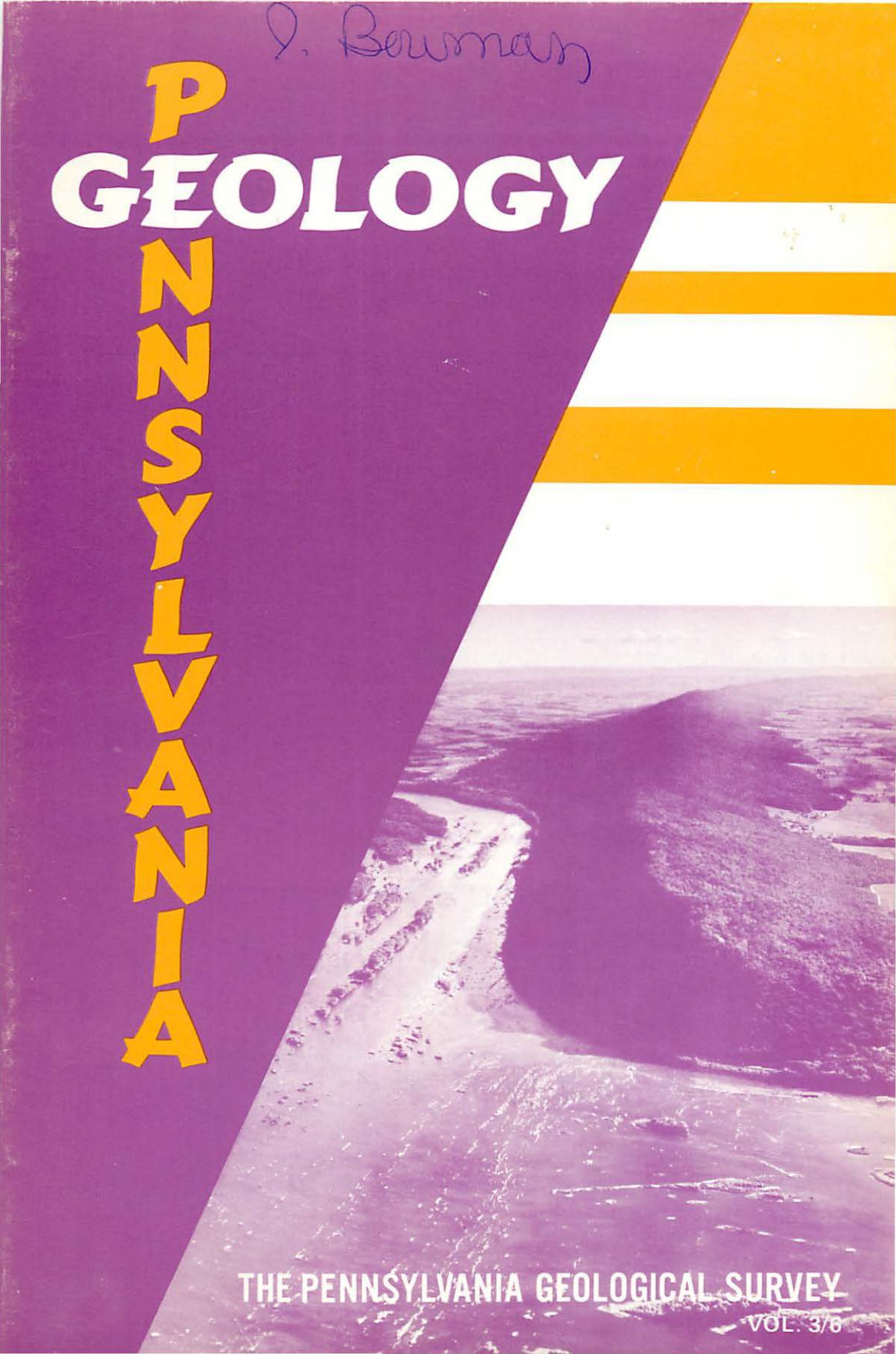
I. Berman

PENNSYLVANIA GEOLOGY



THE PENNSYLVANIA GEOLOGICAL SURVEY

VOL. 3/6

COMMONWEALTH OF PENNSYLVANIA
Milton J. Shapp, Governor

DEPARTMENT OF ENVIRONMENTAL RESOURCES
Maurice K. Goddard, Secretary

TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, State Geologist

CONTENTS

ON THE COVER – View along Susquehanna River near Liverpool where it cuts through the limb of one of the curving fold structures of the Appalachian Mountains. *Photo courtesy of Grant Heilman.*

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

DECEMBER 1972

FROM THE DESK
OF THE
STATE GEOLOGIST . . .

THE LESSONS OF AGNES

At the recent Minneapolis meeting of the Geologic Society of America, I was touched by the number of persons who extended their sympathy for our Survey's flood disaster, and who offered various forms of assistance. The response there and through the mails has truly been heartwarming and has made me prouder than ever of the geological profession.

One question which has been repeatedly asked of me is how a geological organization, knowledgeable in surficial processes, came to be located in a floodprone area. The answer, simply, is that pressures for space on the Capitol grounds had resulted in a decision to relocate us from our previous quarters in the Old Museum Building. Requiring a sizable area with special facilities to handle the needs of a Survey, the available sites were extremely limited.

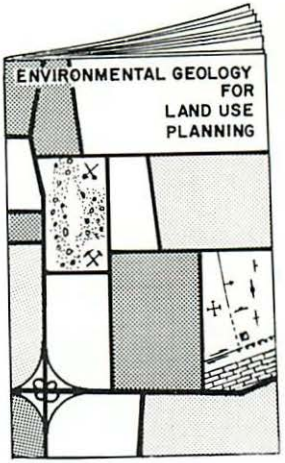
As we are struggling to rebuild, our hope is that all of Pennsylvania may be wiser from the experience of Agnes. There is clearly a need for a sound, statewide program of floodplain management which will prevent the double agonies of people being victimized by flooding while the burden of rescue and financial salvation falls on their fellow men and the taxpayers. We should not be lulled by the tidiness of the area as the heroic efforts have cleaned up the mess. Nor should we be consoled by misleading statistical probabilities of a so-called once-in-a-hundred-year flood, or two hundred year flood. Virginia recently had two once-in-a-hundred year floods within a twelve-month period. And what about the 500 or 1000 year floods on which we have no data?

Once and for all, we should recognize that certain locations have natural hazard potentials. We should have mandatory planning and regulate the use of such areas so as to forestall the suffering and costs to all. We speak from experience.

Arthur A. Socolow

GEOLOGY FOR LAND USE PLANNING - AN AID TO PLANNERS

What are the topographic limitations of the land available for expansion? Are major engineering modifications necessary to prepare the land for a specific use? Can the extraction of mineral resources be compatible with urban development? Will liquid and solid waste disposal sites be adequate? Are water resources adequate? These and many similar questions are discussed in a new publication recently released by the Bureau of Topographic and Geologic Survey.



"Environmental Geology for Land Use Planning", Environmental Geolory Report 2 explains what environmental geology is, why it is important, how it is used, and the major geologic factors that are involved. Continuing in the format of Environmental Geology Report 1, this pamphlet features the use of many photos and sketches to visually illustrate each subject. The pamphlet is designed to bring to the readers attention the effect of geology on man's activities, whether it be geological features as hazards or as resources. Geology is a valuable tool for planning, for conservation, and for wise use of the land. This report attempts to bridge the gap between basic geologic facts and the real-world, daily needs of a fast moving, ever changing society and man's impact on the face of the earth.

Geology has an important role to play in improving and protecting the environment of Pennsylvania. The Environmental Geology series of publications are designed to present information that will assist in defining the most effective use of our land and mineral resources. The Bureau of Topographic and Geologic Survey is pleased to make another contribution to better environmental planning and development.

Environmental Geology Report 2 may be obtained by writing to the Pennsylvania Bureau of Publications, P. O. Box 1365, Harrisburg, Pa. 17125. The cost per copy is $1.40 plus 6% state sales tax for Pennsylvania residents.

GEOLOGY IN THE PUBLIC DECISION-MAKING PROCESS

At the recent annual meetings of the Geologic Society of America at Minneapolis, a special session emphasized the growing importance and need for geology and geologists to be involved officially and individually in the decision-making processes of our society.

Presented below are the abstracts of two-papers which were presented at the Minneapolis meetings.

The Geologist in Environmental and Resource Decision-Making

Everett, A. Gordon, Director, Office of Technical Analysis, Environmental Protection Agency, Washington, D. C.

In the course of environmental and resource planning and management, geologists have two potentially important roles to play. The first is to provide the substantive physical and chemical framework, both static and dynamic, into which biological and other scientific, engineering, economic, social, and political factors can be placed. This requires clarity and completeness in the presentation of assumptions, data, processes, and projected consequences. It is critical that incomplete or omitted factors be noted as well, in order that decision-makers can assess the probabilities of alternative courses of action.

Beyond providing the physical setting for informed, effective decision-making, geologists can also serve effectively as leaders in the decision-making process. The breadth of considerations requiring knowledge from various disciplines such as is necessary in effective, broadly-interpretative geology is necessary in environmental and resource planning and management. The integration of processes in three dimensions, through time, is not customary in most other fields. The temporal factor, obviously critical in public environmental and resource considerations, is also necessary in private sector considerations.

Thus, geologists have both substantive and methodological contributions to make in the increasingly important decisions affecting the environment and resources, decisions which will ultimately determine the quality of life in America and the world.

Communication - Keystone Between Geological Science and Metropolitan Problem Solving

Zeizel, Arthur J., Office of the Assistant Secretary for Research and Technology, Department of Housing and Urban Development, Washington, D. C.

National priorities are shifting to apply science and technology to domestic problems. As these problems are concentrated in metropolitan areas and are chiefly the responsibility of State and local government, the geologic profession must help strengthen these governments. Provisions for putting geologic information into decision-making will remain inadequate until problems are prevented and environmental and social goals equal those of the marketplace. Professions and public officials are realizing the need to increase

effectiveness by joining forces. Insights into mechanisms for improving multi-disciplinary, problem-oriented research, user involvement, and technology transfer are emerging from an environmental planning research and demonstration project being conducted by HUD and the U.S.G.S. Lessons learned include the need for careful project design and management, multidisciplinary teams including planners, early, substantive, and continuous user involvement, early definition of user needs and products, and mechanisms for feedback and evaluation. Constraints to communication which must be overcome include inadequate appreciation of geologic information, difficulty in making scientific information understandable, and reluctance of geologists to work close to political processes. The Federal government is encouraging a partnership in science and technology with State and local governments. It is timely for the geologic profession to demonstrate its capability. What is required is expansion of the profession's role in urban affairs; willingness to work with policy, planning and operational personnel; increased influence upon the political process; and effective communication.

CLAY AND SHALE RESOURCES IN THE GREATER PITTSBURGH REGION – PHASE 1. ON OPEN FILE

The Bureau of Topographic and Geologic Survey, Department of Environmental Resources, in cooperation with the U. S. Geological Survey, is engaged in a two-phase clay-shale program under the Greater Pittsburgh Regional Studies Program. Phase 1. of this program is a comprehensive compilation of existing lithologic, physical, chemical, mineralogical, and use data on clay-shale samples from the six counties (Allegheny, Armstrong, Beaver, Butler, Washington, and Westmoreland) in the Pittsburgh Regional Study area. In accordance with the aims of this study, the early release of these data by placing this report immediately on open file should help provide for the optimum development, utilization and conservation of this important natural resource; and, also, make available mineral resource information that could lead to improved urban and regional land-use planning.

Phase 1. is now on open file at three locations: Bureau of Topographic and Geologic Survey, 401 Pittsburgh State Office Building, 300 Liberty Avenue; the U. S. Geological Survey, 102 East Mall (Second Floor), Carnegie; and the Bureau's Harrisburg Headquarters at 3rd. and Reily Streets. All interested persons are encouraged to examine this report at these offices. Copies of the report may be made available at the expense of the individual.

NEW GEOLOGY MAP OF CLARION COUNTY, PA.

The U. S. Geological Survey has released a new map showing the general geology and outcrop lines of coal beds in Clarion County. It consolidates and revises older maps covering parts of the county and extends mapping into portions not previously published. The map, entitled **Geologic and Coal-bed Map of Clarion County, Pennsylvania** (Map I-715) by E. D. Patterson and J. A. Van Lieu, is available for $ .75 from the following address:

U. S. Geological Survey
1200 South Eads Street
Arlington, Virginia 22202

AN ENVIRONMENTAL GEOLOGY FIELD TRIP

On November 9th members of the Bureau of Topographic and Geologic Survey conducted an environmental geology field trip for planners of the North-Central Regional Planning Commission at Ridgway in Elk County. The program was divided into two sessions. Mr. Jesse L. Craft of the Bureau's Environmental Geology Division opened the morning session with a presentation on "Questions Asked By Planners in the Evaluation of A Development Site". The morning continued with a short presentation of the general geology of the DuBois area, including Clearfield, Jefferson, and Elk counties, by William Bragonier of the Bureau's Field Geology Division. A lively question and answer period followed and concluded this session.

The afternoon program involved an environmental geology field trip through the DuBois area. The trip was conducted by Mr. William Bragonier, who with Albert Glover, has been mapping the geology and mineral resources of the area. The six stops visited in the afternoon included a sanitary landfill site in an abandoned strip mine of the Lower Kittanning Coal northeast of DuBois, an underground mine collapse near the Hummingbird Speedway, strip mine highwall stability problems, burning tailing piles and acid-mine ground water discharge problems and solutions.

The group participating in this field trip included county planners, county commissioners, soil conservantionists, soil scientists, and Geologic Survey personnel. Twenty-four people attended the morning session with sixteen of these braving the afternoon cold and mud on the field trip.

This type of seminar and field trip was a new experience for the Survey and we feel one that was promising and will be repeated in other locations of the state.

Alan R. Geyer

CLAM BURROWS IN THE UPPER DEVONIAN OR: "QUO VADIS *ARCHANODON?*"

Much of a field geologist's time is spent with his nose at the outcrop . . . searching. He pokes, scratches, hammers, peers, and generally sniffs out anything that might give him a new insight for interpreting the rocks. Since his interpretations and predictions may sway the balance of some pretty weighty economic decisions, he can't afford to overlook any clues.

One "clue" that we have learned to recognize and understand in the Catskill Formation of northeastern Pennsylvania is the fossil burrow made by an elusive clam during the Late Devonian (about 355 million years ago). The borrows are cylindrical and are generally perpendicular to bedding planes. They occur in the basal sandstone member of the Catskill and are easy to recognize with a little practice. The burrows vary from 3 to 5 cm. in diameter and are up to about 1.3 m. long. Some display internal crescentic structure (Fig. 1), the effect of burrow backfilling by the clam. These burrows are straight, curved (Fig. 2), or slightly sinuous. In some beds, several curved burrows tend to curve in the same direction. Cross sections of burrows as seen on bedding planes are either circular or elliptical; when elliptical, the long axes of the ellipses are sometimes aligned in the same direction (Fig. 3).

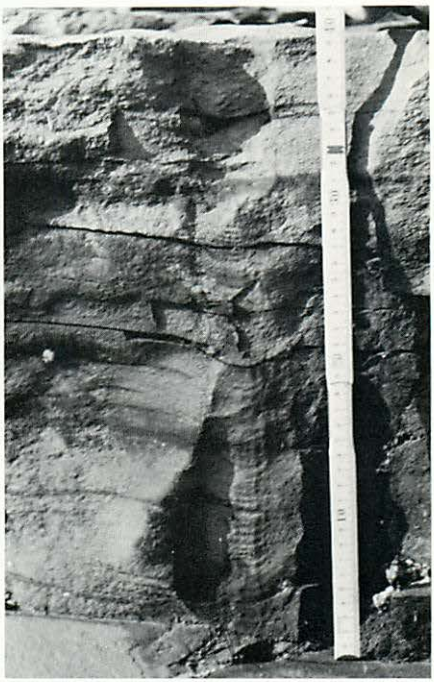


Figure 1. **Crescentic structure in an *Archanodon* burrow, reflecting burrow backfilling by the clam. Scale marked in cm.**

Figure 2. **Curved pelecypod burrow in outcrop near Port Jervis, N.Y. Hammer gives scale.**

Figure 3. Bedding plane showing parallel orientation of elliptical burrow cross-sections.

Figure 4. Molds of *Archanodon* sp. in sandstone outcrop, southern Carbon County.

At a key outcrop in southern Carbon County, Pennsylvania, abundant molds of the pelecypod *Archanodon* sp. (Fig. 4), are preserved along with the burrows. Other sandstone exposures in the outcrop belt as far as 65 miles to the northeast at Port Jervis, New York yield identical burrows, but no clams to date. The general shape of the fossils of *Archanodon* sp., the occasional parallel orientation of curved burrows, and the alignment of elliptical burrow cross sections are all features that bear a striking similarity to certain modern seaward-burrowing pelecypods that live in an intertidal beach environment. The primary sedimentary structures associated with the burrowed sandstones are also similar to those we find on modern sandy beaches. These sedimentary structures include plane bedding, medium scale cross-stratification, ripple marks, large scale cuspate features, and some parting lineations.

Previous interpretations of *Archanodon* have indicated that it was a freshwater pelecypod. If the specimens in the basal member of the Catskill are truly analogous to modern burrowing clams in the interidal zone, then further study of the paleoecology of *Archanodon* must be done.

The interpretation of Archanodon sp. as a marine clam confirms and amplifies the recent interpretation of J. D. Glaeser (Pennsylvania Geological Survey Staff) that the basal sandstone member of the Catskill was deposited in a tidally-affected environment, rather than a fluvial environment.

Assuming that *Archanodon* sp. was seaward-burrowing, the burrows that curve in the same direction in the same bed probably curve towards the location of the Late Devonian sea. The parallelism of elliptical burrow axes may also indicate a seaward direction since apparent modern analogues frequently orient their shell hingelines toward the sea.

In the study of sedimentary rocks, it is often a single clue, like the remains of a clam, that completes the picture of an ancient depositional environment.

When we better understand how and where the rocks were formed, we can better predict their lateral extent and degree of variability. This degree of understanding is important in the case of such rocks as the basal sandstone of the Catskill Formation; natural gas shows have been recorded at this horizon in several exploratory wells drilled in northeastern Pennsylvania. If the basal sandstone of the Catskill was deposited in a tidally-affected delta front environment, the unit will be sheetlike in its distribution, in contrast to the more belted nature of fluvial deposits.

Thomas M. Berg
Field Geology Division

U.S. BUREAU OF MINES LIAISON OFFICE

Recognizing the mutual concern of the U. S. Bureau of Mines and the States for effective and wise utilization and conservation of mineral resources, the U. S. Bureau of Mines has implemented a liaison program to expedite Federal, State and Industry cooperation in this area. The Liaison Office promotes cooperation in programs reflecting mutual concern for the effective and wise utilization and conservation of our national mineral resources with adequate environmental protection. Mr. Arnold H. Harvey has been appointed as the Liaison Officer for Pennsylvania by the Bureau of Mines, representing the Director and serving as a Federal point of contact.

Mr. Harvey received his Mining Engineering education from The Pennsylvania State University. His understanding of the mineral activities in Pennsylvania was broadened through twenty years of experience as Chief Engineer and Assistant Superintendent in various anthracite mines. He also has a thorough knowledge of bituminous mining and its associated problems, and has had close contact with other related mineral industries in the Commonwealth.

Since Mr. Harvey has been with the Bureau of Mines, he has been responsible for managing and coordinating Federal-State projects under authorized programs for the control of and extinguishment of underground and outcrop coal mine fires, surface subsidence control, and mined land reclamation. These projects, for the greater part, have been located in the bituminous and anthracite regions of Pennsylvania.

Mr. Harvey has established an office in Room 334, Federal Building, Harrisburg, Pennsylvania. He is available to render technical assistance or supply information to Legislators, State officials, mineral industry representatives, educational institutions and interested citizens regarding Federal cooperative programs. His mailing address is P. O. Box 783, Harrisburg, Pennsylvania 17108.

KINK BAND FOLDING IN CENTRAL PENNSYLVANIA - III

The kink band folds in the Valley and Ridge province exhibit a variety of profile (cross-section) geometries. Some are upright and symmetric; others are inclined and asymmetric; a few are even recumbent. Many are simple folds, with two limbs and a single axial surface; others are conjugate, with three limbs and two axial surfaces. In view of this geometric variety, the question arises whether kink bands can be arranged in different ways to reproduce all the observed profiles.

As simple as single kink bands are, they are by no means uniform. As demonstrated previously (Pennsylvania Geology, v. 3, no. 1, p. 6-9) kink bands of all sizes occur in this province. Although kink bands are usually inclined to the enveloping bedding* at about 60 degrees, a considerable divergence of 45 to 90 degrees has been observed. Similarly, the amount of bed rotation within kink bands can vary from 10 to 120 degrees. With this variability in kink band geometry, it is not surprising that resulting kink band folds also exhibit profile variability.

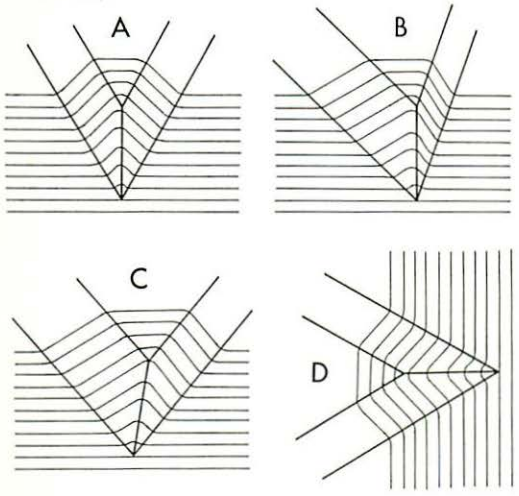


Figure A. **Variation of fold profile geometry as a function of variations in kink band arrangements. a. an upright, symmetric fold. b. An upright, asymmetric fold. c. An inclined, asymmetric fold. d. A recumbent, symmetric fold.**

If two kink bands are of equal width, equal amount of bed rotation (but in opposite senses), and oppositely inclined to the enveloping bedding, then the resulting fold at their junction will be upright and symmetric (Figs. Aa and B). On the other hand, if the kink bands are of different amount of bed rotation, and are inclined to the enveloping bedding by different amounts, the resulting fold at their junction will be upright and asymmetric (Fig. Ab) or inclined and asymmetric (Figs. Ac and C).

* Enveloping bedding is the attitude of the beds outside of and surrounding the fold, kink band, or other structure in question. Rather than the horizontal datum, the enveloping bedding is used as a local datum to simplify discussion of the geometry of the structure. To visualize this principal, rotate Fig. B and D such that the enveloping bedding appears horizontal.

Figure B. A symmetric, low amplitude kink band fold in the Mahantango Formation, along Cocolamus Creek 2 miles north of Millerstown, Pa. Although the axial surface of the fold is inclined relative to the horizontal datum, it is upright (perpendicular) relative to the enveloping bedding.

Figure C. An asymmetric, nearly upright anticline in the Wills Creek Formation, along Rt. 22, 6 miles northwest of Huntingdon, Pa.

The presumption in these examples has been the enveloping bedding is horizontal. However, many small folds occur within the limbs of larger folds (thereby imparting a complexity to the larger folds which justifies the terms anticlinorium and synclinorium). Because the bedding in the large fold limb possesses a dip between 1 and 90 degrees, all the smaller folds will be similarly inclined. As an extreme example, if the bedding in the larger fold limb is vertical, the enclosed fold is recumbent (relative to the horizontal datum) even though it upright and symmetric relative to the enveloping bedding (Fig. Ad). A recumbent fold, that is inclined and asymmetric relative to the enveloping bedding, is illustrated in Figure D.

Figure D. A recumbent, asymmetric syncline in nearly vertical beds of the Tuscarora Formation, along Rt. 322, 2 miles northwest of Milroy, Pa.

The majority of the folds in the Valley and Ridge province are simple, possessing only two limbs and a single axial surface. Yet folds with three limbs and two axial surfaces, conjugate folds, are not uncommon. Conjugate folds and simple folds are actually two parts of the same kink band structure, as can be seen in Figure E. Where two inclined kink bands join, a simple fold geometry results. Above this junction, where the two kink bands are separated by an unrotated *interlimb,* the single axial surface bifurcates into two axial surfaces, which are the kink planes of the two kink bands.

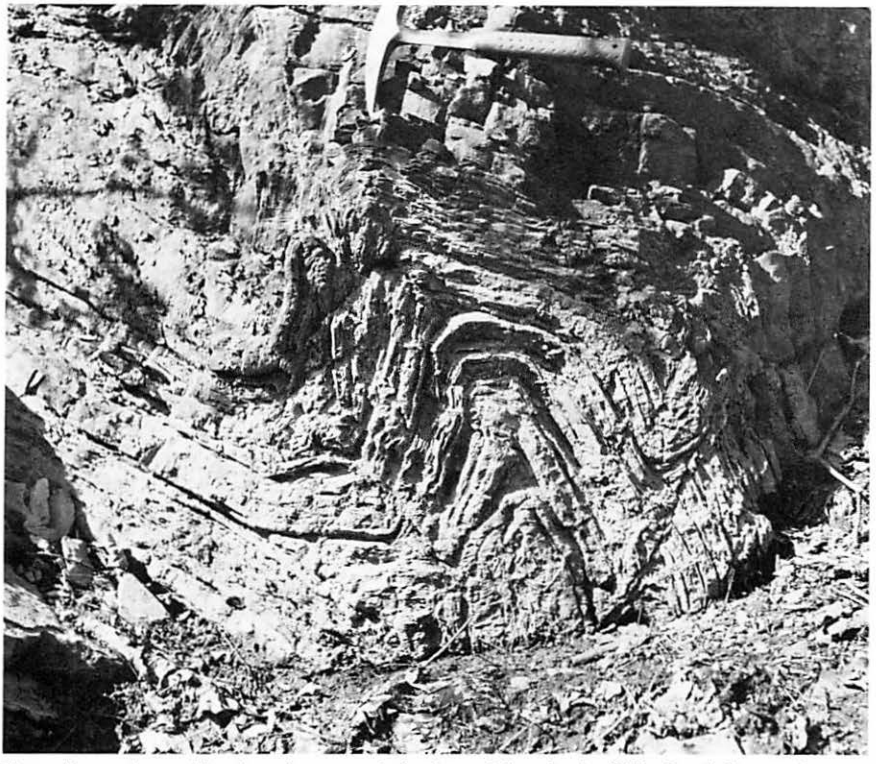


Figure E. A combined conjugate and simple anticline in the Wills Creek Formation, on the west bank of the Juniata River and 6 miles northwest of Huntingdon, Pa. Above the simple fold, the two kink bands are separate and a conjugate fold is present.

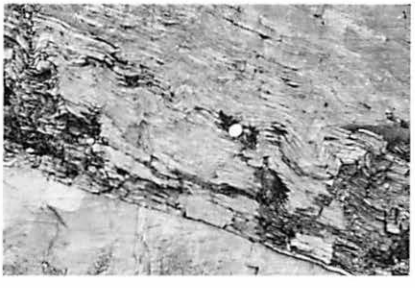


Figure F. Two oppositely inclined kink band arrays producing a continuous train of folds in a laminated bed. Wills Creek Formation along Rt. 22, 6 miles northwest of Huntingdon, Pa.

The combination of conjugate and simple folds can be seen in the kink band array developed in a laminated bed (Fig. F). Two sets of kink bands oppositely inclined have produced a nearly continuous train of folds of various geometries. Because of the similarity of these small fold geometries with the largest ones in the province, this small array is a reasonable model of the large folds across the entire province.

Rodger T. Faill

PENNSYLVANIA ANTHRACITE IN 1971

Latest figures just released by the U. S. Bureau of Mines show that anthracite production in Pennsylvania was 8.7 million tons, down 1023 percent from the previous year. The production came from 155 underground mines (producing 15 percent of the total), 180 strip pits (producing 51 percent of the total), 81 culm and silt banks (producing 30 percent of total), and 8 dredging operations (producing 4 percent of total).

Decreased domestic consumption (down by 11 percent) and much smaller foreign demands were the major factors responsible for the decline in anthracite production.

Schuylkill County, with 3.6 million tons, and Luzerne County, with 2.6 million tons, were the leading anthracite producers. Other anthracite producers of record were Northumberland, Lackawanna, Carbon, Columbia, Lancaster, Sullivan, Snyder, and Berks.

The anthracite production industry employed 5800 men in 1971 and the average value of the coal at the plant was $12.08 per ton.

PENNSYLVANIA MINERAL PRODUCTION RISES

Pennsylvania mineral production in 1971 showed an increase of 4.9 percent over the previous year, attaining a raw material value of $1.15 billion, the fifth highest in the nation.

Coal again was the leading mineral commodity, accounting for 62 percent of the total value and showing an increase over the prior year despite a 44 day work stoppage. The value of cement products, the second ranking mineral commodity in Pennsylvania, also showed an increase, up to $152 million. Sand and gravel products showed increases for the year, while copper showed an impressive 32 percent production increase over 1970. Production of stone, lime, petroleum and natural gas each held pretty much at the level of the previous year.

SEDIMENT THANKS TO AGNES

The Pennsylvania Department of Environmental Resources reported that 8,130,800 tons of suspended sediment were discharged by the Susquehanna and Schuylkill Rivers as a result of Tropical Storm Agnes. Of the total, 7,430,000 tons were recorded for the Susquehanna River at Harrisburg and 700,800 tons for the Schuylkill River at Philadelphia. The total amount of sediment discharged on the two rivers was equivalent to approximately one-half inch of soil from 203,000 acres.

The sediment load normally carried past Harrisburg in three years was carried past the city in 10 days during the flood. At Philadelphia, 2.6 times the normal annual sediment load for the Schuylkill River was carried past in four days.

SURVEY ANNOUNCEMENTS

SURVEY RELEASES NEW BIBLIOGRAPHY OF PENNSYLVANIA GEOLOGY

The **"Annotated Bibliography of Pennsylvania Geology - Supplement to 1969"** by Howard Ross Cramer was published last month.

This new publication may be purchased for $5.00 from the State Book Store, Tenth and Market Streets, Harrisburg, Pennsylvania. Mail orders with payment of $5.00 plus $ .30 sales tax for Pennsylvania residents should be sent to Department of Property and Supplies, Bureau of Management Services, State Book Store, P. O. Box 1365, Harrisburg, Pennsylvania 17125. Checks or money orders should be made payable to the Commonwealth of Pennsylvania.

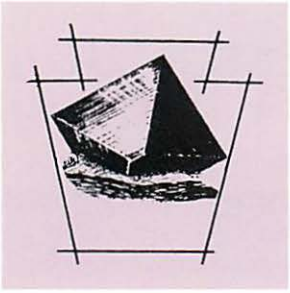
This publication is the third bibliography published by the Survey. The others are Bulleting G-34 and G-42 which sell for $5.75 and $2.30 respectively.

The new hard cover volume of 345 pages contains annotated, alphabetical listings of publications pertaining to geological investigations in the Commonwealth. It is a continuation or, and supplement to the earlier bibliographies which include publications to 1959. The new bibliography contains citations, annotations, and indexing not only of those articles dated from 1960 to 1969, but those of earlier dates which were not included in the other two publications.

The book includes a listing of scientific publications cited; a bibliography by author's name and an index by county, subject and geologic age.

GEOLOGIST JOINS SURVEY STAFF

We are pleased to announce that Mr. Evan T. Shuster has joined the staff of the Pennsylvania Geological Survey at the Survey's Harrisburg office. Working as a member of the Environmental Geology Division, Evan will be primarily responsible for carrying out the Division's goals and objectives in the subject area of ground water. He received his Bachelor of Science Degree from The Pennsylvania State University in 1966 and his Master of Science Degree from the same university in 1970. Evan Shuster's professional experience includes work as a research assistant in the Mineral Conservation Section at Penn State on various ground water projects and recently with the Division of Minerals in the Bureau of Forestry, as their ground-water geologist. He has written several professional papers and is a member of several state and national geological societies. Evan, his wife and daughter reside in Harrisburg.



EARTH SCIENCE TEACHERS' CORNER

secondary earth science education in pennsylvania

A Progress Report

During the past year, a study has been underway at Temple University to determine the present status of earth science teachers and earth science programs in the public secondary schools of Pennsylvania (reported in "Pennsylvania Geology" magazine, Vol. 3/2). Although the final analysis of data is currently in progress, a comparison of results from this survey and the 1969 survey by Geyer and Shirk is presented to illustrate trends over a period of three years.

Earth Science Teacher Preparation	**Cross**	**Geyer and Shirk**
1) Holding Master's Degree	44%	35%
2) Years of total teaching experience	9%	8½%
3) Years of earth science teaching experience	5½%	3½%
4) Teachers reporting institute participation	64%	54%
5) Attended institutes in earth science/geology	45%	63%
Attended institutes in earth science areas (i.e. meteorology, oceanography, etc.)	67%	*
6) Teachers majoring in earth science/geology at undergraduate level	32%	10%
7) Teachers having no courses in earth science	11%	20%
Earth Science Programs		
Texts in use:		
1) ESCP - Investigating the Earth	20%	19%
2) Namowitz - The World We Live In	23% } 65%	30% } 74%
3) Ramsey - Modern Earth Science	22%	25%
4) No single text dominant	15%	*

(*Not applicable to survey)

In the Geyer and Shirk survey a population of 400 included secondary teachers teaching earth science at least one semester or teachers using an earth science text for part of a general science course. This survey covered the 1967-68 school year. Whereas, the Cross survey included a population of 265 teachers teaching at least 50 per cent of their classes in earth science and certified to teach earth science, according to the annual Secondary School Report. The Cross survey covered the 1970-71 school year. It should be noted that the characteristics of the populations as defined for each study would cause one to expect the teachers in the Cross study to have stronger earth science background.

Whitman Cross II

References

Cross, Whitman II (in progress), **Status of Earth Science Programs and Profile of Earth Science Teachers in Public Secondary Schools of Pennsylvania: 171-72.** Doctoral Dissertation, Temple University.

Geyer, A. R. and Shirk, W. R. (1970), **Pennsylvania's Secondary School Earth Science Course—Ten Years of Progress.** Journal of Geological Education, v. 18, n. 3, p. 118-121.

summer scientists at seneca valley high school

Girls using forel water comparator and secchi disk. Prince Gallitzin State Park.

Twenty-six Seneca Valley sophomores participated in a four-week summer science course entitled, "Field and Laboratory Experiences in the Environmental Sciences". Each student became an environmental scientist for four weeks. The course included the environmental sciences of geology, zoology, botany and limnology working under the leadership of Mr. Thomas Konvolinka and Jeffery Wilhelm. In addition to learning field-study techniques and the use of scientific equipment in these sciences, the course was highlighted by a five-day camping trip to Prince Gallitzin State Park in the foothills of the Allegheny Mountains.

The 460-acre lake at Prince Gallitzin State Park and the surrounding mountains served as a classroom for such activities as water sampling, coring and dredging the lake bottom, seining, navigational techniques, map interpretation, exploration of limestone caves and underground coal mines and the geology of the Horeshoe Curve.

Part of the four weeks provided time to use the laboratories in the new Seneca Valley Junior High School where tests and additional studies were made of the samples and collections of rocks, plants, animals and lake sediments.

Many students felt that these four weeks in the field were of greater value than a whole year in the classroom.

Students preparing H_20 sampling bottle. Photo taken on Lake Glendale in Prince Gallitzin State Park.

NEW HISTORY OF PITHOLE, EARLY OIL BOOM TOWN OF VENANGO COUNTY

Pithole, the Vanished City, by Professor William C. Darrah is a fascinating new book on the history of Pithole, Pennsylvania's fabulous oil boom town. Pithole sprang up in the Venango County wilderness in 1865 following a nearby oil strike. Within three months Pithole had blossomed into a sprawling, lusty community of 20,000, complete with homes, stores, large hotels, and all the other elements of a small city. Two years later the speculative bubble burst and Pithole went into a rapid decline. Today not one building remains.

In addition to being a highly-readable, well-researched history of Pithole itself, Dr. Darrah's book also provides an exceptional insight into early developments in the operations and technology of the American oil industry.

Pithole, the Vanished City is thoroughly documented for historical accuracy and amply illustrated with dozens of contemporary maps and photographs.

William C. Darrah is a member of the faculty at Gettysburg College and an eminent paleobotanist. He is also the author of ten other books including **Powell at the Colorado** and **Stereo Views: A History of Stereographs in America.**

Pithole, the Vanished City can be obtained for $8.50 per copy (post-paid if payment accompanies order; Pennsylvania residents add 6% sales tax) from Professor William C. Darrah, R. D. 1, Gettysburg, Pennsylvania, 17325.

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