with 50-75% white qtz pebbles $\frac{1}{8}$ - $\frac{1}{4}$ " diam and some pebbles to $\frac{1}{2}$ ", pyrite nodules, qtzitic, v lgt gy, massive, sharp irregular upper contact, weathers to yel bn, laterally may thin to 0'.	3	0
43	Ss, cg, md gy (N5), qtzitic, scattered white qtz pebbles to $\frac{1}{2}$ " diam, massive, some cross bedding, some of cglatic parts are up to 50% pebbles in zones 6" thick, sharp but indistinct upper contact.	11	0
42	Ss, cg, md dk gy (N4), qtzitic, white qtz pebbles $\frac{1}{8}$ - $\frac{1}{2}$ " diam along planes in lower 2', abundant plant debris along irregular planes, sharp upper contact.	8	0
41	Cgl, vcg ss matrix and 50% white qtz pebbles $\frac{1}{8}$ - $\frac{1}{2}$ " diam, qtzitic, bk on weathered surface, gradational upper contact.	2	0
40	Ss, mg, md lgt gy, qtzitic, massive, occasional qtz pebbles to $\frac{1}{2}$ " diam, sharp irregular upper contact.	4	0
39	Sh, dk gy, nearly all weathered away, separates two units, may not be laterally persistent.		1
38	Ss, cglatic, cg-vcg, with 5% $\pm$ white qtz pebbles to $\frac{1}{2}$ " diam scattered throughout, few gy sh chips, sharp at base, sharp upper contact.	3	0

Unit	Description	Thickness	
		(Ft)	(In)
37	Ss, as 36, with few qtz pebbles to $\frac{1}{2}$ " diam and sh chips at base, sharp upper contact.	9	0
36	Ss, mg-cg, md lgt gy (N6), qtzitic, ocasional qtz pebbles to $\frac{1}{2}$ " diam, grades into cg slst in upper 1", sharp upper contact.	4	0
35	Ss, cg-vcg, cglatic with 5-25% white qtz pebbles generally less than $\frac{1}{4}$ " diam, some sh chips, qtzitic, lgt gy gradational upper contact.	2	0
34	Ss, mg-cg, md gy (N5), qtzitic, massive beds 6"-1' thick, some of unit dominantly mg, some parallel-sided beds, sharp irregular upper contact.	16	0
33	Ss and slst grading up into sh, 2 beds of md lgt gy (N6) slst (lower) and ss, vfg (upper) grade up into lgt gy sh, sharp upper contact.	2	0
32	Ss, cg-vcg, with 5-25% white qtz pebbles, white to v lgt gy, qtzitic, cross bedded, some parts have no pebbles, pebbles generally less than $\frac{1}{2}$ " diam, rare pyrite nodules, sharp upper contact.	8	0
31	Ss, mg, md lgt gy (N6), qtzitic, parallel laminations massive 1-2' thick beds, sharp irregular upper contact.	35	0
30	Slst, mg-cg, md lgt gy (N6), massive, structureless, bounded by $\frac{1}{4}$ - $\frac{1}{2}$ " thick platy sh layers at each contact, sharp upper contact.	1	0
29	Ss, vfg, md dk gy (N4), banded with lgt gy (N7) and dk gy (N3) abundant parallel-sided beds, micaceous, plant debris, pyrite nodules, beds 2-4" thick; becomes finer grained, more massive and dk gy (N3) in upper 10', massive beds weather to ellipsoids, sharp upper contact.	24	0
28	Sh, leached to v lgt gy (N8), cleavage dominated, separated in middle at road level by $1\frac{1}{2}$ ' thick wedge of md lgt gy (N6) vfg ss which thins laterally upslope to 0', sharp upper contact.	4	0
27	Ss, fg, md lgt gy (N6) to md gy (N5), qtzitic, massive, micaceous, sharp irregular upper contact.	20	0
26	Ss, mg, with abundant gy sh chips up to 1' long, chaotic bed, sharply gradational upper contact.	1	0

Unit	Description	Thickness	
		(Ft)	(In)
25	Ss, mg-cg, md lgt gy (N6), qtzitic, massive parallel-sided beds, layer of pebbles to $\frac{1}{2}$ " diam occurs 2' above base, micaceous, becomes mg within 4' above base, sharp irregular upper contact.	22	0
24	Sh, gy rd (5R 4/2), silty, more blocky weathering than underlying bed, beds 2-4" thick are not distinct above 12' above base, rd color is mottled with md lgt gy (N6) and at top of unit no rd is present, sharp irregular upper contact, uppermost 1' is leached. Laterally on east side of road, this rd color occurs only as a small amount of mottling at the top of the unit (upper 6-8') and lower part shows no rd sh.	18	0
23	Sh, base is 1' + of md lgt gy (N6) with suggestion of rd tint, grades upward into gy rd (5R 4/2) silty sh at base becomes c sh which is completely dominated by cleavage, sharp upper contact.	8	0
22	Ss, cg, md lgt gy (N6), qtzitic, massive beds, occasional qtz pebble to $\frac{1}{2}$ " diam, some obscure cross bedding, sharp upper contact.	23	0
21	Ss, cg-vcg, with 5-15% white qtz pebbles up to 1" diam, pebbles mainly less than $\frac{1}{2}$ " diam, qtzitic md lgt gy (N6), gradational upper contact.	3	0
20	Ss, cg, md lgt gy (N6), qtzitic, abundant cross bedding 1' above base is parting plane with numerous sh chips sharp irregular upper contact with no physical break.	4	0
19	Sh, silty, md lgt gy (N6), massive, leaching along upper and lower contacts, sharp upper contact.	1	6
18	Ss, fg, md lgt gy (N6), massive, sharp upper contact.	3	0
17	Slst, mg, lgt ol gy (5Y 5/2), massive, internal parallel-sided beds, sharp irregular upper contact.	1	5
16	Ss, as 14, sharp upper contact.	12	0
15	Ss, vfg, lgt gy (N7), massive bed, laterally variable in thickness, sharp upper contact.	1	7

Unit	Description	Thickness	
		(Ft)	(In)
14	Ss, mg-cg, md gy (N5), qtzitic, massive, cross bedded beds 1-3' thick, sharp upper contact.	38	0
	Total thickness of Pocono Formation	550+	0
CATSKILL FORMATION			
13	Slst, cg, md dk gy (N4), micaceous, some parallel-sided beds, blocky break-up, sharp base, lower 1' leached and more platy with plates parallel to curved, 14' above base unit becomes very platy with parallel-sided beds, mica, abundant plant debris and pyrite nodules, sharp upper contact.	19+2	0
12	Slst, cg, md gy (N5), massive, 1-2' thick beds; laterally those rocks at road level of unit 12 as well as some of unit 11 have been cut and the channel filled with unit 13.	10	0
11	Slst, mg, lgt gy (N7), apparently a leached version of 10, sharp irregular upper contact.	3	0
10	Slst, cg, gy rd (5R 4/2) in lower part becoming mottled with gy and above 12' above base color is md gy (N5), massive, blocky, laterally upslope color is entirely rd at top, gradational upper contact.	18	0
9	Sh, gy rd (5R 4/2), as 7, sharp upper contact.	4	0
8	Sh, gy rd (5R 4/2), massive, harder and more blocky than underlying unit, sharply gradational upper contact.	6	0
7	Sh, gy rd (5R 4/2), massive, cleavage dominated, breaks up into small chips, sharply gradational upper contact.	10	0
6	Sh, gy rd (5R 4/2), silty in lower part, massive, cleavage dominated, top marked by irregular 6" thick zone of leached sh between gy pk (5R 8/2) and v lgt gy (N8), gradational upper contact.	8	0
5	Ss, mg, gy rd pur (5RP 4/2) with lgt bands, massive in 1-2' thick beds, sharp upper contact.	20	0
4	Sh, gy rd (5R 4/2), massive, cleavage dominated, sharp irregular upper contact.	5	0

Unit	Description	Thickness	
		(Ft)	(In)
3	Slst, fg-mg, gy rd (5R 4/2), massive, sharp upper contact.	1	0
2	Sh, silty in lower part, gy rd (5R 4/2), massive, cleavage dominated, sharp upper contact.	8	0
1	Slst, mg-cg, gy rd (5R 4/2), massive, breaks into beds about 1' thick, micaceous, cut by numerous joints, may have parallel-sided bedding, occasional plant impressions, base lost in cover, gradational upper contact.	12	0
Total thickness of Catskill Formation		124	0

SECTION E

Stratigraphic description of Catskill and Pocono rocks along US Interstate 81 north of Scranton. Section occurs along north bound lane and starts at south end of gully immediately south of sign for exit 58.

Unit	Lithologic Description	Thickness	
		(Ft)	(In)
POTTSVILLE FORMATION			
44	Cgl, massive, abundant rounded qtz pebbles, v lgt gy interbedded ss, section continues upward but not described.	20+	0
	Total thickness of Pottsville Formation	20+	0
POCONO FORMATION			
43	Sh, md dk gy (N4), massive, very hackly breakup, sharp upper contact.	18	0
42	Ss, mg-cg, cglatic in lower 4' grading upward into ss with scattered pebbles in next 6' then becoming markedly cross bedded, abundant iron inclusions, hard, lgt gy (N7), rounded qtz pebbles to 1" diam, sharp upper contact.	20	0
41	Sh, as 39, sharp upper contact.	1	6
40	Ss, as 38, sharp upper contact.	9	0
39	Sh, dk gy (N3), platy, irregular bedding, variable thickness, sharp upper contact.	2	0
38	Ss, mg-cg, lgt gy (N7), abundant iron inclusions, massive in appearance but has abundant parallel-sided beds up to 1' thick, sharp upper contact.	21	0
37	Ss, cglatic, laterally variable from cgl with 50% + rounded qtz pebbles to ss with few pebbles, some thin sh layers, rather messy unit, sharp upper contact.	4	0
36	Sh, cg, lgt gy (N7), some iron inclusions, sh pebbles up to 6" diam at base, sharp upper contact.	8	0
35	Sh, deeply weathered and recessed, forms separation plane and seems laterally persistent.	0	1
34	Ss, as 31, sharp upper contact.	10	0

Unit	Description	Thickness	
		(Ft)	(In)
33	Ss, vfg, lgt gy (N7), no iron, qtzitic, platy almost sh nature, may be laterally discontinuous, sharp upper contact.	2	0
32	Ss, mg-cg, lgt gy (N7), massive, lacks pebbles found in underlying bed, grades upward into 33.	2	0
31	Ss, cg, iron inclusions throughout are $\frac{1}{4}$ - $\frac{1}{2}$ mm hematite, massive, qtzitic, yel o weathered color, lgt gy (N7) fresh, sh chips to 4" diam on basal surface, scattered rounded qtz pebbles to 1" diam, may have some obscure cross bedding, sharp upper contact.	8	0
30	Cgl, 50% + rounded white qtz pebbles to 1 $\frac{1}{2}$ " diam average $\frac{1}{2}$ - $\frac{3}{4}$ ", mg-cg ss matrix, hard, laterally discontinuous, sharp irregular upper contact.	2	0
29	Ss, mg-cg, lgt gy (N7), abundant iron inclusions throughout, massively cross bedded, sharp upper contact.	8	0
28	Cgl, 15-25% pebbles up to 1" diam of rounded qtz, matrix of mg-vcg sand, laterally discontinuous, very irregular basal contact, locally underlain by dk gy (N4) slst in pockets on underlying ss, some sh chips in cgl, sharp upper contact.	2	0
27	Ss, mg-cg, lgt gy (N7), hard, iron inclusions, parallel-sided beds begin abruptly to stand out in appearance, weathered color is typical gy o (10YR 7/4), some large cross beds.	48	0
26	Ss, mg-cg, lgt gy (N7), abundant iron (hematite) inclusions scattered throughout, micaceous, massive beds give way occasionally to laminated (probably cross bedded) fg ss; 28' above base are several rounded sh nodules up to 8" in diam, bedding plane upper contact.	36	0
25	Sh, md dk gy (N4), massive, breaks up into plates, some vfg-fg ss layers up to 1" thick with occasional pyrite nodules up to 1 $\frac{1}{2}$ " diam, pyrite nodules deeply leached, sharp upper contact. Contact area occurs at start of upper tier cut over highway level. Slst here is involved in some wedging and overlap of section. Description continues along highway level.	28	0
Total thickness of Pocono Formation		229	7

Unit	Description	Thickness	
		(Ft)	(In)
CATSKILL FORMATION			
24	Ss, mg-cg, md lgt gy (N6), hard, massive, contact obscured by cover but probably sharp.	5	0
23	Slst, md dk gy (N4), grades up from vfg ss at base within 1', blocky, develops rounded nodular appearance on weathering, upper 3' deeply weathered and heavily iron stained, sharp upper contact.	8	0
22	Ss, mg, md lgt gy (N6), massive, sharp upper contact.	6	0
21	Covered interval.	8	0
20	Ss, mg-cg, md lgt gy (N6), cross bedded in part, massive in part, rare iron nodules and dk gy slst pebbles to $\frac{1}{2}$ " diam.	12+	0
19	Slst, as 17, sharp upper contact.	9	0
18	Ss, mg, lgt ol gy (5Y 5/2), massive, gradational upper contact.	3	0
17	Slst, dk gy (N3), massive, platy disintegration, micaceous, sharp upper contact.	1	6
16	Ss, mg-cg, lgt ol gy (5Y 5/2), massive with obscure cross bedding, hard, thin zones of sh chips and limonite nodules up to $\frac{1}{2}$ " diam, some dk gy slst nodules up to 2" diam; zone 25' above base is lense with maximum of 2' thick, contains up to 25% iron nodules up to $\frac{1}{2}$ " diam and some white qtz pebbles, base at milage marker 192.	47+	0
15	Covered interval.	112	0
14	Ss, cg, md lgt gy (N6) to lgt gy (N7), numerous sh chips, may be cross bedded, rather dirty appearance.	18+	0
13	Covered interval.	75	0
12	Ss, mg, lgt ol gy (5Y 5/2), massive to cross bedded in thick sets, contains discontinuous sh beds and becomes very cross bedded in upper part, top lost in cover at about north end of drain culvert.	30	0

Unit	Description	Thickness	
		(Ft)	(In)
11	Sh, ol gy (5Y 4/1), thin plates, sharp irregular upper contact.	1	0
10	Ss, mg, md gy (N5), parallel-sided beds, grades up into overlying bed.	1	0
9	Ss, mg-cg, md gy (N5), massive, abrupt gradational contact into overlying unit.	7	0
8	Ss, fg, md dk gy (N4), massive, some parallel laminations, sharp upper contact.	6	0
7	Slst, gy rd (5R 4/2) in lower 2' grades laterally and upwards into md dk gy (N4) with slight gn tint, massive, sharp upper contact.	4	0
6	Ss, fg, md dk gy (N4), cross bedded in $\frac{1}{2}$ -1" thick sets, some beds of cg ss and mg ss, dirty sh chip and cg ss zone in lower 2', micaceous, gn tint in upper 2' gradational upper contact.	27	0
5	Ss, mg-cg, md gy (N5), massive in appearance but cross bedded, discontinuous sh zone 8' above base, scattered dk gy sh chips.	12	0
4	Ss, cg with abundant mixture of sh chips and discontinuous sh beds, dirty in appearance, near lgt ol gy (5Y 5/2), one sh block 3" thick and 10" long, sharp upper contact.	4	0
3	Ss, cg, md lgt gy (N6), some small sh chips, thick wedge-shaped cross beds, parallel laminae in cross bed wedges, sharp upper contact.	26	0
2	Sh, gy rd (5R 4/2), massive, blocky disintegration, grades up into lgt ol gy (5Y 5/2) sh in upper 3', sharp upper contact.	9	0
1	Ss, mg, lgt ol gy (5Y 5/2), micaceous, cross bedded, platy float, becomes vfg in upper part, base lost in cover, gradational upper contact.	16	0
Total thickness of Catskill Formation		447+	0

SECTION F

Stratigraphic description of Catskill and Pocono Rocks along Pa 247 along Wildcat Creek on north side of Lackawanna Basin. Section starts at top of hill in rock which forms prominent scarp on Myers Mountain to the northeast.

Unit	Lithologic Description	Thickness	
		(Ft)	(In)
POTTSVILLE FORMATION			
10	Cgl, pebbles generally less than ¼" diam with some over ½", pebbles form 75% <u>±</u> of rock, massive, base is on eroded surface, grades upward into cg ss with scattered pebbles, pebbles are qtz, color is v lgt gy fresh, weathers to yel gy, lost upwards in cover.	14	0
	Total thickness of Pottsville Formation	14	0
POCONO FORMATION			
9	Ss, mg-cg, v lgt gy (N8) to white, weathers to near gy o (10YR 7/4), qtzitic, massive beds 2-3' thick show internal parallel laminae, very uniform throughout, eroded upper contact has relief of at least 4', crops out in old roadside quarry, base lost in cover.	35	0
8	Covered interval.	145	0
	Total thickness of Pocono Formation	180	0
CATSKILL FORMATION			
7	Ss, fg-mg, near lgt ol gy (5Y 6/1), cross bedded with beds 1-2" thick on average, variable cross bed orientation, becomes mg-cg in upper 1' of exposure and lgt gy, lost in cover.	30	0
6	Covered interval.	50	0
5	Ss, mg, lgt gy (N7), massive, hard, speckled appearance from dk grains, overlain by ss, fg-mg, md gy (N5) to md dk gy (N4) with abundant iron stain, irregular bedding with beds 1-2" thick, sh chips and some chert nodules in lower part.	20	0
4	Covered interval.	67	0

Unit	Description	Thickness	
		(Ft)	(In)
3	Sh, gn gy (5GY 5/1) in lower part grading upward into sh, gy rd (5R 4/2) which in turn grades into sh, gn gy. Rd sh about 1' thick. Slightly silty, micaceous, irregularly laminated, breaks up into irregular plates.	4	0
2	Covered interval.	100	0
1	Ss, mg, md gy (N5), intensely cross bedded, weathers to near lgt ol gy (5Y 5/2), cross bed plates develop well on weathering and average 1" thick, cross bed orientation quite variable, base lost in cover.	44	0
	Total thickness of Catskill Formation	315	0

SECTION G

Stratigraphic description of Pocono Formation along route Pa 309 north of Mountain Top on east side of north bound lane. Section begins at south end of steep road cut immediately north of gully recess. Gully contains some sandstone and siltstone outcrop, but is mainly float of similar rock. Red Catskill rocks occur along east side of road south of gully.

Unit	Lithologic Description	Thickness	
		(Ft)	(In)
POCONO FORMATION			
24	Ss, fg, md gy (N5), qtzitic, micaceous, parallel-sided laminae and beds, abundant partings, cross bedded in long tabular sheets, beds 1-2" thick, unit persists to end of exposure and probably underlies cgl bed which outcrops on south bound lane and occurs within 50' stratigraphically of this unit.	20+	0
23	Ss, mg, md gy (N5), very micaceous, qtzitic, massive basal 4' thick bed gives way to thin irregular beds, gradational upper contact.	16+	0
22	Slst, mg-cg, md dk gy (N4), micaceous, massive, lateral change to ss, gradational lower contact, sharp upper contact.	4+	0
21	Ss, as 19, sh somewhat more numerous, some beds in upper part are massive and up to 3' thick, laterally grades into sh, pebbly and ironstone zones common.	30	0
20	Cgl, with pebbles to 1" diam, discontinuous laterally, marks base of ss as 19, gradational upper contact.	2	0
19	Ss, mg-cg, md gy (N5), qtzitic, massive beds of variable thickness, cross bedded, bases of some cg beds contain occasional qtz pebbles to ½" diam, ironstone pebbles, sh pebbles which weather leaving pitted surface, sh lenses up to 1' thick scattered throughout, channels and truncated beds common, sharp upper contact.	40-50	0
18	Ss, mg-cg, md gy (N5), qtzitic, parallel sided beds 1/8-1" thick, sharp upper contact.	5	6
17	Cgl, 25% + qtz pebbles generally ¼" or less in diam, mg ss matrix, gradational upper contact.		6
16	Ss, as 14, sharp upper contact.	2	9

Unit	Description	Thickness	
		(Ft)	(In)
15	Cgl, 50% pebbles less than ½" diam, massive, gy, qtzitic, mg ss matrix, sharp upper contact.	1	0
14	Ss, fg-mg, md gy (N5), qtzitic, massive beds with irregular partings, sharp upper contact.	10	0
13	Cgl, in part 50% + qtz pebbles up to ¼" diam set in mg-vcg ss matrix, qtzitic, gy, in part ss with cglatic beds, in part massive and structureless, in part has well developed parallel-sided beds, sharp upper contact.	14	0
12	Sh, laterally discontinuous, near md gy (N5), silty, sharp contacts.		1
11	Ss, fg-mg, qtzitic, md gy (N5), massive beds, sharp upper contact.	7	0
10	Ss, vfg, qtzitic, md gy (N5), massive, some partings in upper 2', sharp upper contact.	7	6
9	Ss, vfg, qtzitic, md gy (N5), beds 1"-1' thick interbedded with ½-1" thick beds of same ss, some poorly developed ripples.	5	0
8	Ss, vfg, qtzitic, md gy (N5), in beds 4-5" thick, mixed with slst, similar to 7, ss appears distorted and may be chaotic in part, sharp upper contact.	2	6
7	Slst, massive, structureless, poorly sorted with scattered qtz s grains and pebbles of rounded qtz up to 1" diam, one schist pebble 5" x 3" x 2"; md dk gy (N4) with slight gn tint, not laterally persistent upslope, sharp upper contact.	7	0
6	Slst, cg, lgt ol gy (5Y 5/2) and vfg ss, massive with tendency to disintegrate into parallel-sided plates, gradational upper contact.	6	0
5	Slst, cg, lgt ol gy (5Y 5/2) mottled along laminae with gy rd (5R 4/2) to gy rd pur (5RP 4/2), qtzitic, well laminated, color often marks laminae, more or less base of bedded zone, ss lenses occur but tend to be long and aligned with bedding, about 6' above base unit loses mottled color and is ol gy, gradational upper contact is arbitrary along road and perhaps non-existent upslope.	13	0

Unit	Description	Thickness	
		(Ft)	(In)
4	Slst, cg, near lgt ol gy (5Y 5/2), micaceous, color sometimes mottled with gy rd (5R 4/2) to gy rd pur (5RP 4/2), contains discontinuous and sometimes boundary indistinct lenses of lgt gy (5Y 5/2) qtzitic vfg-mg ss, massive unit with no apparent bedding, appears chaotic, hard tough unit, ss masses generally have rounded margins and are less than 2' diam but some are 2-3' thick and up to 10' long, long ss masses appear bedding parallel 24' above base road side occurrence of ss lenses increases, laterally upslope the lenses are variable and may be less abundant; a distorted 0-4" thick lgt ol gy sh occurs about 5' below top gradational upper contact delineated by change from massive slst to laminated slst.	35+10	0
3	Ss, as l, sharp upper contact.	5	6
2	Slst, cg, lgt ol gy (5Y 5/2), micaceous, platy disintegration, sharp upper contact.		4-8
1	Ss, vfg-fg, qtzitic, lgt ol gy (5Y 6/1), weathers ol gy massive, may have parallel laminae, sharp upper contact.	8	0
	Total thickness of the Pocono Formation	253+	0

SECTION H

Stratigraphic description of the uppermost Catskill and lower Pocono rocks exposed along the west side of the Lehigh River below Bald Mountain in the Christmans 7½' quadrangle, Carbon County, Pennsylvania (Stop II). Section is 0.4 mile south of mouth of Drakes Creek on opposite of Lehigh River. Base of section is at start of continuous outcrop along road bed of former New Jersey Central Railroad.

Unit	Lithologic Description	Thickness	
		(Ft)	(In)
POCONO FORMATION			
6	Ss, mg, md lgt gy (N6), qtzitic, well sorted, very high qtz content, some thin discontinuous zones of pebbles up to ¼" diam, some zones with randomly scattered pebbles, planar bedding dominates outcrop, sharp conformable basal contact, basal ss is cglatic in some places, 21' above base is a recessed zone about 6' thick; some ripple marks below recess are asymmetrical while those above recess are symmetrical, recess zone contains laterally discontinuous zone of load casting, grain size above recess becomes fg, upper contact lost in cover but can be seen to east across Lehigh River as gradual change to alternating ss and slst.	50+	0
5	Tilloid, unsorted mixture of clay, slt, s and pebbles, pebbles commonly less than 1" diam but up to 6" long, lgt ol gy (5Y 5/2), massive, weathers with spall tendency and bn color, above 45' above base contains included masses of fg-vfg, md gy (N5), qtz ss, these masses have irregular shapes and are often normal to bedding orientation, uppermost 15' contains abundant distorted ss, slst and cgl beds, upper part may contain less s size material than lower part, sharp upper contact.	97	0
	total thickness of Pocono formation	147+	0
CATSKILL FORMATION			
4	Ss, mg, md gy (N5), some cg s and rd sh chips to 1" diam in lower 2', qtzitic, sharp upper contact.	20	0
3	Sh, silty, gy rd (5R 4/2), massive, structureless, a deep recess occurs 34' above base with no apparent lithologic change, another recess at 47' above base is same, uppermost 2' is lgt ol gy (5Y 5/2), sharp irregular upper contact.	55	0

Unit	Description	Thickness	
		(Ft)	(In)
2	Ss, mg-cg, near lgt ol gy (5Y 6/1), qtz, rd sh chips to 1" diam in lower 1', massive with beds of varying thickness, some cross bedding at 20' and 38' above base, 6' above base is 3' thick zone with rd sh chips to 3" diam, 62' above base is 1' thick gy rd (5R 4/2), vfg-fg ss which is probably laterally discontinuous, 66' above base is 3' thick zone of mg, gy rd (5R 4/2), massive slst which is laterally discontinuous, about 72' above base becomes fg-mg and changes to gy rd color, gradational upper contact.	72	0
1	Sh, gy rd (5R 4/2), silty, massive, structureless, sharp irregular upper contact, lower contact lost in cover.	6+	0
	Total thickness of Catskill Formation	153+	0