GENERAL DESCRIPTION

The Jeansville Basin covers approximately 20 square miles of the southern part of the Eastern Middle Anthracite Field along the edges of Luzerne, Schuylkill, and Carbon Counties in central eastern Pennsylvania. The Basin occupies the narrow valley between Pismire Ridge on the north and Spring Mountain on the south, approximately 1-1/2 miles south of the City of Hazleton. It extends in a northeast-southwest direction for about 9 miles and is approximately 2.3 miles wide. The summits of the enclosing mountains are approximately 1900 feet above sea level. The enclosed valley, containing the coal measures, ranges from about 1550 to 1800 feet above sea level.

The Jeansville Basin consists of a series of tightly folded anticlines and synclines enclosed within one of the synclinoria that comprise the anthracite fields of northeastern Pennsylvania. The coal measures form the central part of the synclinal structure and underlie the valley between Pismire Ridge and Spring Mountain. These two promontories are composed of resistant sandstone and conglomerate beds of the Pottsville Formation, which have formed topographically elevated ridges around the outer rim of the syncline and are folded in "canoe" shapes beneath the coal measures. Underlying the Pottsville Formation and outcropping in the valley to the south of Spring Mountain are the soft shales and sandstones of the Mauch Chunk Formation.

The Basin is situated topographically on a divide separating the Susquehanna River watershed on the west and the Delaware River watershed on the east. Its western half lies on the headwaters of Catawissa Creek, which subsequently enters the Susquehanna River near Catawissa Borough. Its eastern half lies on the headwaters of Beaver Creek, which comprises a portion of the subwatershed of Black Creek and the Lehigh River, with eventual discharge to the Delaware River.

Extensive surface and underground mining has been conducted in the Basin coal measures since the mid-1800's. To alleviate groundwater and pumping problems in the deep mine workings, two drainage tunnels were driven through the enclosing ridges:

1. Audenried Tunnel near the western end of the Basin with discharge to Catawissa Creek.
2. Quakake Tunnel near the eastern end of the Basin with discharge to Wetzel Creek.

Mining and subsequent collapse of the underground workings, together with extensive strip mining, have completely destroyed the natural drainage patterns of the surface streams within the Basin. As a result, surface waters infiltrate through the broken strata or the strip pits, pick up acid and iron from oxidizing sulfide minerals, and discharge as mine drainage to the surface through the two drainage tunnels. These mine drainage discharges cause extensive pollution of Catawissa and Wetzel Creeks.

The area within the Basin underlaid by coal measures includes the Borough of Beaver Meadows, and the Villages of Audenried, Beaver Brook, Junedale, Tresckow, and Jeansville. The Borough of McAdoo and the Village of Kelayres lie within the Basin but outside the coal measures.

HISTORICAL GEOLOGY

The rocks of this region were originally deposited as sediment, in a near-shore environment, about 250 to 350 million years ago, during the Pennsylvanian and Mississippian geologic periods. Changes in the relative depth of water, the character at sediment source areas, and the depositional environment resulted in the formational variations present. Subsequent consolidation and cementation of these sediments has caused alternating sequences of conglomerate, sandstone, and shale strata. Coal measures formed from the compaction and chemical alteration of highly organic material that had accumulated in large swamp-like areas and had been rapidly buried in an oxygen deficient environment.

The structural features of the region are the result of the Appalachian Orogeny that occurred approximately 230 million years ago. Compressive forces from the southeast caused the earth's crust to fold and wrinkle into a series of parallel anticlines and synclines, forming alternating ridges and valleys. This lateral compression also caused thrust faulting that contributed to the northwest-southeast crustal shortening. Subsequent erosion, followed by upwarping and the selective removal of weaker rocks to lower levels, has resulted in the present complex mountain structure. The Jeansville Basin is part of the region, extending from New York to Alabama, known as the Ridge and Valley Physiographic Province. It is marked by long, narrow even-topped mountain ridges, which are continuous over long distances or are offset in an "*en echelon*" pattern as seen in the anthracite basins.

EXTENT OF DEEP MINING

Development of the coal measures by deep mining in the Basin started in approximately 1835 near Beaver Meadows. The greatest Basin coal production occurred between the start of World War I in 1914 and the mid-1920's. Underground development of these measures was accomplished by large-scale mining complexes. For purposes of this report, these complexes have been designated as follows:

1. Audenried
2. North of Fault
3. Tresckow
4. Beaver Brook
5. Spring Brook
6. Spring Mountain
7. Coleraine
8. Beaver Meadow

The Basin coal measures have been extensively deep mined within these complexes until virtually the entire Basin surface area has been undermined. Although all major Basin deep mines have been abandoned, future deep mining could be possible where the demand for the remaining coal justified its removal,

The extent of underground mining and the locations of the designated complexes are shown on Plate II.

PAST UNDERGROUND DRAINAGE CONTROL

Water encountered during Basin deep mining was a major problem. To control the water, several systems were developed around the basic drainage system established by construction of the Audenried and Quakake Tunnels. These systems consisted of the following:

1. Tunnels were driven between different coal veins or across faults within the mines to expedite the haulage of coal and the passage of miners and equipment. These tunnels also served to interconnect these workings with the drainage tunnels, permitting free-flowing gravity drainage from those mined areas lying above the elevations of the drainage tunnels.

2. In those sections of the deep mines where workings were connected with a drainage tunnel but were at lower elevations, water encountered was either pumped to the surface or to a point in the underground workings from which it would flow by gravity to the drainage tunnel. When recoverable coal was extracted in these locations, and when it was determined that the section of the mine involved was no longer useful in the general operation of the mine, pumping ceased, and pools were allowed to form. Water in the section continued to rise until it spilled over into the gravity system served by the drainage tunnel.

3. In one large mining complex (Spring Mountain), a portion of the deep mine was deliberately flooded to provide a source of water for coal preparation facilities. This flooding was accomplished by damming a gangway that had served as a drainage passageway. To prevent this pool from spilling over into other areas of the mine through interconnections at higher elevations, two 10-inch horizontal holes regulated by valves were installed in the dam.

4. In those portions of the Basin that were owned by different companies or that were mined as separate entities, barriers of un-mined coal were left along the mine boundaries. These barriers prevented or minimized water flow between mines. As mining progressed, and as various portions of mines were no longer useful, these barrier pillars were abrogated by mutual agreement, or boreholes were drilled through them to allow gravity flow to those portions of the deep mines that contributed water to the drainage tunnels.

PRESENT UNDERGROUND DRAINAGE CONTROL

Since large-scale deep mining was discontinued in the Basin, there was no further need to control water elevations in the deep mines. Consequently, all pumping has been discontinued, and water within the mines has sought its own drainage path. At present, water entering the existing deep mine workings eventually discharges by gravity from either the Audenried Tunnel or the Quakake Tunnel.

According to information obtained from available mine maps, the Audenried Tunnel presently drains the deep mine workings of Audenried, North of Fault, Tresckow, Beaver Brook, Spring Brook, and portions of Spring Mountain. The deep mine workings of Beaver Meadow, Coleraine, and the other portions of Spring Mountain are drained by the Quakake Tunnel.

The deep mine workings contributing to each of the two tunnels are shown on Plate II.

DRAINAGE PATTERNS IN DEEP MINES SERVED BY THE AUDENRIED TUNNEL

The Audenried Tunnel was driven through rock strata from the Gamma vein in the Audenried Mine at an elevation of approximately +1207 in a westerly direction for about 16,150 feet to a point outside the Basin on the Catawissa Creek watershed at an elevation of +1178. A study of available mine maps indicates that this tunnel drains the Audenried, North of Fault, Tresckow, Beaver Brook, Spring Brook, and portions of Spring Mountain workings.

The Audenried, North of Fault, and Tresckow Mines are contiguous and were developed under one ownership. Consequently, drainage patterns within these mines were established to maximize use of the Audenried Tunnel. Available maps did not show the common boundary between the Audenried and Tresckow Mines.

The North of Fault Mine lies north of the Audenried Mine. Its coal measures are separated from the coal measures in the Audenried Mine by a major fault that extends in an east-west direction. To provide a drainage course, a rock tunnel was driven through the fault to interconnect the Buck Mountain and Lykens veins in the North of Fault Mine with the Mammoth, Wharton, Gamma, Buck Mountain, and Lykens veins in the Audenried Mine at an elevation of approximately +1348.

The workings in the Mammoth, Wharton, Gamma, Buck Mountain, and Lykens veins in the Tresckow Mine are continuous with, and are intimately connected to, the workings in the Audenried Mine at all elevations. In addition, mine maps indicate that a rock tunnel was driven eastward from near the Audenried Tunnel in the Gamma vein workings in the Audenried Mine to the Lykens vein workings in the Tresckow Mine at an elevation of +1217.

Water present in the Beaver Brook Mine workings finds access to the Audenried Tunnel via continuous mining across its boundary with the North of Fault Mine in the Gamma, Buck Mountain, and Lykens veins. The minimum elevation at which this occurs is +1350 in the Lykens vein. This also can occur in the Buck Mountain and Gamma veins starting at +1420 and +1480, respectively.

Drainage from the Spring Brook Mine to the Audenried Tunnel can occur via interconnections with the North of Fault, Audenried, and Beaver Brook Mines. Interconnections with the North of Fault Mine occur in the Buck Mountain, as well as the Lykens Overlap and Underlap veins, where the barrier pillars separating the two mines were abrogated above +1300. Similarly, the barrier pillars between the Spring Brook and the Audenried Mines in the Buck Mountain and

Lykens Overlap and Underlap veins were abrogated above an elevation of +1300. In addition, continuous mining across this boundary occurred in the Wharton vein. Two 6-inch horizontal boreholes were drilled from the Buck Mountain vein in the Audenried Mine to the Lykens vein in the Spring Brook Mine at an elevation of +1219. However, according to former employees of the Audenried Mine, the workings in the Buck Mountain vein in the Audenried Mine were gobbed in this area. This gobbing, where it was done, may cause a severe restriction in flow.

It is believed that continuous mining in the Gamma, Buck Mountain, and Lykens veins occurred across the boundary separating the Spring Brook and Beaver Brook Mines. If this mining has occurred, it would provide another drainage path for water in Spring Brook to migrate to the Audenried Tunnel.

The workings in the Spring Mountain Mine are drained by both the Audenried and Quakake Tunnels. Portions of its workings in the Buck Mountain and Lykens veins are connected with workings in the Spring Brook Mine via continuous mining across boundary lines in those veins starting at +1148 in the Buck Mountain vein and +1099 in the Lykens vein. This allows drainage from a portion of Spring Mountain to enter the Audenried Tunnel drainage system. The overlying Wharton vein in the Spring Mountain Mine is connected to the Wharton vein in the Spring Brook Mine by a rock tunnel at +1398. However, the tunnel does not currently serve as a drainage path since the Wharton vein workings in the Spring Mountain Mine are drained to the Quakake Tunnel at the lower elevation of +1334 via two 10-inch horizontal holes in a dam constructed across a rock tunnel connecting the Wharton vein in the Spring Mountain Mine with the Gamma vein in the Beaver Meadow Mine. The Wharton workings in the Spring Brook Mine drain into the Audenried Tunnel drainage system via interconnections with the underlying Buck Mountain and Lykens veins.

Controlling interconnections between mines drained by the Audenried Tunnel are shown schematically in Exhibit A and are summarized in Exhibit B.

The extent of deep mine workings contributing to the Audenried Tunnel discharge, together with underground flow patterns, is shown on Plate II.

DRAINAGE PATTERNS IN DEEP MINES SERVED BY THE QUAKAKE TUNNEL

The Quakake Tunnel was driven in a southeast direction from a point in the Beaver Meadow Mine in the Gamma vein at an elevation of +1308. It intercepted the Lykens vein at +1307 and then continued for approximately 3,900 feet beyond the Lykens vein to the ground surface outside the Basin on the Wetzel Creek watershed at a portalelevation of approximately +1290. A study of available mine maps shows that the tunnel drains the Beaver Meadow and Coleraine Mines, as well as portions of the Spring Mountain Mine.

Drainage from the Coleraine Mine to the Quakake Tunnel can occur via interconnections with the Beaver Meadow Mine, where continuous mining in the Wharton vein occurred across the boundary line starting at an elevation of approximately +1420. In addition, a rock tunnel was driven between the Buck Mountain workings in both mines at +1513. A further interconnection occurs at an elevation of +1329, where a rock tunnel in the Buck Mountain vein in the Coleraine Mine was driven to intercept a shaft driven from the surface over the Beaver Meadow Mine to the Lykens vein.

As was previously mentioned, a portion of the Spring Mountain workings drains to the Quakake Tunnel at an elevation of +1334 via two 10-inch horizontal holes in a dam constructed across a rock tunnel connecting the Wharton vein in the Spring Mountain Mine with the Gamma vein in the Beaver Meadow Mine. Furthermore, the barrier pillar between the Spring Mountain Mine and the Coleraine Mine was abrogated in the Mammoth Overlap vein beginning at +1470 and in the Mammoth Underlap vein beginning at +1500.

Controlling interconnections between mines drained by the Quakake Tunnel are shown schematically in Exhibit A and are summarized in Exhibit C.

The extent of deep mining contributing to the Quakake Tunnel discharge, together with underground flow patterns, is shown on Plate II.

SURFACE CONDITIONS CONTRIBUTING TO TUNNEL DISCHARGES

For all practical purposes, the outcrops of all mineable coal in the Basin have been strip mined. These strip mines were operated to a depth where most of the coal had been recovered by deep mining operations, and further removal of overburden was no longer economical. In some cases, deep mining extended close to the surface, and as a result, extensive subsidence along the outcrop occurred. Accordingly, much of the surface water from the watershed areas tributary to or overlying the coal measures in the Basin is intercepted by the strip mines or surface subsidence from deep mining and is directed into the deep mine workings. This surface water then enters the underground drainage patterns with subsequent discharge as mine drainage from either the Audenried Tunnel or the Quakake Tunnel. This mine drainage includes water from the headwaters of Catawissa Creek and Beaver Creek, where for all practical purposes, the stream beds for both streams are nonexistent.

In addition to surface water interception by strip and deep mining, two other water sources contribute to the tunnel discharges. These are make-up water for coal preparation plants from sources outside of the drainage areas tributary to the Basin coal measures and wastewater from the villages and private dwellings overlying the Basin coal measures.

SURFACE WATER FLOW ROUTES INTO AND THROUGH DEEP MINE WORKINGS

During the field investigations, 19 point sources of surface water that normally drain toward the Basin coal measures were located. Of these sources, 18 are intercepted by strip mines or subsidence areas and are directed into the underlying deep mine workings. A study of available mine maps and other information indicates that one source flowing toward the Basin coal measures is believed to discharge away from the Basin due to a restriction in flow caused by construction of Interstate Route 81. This source is shown as A-1 on Plate II. Six sources enter the deep mine workings drained by the Audenried Tunnel, and the remaining 12 sources contribute to the Quakake Tunnel discharge.

Of the six sources entering the Audenried Tunnel drainage system, four occasionally provide make-up water for the two breakers located in the Basin. In addition to the 19 sources of surface water, approximately 1.2 mgd of water is pumped daily from sources outside of the Basin watershed to one of the breakers when it is operating. All water currently used in the two breakers eventually becomes part of the Audenried Tunnel discharge.

The only major source of wastewater that contributes to the Basin mine drainage discharges originates in the Village of Tresckow. The Village has a wastewater collection system that discharges into an open ditch along the south edge of the Village. During the field investigations, this wastewater was conveyed eastward for approximately 4,700 feet, where it subsequently disappeared into the underlying Coleraine deep mine workings. Other wastewater flows apparently originate from private on-site disposal systems within the Villages of Audenried, Beaver Brook, Jeansville, and Junedale, from which they infiltrate into the deep mines beneath each community. However, no attempt was made in this study to locate these sources or to estimate their contributions to the tunnel discharges since their total volume would be an insignificant portion of the tunnel flows.

The Village of Kelayres and the Borough of McAdoo discharge their wastewaters into an open channel that conveys these wastewaters and surface flows across the Basin into Catawissa Creek farther downstream. Wastewater from the Borough of Beaver Meadows is conveyed to a treatment facility located outside the coal measures on Beaver Creek.

The location of each of the 19 point sources is shown on Plate II.

MINE DRAINAGE GAGING, SAMPLING, AND ANALYTICAL PROGRAM

To define the current extent of mine drainage pollution originating within the Basin, the volume and quality of the Audenried and Quakake Tunnel discharges had to be established. Therefore, the two discharges were gaged, sampled, and analyzed from November 1969 through September 1970. As part of the field investigations, 20 instantaneous flow measurements were made and 10 samples were obtained at the two discharge points during dry, normal, and wet weather. All of the samples collected were analyzed for pH, iron, and acidity. In addition, some of these samples were analyzed for sulfates, manganese, and dissolved solids. The data collected are presented in Exhibit D.

On the basis of discharge conditions encountered during low, average, and high groundwater levels, the discharges from the Audenried and Quakake Tunnels had the following ranges in volume and major constituents and characteristics:

Exhibit E summarizes mine drainage volumes, constituents, and characteristics measured at both tunnels during the gaging, sampling, and analytical program at low, average, and high groundwater conditions.

Ranges	Audenried Tunnel	Quakake Tunnel
Volume - mgd	7.3-44.6	7.3-40.6
pH	3.2- 3.5	3.2- 3.6
Total Iron		
mg/l	0.9- 8.2	0.7- 6.4
tons/day	0.17-0.40	0.07-0.31
Acid (as $CaCO_3$)		
mg/l	256- 432	160- 340
tons/day	10.5-47.6	8.35-27.1

During the period covered by this program, the yearly precipitation in the Basin was approximately 10.5 percent less than the average yearly precipitation over a 37-year period of record. Also the total precipitation during the period affecting the spring high flows (December 1969 through April 1970) was approximately 8.4 percent less than the December through April average over the same period of record. The total Basin precipitation during dry weather (August through September) was approximately 47.3 percent less than average precipitation during these same months over this period of record.

MINE DRAINAGE DESIGN VOLUMES AND QUALITY

In addition to establishing water flow routes into, through, and out of the deep mine workings, the design conditions at each discharge point had to be established before abatement measures could be planned and their effectiveness estimated. The mine drainage design volumes, constituents, and characteristics used in planning and evaluating the effectiveness of abatement measures are described in this section of the report.

Three conditions of discharge were established at each discharge point to determine the need for abatement measures, to design abatement measures, and to estimate their effectiveness. The three conditions are described as follows:

Design Average

Average daily mine drainage volumes, constituents, and characteristics during a year of normal precipitation.

Design Wet-Weather

Average daily mine drainage volumes, constituents, and characteristics during spring high groundwater level periods caused by normal precipitation from December through April.

Design Maximum

Maximum daily mine drainage volumes, constituents, and characteristics resulting from the maximum 24hour accumulation of rainfall occurring, on the average, no more often than once every 10 years.

The design maximum conditions could have been selected from a wide range of precipitation conditions. Maximum mine drainage discharges resulting from as little as the 72-hour accumulation of rainfall occurring no more often than once a year to as much as the 30-minute accumulation of rainfall occurring no more often than once every 1,000 years could have been adopted. After discussions with personnel from the Department of Environmental Resources, the recommended design maximum conditions were selected to provide reasonable protection to receiving streams. Excess mine drainage over design maximum loads can be absorbed by receiving streams whose flows will have been significantly increased by excess precipitation.

Design average, wet-weather, and maximum mine drainage volumes were calculated using precipitation records, assumed surface-water runoff coefficients, and evaporation-transpiration losses, as well as the estimated extent of deep mining and surface acreage contributing groundwater or surface water to each tunnel. The mine drainage constituents and characteristics for design average and wet-weather conditions were based upon the previously discussed sampling and analytical program results obtained during normal and high groundwater level periods, respectively. The design maximum constituents and characteristics were estimated from sampling and analytical results, as well as previous experience.

Mine drainage volumes, as well as major constituents and characteristics used for design purposes, are summarized as follows:

Design Mine Drainage Volumes, Constituents, And Characteristics

	Design Average		Design Wet-Weather		Design Maximum	
	Audenried Tunnel	Quakake Tunnel	Audenried Tunnel	Quakake Tunnel	Audenried Tunnel	Quakake Tunnel
Volume (mgd)	18.4	16.6	24.5	19.6	317	285
pH Range	3.2-3.5	3.2-3.6	3.2-3.5	3.4-3.6	3.2-3.5	3.4-3.6
Total Iron						
mg/1	4.6	3.6	3.1	1.6	3.1	1.6
tons/day	0.35	0.25	0.32	0.13	4.1	1.9
Acid (as $CaCO_3$)						
mg/1	345	235	329	208	329	208
tons/day	26.5	16.3	33.6	17.0	435	247

Exhibit F presents the assumptions and calculations used to establish design volumes for the Audenried and Quakake Tunnels.

EFFECTS OF MINE SEALING ON MINE DRAINAGE DISCHARGES

The chemical and physical processes involved in the formation of acid mine drainage are fairly well understood. During mining, the pyrite (iron disulfide) closely associated with coal is disturbed and becomes exposed. The exposed faces oxidize in the presence of oxygen and water vapor. Ferrous sulfate and sulfuric acid are formed. As mining continues, water enters the mine and dissolves these oxidation products. When this water leaves the mine, the oxidation products are carried into the receiving stream. As mining proceeds, and in fact, long after mining ceases, these oxidation and dissolving processes continue.

However, if the pyrite can be inundated with water, the oxidation process can be significantly retarded. Sealing the Audenried and Quakake Tunnels will inundate exposed pyrite in the mine workings beneath the level of the anticipated overflow. After the overflow is established, water entering the Basin will pass through the mine workings to this overflow. The dissolved oxidation products along these water flow routes will be flushed from the mine workings. Then the only contribution of acid and iron will come from the remaining exposed pyrite located above the level of the anticipated overflow. It is estimated that 70 percent of the now exposed pyrite will be inundated. After water flow routes have been established, the acid and iron contribution from the Basin should be commensurately reduced.

GEOLOGIC INVESTIGATION

In order to determine the feasibility of sealing the tunnels and inundating the underground workings, detailed knowledge of the Basin geology and the structural competency of the rock formations surrounding the Basin is necessary. The geologic map of Pennsylvania and geologic reports of applicable portions of the Anthracite Field were studied to determine the rock formations and the general geologic structure of the region. Reports dealing specifically with the geology of the Jeansville Basin have not been published. Stereoscopic aerial photographs were examined to determine the surface features of the Basin, including rock outcroppings, faults, fracture traces, and apparent rock structure. Field examinations of these and other features were conducted. Detailed geologic mapping was performed within the first 1,300 feet of the Audenried Tunnel and the first 3,900 feet of the Quakake Tunnel to delineate geologic formations and structures and to determine the physical condition of the rock. Available mine maps were examined to determine the structural configuration of the coal measures, fracture zones, and the depth of the mine workings.

STRATIGRAPHY

Five generally mappable rock units of Upper Mississippi an through Upper Pennsylvanian age are exposed within the area. The oldest rocks, exposed in the low-lying valley south of Spring Mountain, are the red beds of the Middle Member of the Mauch Chunk Formation. Lying on the lower slopes of Spring Mountain is the Upper Member of the Mauch Chunk Formation, an intertonguing of red beds - characteristic of underlying rocks - with gray sandstones and conglomerates - characteristic of the overlying Pottsville Formation.

The Pottsville Formation can be subdivided into two easily identifiable members. The Lower Member consists largely of an interbedded sequence of gray shales, siltstones, sandstones, and conglomerates. Pebbles in the conglomerates consist of a wide variety of rock types, including white vein quartz, white to dark gray quartzite, many colors of chert, sandstone, shale, gneiss, phyllite, and others. In contrast, the Upper Member consists almost entirely of sandstone and conglomerate beds. Its pebbles consist predominantly of white vein quartz and white to gray quartzite, making the distinction between the two members generally obvious. Both members of the Pottsville Formation outcrop on the upper slopes of the ridges. However, the coarse-grained conglomerate of the Upper Member usually forms the highest points. Most natural outcrops in the area consist of one or the other of these hard conglomeritic strata.

The youngest rocks exposed within the area are those of the Llewellyn Formation. These units, found in the enclosed valley, are a sequence of interbedded coals, clays, shales, and sandstones.

STRUCTURE

The dominant structural features of the area are the intensely folded anticlines and synclines that trend N 75-80^0 E in an irregular *"en echelon"* pattern. These synclines contain the coal measures. Faults noted during the investigations include bedding plane slippages, low angle thrusts, and some minor normal faults. The trend of the faults is mainly northeast-southwest, nearly parallel to the trend of the folding and the strike of the bedding. The faults seem to be short and discontinuous, and they do not appear to extend beyond the Basin. Displacement seems to have been small, resulting mainly from local stress relief rather than major crustal movement.

Major displacements resulting from low angle thrusts have been identified at several locations within the coal measures. A typical thrust fault, and one of the most dramatic because of its exposure, occurs in the road cut of Interstate Route 81 through Spring Mountain. The synclinal structure of the Upper Member of the Pottsville Formation has been thrust an estimated 100 feet to the north over the older beds. Several other smaller faults branch from the main displacement.