Day One
Friday, May 19, 1995

ENERGY AND MINERALS

Trip Leaders:
Raymond Follador, Angerman Associates, Inc.
Viktoras W. Skema, Pennsylvania Geological Survey
Karen Rose Cercone, Indiana University of Pennsylvania

Meeting Point: Monroeville Mall Park and Ride lot (In front of Lazarus Dept. Store).
Meeting Time: 8:00 AM to 8:30 AM. **DISEMBARK at 8:30 AM PROMPTLY.**

Mileage Interval	Mileage Cumulative	Field Trip Itinerary
0.0	0.0	Monroeville Park and Ride Bus Shelter, Monroeville Mall, Monroeville, PA.
1.0	1.0	Turn right onto Mall Boulevard and continue to Business Route 22 east. Continue east towards Murrysville.
4.5	5.5	Enter municipality of Murrysville at traffic light (near McDonalds). The approximate axis of the Murrysville anticline is located here. Historical Marker for Murrysville Gas Well on right of highway.
3.7	9.2	Approximate axis of Irwin syncline located at the intersection of Route 22 and Harrison City Road.
4.1	13.3	CNG Transmission Co. Oakford Gas Storage Facility on left side of highway. The approximate axis of the Grapeville anticline is located here.
5.9	19.2	Current road construction on Route 22 has included the stripping of coal.
10.9	30.1	Exit Route 22 at Blairsville (Torrance Hospital exit) and follow Route 217 south through the town of Blairsville and across the Conemaugh River. At this point we are traveling along the east flank of the Fayette anticline from which Chestnut Ridge anticline can be viewed from a distance on the left side of the highway.

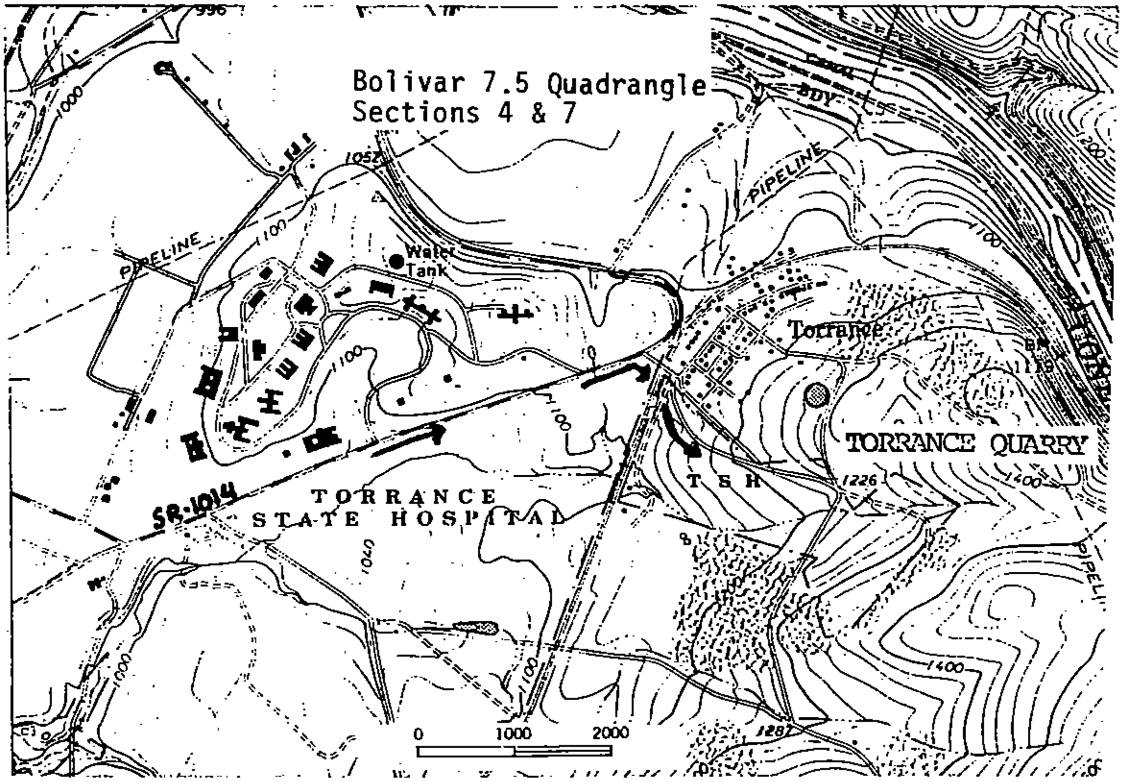


FIGURE 1-1

1.8	31.9	Left turn off Route 217 onto SR 1014 at sign for Torrance State Hospital. Pass hospital on left and bear right over railroad tracks (Figure 1-1).
2.2	34.1	Bear right immediately after railroad tracks onto quarry access road. Pass trailers on left side of the road.
1.0	35.1	Entrance of the Torrance Quarry owned and operated by the Davison Sand and Gravel Company.

STOP 1
Loyalhanna Limestone Exposure
Torrance Quarry
Davison Sand and Gravel Company

The Torrance Quarry mines the Loyalhanna for railroad ballast. The Torrance mine is one of the older Loyalhanna mines and produced 1,036,629 tons and sold 959,229 tons in 1993-1994. The mine employs approximately 30 people. The following discussion is quoted from Miller (1934).

Loyalhanna (Siliceous) Limestone

"The oldest limestone in Westmoreland County is the Loyalhanna, which has such a large siliceous content that it might more properly be termed a calcareous sandstone than a limestone. It has, however, been grouped with the limestones and is therefore described here. It consists os grains of silica cemented by calcium carbonate. It lies between the Mauch Chunk and Pocono series and is underlain by a big thickness of non-calcareous sandstone. At one time this bed was placed in the Mauch Chunk series. It is exposed only in Chestnut Ridge and Laurel Hill, both of which hills are pronounced upward folds anticlines). Were it not for these sharp folds it would not appear at the surface. The best exposures are in the gorges produced by Conemaugh River and Loyalhanna Creek cutting through Chestnut Ridge and Laurel Hill.

This limestone has in the past been burned for lime in several places. The calcareous portion produced a white lime which slaked readily while grains of quartz remained unchanged. The burned product containing the lime and sand made a fair mortar. In recent years the sole use made of this stone has been for railroad ballast, paving blocks and for highway construction.

One of the most characteristic features of the Loyalhanna is, the prominent cross bedding, which is especially pronounced on weathered surfaces. On weathering, the calcareous cement is removed by solution and the resulting mass is practically pure quartz sand. Where fresh, the rock breaks with a conchoidal fracture and is light blue to gray in color. In places it contains some pyrite which readily oxidizes near the surface and produces a rusty brown discoloration. The rock occurs is massive beds and, when blasted, comes out in large blocks, which, however, can readily be split because of its brittle character. In thickness it varies from 40 to almost 80 feet in Westmoreland County. Where Conemaugh River cuts through Laurel Ridge in the extreme northeast corner of the county, the Loyalhanna is about 50 feet thick. It is somewhat thicker in places where the same stream cuts through Chestnut Ridge. Here it has been worked on the Indiana County side...and on the Westmoreland County side by Booth and Flinn near Blairsville Intersection (Torrance Post Office). This is known as the Packsaddle quarry...The Torrance plant has an annual capacity of about 40,000 tons of crushed stone [Note production figures above, and 60 years later].

Loyalhanna Creek, cutting through Chestnut Ridge and into the west slope of Laurel Hill, has exposed the Loyalhanna limestone and made conditions favorable for quarrying, especially in the gap through Chestnut Ridge. For a number of years, Booth and Flinn have operated an extensive quarry along Loyalhanna Creek at Long Bridge, about I mile southwest of McCance Post Office. The calcareous portion worked is 50 to 55 feet thick and the quarry face is about half a mile long. Most of the stone is crushed for railroad ballast and for highway construction but some is made into paving blocks. The States Highway Department has accepted the finer stone for the State highways.

The base of the Loyalhanna lies about 200 feet above the creek bed. The strata are almost flat but actually form a low anticline with gentle dips toward the ends of the cut. The stone is bluish gray in color, greatly crossbedded and so massive that true bedding planes are not readily observed in the quarry face. Vertical joints break across the beds and a few solution cavities were seen. Fossils were not observed, but quarrymen report that they are occasionally noted.

Immediately overlying the Loyalhanna limestone is a non-calcareous sandstone about 18 feet thick and still higher up is red shale with some greenish bands and sandstones and limestones of the Mauch Chunk group. The material stripped as overburden averages about 30 feet is thickness.

At times most of the material is sold for railroad ballast but at other times it may be used for the highways or for Belgian blocks. The railroad ballast is from 1 and 1½ to 3 inches in size. The Belgian block for paving are of two sizes. The small ones are 8 to 14 inches long, 4 to 5 inches wide and 5 to 5½ inches thick. The larger ones are 8 to 16 inches long, 3½ to 5 inches wide, and 6 to 7 inches thick. All of the chips from dressing the stone and the fine sizes screened from the railroad ballast material are used on the roads. The stone is hauled from quarry face to the crusher by truck.

Analysis of composite sample of Loyalhanna limestone, Long Bridge
Pittsburgh Testing Laboratory, analyst after drying at 105o C

SiO	49.54
AL_2O_3	3.44
Fe_2O_3	1.72
TiO_2	0.30
CaO	24.80
MgO	0.58
Loss on ignition	19.30
SO_3	trace

South of Loyalhanna Creek, there are several places where the same limestone has been worked in both Chestnut Ridge and Laurel Hill. In most places the quarries were small and furnished only a small amount of stone for burning. These have long since been abandoned...An almost unlimited amount of Loyalhanna limestone is available in Westmoreland County but the operations must necessarily be confined to those localities where transportation facilities are favorable."

Road Log Continues from Stop 1.

1.0	36.1	Return to SR 1014. Turn left.
2.2	38.3	Return to Route 217 north. Turn right.
2.0	40.3	Return to Route 22 west (note that to reach ramp you must

make a left turn in Blairsville).

17.4 57.7 Follow Route 22 west to intersection with Route 66 south (pass Oakford Storage on right side of highway). This is the new section of Route 66 which is a toll road. Stop at Uni-Mart on right (next to Kings Restaurant) (FIGURE 1-2).

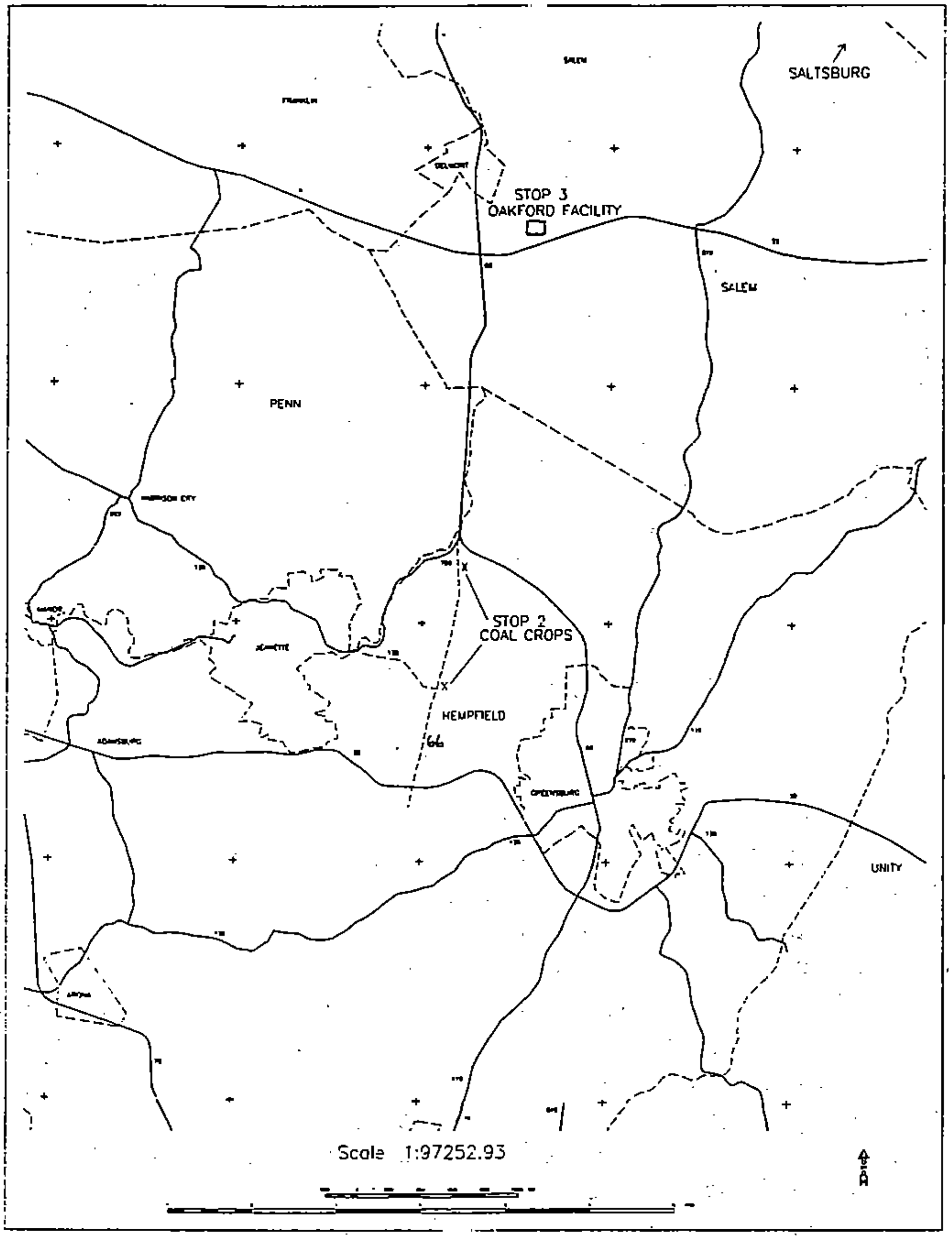


FIGURE 1-2

3.1	60.8	Pass slope with exposed coal/limestone on left side of road.
1.0	61.8	Exit Route 66 at Route 130 (Harrison City). Turn left at light and immediately re-enter toll booth--access road to reach exposed rock slope on right side of Route 66 north, Stop 2.

STOP 2
NEW EXPOSURES OF CONEMAUGH COALS, MARINE ZONES AND PALEOSOLS ALONG NEW TOLL ROAD 66 NEAR GREENSBURG.

Viktoras W. Skema
Pennsylvania Geological Survey

Cuts along the recently constructed toll road of the Pennsylvania Turnpike Commission, new Route 66, west of Greensburg, expose many large vertical sections through the Glenshaw Formation and provide new insight into the character of the marine portion of the Pennsylvanian Conemaugh Group (Figure 1-3). Two of these cuts are particularly outstanding. The first is a continuous compound section at Route 130 exposing rocks from below the Brush Creek coal up through the Duquesne coal horizon and into a portion of the overlying Birmingham shale. This section includes all of the major Conemaugh marine zones, a few of the lesser known ones, and an unusually thick occurrence of the Upper Bakerstown coal. The second interesting exposure is located at the beginning of the northbound exit ramp to old Route 66. The excavated slope here cuts perpendicularly through two fluvial channels situated between the Pine Creek Limestone and the Lower Bakerstown coal. Thick channel-bottom coals and other unusual features associated with these channels reveal interesting clues about possible climatic conditions and other aspects of depositional environment.

STOP 2a - Conemaugh Cut; Brush Creek through Skelly Limestone.

Section at Route 130 exit

The large road cut along the northbound lanes of the highway at the beginning of the Route 130 exit ramp combined with the contiguous cut of the descending ramp comprises 226 feet of continuous section. Above the main roadway, starting from the top, the cut contains the brackish to fresh water facies of the Skelley marine zone, the Ames Limestone, the Pittsburgh red beds, the brackish facies of the Noble marine zone, the Upper Bakerstown coal, and the top of the Saltsburg sandstone. Continuing down the ramp, the following units are exposed: the massive basal portion of the Saltsburg sandstone, the marine Woods Run Limestone and associated dark shale, and the marine Pine Creek Limestone. Across Route 130, the Brush Creek coal and Brush Creek limestone and associated dark shale are exposed along the northbound entrance ramp.

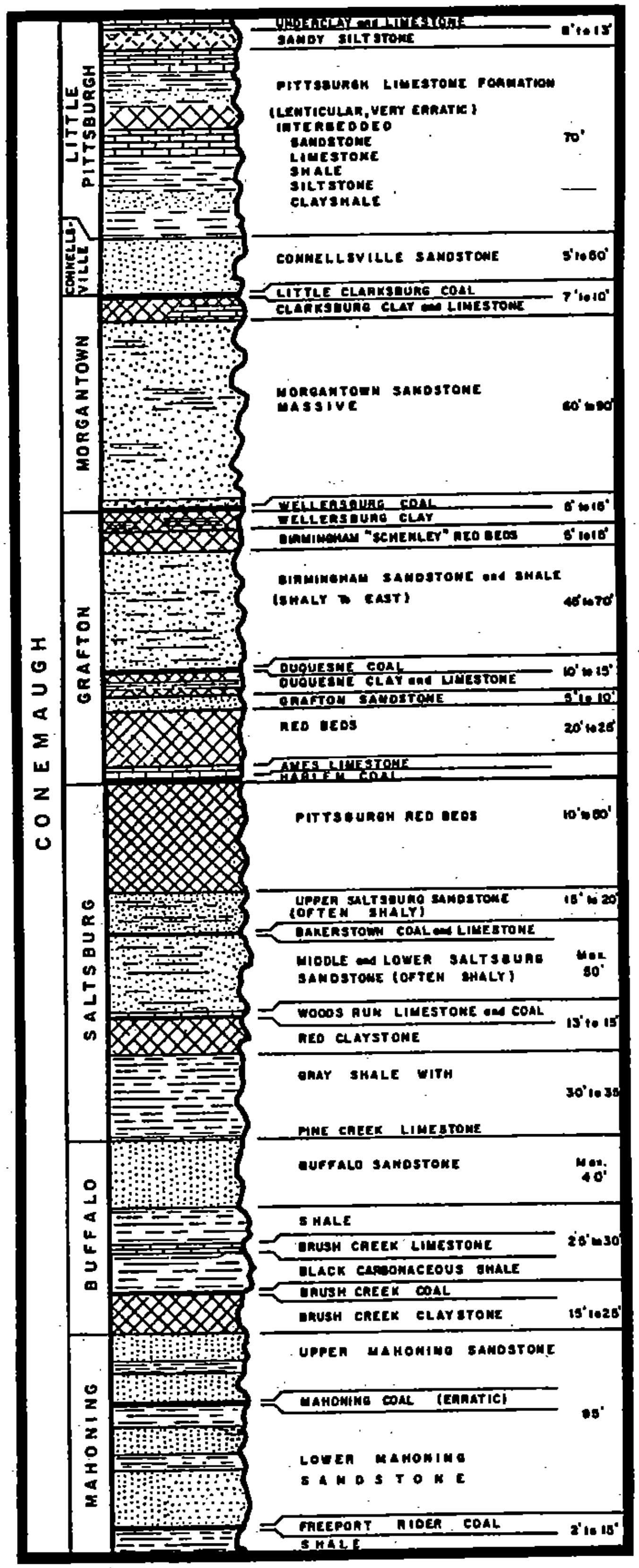


Figure 1-3 Generalized columnar section for the Greater Pittsburg.. Area.

Road Log Continues from Stop 2a

1.0	62.8	Continue north on Route 66 to exposed coal/limestone slope, Stop 2a.

STOP 2b
Brush Creek/Pine Creek channel coal deposit
Section at old Route 66 exit

Highway excavation through the hill south of old Route 66 uncovered two unusually shaped coal deposits. Both can be seen in the cut slope east of the highway 30 to 40 feet up from road level, situated directly above the Buffalo sandstone (Figure 1-4) They are relatively thick and distinctly lenticular shaped. The northernmost deposit is approximately 90 feet wide and, with partings included, measures 4.7 feet at its thickest point. The deposit on the southern end of the cut is about 30 feet wide with a maximum thickness of 2.9 feet. This southernmost coal can be seen also in the cut wall on the opposite side of the highway. The site construction superintendent reported that the thicker northernmost coal curved out into the highway and southward toward the thinner coal and ended abruptly before reaching it. The two coals are vertically offset with the southernmost, through-going coal, situated approximately 10 feet higher.

A close examination of the coals indicates that they were deposited at the bottom of two channels. The erosional surface at the base of the channel system containing the thicker, northernmost coal has the asymmetric profile characteristic of a down-cutting, laterally migrating, meandering stream. One side, the cut bank side, is steep, whereas the opposite side slopes gently up from the deepest part of the channel. The upper end of the erosional surface on the gently sloping side is covered by point bar sediments. These have a maximum thickness of 22 feet. Even though some details are obscured, it appears that these point bar deposits are composed of a laterally discontinuous, thin basal unit made up of sandstone that is generally coarser, relatively cleaner, and lighter colored than the thicker overlying unit, which is composed of interbedded silty sandstones, siltstones, and shales. The general upward reduction in grain size and especially the overall geometry of this particular deposit are characteristic of a typical point bar sequence formed by a meandering stream transporting a mix of mostly suspended sediment load with some coarser bed load. The coarser basal sandstones typify bed load deposits of the lower portions of the point bar and channel bottom. Whereas the slightly inclined, finer grained interbeds found in the upper unit are the result of suspension load sediments being deposited in the mid to upper portion of the point bar during floods. The backside of the point bar deposits thin gradually, become finer grained, and appear to grade laterally into overbank deposits.

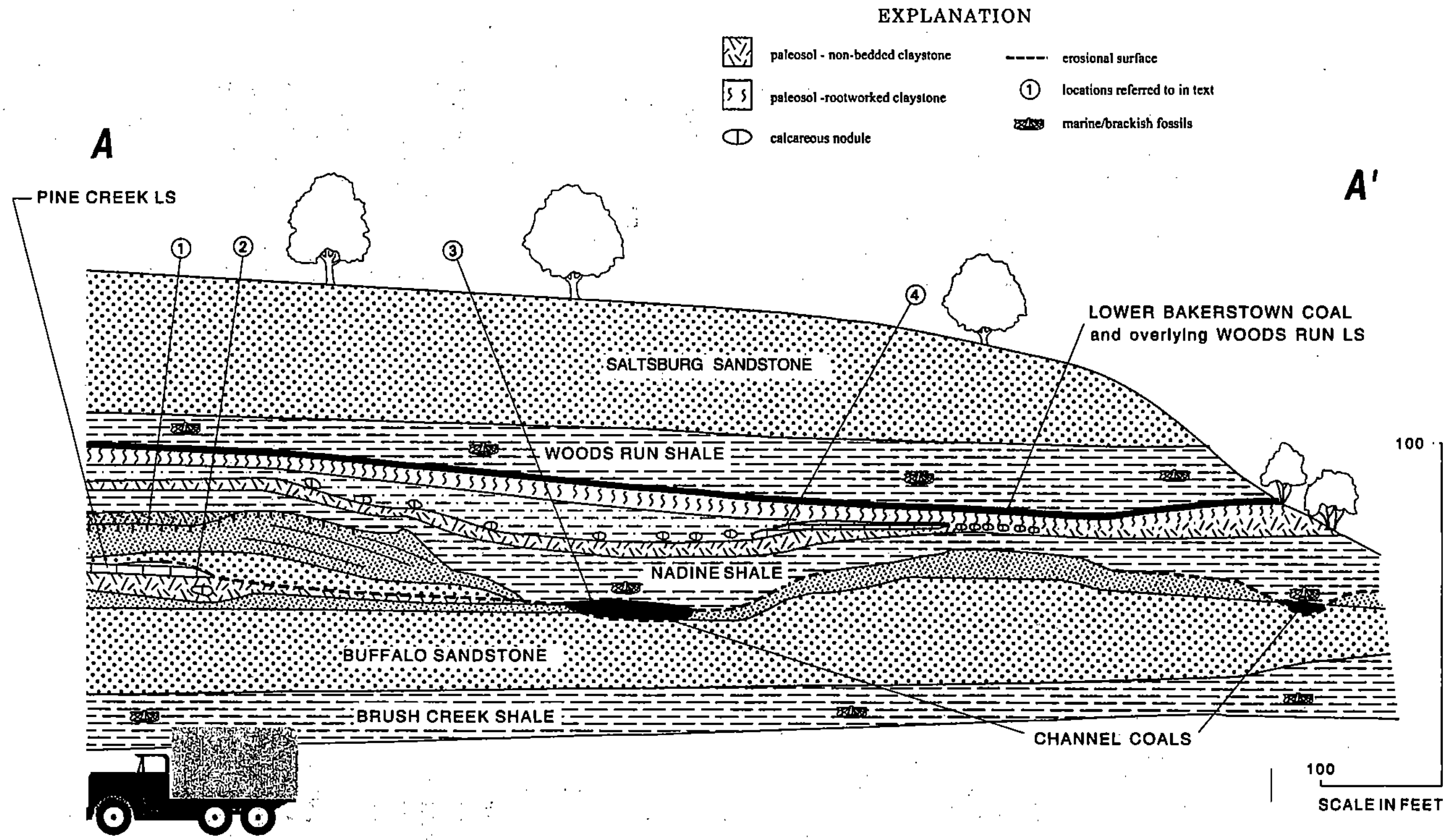


Figure 1-4 Road cut at old Route 66 exit shows meandering-stream paleochannels, which cut down through the Pine Creek Limestone and contain channel-bottom coals.

The top of the point bar at its highest point and along the sloping back side contains features suggestive of prolonged sub-aerial exposure (area 1: Figure 1-4). A thin, massive, sandy siltstone capping the top of the deposit contains vertical cracks filled with ferro-calcareous material. Directly below this bed, the top of the interbedded sandstone and sandy siltstone unit contains patchy deposits of arenaceous, limestone nodules. These features are not seen on the other, sloping, channel side of the point bar. The features are interpreted to be desiccation cracks and calcrete formed just above the water table in a paleosol that developed on the topographically higher portions of the point bar deposits after channel abandonment.

The erosional surface (heavy dashed line in Figure 1-4) of the channel containing the thicker coal is approximately 530 feet long. Proceeding from north to south, the surface initially has a relatively steep slope where it cuts down through the Pine Creek Limestone (area 2: Figure 1-4), dropping 6 feet vertically in 75 feet horizontally. The surface then flattens and slopes gently level for approximately 1 foot over the next 260 feet. In this distance, the erosional surface comes out from under the point bar deposits and onto the bed of the open channel. It then drops steeply into a narrow scour channel located in the center of the open channel bed.

The curved areal configuration of this stream segment and its spatial relationship with the other channel at the southern end of the highway cut (Figure 1-5) is the most persuasive indication that these deposits are associated with an abandoned meander loop. Stream flow appears to have been diverted when the meander loop was cut off at the neck by the other channel. No point bar or channel bottom deposits associated with this second channel were found. However, the non-bedded siltstone deposited on the Buffalo sandstone in the high ground area between channels may be partly levee deposits. The apparent scarcity of sediments and narrowness of the second channel suggests that it was abandoned quickly, possibly by major avulsion farther upstream.

The Conemaugh Group was originally referred to as the Lower Barren Coal Measures because of the pronounced economic inferiority of the coals found in that particular section. The coals are generally thinner, less persistent laterally, and of poorer quality than those of the overlying Allegheny and Monongahela Groups. They generally contain a large amount of the dull coal lithotypes (i.e., fusain, durain, and the duller of the thinly banded clarains) and consequently tend to have intermediate to dull luster (Karytsas, 1992). These characteristics have been attributed to the effects of climate (Cecil et al., 1985; Karytsas, 1992). Climate was thought to have changed from being uniformly wet to seasonally wet and dry soon after the beginning of Conemaugh deposition. The resulting periodic lowering of water table would have caused severe oxidation of accumulating plant debris substantially reducing the volume of peat, and increasing the percentage of the more carbon-rich, duller looking products of oxidation such as fusain.

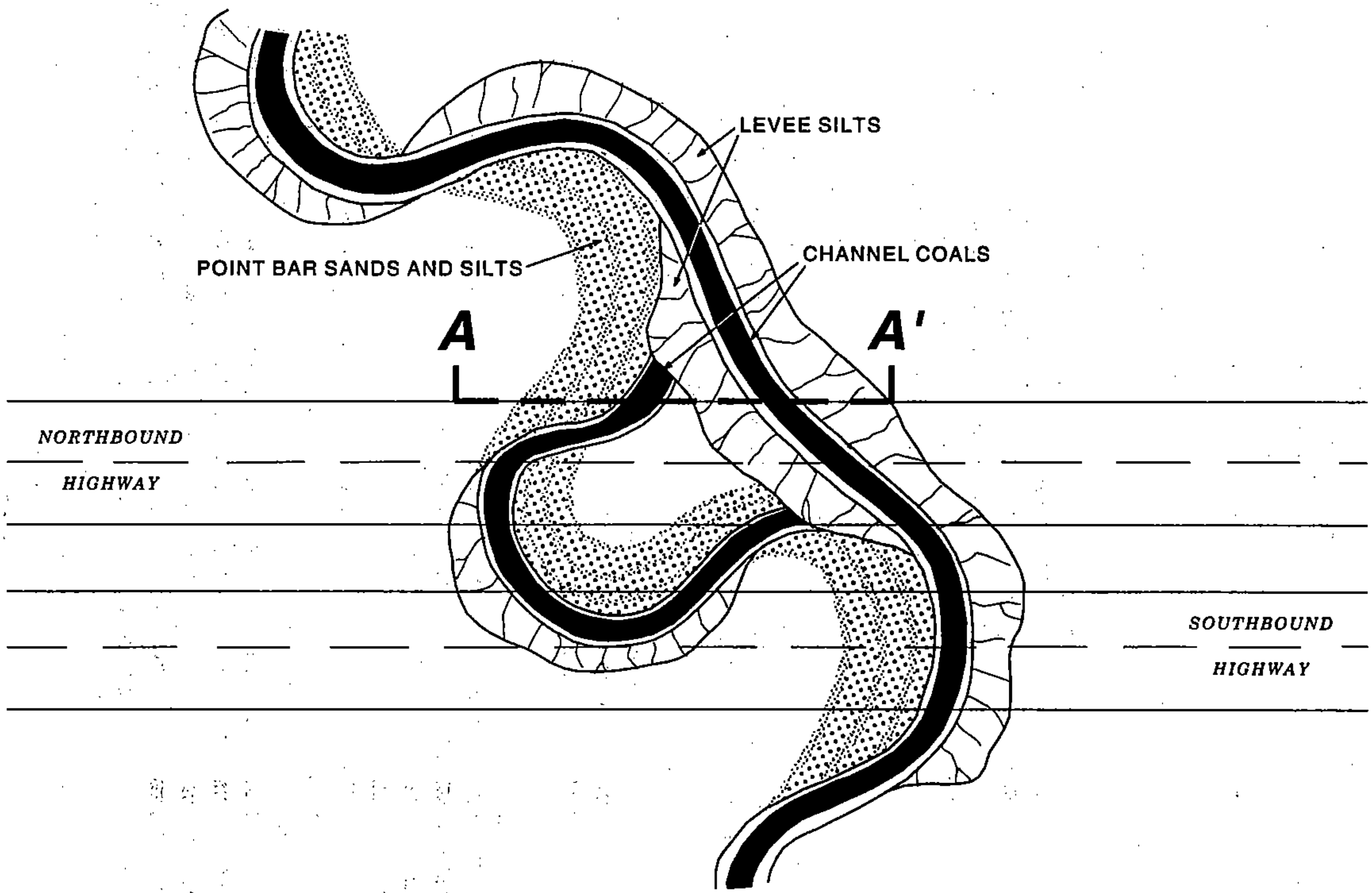


Figure 1-5 Aerial view of meandering-stream deposits and channel coals (diagrammatic and not to scale). Cross section A-A′ is shown in Figure 1.

The channel coals in the road cut compare fairly well with this general profile of Conemaugh coals. A megascopic examination indicates that both coals are banded and primarily composed of clarain with intermediate luster. The thicker of the two coals (area 3: Figure 1-4) contains several interbeds of dull coal, a few fusain lenses, and very thin pyrite laminae near the top. A few *Neuropteris* leaf and *Calamites* and *Sphenophylum* stem compressions were found on bedding planes of the dull coal interbeds.

An intriguing feature of the channel coals in this road cut is that they are restricted to the deepest portion of the stream bed. They do not cover the entire channel floor, nor do they conform to the shape of the abandoned channel as would be expected in oxbow deposits. A possible explanation for this unusual shape is that climatic conditions were generally dry, keeping the water table level low. In such climate, it is conceivable that only the deepest part of the channel would contain enough water to sustain luxuriant plant growth and to protect the accumulating peat from total destruction by oxidation during the cyclic dry periods. The desiccation cracks and calcrete on the top and back side of the levee deposits (area 2: Figure 1-4) provide additional evidence for this interpretation.

Additional indications of an alternating wet and dry climate can be seen in the section between the channel coal and the Lower Bakerstown coal. At least two other paleosol horizons appear to be present in this interval. The most distinct of these is situated directly beneath the Lower Bakerstown coal. It is considerably thicker and laterally more persistent than the paleosol that developed on the back side of the point bar. However, it is similar in that it has features suggestive of formation in a seasonally dry climate. Its profile from top to bottom consists of a thin, non-bedded, crumbly, olive gray claystone containing small carbonaceous root traces underlain by approximately 2.5 feet of non-bedded claystone having granular texture and containing small (typically pea size or smaller), irregular-shaped, ferro-calcareous nodules (glaebules). The glaebules are very calcareous at the bottom of the bed and become increasingly iron-rich upward. Some calcareous glaebules also occur in the upper part of the underlying bedded, silty shale. This profile corresponds well with the general description of other paleosols thought to have formed in semi-arid climate characterized by seasonally cyclic wet and dry conditions with an overall net deficiency in moisture (Smith, 1990).

Another possible paleosol horizon is situated about half way between the thick channel coal and the Lower Bakerstown coal. It is a 3- to 5-foot thick, non-bedded claystone containing small randomly oriented compaction slickensides. This claystone appears to have formed on the upper surface of a dark shale that blanketed the fluvial deposits and channel bottom coals. The orientation of this ancient soil horizon conforms with the underlying fluvial deposits forming a depression over the channel below. An unusual limestone conglomerate of limited extent was deposited on top of the paleosol along the sloping side of the depression (area 4: Figure 1-4). The rock is composed of mostly rounded, spherical to irregular-shaped, micritic, limestone clasts and a few sub angular, irregular-shaped, greenish gray, claystone clasts in a micritic limestone matrix. Small fractures containing crystalline calcite occur within the limestone clasts and also cutting through both limestone clasts and limestone matrix. The deposit thins upward as it rises out of the depression and at its uppermost end becomes nodular, very sideritic, weakly calcareous and has an extremely weathered appearance. It is interpreted to be an accumulation of calcareous glaebules eroded out of the underlying paleosol from the higher interchannel area and washing down into a fresh water pond filling the depression over the channel. The upper portion of the deposit is altered radically after burial because it is incorporated in the thick soil under the Lower Bakerstown coal.

The dark shale covering the accretionary deposits and filling the channels was deposited during a period of marine transgression. It is thin on the topographically higher point bar and inter-channel deposits and thicker in the channels. It contains a few brachiopod (*Lingula*), bivalve (*Dunbarrela*), and gastropod fossils, but these are found only at the base of the thicker channel fill deposits. Because of its stratigraphic position between the Pine Creek Limestone and the Woods Run marine zone, it is assumed that this unit is a distal deposit of the Nadine marine transgression. It has a very spotty occurrence in the Greensburg area, apparently being deposited only in stream valleys and other low areas.

The sedimentological features seen in this cut dramatically demonstrate that the rocks between the Pine Creek Limestone and the Lower Bakerstown coal are the product of a diverse and complicated set of depositional events. Deposition appears to have been strongly influenced by both widely fluctuating position of relative sea level and the effects of a semi-arid monsoonal climate. The Pine Creek marine transgression was apparently quickly succeeded by emergence and the development of an alluvial plain by accretionary, down cutting, meandering, stream systems. This was followed some time later by the weaker Nadine marine transgression. Depositional hiatuses of varying duration separated these events producing paleosols bearing the imprint of a semi-arid climate. Enigmatically, one of these paleosols, the one developed on top of the point bar and overbank deposits, appears to have formed at about the same time as the relatively thick channel coal deposits.

Road Log Continues from Stop 2.

3.1	65.9	Return to intersection of Route 22 and turn right (east).
0.7	66.6	Turn right to enter Stop 3, Oakford Storage Facility.

STOP 3

Oakford Gas Storage Facility
Murrysville and Fifth sandstone storage reservoirs.

Ray Follador, Angerman Associates, Inc.

The Oakford Gas Storage facility near Delmont, Pennsylvania is owned and operated by the Consolidated Natural Gas Transmission Company (CNGT). This stop will begin with the viewing of a video describing the gas storage facility and compression stations and conclude with a walk through the main facility. CNGT facility employees who will act as our guides have not prepared any information concerning the geology, drilling, or historical development of the gas fields that were later converted to storage in 1951. The following is a condensed description of the geology of the storage reservoirs in this field as well as a brief history of the drilling and development of those gas fields.

Geography

The Oakford Storage Field encompasses greater than 13,000 acres located in Westmoreland County, Pennsylvania (Figure 1-6). This field has an northeast-southwest orientation with an estimated length of 13 miles. To the northeast the field ends in Salem Township two (2) miles southwest of the town of Saltsburg. The field extends to the southwest and traverses Route 30 just south of the town of Jeanette and reaches its southern limits south of the town of Arona in Hempfield Township (Figure 1-7). The width of the field varies along its strike. An estimated width of three (3) miles is common in the northern reaches of the field tapering to less than one mile at its northern and southern extremes.

Structure

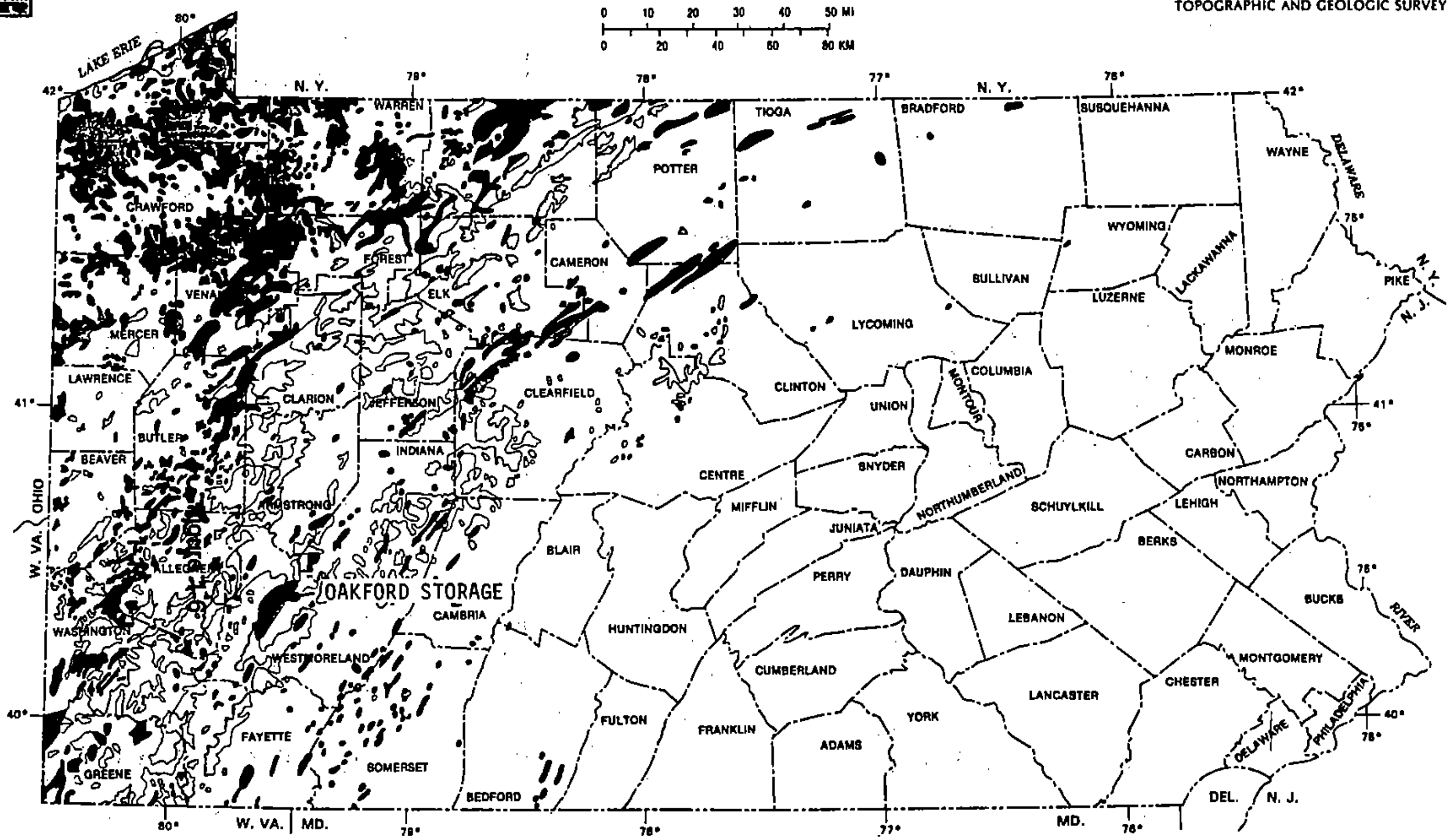
The Oakford Storage Field is located structurally along the east flank and axis of the Grapeville anticline and mirrors this anticline along its entire length (Figure 1-8). The southern end of this anticline plunges abruptly south of Little Sewickly Creek east of the town of Herminie. From here, the crest of the anticline rises rapidly to the northeast to where two (2) domal areas are separated by a structural saddle (Johnson, 1925). Traveling to the northeast the first of these domal areas is located at the town of Grapeville in Hempfield Township and the second is near Jeanette. The anticline then rises to its highest point three (3) miles northeast of the town of Jeanette. The anticline then plunges to its northern termination near the town of Saltsburg.

MAP 10

OIL AND GAS FIELDS OF PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF PARKS AND FORESTRY
BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY

SCALE 1:2,000,000



EXPLANATION

Shallow oil field

Shallow gas field

Deep gas field

Gas storage area

Figure 1-6

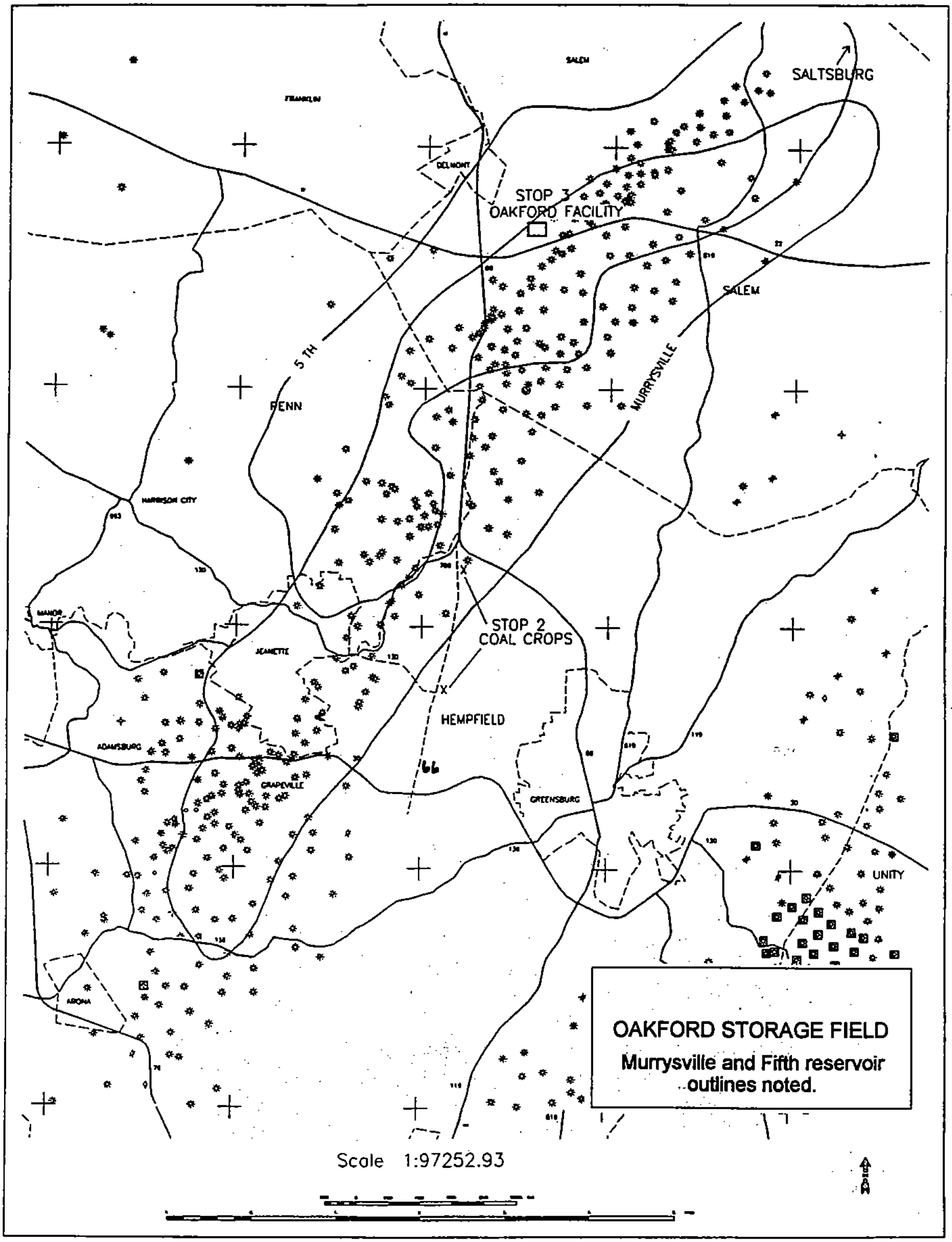

SALTSBURG
STOP 3
OAKFORD FACILITY
5 TH
PENN
SALEM
MURRYSVILLE
STOP 2
COAL CROPS
HEMPFIELD
UNITY
OAKFORD STORAGE FIELD
Murrysville and Fifth reservoir outlines noted.
Scale 1:97252.93

Figure 1-7

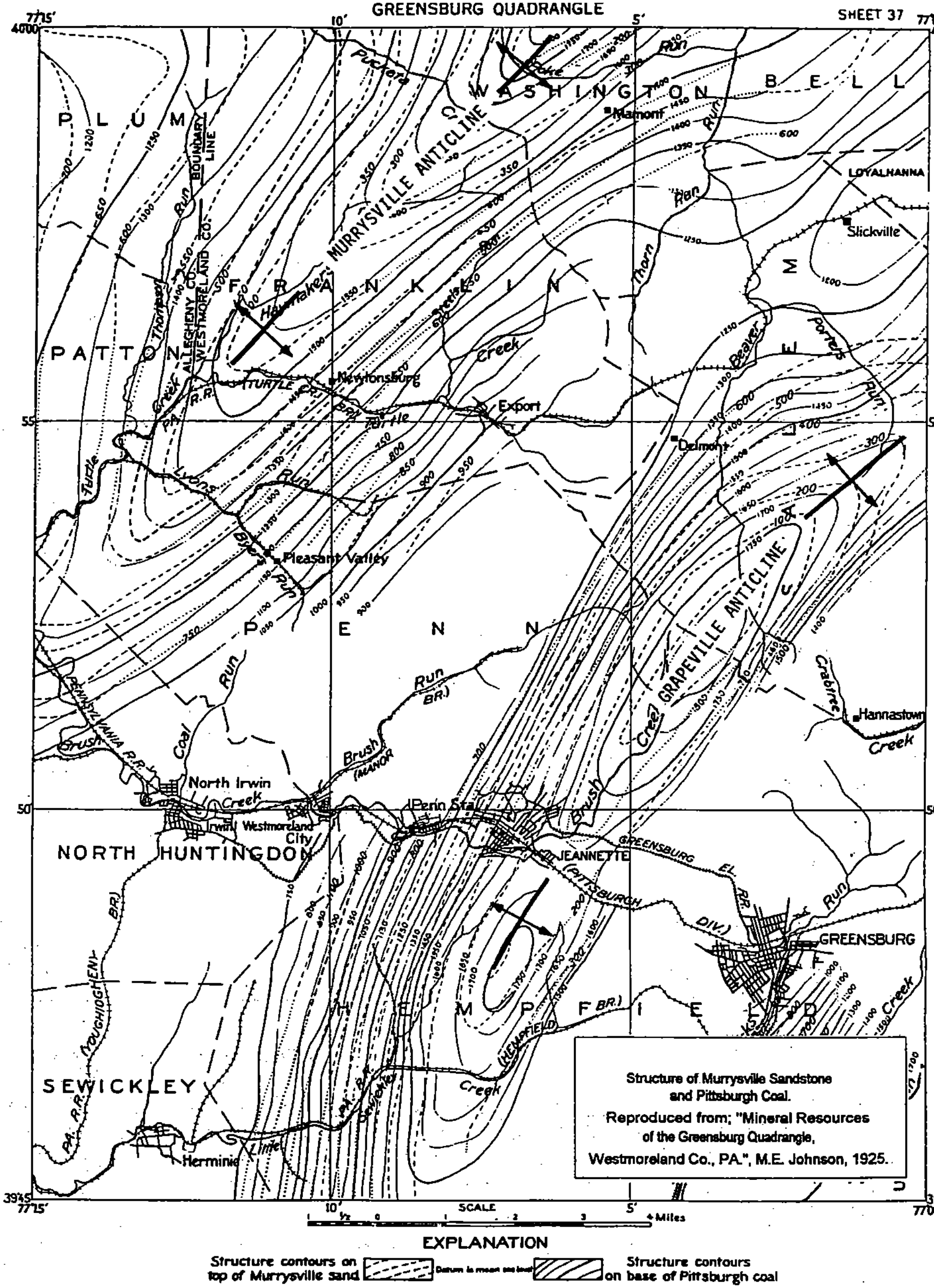


FIGURE 9. Structure-contours on Murrysville sand and Pittsburgh coal.

Figure 1-8

Geology of the Storage Reservoirs

Several sandstone's have proven to be prolific gas reservoirs along the Grapeville anticline since 1887 when gas was first discovered along this structure. These gas fields were named the Delmont and Grapeville/Arona Fields at or near the turn of the century (Ashley and Robinson, 1922). Shows of gas and production have been reported in Pennsylvanian and Mississippian sandstones in this region but the greatest natural flows of gas were recorded in Upper Devonian Venango and Bradford Group sandstones (Figure 1-9). Of these reservoirs, the Murrysville and Fifth sandstones of the Venango Group serve as the gas storage reservoirs of the Oakford Field (Figure 1-7).

The shallower Murrysville sandstone caps the top of the Upper Devonian section and is an estimated 1400 feet beneath the surface. The gross sandstone thickness is 100 feet with an average pay thickness of 50 feet. The sandstone is very coarse and sometimes pebbly with a maximum estimated porosity of 20% in the pay section (Lytle, 1963). Structure plays a role in trapping gas in the Murrysville sandstone with gas accumulating in the crest of the anticline. The first productive gas wells drilled in the Murrysville sandstone in Oakford occurred in 1887 (Lytle, 1963). The original rock pressures of these wells were gauged at greater than 600 psi with initial flow rates ranging from 10 Mmcf to 40 Mmcf per day.

The Fifth sandstone is the lower of the two storage reservoirs and is an estimated 2200 feet beneath the surface. This sandstone has an estimated gross thickness of 60 feet. The net reservoir pay of the Fifth sandstone is an estimated 20 feet with an average porosity of 13% in the pay section (Lytle, 1963). The trapping mechanism for this reservoir is stratigraphic with nonporous sandstone and siltstones sealing the porous pay zones. The initial productive wells drilled to the Fifth sandstone occurred in 1907 (Lytle, 1963). These wells had original rock pressures of 1100 psi and initial flow rates of 20 Mmcf to 30 Mmcf per day.

Conversion to Storage

New York State Natural Gas, the predecessor to CNGT, began to convert the Murrysville and Fifth sandstone reservoirs to storage in 1951. Natural gas storage figures compiled for a 1960 report by the American Gas Association (AGA) reported the Murrysville and Fifth reservoirs to have total working capacities of 51,408 Mmcf and 8,952 Mmcf respectively for a total working capacity of over 60,000 Mmcf nine years after the conversion was initiated (Lytle, 1963). In the most recent survey of underground gas storage facilities by the AGA (1988), the Oakford Field is reported to have 277 total wells of which 231 serve as input/output wells and 46 serve as pressure control/observation wells. Four (4) compressor stations operate within the field with a total of 51,250 horsepower and field pipeline sizes ranging from 2 to 20 inches.

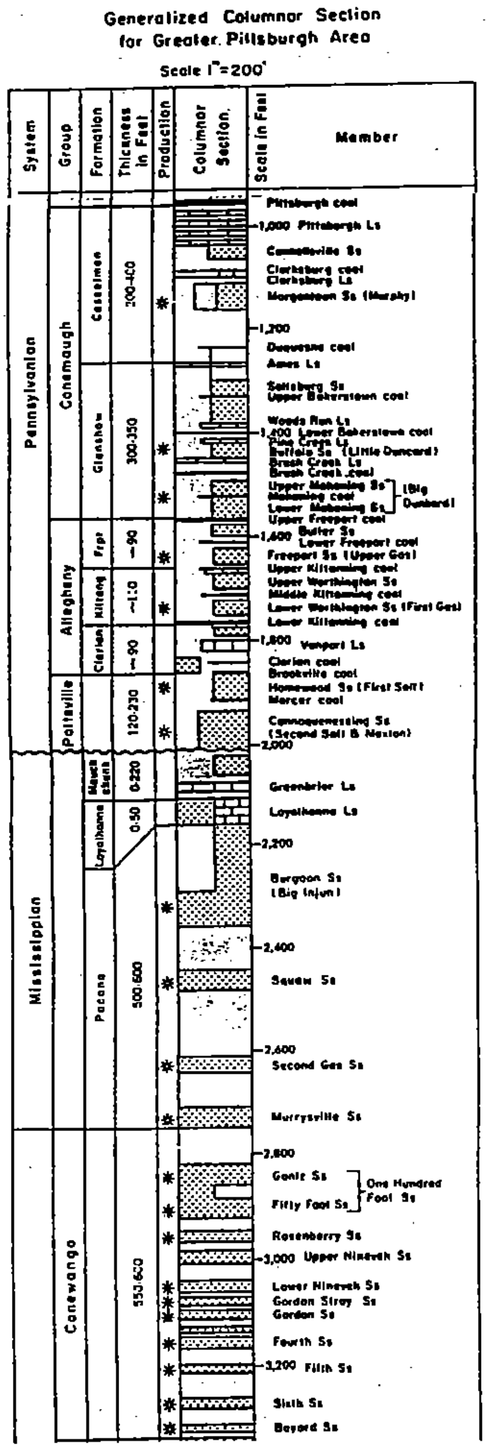


Figure 1-9 Generalized stratigraphic column showing productive.

The AGA reported the total base gas/working gas capacity of the Oakford Storage facility was 102,174 Mmcf in 1988. The future undeveloped (unused capacity) base gas at this time was estimated to equal 123,252 Mmcf bringing the ultimate storage capacity to equal 225,426 Mmcf.

Road Log Continues from Stop 3.

13.4	80.0	Follow Route 22 west to Monroeville Mall Park and Ride.

END OF ROAD LOG