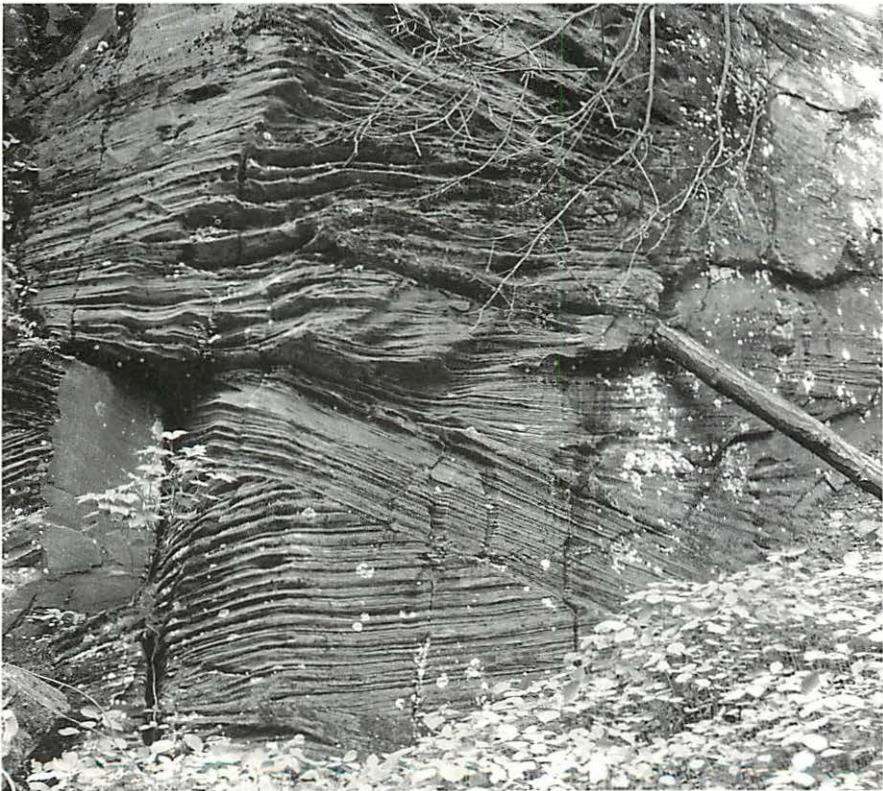


VOL. 23, NO. 2

Pennsylvania **GEOLOGY**



COMMONWEALTH OF PENNSYLVANIA

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ON THE COVER

Planar crossbedding in the Loyalhanna Formation in the bluestone quarry at Linn Run State Park, Westmoreland County. The tree trunk on the right side of the photograph is approximately 10 inches in diameter. Photograph by William E. Kochanov.

PENNSYLVANIA GEOLOGY

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The Intrusion of Nature on Humanity and Vice Versa

In an article in the *Washington Post* (March 15, 1992), Richard Cohen wrote about the "perversity of nature," citing as an example "an awful drought." In the past year, many areas of our nation, including parts of Pennsylvania, experienced a period of water shortage because of below normal rainfall. This circumstance at times forced individuals, public water suppliers, and Pennsylvania water resource management agencies to impose personal or public restrictions on water use. Once again, nature, in the form of a drought, has intruded on human events; a "perversity" to Mr. Cohen and possibly some others. But to classify a drought (or any other natural event that negatively affects humans, such as the recent Hurricane Andrew) as perverse is a failure in understanding naturally occurring events. Although we sympathize with those who suffer from such events, to suggest, as does Mr. Cohen, that there is a "perversity of nature" is, in a sense, to ascribe to nature an ability to consciously inflict benefit or harm on humanity. That is not our present understanding of nature. Circumstances that impact humanity such as sinkhole collapse, landslides, earthquakes, volcanic eruptions, and global climatic change (including droughts) are natural events that have repeatedly occurred throughout geologic time and will continue to do so as dynamic earth systems fluctuate in response to the energy of the system at a particular time.

Any "perversity" that can be attached to such natural events comes not from the natural events but from human lack of understanding and occasional hubris that refuses to acknowledge or accept the predictable impacts of human intrusion into the earth's natural geologic and environmental systems. As humanity expands over the globe, we increasingly interact with natural systems. If we exceed the capacity of these systems, such as by overuse, we, not nature, cause harm. Unless we understand natural systems, we increasingly will be restricted by nature or we will damage the systems and thereby damage ourselves.

It is the responsibility of earth scientists to educate our public (and national writers) to the reality and importance of the earth's natural systems so that we can better understand, and through understanding, effectively plan how to operate in harmony with nature. Not to understand and plan is the true perversity.



Donald M. Hoskins
State Geologist

IN MEMORIAM

William Stuckley Lytle **1915-1991**

1933-1977 Pennsylvania Geological Survey

William Stuckley Lytle will be remembered for his love; his love of God, his love of family, his love of mankind, and his love of geology. He gave totally of himself and lived his life to the fullest.

Born in Pleasantville, just 6 miles from the site of the Drake oil well, Bill was destined to choose oil and gas as his career. One of four children, he helped his father pump family oil wells in Titusville during his high school years. He graduated from Pennsylvania State College in 1940 with a degree in petroleum and natural gas engineering. While in school, he worked as an assistant in the Pleasantville-Oil City area for the Bureau of Topographic and Geologic Survey during the summer. Upon graduation, he joined the staff full time.

For 34 years, until his retirement in 1977, Bill was the Survey's backbone in all matters relating to the Commonwealth's oil and gas resources. His only interruption in Survey service was a four-year tour of duty with the U.S. Army Corps of Engineers during World War II. After the war, he maintained active status in the Reserves for over 30 years and retired as a full colonel.



Bill spent much of his career mapping and writing about oil and gas. His published reports on Pennsylvania's crude oil reserves, oil and gas fields, and underground gas storage, his annual reviews of oil and gas developments in Pennsylvania from 1954 through 1976, and the field atlas of the Butler quadrangle still stand as basic references on these subjects. He had over 100 articles published in major oil and gas journals, and he presented well over twice that number of talks to professional societies in and out of the state.

Bill served on committees and was an officiator of numerous professional organizations, but he was equally proud of his service to his church, the public, and the community.

Bill is survived by his wife, Virginia Heath Lytle, a gifted writer and poet, and four talented children, all of whom he spoke of often and lovingly.

We will miss Bill, but a part of him lives on in each of us.

—Cheryl L. Cozart

THE GREAT PENNSYLVANIA EARTHQUAKE THAT NEVER WAS

by Charles K. Scharnberger
Department of Earth Sciences,
Millersville University

INTRODUCTION. There it was, right on the cover of the November 1990 issue of *Geotimes*: a map with a large red square in northeastern Pennsylvania indicating the epicenter of one of 10 "more significant" earthquakes to have occurred in the Eastern United States in historic times. In the accompanying article (Snider, 1990), the author discussed the earthquake hazard in the East and identified this event as "Wilkes-Barre, Pa., 1954, Magnitude 5.0." Six months later, *Geotimes* carried another map (Anonymous, 1991), "Damaging Earthquakes, 1534-1988," showing two supposed magnitude 5.0 earthquakes in Pennsylvania, one at Wilkes-Barre and the other in the central part of the state. (The latter "earthquake," almost certainly a quarry blast, is not further discussed here.)

The notion that a significant earthquake had occurred in Wilkes-Barre took hold almost immediately after the event itself in February 1954 and found its way into various earthquake catalogs (e.g., Murphy and Cloud, 1956; Dames and Moore, 1970; Conrad and Geyer, 1971; von Hake, 1976; Howell, 1979; Coffman and others, 1982; Stover and others, 1987). In these catalogs, an earthquake having a maximum intensity of VII on the Modified Mercalli Scale is listed for February 21, 1954, accompanied by a strong aftershock (maximum MMI VI) on February 23.

To be sure, some catalogs indicate a possible nontectonic origin for these events, and an investigation of seismic hazard at the site of the Susquehanna Steam Electric Station conducted by Weston Geophysical Research, Inc., for the Pennsylvania Power and Light Company concluded that no earthquakes had occurred (Pennsylvania Power and Light Company, 1975). I was aware from informal conversations with various seismologists in the Eastern United States that the best-informed opinion was that the Wilkes-Barre "earthquake" of 1954 was an instance of mine collapse, quite a common occurrence in both the anthracite and bituminous coal regions of Pennsylvania. Yet, in a conversation with Carl Stover, a seismologist with the U.S. Geological Survey, I learned that the U.S. Geological Survey, while aware of the mine-collapse theory, felt that no one had yet investigated the matter sufficiently to establish whether a significant

earthquake had occurred in Wilkes-Barre. Thus, I decided to examine the event insofar as possible after 37 years had elapsed.

WHAT HAPPENED IN WILKES-BARRE IN LATE FEBRUARY 1954?

Most of my research was done in the newspaper room of the State Library, where back issues of virtually every newspaper ever published in Pennsylvania are available on microfilm. There, through the pages of the *Wilkes-Barre Record*, I tried to understand what had happened in Wilkes-Barre that February. Here is a summary of what I learned.

At 2:50 p.m., EST, on Sunday the 21st, residents of a four-block area in what is known as the Old River Road section of Wilkes-Barre (about 1 mile west of the center of the city) were startled by a loud noise and a sudden jolt to their houses that caused windows to break and walls to crack. One resident described a sound "like hail hitting windows" that continued for about 5 minutes following the first noise (*Wilkes-Barre Record*, February 22, 1954). Outside, streets and driveways had buckled and sidewalks had heaved. One witness reported seeing a road buckle about 10 minutes after the first shock. News stories over the next several days make it clear that earth movements continued and damage accumulated gradually. More pavement was observed in the process of upheaving on Monday, February 22. A particularly large and sudden earth movement occurred the next day (the "aftershock" of many earthquake catalogs). A water main broke on the 24th and another on the 26th. Meanwhile, more upheavals were reported as having been observed on Thursday, the 25th (*Wilkes-Barre Record*, February 22-27, 1954). The affected area gradually increased beyond the initial four blocks. It is difficult to infer from the newspaper accounts the exact limits of the area that eventually was affected, but it seems to have been approximately as shown in Figure 1.

Speculation about the cause of these events naturally focused on the possibility of mine collapse, though spokespersons for the Glen Alden Coal Company firmly denied that their workings beneath the damaged area were in any way responsible. Some residents suggested that the earth movements could be related to a supposed former subterranean course of the Susquehanna River through the area. The possibility of an earthquake was suggested in the newspaper by a quoted remark from a citizen who compared what he had just experienced to what he remembered from San Francisco in 1906.

THE EARTHQUAKE MYTH. It is not completely clear how the interpretation of the Wilkes-Barre events as earthquakes came to be accepted. The *New York Times*, *Philadelphia Inquirer*, and *Philadelphia Evening Bulletin* of February 22 carried stories of "tremors" felt in Wilkes-Barre. It seems likely that the term "tremors" was chosen

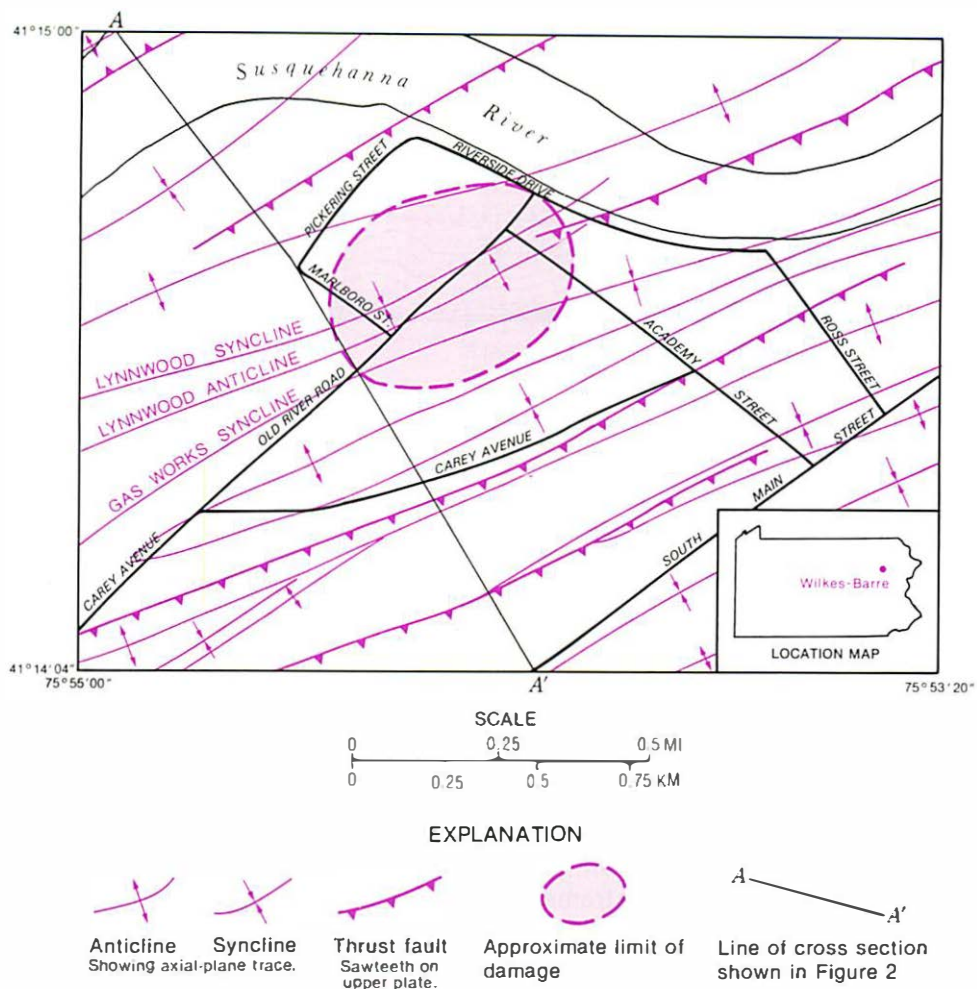


Figure 1. Map of part of Wilkes-Barre, Pennsylvania, showing the approximate limit of surface subsidence in February 1954 in relation to geologic structure in the Llewellyn Formation. Geology from Bergin (1976).

to be purely descriptive without implication as to cause. This term, however, frequently is used in connection with earthquakes and so may have helped plant the earthquake idea. In any case, by Thursday the 25th the impression that an earthquake had occurred in Wilkes-Barre was widespread, as indicated by a story in the *Wilkes-Barre Record* (February 26, 1954) about a local woman who had received a telephone call from her worried husband in Korea who had heard on Armed Forces radio about the serious earthquake back

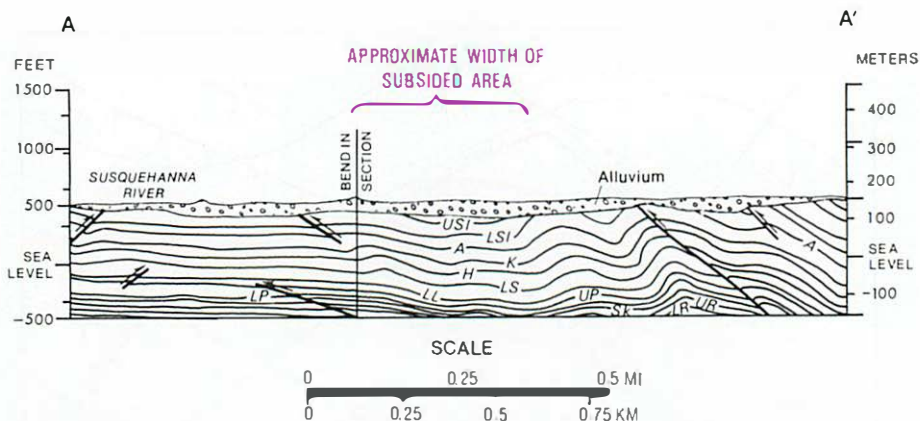


Figure 2. Structural cross section along line A-A' of Figure 1, showing surficial deposits, major anthracite seams, and the relationship of the subsided area to geologic structure. The anthracite seams shown are as follows: USI, Upper Snake Island; LSI, Lower Snake Island; A, Abbott; K, Kidney; H, Hillman; LS, Lower Stanton; LL, Lower Lance; UP, Upper Pittston; LP, Lower Pittston; Sk, Skidmore; UR, Upper Ross; LR, Lower Ross. Geology from Bergin (1976).

home. It is interesting to note that the *Record* treated this story semi-humorously, as it did a story about out-of-towners flocking to Wilkes-Barre to see the "earthquake damage." This suggests that folks in Wilkes-Barre did not think that they had experienced an earthquake, whatever "outsiders" might think.

If for no other reason, an earthquake explanation must be rejected because of the extremely small area over which the "tremors" were felt. Based on the damage inflicted, seismologists have assigned a maximum Modified Mercalli intensity of VII to this "earthquake." But if it really had been an earthquake, then we would expect a zone of intensity VI to have surrounded the zone of maximum intensity, a zone of intensity V to have surrounded that zone, and so forth. The total area over which such an earthquake was felt ought to have been several tens of thousands of square miles. In fact, nothing resembling this pattern of seismic intensity occurred in 1954.

Ironically, one of the factors that seems to have contributed to the earthquake myth was the very thing that should have quashed it: a seismologist's statement that no earthquake was recorded at or around 2:50 p.m. on February 21. The seismologist consulted by the media was Rev. Joseph Lynch of Fordham University. Fr. Lynch clearly stated that nothing was recorded on the Fordham seismo-

graph at 2:50. However, he also mentioned that “shocks” were recorded at 11:19 a.m. and 6:45 p.m. (*Philadelphia Inquirer*, February 23, 1954). It may seem obvious to the seismologically minded that these events, whatever they were (the one at 11:19 was an earthquake in Alaska), were at the wrong times to explain what had happened in Wilkes-Barre, but that was not obvious to the reporters, who seemed impressed by the fact that something was recorded on the seismograph, regardless of the time. It did not help that the news story in the *Inquirer* reported that Fr. Lynch “would not say whether [the shocks] were in any way connected with the Wilkes-Barre tremors.” There is a world of difference between “would not say whether” and “said that they were not.” It is not certain what Fr. Lynch actually said, but the way his statement was reported in the paper implied uncertainty and the possibility that the recorded seismic events were related to the event at Wilkes-Barre. Soon the papers were mentioning in an offhand way, as though it were an established fact, that the Wilkes-Barre event of February 21 had been recorded seismographically (e.g., the *Allentown Morning Call*, February 24, 1954).

WHAT WAS IT, REALLY? Despite the denials of the coal company, what actually happened in Wilkes-Barre almost certainly was a mine collapse. This is borne out by two reports made at the time, one by Retsel and others (1954), federal mine inspectors, and the other by MacCartney and Kudlich (1954), consulting engineers. Pillar failure apparently occurred in recently abandoned workings in the Hillman vein, some 500 feet below the surface at that point. Collapse propagated upward until it reached the surface, where its effects were enhanced by the presence of more than 150 feet of Quaternary surficial deposits. The collapse seems to have been confined to the area of a broad syncline, the Lynnwood/Gas Works syncline, which contains a low-amplitude medial anticline, the Lynnwood anticline (Figures 1 and 2). More details of the collapse and its relationship to local geology are given by Scharnberger (1991).

One reason that the reports of the mine inspectors and engineers were not effective in countering the earthquake theory was that they were made public in May 1954, at which time the *Wilkes-Barre Record* was not publishing because of a strike. Thus, these reports did not get the publicity that had been accorded the earlier speculations about earthquakes.

CONCLUSION. Seismic hazard in the Eastern United States is a matter of genuine concern. Earthquake history plays an important role in the scientific investigation of this hazard; therefore, it is important to have as accurate an earthquake history as possible. A

perfectly accurate record, of course, is impossible—some real earthquakes almost certainly have been lost to history, and the true cause of some ambiguous cases may never be firmly established. But we should remove “Wilkes-Barre, magnitude 5.0, February 1954” from the earthquake catalogs, because it is definitely an “earthquake that never was.”

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Life in a Fossil Shellfish Community: an Excellent Outdoor Classroom and a Collector's Paradise

by John A. Harper
Pennsylvania Geological Survey

Life in the oceans has not changed much over the last 300 or 400 million years. True, many specific life forms of the Paleozoic Era, such as clams, worms, and brachiopods, have come and gone, but the roles that these now-defunct animals played are not very different from those played by modern life forms. The occupations remain the same; only the names have been changed.

This can be seen in a remarkable fossil locality in Youngwood, about 5 miles south of Greensburg in Westmoreland County (Figure 1). Some very fossiliferous Pennsylvanian rocks of the Brush Creek marine zone occur in an outcrop and associated spoil pile at the Con-

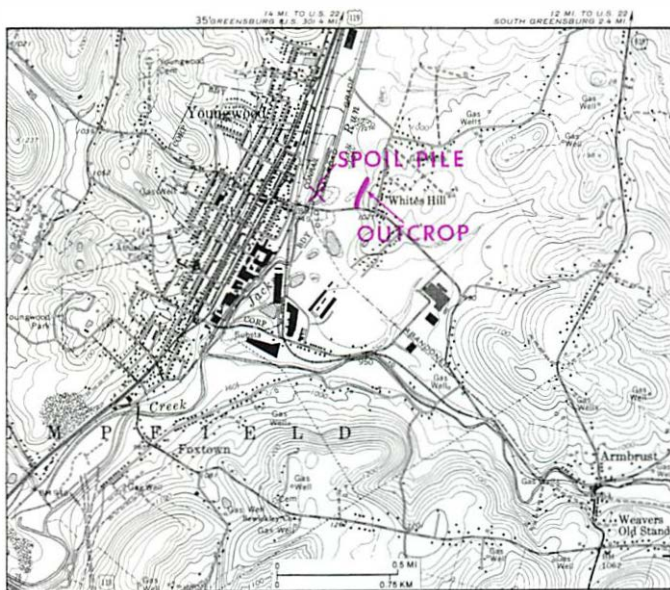


Figure 1. Location of the Youngwood fossil-collecting locality, Mt. Pleasant 7.5-minute quadrangle.

rail Industrial Park east of the town center (Figure 2). The rock was excavated from a hillside during construction of the warehouses, offices, and storage lots that occupy the park, and some of the excavated material was dumped in the vacant lot just west of the buildings. The Brush Creek is the oldest of six marine zones in the Glenshaw Formation (Conemaugh Group) in western Pennsylvania and second only to the Ames Limestone in diversity and abundance of invertebrate fossils. The Youngwood locality is particularly interesting and important because of an unusual abundance of fossils, many preserved in life position. Clams, snails, scaphopods, and other invertebrates died suddenly on the sea bottom at this locality, their shells encased in the organic-rich mudrocks for 300 million years.

The clam *Astartella*, which typically measures less than three fourths of an inch in the longest dimension, dominates the fauna. Hundreds of specimens can be collected within the space of a half hour; needless to say, the discriminating collector becomes very selective in a short time. *Astartella* can be considered the Pennsylvanian version of the cherrystone clam, making Youngwood a fabulous 300-million-year-old shell fishery (for gourmands with very small appetites—at least the clam chowder would have been plentiful). Other clams such as *Nuculopsis* and *Phestia* also occur, as well as a wide variety of snails dominated by *Pharkidonotus*, *Amphiscapha*, and *Raphistomella*. Whole and broken clam shells occur with other fossils in jumbled masses, apparently accumulated in sediment pockets during storms. Complete, uncrushed, and unbroken specimens of *Astartella* occur throughout the rock, however, standing in life position almost perpendicular to the bedding of the shale (Figures 3A and 4). These clams are similar to the Recent-age clam *Mulinia lateralis*, described by Stanley (1970) as a lagoonal species abundant in mud-bottom conditions. *Mulinia*, and by analogy *Astartella*, burrow head down at a



Figure 2. Brock University geochemist Uwe Brand examines the Brush Creek shale at the spoil pile in Youngwood.

slight angle into mud and feed through inhalent currents entering the rear of the shell near the sediment-water interface. Numerous specimens of complete snail shells can also be found in life position, their shells oriented upright in the rock (Figure 3B, 3C). Although scaphopods are relatively rare at this locality, those specimens of *Plagioglypta* that were collected were also found in life position, with the shell oriented at a low angle to the rock layers.

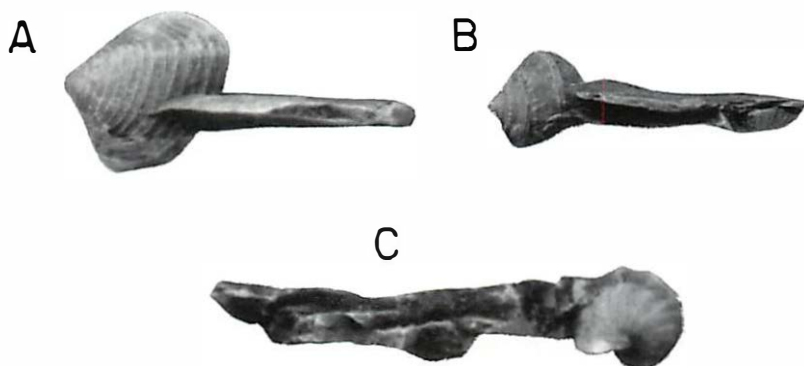


Figure 3. Fossils from the Brush Creek black shale preserved in life position. A, *Astartella*, a burrowing clam; B, *Raphistomella*, a mobile, surface-dwelling snail; C, *Pharkidonotus*, a limpet-like bellerophon snail. A fragment of rock strata has been left attached to each to indicate the life orientation of the animal.

Why are so many of the fossils at this locality found in life positions? This phenomenon is probably due to a combination of rapid death, most likely caused by oxygen depletion (hypoxia) in the water and bottom muds, and quick burial, caused by rapid sediment influx. Hypoxia and rapid sedimentation commonly occur today in such coastal areas as Texas and Louisiana. For example, Harper and others (1981) documented seasonally recurrent hypoxia events off the coast of Texas that occurred following spring runoff periods. Increased runoff from local Texas rivers carried higher than normal loads of dissolved organic material into the ocean, resulting in large diatom blooms that declined only when the nutrients became exhausted. Calm seas in the Gulf of Mexico and the normal influx of fresh water during the summer produced intense water stratification, greatly reducing oxygen diffusion from surface waters. The dead diatoms accumulating on the sea floor attracted bacteria whose activity further helped to reduce the oxygen in the bottom waters. The final step occurred when sulfate-reducing bacteria took over, generating poisonous hydrogen sulfide. These conditions prevailed off the Texas coast throughout

Table 1. List of Fossils Observed or Collected from the Youngwood Brush Creek Locality

FORAMINIFER	GASTROPODS (continued)
<i>Tolypammina</i> sp.	<i>Worthenia tabulata</i> (Conrad)
CORAL	<i>Phymatopleura brazoensis</i> (Shumard)
<i>Stereostylus</i> sp.	<i>Palaeostylus</i> (<i>Pseudozygopleura</i>) <i>scitula</i> (Meek and Worthen)
CONULARIID	<i>Meekospira peracuta</i> (Meek and Worthen)
<i>Conularia</i> sp. cf. <i>C. crustula</i> White	<i>Strobeus primogenius</i> (Conrad)
BRACHIOPODS	<i>Girtyspira minuta</i> Knight
<i>Lingula carbonaria</i> Swallow	CEPHALOPODS
<i>Lingula lemniscata</i> Price	<i>Brachycycloceras</i> sp.
<i>Chonetinella plebeia</i> (Dunbar and Condra)	<i>Pseudorthoceras knoxense</i> (McChesney)
<i>Neochonetes granulifer</i> (Owens)	<i>Metacoceras mcchesneyi</i> Murphy
<i>Pulcratia</i> sp.	BIVALVES
<i>Juresania</i> sp. cf. <i>J. nebrascensis</i> (Owen)	<i>Nuculopsis girtyi</i> Schenck
<i>Linoproductus</i> sp. cf. <i>L. prattenianus</i> (Norwood and Pratten)	<i>Nuculopsis croneisi</i> Schenck
<i>Composita subtilita</i> (Hall)	<i>Phestia arata</i> (Hall)
<i>Crurithyris planoconvexa</i> (Shumard)	<i>Phestia bellistriata</i> (Stevens)
Miscellaneous spines	? <i>Septimyalina</i> sp.
OSTRACODES	<i>Aviculopecten</i> sp.
? <i>Bairdia</i> spp.	<i>Euchondria</i> sp.
GASTROPODS	<i>Palaeolima triplistriata</i> (Stevens)
<i>Euphemites vittatus</i> (McChesney)	<i>Schizodus wheeleri</i> (Swallow)
<i>Bellerophon</i> (<i>Bellerophon</i>) <i>steven-</i>	<i>Permophorus costatiformis</i> (Meek and Worthen)
<i>sianus</i> McChesney	<i>Astartella concentrica</i> (Conrad)
<i>Pharkidonotus percarinatus</i> (Conrad)	<i>Edmondia anodontoides</i> (Meek)
<i>Retispira tenuilineata</i> (Gurley)	<i>Prothyris</i> (<i>Prothyris</i>) <i>elegans</i> Meek
<i>Knightites</i> (<i>Cymatospira</i>) <i>montfortianus</i> (Norwood and Pratten)	SCAPHOPOD
<i>Patellilabia</i> (<i>Patellilabia</i>) <i>tentoriolum</i> Knight	<i>Plagioglypta meekiana</i> (Geinitz)
<i>Amphiscapha catilloides</i> (Conrad)	STARFISH
<i>Amphiscapha reedsi</i> (Knight)	<i>Syntomospina kuehni</i> Morris, Rollins, and Shaak
<i>Amphiscapha subrugosa</i> (Meek and Worthen)	Starfish plates
<i>Raphistomella</i> (<i>Raphistomella</i>) <i>grayvil-</i>	CRINOIDS
<i>lense</i> (Norwood and Pratten)	Assorted crinoid columnals and calyx plates

much of the summer and only ceased when water mixing elevated oxygen levels in late summer and early autumn.

Did something like this happen periodically at Youngwood 300 million years ago? It seems entirely likely. The Brush Creek typically consists mostly of mudrocks having relatively high organic content. Geochemical analyses of other Brush Creek localities in western Pennsylvania indicate that the sediments were oxygen poor during deposition, especially in areas where original aragonitic mollusc

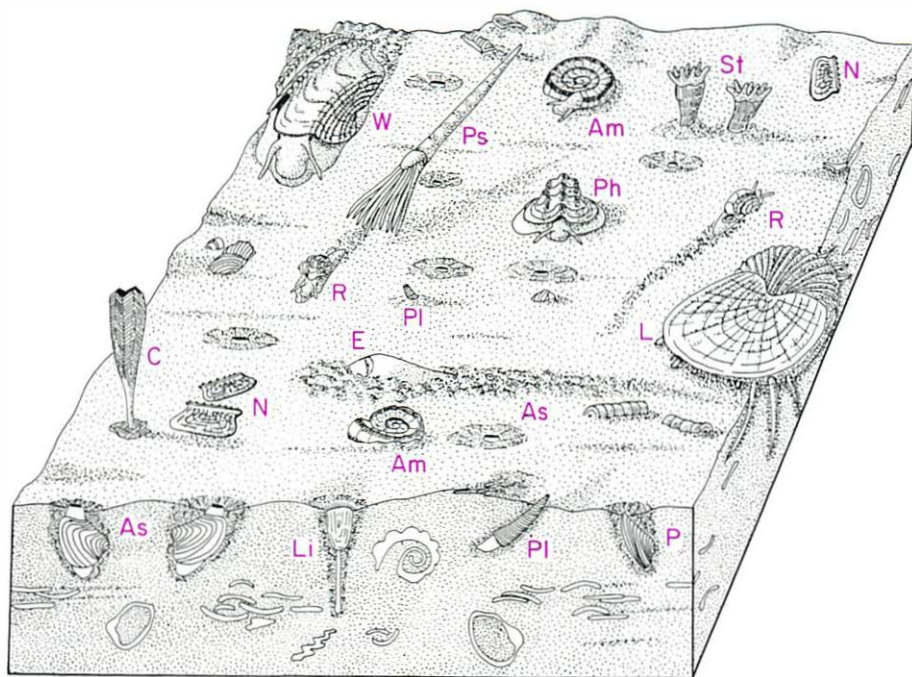


Figure 4. Reconstruction of the fossil community at the time of deposition of the Brush Creek shale at Youngwood. Abbreviations refer to bivalves *Astartella* (As) and *Phestia* (P); gastropods *Amphiscapha* (Am), *Euphemites* (E), *Pharkidonotus* (Ph), *Raphistomella* (R), and *Worthenia* (W); scaphopod *Plagioglypta* (Pl); cephalopod *Pseudorthoceras* (Ps); brachiopods *Lingula* (L), *Linoproductus* (Li), and *Neochonetes* (N); coral *Stereostylus* (St); and conularid *Conularia* (C).

shells are preserved (Cercione and others, 1989). Aragonite, a form of calcium carbonate that most molluscs use to form their shells, is unstable under normal conditions; it tends either to recrystallize to calcite or dissolve completely after burial. In unusual cases, however, such as in some Brush Creek localities where the rock has a high organic content, the aragonite may be preserved in its original form and structure. The presence of abundant aragonitic shell material in the Brush Creek shale is strong evidence for high organic content and hypoxic conditions in the muds deposited at Youngwood. Hypoxic conditions may be further corroborated by the absence of noticeable bioturbation (reworking of sediment by living organisms) in the rock. Invertebrate shells are rarely preserved in any preferred orientation because worms and other sediment-churning animals tend to disturb or disarticulate lifeless skeletons. Hypoxic bottom waters and muds have a deleterious effect on these animals, however, just as they do with the normal inhabitants. In addition, rapid

deposition of muds during the hypoxic events would have quickly buried even the most mobile surface dwellers.

Teachers interested in visiting this outdoor classroom should be aware that the actual outcrop is situated in a restricted area belonging to Bell of Pennsylvania and that permission to enter the premises may not be granted. The spoil piles should present no problem for visitors, however, and are especially recommended because of their accessibility. Fossil collectors should restrict themselves to the spoil piles. From U.S. Route 119 in Youngwood, turn east on Depot Street, cross the railroad tracks and turn left almost immediately. The spoil piles are located near the bushes on the right in the unpaved lot directly ahead. The lot has plenty of parking even for large groups. It will not be difficult to find the spoil piles; the Brush Creek has a noticeable salt-and-pepper aspect because of the chalky whiteness of the aragonitic shells in the black shales.

The following notes will be of interest to fossil-collecting enthusiasts: (1) The name *Raphistomella* may look strange and new to experienced collectors of Pennsylvanian fossils. Batten (1989, p. 7, 8) pointed out that the European Triassic genus *Raphistomella* Kittl, 1891 was indistinguishable from the Paleozoic genus *Glabrocingulum* Thomas, 1940. By the rules of zoological nomenclature, the older name has precedence. (2) Numerous specimens of the tiny brittle star *Syntomospora* (less than one-half inch from arm tip to arm tip) were found on one or more bedding planes in the rock at this locality. Fossil starfish of any sort are typically very rare, so here is a treasure worth looking for. (3) Some of the better preserved molluscs retain color-band patterns. These are especially prominent in specimens of *Amphiscapha* that have buff-colored shells. Inasmuch as most of the fossils at this locality have a black coating, these specimens tend to stand out upon close examination.

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EARTH SCIENCE TEACHERS' CORNER

"Out of the Rock": A New Video on Mining and Minerals

by John H. Barnes
Pennsylvania Geological Survey

A new videotape from the U.S. Bureau of Mines, "Out of the Rock," provides 29 minutes of well-chosen visual images that nicely complement an informative and interesting narrative on the role of mining and minerals in the modern world. The following are among the points presented:

- No matter how complex or simple a finished product may be, or how routine its use, it exists because of something found in the ground that we can mix, mold, melt, cast, extrude, alloy, stamp, or stretch into something useful. But first, it has to be mined. Mining is not a gentle process.
- Some materials considered essential today will become less and less important. New ways are found to use materials once thought common and without value.
- Technological achievements come with a price—a total dependence on an ever-increasing flow of raw materials and the dangerous illusion that there are no limits to expansion.
- Mining can never end. The driving force is human consumption.

After watching this video, the viewer is left to realize that mining is something without which no semblance of civilized life could exist, and that modern life is forcing change on the mining

industry in ways that might not be expected. For example, as a consumer-driven society demands more in the way of products with elaborate packaging and throw-away convenience, a tremendous strain is placed not only on waste-disposal facilities, but also on the mining industry, which must produce the raw materials necessary to make the new products and packaging.

The ramifications of our demands on the mining industry extend beyond our nation's borders. We have had to turn to less-developed nations, some with unstable governments, for minerals that are absolutely essential to manufacture products in such fields as medicine, national defense, and aviation. Meanwhile, some of these supplier nations aspire to develop their own industrial potential, thus creating even more demand for the world's limited supply of resources.

Recycling helps, but it is not a replacement for mining, as some might think. It is pointed out that even if billions of dollars worth of goods were not lost to corrosion each year and 100 percent recycling were possible, our nation's

increasing demand for resources still could not be met.

The emphasis of the video is on metallic minerals, but the problem of increasing demand and decreasing supply also affects nonmetallic resources, such as sand and gravel, especially in heavily populated states such as Pennsylvania. Although this problem is not discussed, the video does demonstrate the importance of these resources in our lives.

Overall, because it does a good job of letting the viewer see the world a little differently, this video is well worth viewing. To quote from the narration,

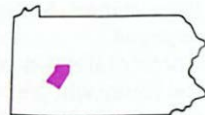
There are few times, if any, that we stop to consider the importance of mining and minerals. We tend to focus, instead, on the more tangible end uses of raw materials, on

the products and conveniences they make possible. Quality of life, national security, the stability of domestic and world economies, science, industry, and the arts all depend on the mineral resources we take out of the rock.

"Out of the Rock," written by William J. Gage and Gerald Weinbren, may be borrowed by any responsible group or individual by writing to Audiovisual Library, U.S. Bureau of Mines, Cochran's Mill Road, P.O. Box 18070, Pittsburgh, PA 15236. Please include your telephone number, specify whether you require the VHS or U-Matic format, and indicate a first and second choice for a viewing date. It can also be purchased, \$14 for VHS or Beta or \$21 for U-Matic, from Video Transfer, Inc., 5710 Arundel Avenue, Rockville, MD 20852.

NEW PUBLICATION

Water Resources Data for Indiana County



The U.S. Geological Survey has released a compilation of hydrologic data collected in Indiana County from May 1986 through September 1988. This report, by Donald R. Williams of the U.S. Geological Survey and Thomas A. McElroy of the Pennsylvania Geological Survey, includes inventory data for 517 wells and 133 springs, water-quality data for 300 wells and 118 springs, hydrographs for 19 wells, aquifer-test data for 22 wells, and extensive data on surface water and precipitation in the South Branch Plum Creek

and Cherry Run basins. Prepared in cooperation with the Pennsylvania Geological Survey and the Indiana County Commissioners, U.S. Geological Survey Open-File Report 90-384 consists of a 147-page book and two 1:50,000-scale plates on which sample sites are plotted. **Water Resources Data for Indiana County, Pennsylvania** can be purchased for \$31.25 (paper) or \$5.50 (microfiche) from USGS Book and Report Sales, Box 25425, Denver, CO 80225. Please make checks payable to *Dept. of the Interior—USGS*.

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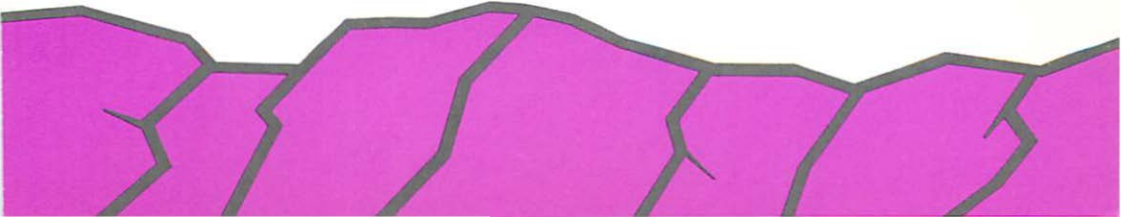
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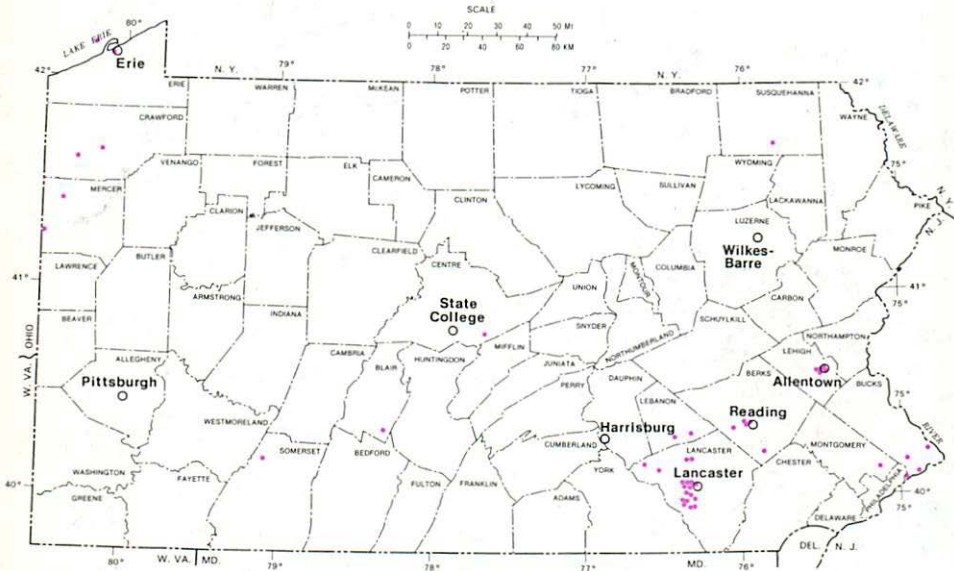
TOPOGRAPHIC MAPPING

GROUNDWATER-RESOURCE MAPPING



HISTORIC EARTHQUAKE EPICENTERS IN PENNSYLVANIA

(See article on page 3)



EXPLANATION

Historic earthquake epicenter

Based on known earthquake history of Pennsylvania through August 1992. Many locations are approximate.

SOURCE: Scharnberger, C. K. (1989), *Earthquake hazard in Pennsylvania*, Pennsylvania Geological Survey Educational Series 10, p. 8; and Scharnberger, C. K., oral communication, 1992.

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