GEOLOGY PENNSYLVANIA

IMPORTANT - SEE CENTERFOLD

THE PENNSYLVANIA GEOLOGICAL SURVEY VOL. 17

COMMONWEALTH OF PENNSYLVANIA
Richard L. Thornburgh, Governor
DEPARTMENT OF ENVIRONMENTAL RESOURCES
Clifford L. Jones, Secretary
OFFICE OF RESOURCES MANAGEMENT
Peter S. Duncan, Deputy Secretary
TOPOGRAPHIC AND GEOLOGICAL SURVEY
Arthur A. Socolow, State Geologist

CONTENTS

ON THE COVER: Pole Steeple in the Montalto gray quartzite member of the lower Cambrian (570 million years old) Harpers Formation is an outstanding promontory above Laurel Lake at Pine Grove Furnace State Park, southern Cumberland County. The cliff rises over 100 feet from its talus slope and stands more than 500 feet above nearby Mountain Creek Valley and Laurel Lake. Photo courtesy of J. P. Wilshusen.

PENNSYLVANIA GEOLOGY is published bimonthly by the Topographic and Geologic Survey, Pennsylvania Dept. of Environmental Resources, Harrisburg, Pennsylvania, 17120.

Editor, Arthur A. Socolow; Associate Editor, Donald M. Hoskins.

APRIL 1981

FROM THE DESK
OF THE
STATE GEOLOGIST

ACTIVITIES OF THE STATE GEOLOGIC SURVEY– A CONTINUING STORY

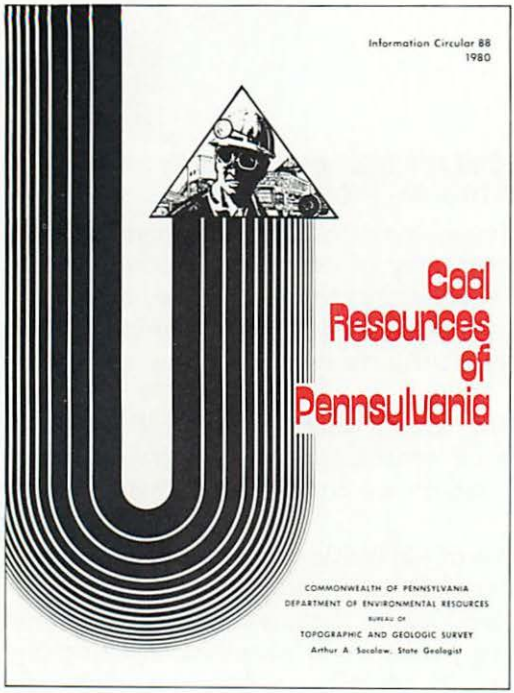
Even as we face a steadily increasing demand for geologic information amongst a wide and diverse array of users, I find that there are still some who are not aware that a state geological survey deals with applications of geology, and not just the mapping and identification of rock formations. Others apparently do not even know the meaning of geology.

Among the 18,867 incoming letters which we serviced in 1980, there were some on matters of geneology, gerontology, geodesy, meteorology, and metrology which we forwarded to more appropriate offices.

On the matter of the variety of applications of geology which our Bureau is involved with, it may best be demonstrated by enumerating just a few of our recent activities: 1) Designating favorable water well sites for critically deficient public water suppliers, utilizing our air photos and geologic maps. 2) Identifying favorable sand and gravel sites for a regional planning commission concerned with development and road building potential. 3) Evaluating geologic hazards and mineral lands along a proposed new high speed rail route. 4) Lab checking for asbestos content in construction aggregates. 5) Evaluating geologically safest and most economical routes for cross state utility lines. 6) Identify skid resistent construction stone for state and industry officials. 7) Advising a municipality on potential geologic problems along proposed sewer routing and sewage treatment sites. 8) Assessing geologic feasibility of proposed underground pump storage electric generating facility. 9) Assisting Civil Defence units with earthquake hazard planning and floodplain area maps. 10) Advising western Pennsylvania municipalities on means of mitigating damaging landslide sites. 11) Identifying engineering geology conditions under dams being checked for safety. 12) Helping to minimize coal mine roof falls by identifying geologic factors which will help to design safe mine construction. 13) Locating reliable groundwater sources for state hospitals and highway rest stops. 14) Identifying favorable waste disposal sites for local and regional needs.

These are only a sampling; the list could go on and on. Every department in the state, all levels of local government, large industries and small businesses, private citizens of all ages and all walks of life, all these are our geologic "customers." Such activities represent an essential function of a state geologic survey.

Arthur A. Socolow



COAL RESOURCES OF PA

The Pennsylvania Geological Survey's new Information Circular 88, *Coal Resources of Pennsylvania* is the result of a success story. The short text, concise tables, and colored maps were originally prepared as a supporting document for last years Governor's Coal Conference. It made such a hit among the conference attendees and their associates that we twice had to reprint it as a conference document.

Recognizing that the well organized, compact data on coal reserves, coal quality, and location of our coal resources is exactly what is needed by all who are interested in encouraging Pennsylvania's coal development, the Pennsylvania Geological Survey has now issued this information as Information Circular 88. This illustrated, 49-page publication is available from the State Book Store, P.O. Box 1365, Harrisburg, PA 17125 for $1.65 (plus 10 cents sales tax for Pennsylvania residents).

CORRECTION: In the February, 1981 issue of Pennsylvania Geology, Progress Report 193, "Oil and Gas Developments in Pennsylvania in 1979" was listed as costing $1.50 plus sales tax for Pa. residents. The actual cost of this report is $1.80 plus tax. We regret the error and hope you haven't had your order returned from the State Book Store for additional funds.

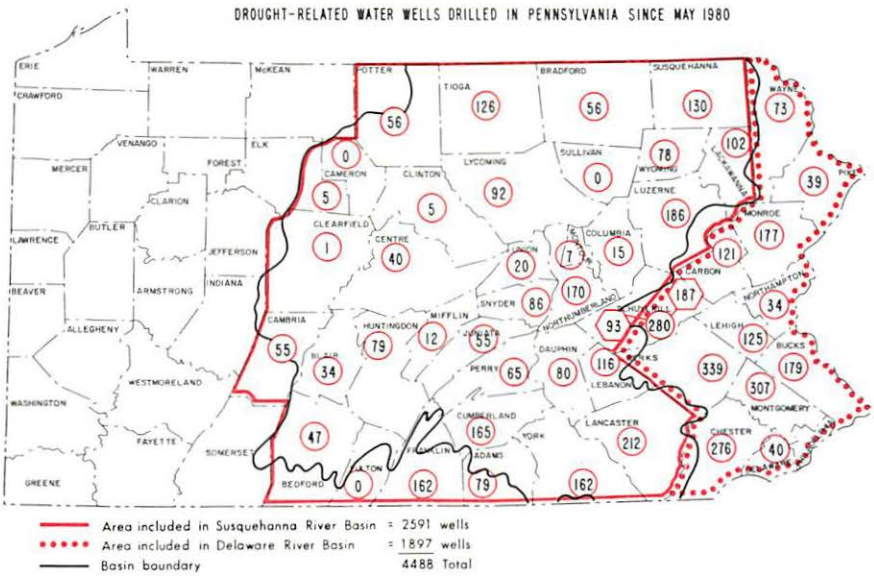
1980-81 DROUGHT

MEANS ADDITIONAL WELLS AND DEEPER DRILLING

The Bureau of Topographic and Geologic Survey recently completed a compilation of the number of drought-related, private water wells drilled or deepened in Pennsylvania since May of 1980.

The Survey's Environmental Geology Division staff canvassed 251 water well drillers in 47 drought-affected counties of the Susquehanna and Delaware River Basins in Pennsylvania. The water well drillers reported drilling 4488 drought-related water wells in Pennsylvania during the period May 1980 to mid-February 1981. They also reported that there now exists a backlog of drought-related water wells to be drilled or deepened and in January and February this demand sharply increased.

The results were incorporated with data compiled by other Department of Environmental Resources' bureaus on drought-related water problems in Pennsylvania, and submitted to the Governor's



Office. This information was used in support of Pennsylvania's request to the Federal Small Business Administration for official disaster designation of the drought-affected areas in Pennsylvania. If granted, businesses, citizens, and communities, who are experiencing drought-related water supply problems, may be eligible for economic assistance to restore damaged supplies or to develop a replacement water supply.

The need for economic assistance was reaffirmed during the canvassing of the water well drillers and by the direct communication of many communities in Pennsylvania now affected by the drought.

The Bureau was pleased to participate in a project that may result in direct benefit to the Commonwealth's businesses, citizens and communities. On behalf of the Department of Environmental Resources, we wish to extend thanks to the water well drillers for their cooperation and timely response.

Donna M. Snyder
Environmental Geology Division

METRIC TOPOGRAPHIC MAPS

The Defense Mapping Agency has developed a new series of 1:50,000-scale metric, 15-minute quadrangle maps for selected areas of the United States. Three quadrangles in Pennsylvania are currently available in this new map format. Harrisburg, dated 1977; New Bloomfield, dated 1974; and Orbisonia, dated 1976. The maps are compiled from U.S.G.S. 7 1/2-minute topographic maps with updated information. The map elements shown in metric units are contours, elevations and distances, and the Universal Transverse Mercator (UTM) Grid. The contour intervals used are either 10 or 20 meters. Elevations are shown in meters, and distances are shown in kilometers. A conversion graph is included in the marginal information on each sheet. The full-line UTM grid is shown in meters. The UTM grid system is a military grid system based on the transverse Mercator projection which consists of 60 north-south zones, each 6° wide in longitude.

The maps are available from the U.S.G.S., Branch of Distribution, 1200 South Eads Street, Arlington, Virginia 22202 for $1.25 each. Additional quadrangles will be issued in the future. These will be announced in "New Publications of the U.S. Geological Survey" which they publish monthly and in "Pennsylvania Geology."

THE TIPTON BLOCK - AN UNUSUAL STRUCTURE IN THE APPALACHIANS

by Rodger T. Faill

The Tipton block is a triangular-shaped downdropped fault block which occurs in northwest Blair County, Pennsylvania. The apex of the block points northwest and the opposite side forms part of the Allegheny Front. Topographically, the block is depressed at least 300 feet, with steep escarpments rising above the northern and western sides. Geologically, it is bounded on these two sides by faults (Fig. 1) and is depressed so that Alleghenian coals exist now in its southern part 1500 feet below their projection from the west.

The internal structure of the block is not simple. The southern quarter, separated by a fault from the rest, is itself faulted, and is structurally lower than the rest of the block. The remainder of the block is traversed through the center by a northeast-southwest trending syncline (Fig. 2) and by an anticline at the northwestern point. These faults and folds are terminated, or offset, by the bounding faults of the Tipton block and thus they represent independent deformation within the block.

Structures atypical of the Allegheny Front occur outside the block as well. Usually, the Plateau structure contours parallel the front; here, they bulge northwestward around the Tipton block (Fig. 2). This indicates that the Plateau rocks adjacent to the block have been elevated relative to a "normal" Plateau position. In addition, the area north of the Tipton block is extensively faulted (Fig. 2) and no where else along the front is there such a concentration of faults. The faults trend generally northwest-southeast, and their slickensides indicate horizontal movement. Thus this area was a "pocket" of strike slip faulting.

The Tipton block, its internal structure, and the adjacent structures is a singular complex along an otherwise simple structural front. The cause for this structural concentration can be found by examining its position within the regional structure.

The Allegheny structural front extends in a broad arc, convex northwestward, from Williamsport in Lycoming County southwestward past Tyrone and Altoona in Blair County to Somerset County and then into western Maryland. The Valley and Ridge Province, composed of large amplitude folds and numerous faults, is to the southeast; the Allegheny Plateau, composed of low amplitude folds and few faults, is to the northwest.

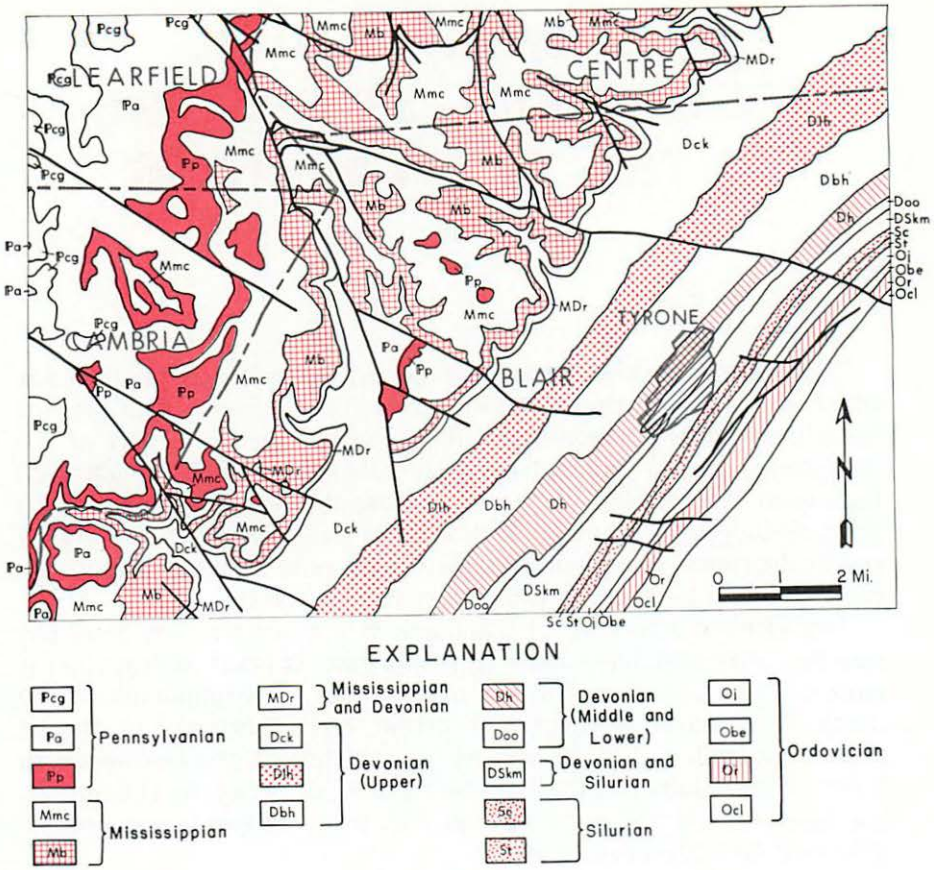


Figure 1. Geologic map of the Tipton block area. The northern bounding fault exceeds eastsoutheastward north of Tyrone, across the Devonian and Silurian and into the Ordovician carbonate formations of Nittany Valley. The western bounding fault terminates in the Devonian rocks to the south, and extends past the Tipton block apex into the Pennsylvanian coal measures. A geometrically similar block, but with much less vertical displacement, exists to the southwest, and an even smaller one is to the northeast.

In both provinces, the Paleozoic rocks have moved northwestward on a deep, regional, bed-parallel fault (decollement) (Fig. 3). This motion was impeded by splay faults branching upward from the decollement, above which folds developed. Thus the northwestward movement on the decollement was converted into deformation (folding and faulting) of the moving Paleozoic rocks. In the Valley and Ridge province, the decollement is located at the top of the

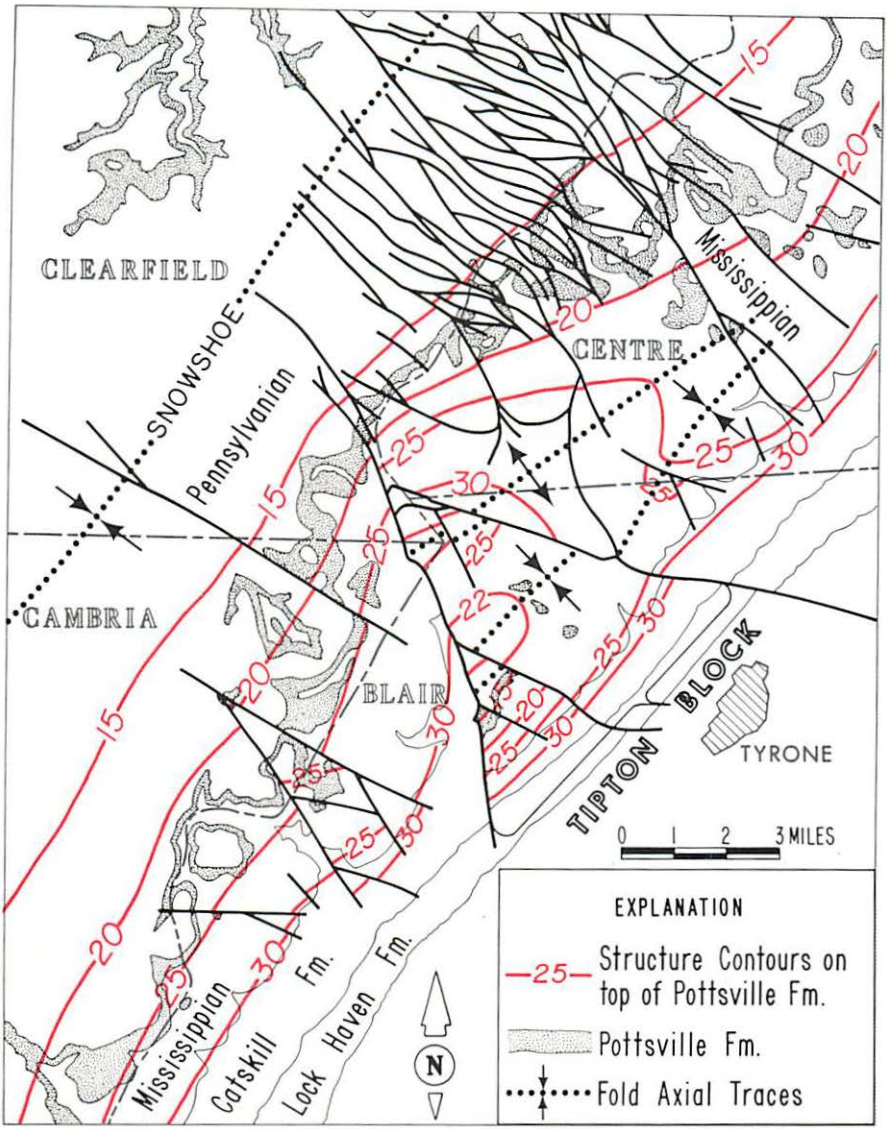


Figure 2. Structure contour map of the Tipton block area, with contours drawn on the top of the Pottsville Formation. Along much of the length of the Allegheny Front (here, approximately at the Catskill-Mississippian boundary), the Plateau rocks dip gently from the Front to a synclinal hinge (here, the Snowshoe syncline). In the Tipton vicinity, the structures are extensively cut by faults, and deflected northwestward around the Tipton block.

Lower Cambrian rocks; in the Allegheny Plateau province, in the Upper Silurian rocks. The boundary between the two provinces, the Allegheny structural front, is where the decollement ramps upward from the Cambrian to the Silurian rocks. As a consequence of smaller decollement movement in the Plateau than in the Valley and Ridge, the Plateau folds have much smaller amplitudes.

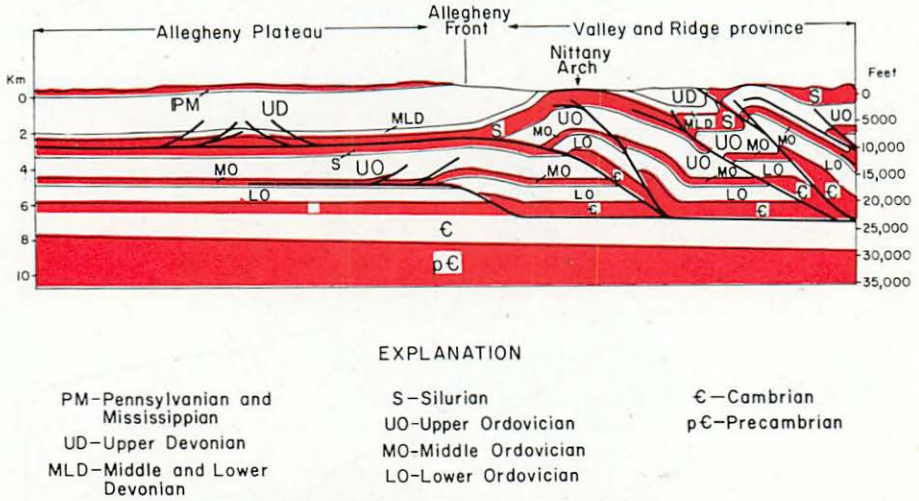


Figure 3. Generalized cross-section of the Allegheny Front, the boundary between the Valley and Ridge, and the Plateau provinces. The fundamental element is the decollement (bed-parallel fault) on which the Paleozoic rocks moved to the northwest. Splays from the decollement lifted the rocks, creating anticlines in the overlying formations. In the Valley and Ridge province, the decollement is in Cambrian rocks, displacement on the splays was large and thus the fold amplitudes are large. In the Allegheny Plateau province, the decollement lies in the Silurian rocks, the splays had small displacement, and thus the folds have only low amplitudes.

The Allegheny structural front comprises two relatively linear segments, with an intervening bend at Tyrone and another bend at its eastern terminus at Williamsport. This latter bend is a consequence of the eastward plunge and diminution of the Nittany Arch, the northwesternmost major anticline in the Valley and Ridge province. The Tipton block sits athwart the first, the intervening bend.

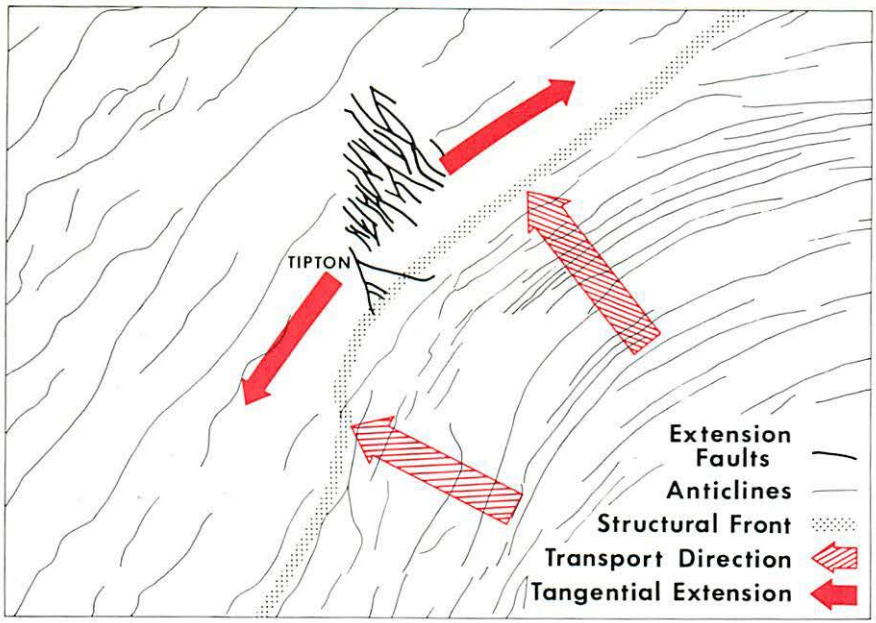


Figure 4. The divergent northwestward movements in the Valley and Ridge province created a zone of northeast-southwest extension, leading to the development of the "pocket" of strike-slip faulting, and of the Tipton block.

Throughout the Valley and Ridge province, slicklines on faults and bedding surfaces indicate that horizontal movement was perpendicular to the fold trends. Hence, the two linear segments of the front moved in divergent directions, creating an area of extension (stretching) (Fig. 4). The strike-slip faults north and southeast of the Tipton block are direct manifestations of this northeast-southwest extension, as reflected by the NW-SE trending strike-slip faults north of the block. Under this reduced stress condition, the triangular shaped Tipton block formed and moved northwestward a greater distance than the adjacent areas. In the process of movement, the block slid partly underneath the adjacent rocks, elevating them, and itself becoming folded in the process. It is not clear what mechanism was acting at depth.

Thus the Tipton block stands as a singular structure in the Appalachians in central Pennsylvania, developed by the divergence of two larger portions of the Valley and Ridge Province.

THE PENNSYLVANIA GEOLOGICAL SURVEY ASSISTS PUBLIC WATER SUPPLIERS

Eight months of drought conditions during 1980 and 1981 produced below normal water-level conditions in the eastern half of Pennsylvania. This continuous streamflow shortage and below normal groundwater levels caused moderate to severe public water supply problems in many eastern Pennsylvania communities. Groundwater levels during the summer and winter months are seasonally lower, but during this drought period they fell below their seasonal normals.

The number of public water supply companies affected by the drought grew steadily from September 1980 to February 1981. By mid-February, 85 companies supplying 440,000 people were experiencing extreme shortages. Rainfall from mid-February to present has helped, but the water supply problems will not be over until recharge to the groundwater brings the water table back to near "normal levels" throughout the 47 counties affected.

During this emergency period of serious public water supply problems, Survey geologists were asked and quickly responded to requests for assistance. In most cases this assistance involved a hydrogeologic study of the immediate area, selection of the most promising aquifer(s) available to the community, and special techniques to identify the best site or sites for new public water supply wells.

The following list includes some of the communities assisted by the Pennsylvania Geological Survey:

Adams County
- Cashtown Borough

Berks County
- Oley Township
- Womelsdorf Borough
- Robesonia Borough

Bradford County
- Troy Borough

Carbon County
- Bowmanstown Borough
- Summit Hill Borough

Dauphin County
- Millersburg Borough

Franklin County
- Washington Township

Lancaster County
- Strasburg Borough
- Akron Borough

Lebanon County
- City of Lebanon
- Richland Borough

Lehigh County
East Bangor Borough
Lycoming County
Williamsport Hospital
Perry County
Duncannon Borough
Schuylkill County
Schuylkill County Municipal Authority
Schuylkillhaven Borough

The Bureau of Topographic and Geologic Survey is pleased that its long-established groundwater data base and its staff of hydrogeologists enabled a prompt response to the emergency needs of these communities.

PALEOECOLOGY OF FENESTRATE BRYOZOANS IN THE WYMPS GAP LIMESTONE OF SOUTHWESTERN PENNSYLVANIA

by August H. Simonsen
Pennsylvania State University
McKeesport, PA

Late Paleozoic strata underlying southwestern Pennsylvania yield many fossils useful in interpreting the ancient environments in which those rocks were deposited. One major group, the phylum Bryozoa, has been virtually unstudied in the region, but is quite abundant in places. Elsewhere in North America, the delicate fronds of fenestrate-type bryozoans have been noted as excellent paleoecologic indicators, biostratigraphic guides, and sedimentologic contributors. Recent recognition of the abundance of fenestrate bryozoans near Uniontown, Pennsylvania stimulates interest in the details of their occurrence, especially for paloenvironmental implications.

The abundant fenestrate bryozoans occur in the non-working Thompson Quarry, 100 yards north of Route 40 about seven miles east of Uniontown, Pennsylvania, and one mile west of Chalk Hill, Pennsylvania. The Wymps Gap Limestone is about 20 to 30 feet thick at this outcrop. It is the thin, marine limestone in the lower Mauch Chunk Formation (Mississippian System). Formerly, it was referred to as the Greenbrier Limestone of Pennsylvania (Flint, 1965). The Wymps Gap Limestone is a thin tongue extending from the much thicker Greenbrier Formation of West Virginia into the

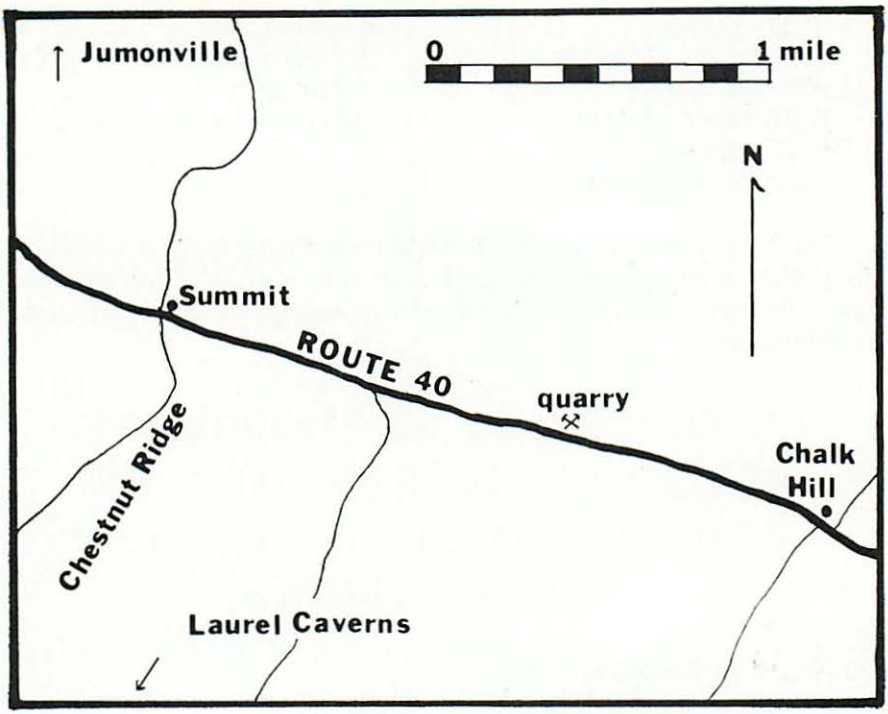


Figure 1. Location Map of the Thompson Quarry Outcrop of the Wymps Gap Limestone

deltaic, clastic beds of the Mauch Chunk Formation representing the transgression of a sea in the MIssissippian Period.

Outcrops of the Wymps Gap Limestone can be found in Fayette and Somerset counties, especially in the Chestnut Ridge and Negro Mountain areas. The site of the type locality is at Wymps Gap, twelve miles south of Uniontown, Pennsylvania. A massive, dark, fossiliferous limestone is overlain by interbedded limestone and calcareous shale. Near Wymps Gap, the limestone has several outcrops which show thicknesses of thirty to forty feet (Hickok and Moyer, 1940). In Westmoreland County the Wymps Gap Limestone pinches out near Latrobe, Pennsylvania.

Several fossil groups are found in the assemblage of the Wymps Gap Limestone, including many species of brachiopods, pelecypods, a cephalopod, a gastropod, a blastoid, crinoids, a solitary coral, a trilobite, and several bryozoans.

Fenestrate bryozoans consist of a hardened colony (i.e. zoarium), in which the polyp-like, individual zooids had lived. The zoarium

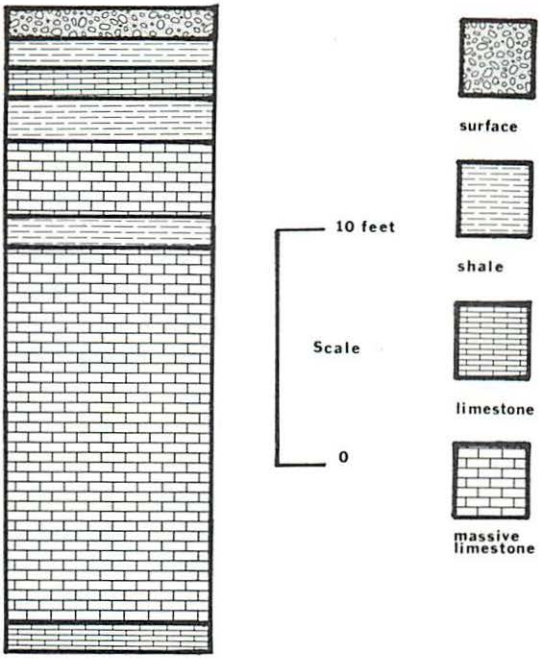


Figure 2. Generalized Stratigraphic Column of the Wymps Gap Limestone at the Thompson Quarry near Chalk Hill, Pennsylvania.

appears as a trellis- like perforated sheet (i.e. fenestrate), composed of branches and crossbars (i.e. dissepiments). The zooecium is the non-living skeleton of the zooid which expresses itself on the frontal side with an aperture. Three genera of fenestrate bryozoans have been identified, *Fenestella*, *Polypora*, and *Septopora*; studies in progress will attempt to further identify these forms to species level.

Fenestella has a very delicate zoarium which is fan-like. The zooecia are arranged in two rows along each branch, with none on the dissepiments. There are three to four zooecia between successive dissepiments in each row. The two rows are separated by a thin, low, straight ridge (i.e. carina) on the frontal side of each branch with nodes or spines at intervals. The largest zoarium found measured 35 mm in length and 16 mm in width at the distal end.

Polypora has a robust, fenestrate zoarium with three or four rows of zooecia on each branch but none on the dissepiments. Between the rows of zooecia, there are low carinas. All of the zoaria found were small broken fragments of larger fronds.

Septopora is medium-sized having a fenestrate zoarium with two rows of zooecia on the branches and some zooecia on the dissepiments. Several nodes appear on the branches. All of the zooaria were broken.

1

2

3

4

PLATE 1

(1) Large frond of *Fenestella*, 2X
(2) Frontal view of *Fenestella* showing zooecial apertures, branches and dissepiments, 25X
(3) Frontal view of *Septopora* showing zooecial apertures, branches and dissepiments, 25X
(4) Frontal view of *Polypora* showing zooecial apertures, branches and dissepiments, 25X

Most of the fenestrate bryozoans collected in the Wymps Gap Limestone were found in the shale and lower massive limestone lithofacies (see Figure 2). Many brachipod species were found in the assemblages containing the fenestrate bryozoans. The large percentage of calcareous matter and the apparent lack of sand-sized particles suggests that the fenestrates inhabited an offshore, normal-marine, shallow environment. The water was deep enough to be below wave base and, therefore, was relatively quiet; possible depth might have been 50 feet or more, in comparison with similar units studied elsewhere. The fenestrate bryozoans were bottom dwellers (i.e. sessile benthonic) and filtered the water that passed by them in order to capture their microscopic prey. The preferred bottoms were limy, mud bottoms as revealed by the various lithofacies.

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WINFIELD OPEN HOUSE

W. O. Faylor, Jr., President of Faylor-Middlecreek, Inc., has announced that mineral club members may visit the Winfield Quarry on May 16th and September 19th between 8:00 AM and 4:00 PM. Food may be purchased at a stand in the parking lot.

Visiting vehicles are never allowed in the quarry and there is a steep climb into and out of the quarry. Hence, no one should enter the quarry unless they are in good enough physical condition to walk out on their own.

Participating clubs should notify Faylor-Middlecreek, Inc., P.O. Box 117, Winfield, PA 17889 in advance. A donation of $1.00 per guest will be used to defray safety personnel costs. Hard hats, safety shoes, and safety glasses are required, and all other rules from the company's personnel must be followed.

Excellent specimens of calcite, sphalerite, and strontianite have been collected in recent years. Celestine, fluorite, and galena are also collectable at times. Additional information is available in the Pennsylvania Survey's General Geology Report 33, "Mineral Collecting in Pennsylvania," 1976 edition.

STATE GEOLOGIST ELECTED TO NATIONAL ASSOCIATION POST

State Geologist Arthur A. Socolow has been chosen to serve as Chairman-Elect of the 4500 member Geology and Geographic Section of the American Association for the Advancement of Science. Dr. Socolow has for many years been active in the affairs of this major national scientific organization which is dedicated to advancing the frontiers of science, as well as applying the results of scientific research to the needs of our society. Dr. Socolow has served not only as an officer, but also as technical manuscript evaluator for "Science," the official weekly journal of the association.

pennsylvania geopics

Rockfall in roadcut, south of Franklin, Pennsylvania. Rockfall here results from the intersection of two sets of rock fractures which are called joints. Rockfalls are a common occurrence where the rock is fractured and water enters the fracture and freezes. Photo by Jesse Craft

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In Cooperation with The U.S. Geological Survey

GROUND WATER DIVISION

In Cooperation with The U.S. Geological Survey

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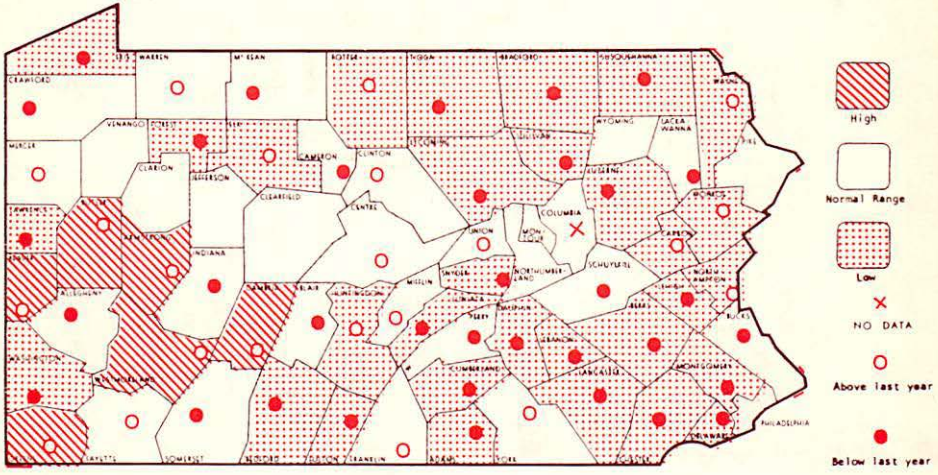
FOR
MARCH 1981



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