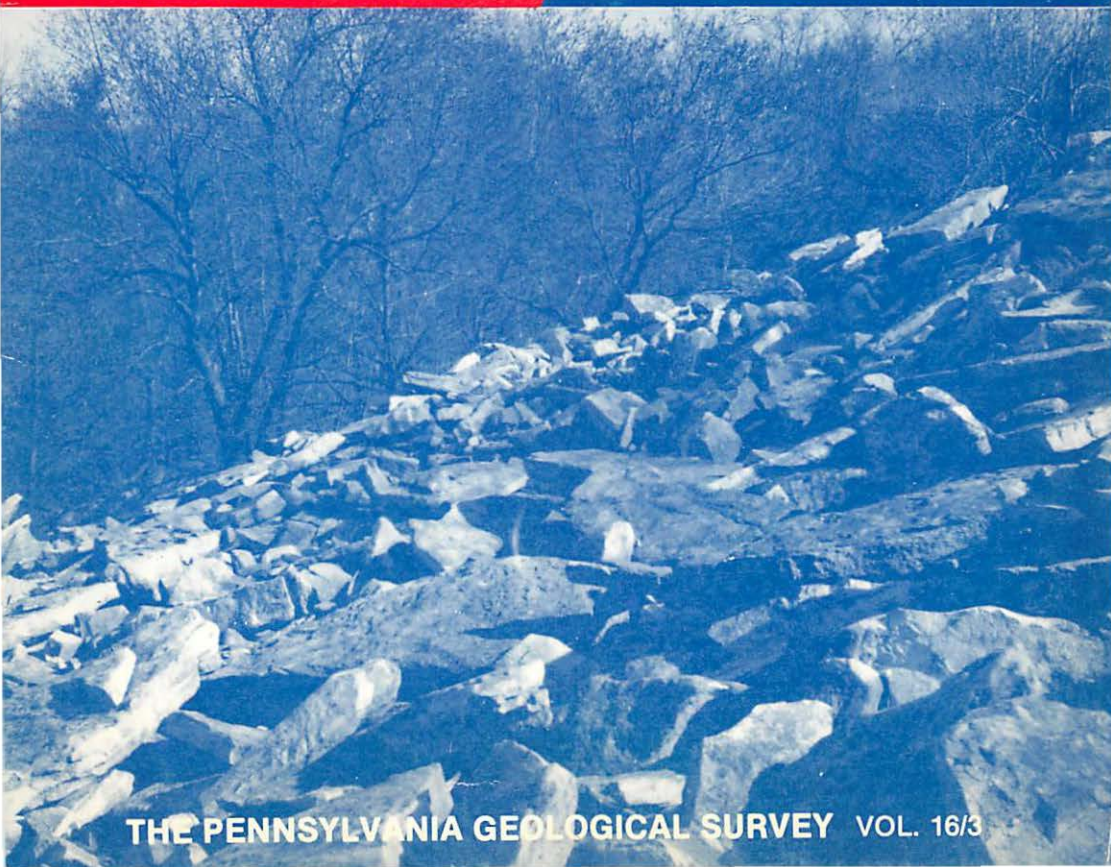
PENNSYLVANIA GEOLOGY



THE PENNSYLVANIA GEOLOGICAL SURVEY VOL. 16/3

COMMONWEALTH OF PENNSYLVANIA
Dick Thornburgh, Governor

DEPARTMENT OF ENVIRONMENTAL RESOURCES
Nicholas DeBenedictis, Secretary

OFFICE OF RESOURCES MANAGEMENT
Patrick J. Solano, Deputy Secretary

TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, State Geologist

CONTENTS

ON THE COVER: A talus slope composed of blocks of the Silurian-age Tuscarora quartzite, exposed on the north slope of Blue Mountain at Waggoners Gap, Route 74, Perry County. Photo courtesy of W. D. Sevon.

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

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

VOL. 16, NO. 3 **JUNE, 1985**

FROM THE DESK
OF THE
STATE GEOLOGIST

A GEOLOGIST'S WORK IS NEVER DONE

Once upon a time, not too many years ago, when labs in the scientific community were able to do analyses which revealed minor constituents in quantities as low as one one-thousandth (.001) of a percent, we were very comfortable that such measurements showed up important contaminants or problem constituents. But analytical techniques and instruments have evolved to give us measurements and accuracies to such levels as one part per billion (or one ten-millionth of a percent). As a result, we have recognized trace elements and minor constituents we previously were not aware of, some of which present contamination or health problems which call for remedial actions.

This revolution in analytical techniques has presented new investigative responsibilities upon our geologic community, as well as the more publicized realm of biological science. For example, what minor constituents in clays affect their utility as raw material for ceramic products? Or what trace elements in a particular bed of coal might produce harmful stack emissions? Where is there a minor, non-economic occurrence of uranium minerals which may yield threatening quantities of radon? And what problematic, minute constituents are dissolved in our groundwater as it passes through our various types of rock formations?

Analytical progress has thus imposed new obligations and challenges upon geologists for accurate data collection and measurements in areas and upon resources where we once thought we had a fairly complete grasp of the geologic environment. Utilizing new equipment and new techniques, we have to revisit, re-examine, and re-sample many geologic situations.

Geology has in recent years received some publicity for innovative, new principles in continental deformation and mountain building (plate tectonics), as well as oceanographic processes relating to formation of mineral deposits. To those new concepts of mega-processes which have caused us to re-think the origins of our geological "backyard," we should also recognize that the details of analytical progress, much less publicized, have imposed a wide array of new duties upon geologists. Much as we have accomplished over the years, much more detailed work now faces us.

Arthur G. Sherlow

Refractory Dolomite Production in Southeastern Pennsylvania—
THE J. E. BAKER CO.

by David A. Hopkins
J. E. Baker Company

The J. E. Baker Company has been in the quarry business since 1889. In the early 1900's, the Baker Company became the first to produce a "roasted" (sintered) dolomite for use as a refractory product by the steel industry. J. E. Baker Company has produced dolomite at numerous quarries in Pennsylvania, including the Billmeyer quarry near Bainbridge, Lancaster County which operated from 1896 until 1962 (Figure 1). Two quarries were also operated directly across the Susquehanna River at Saginaw in York County, from 1902 until 1942. World War I saw increased demand for refractory products and the temporary production of dolomite from the Chickies quarry near Marietta in Lancaster County.

Since the mid-1950's the Baker Company has quarried high-purity dolomite west of the city of York in southeastern Pennsylvania (Figure 2). The associated plant and 300-foot-long rotary kiln were commissioned in 1952 and an additional rotary kiln was added in 1959.

The Middle Cambrian Ledger Formation is the quarry rock from which the high-purity dolomite (generally less than 1% total impurities other than carbonates) is extracted. It is part of the Cambro-Ordovician carbonate sequence that is extensively exploited in the York-Hanover portion of the Conestoga Valley. The Ledger Formation at this site is characterized as a pure, light-gray mottled with dark gray, coarsely crystalline, low porosity dolomite. Locally the dolomite contains oöliths suggesting recrystallization of a rather pure shallow water limestone deposit. Stose and Jonas (1939) estimated the Ledger to be about 1000 feet thick in the general area. Structural complexity in the quarry is masked by the lack of identifiable bedding and extensive faulting. Paleo-karst features within one area of the quarry are attributed to the nearness of the southern border of the Mesozoic Basin.

The geologic complexity encountered through mining has led to the evolution of a very intensive quality-control program that insures proper quality of the various products manufactured (see Hopkins,

Figure 1. Photograph of the J. E. Baker Company's now-abandoned Billmeyer Quarry near the turn of the century showing the process of drilling dolomite.

Figure 2. A southwest-looking view of the J. E. Baker Company's active quarry and plant. Quarry benches are about 50 feet in height. A sense of scale can be achieved by comparing the size of the production drill located on the 3rd level, bottom right of photograph.

in press). The program begins with close spaced diamond core drilling, proceeds through selective quarrying, and ends with extensive sampling of in-process raw-stone and of the finished products. The primary product is a high-purity dolomite grain that has been heated to very high temperatures (this heat treatment yields a product resistant to atmospheric hydration or recombination with CO_2). This "grain" (granular sintered dolomite) is used to manufacture a dolomite brick that is finding increasing use as a refractory product in lining AOD (Argon Oxygen Decarburization) vessels, ladles for the steel making industry, and in lining the burning and transition zones of rotary cement and lime kilns.

Competitive advantages are gained by achieving a sintered dolomite product with only one pass through the kiln. This efficiency is the result of the unique physical and chemical characteristics of the Ledger Formation and Baker Company's pioneering spirit. In fact, these attributes, plus dedication to quality, have made the Baker Company the only manufacturer of a high-purity dolomite grain suitable for the production of a refractory brick in the United States. Besides high-purity refractory products, the company also produces dead-burned dolomite (used to maintain open hearth and electric furnaces used in steel making), pulverized agricultural dolomite, fluxstone, and mineral fillers.

References

Hopkins, D. A. (in press), *Refractory dolomite production in a geologically complex area,* in *Proceedings 20th Forum on the Geology of Industrial Minerals,* Maryland Geological Survey.

Stose, G. W., and Jonas, A. I. (1939), *Geology and mineral resources of York County, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., County Report 67, 199 p.

ADDRESS CORRECTIONS PLEASE!

If you are planning a move or you make a change in your address, please let us know immediately so that we can make the necessary corrections to our mailing list. Send us your name, *old zip code,* and your new address. You cost us $.30 each time a copy of Pennsylvania Geology is returned to us because of your incorrect address. And, as a result, you do not receive that month's information. So to insure you receive each issue of Pennsylvania Geology and to save us considerable cost, please let us know when you are moving.

NATIONAL HIGH-ALTITUDE PHOTOGRAPHY

High-altitude aerial photographs are a valuable source of information. In 1978, several federal government agencies, with the U.S. Geological Survey leading the effort, decided to coordinate data acquisition programs for aerial photography. Under the National High Altitude Photography (NHAP) Program, the U.S.G.S. is systematically acquiring both black-and-white (scale 1:80,000) and color-infrared (scale 1:58,000) photographic coverage of the 48 conterminous states. By the spring of 1986, the entire U.S. will be covered by the NHAP Program, called NHAP-I. Periodic updates of the data are planned.

Several different types of products are available from the NHAP Program. Both black-and-white and color-infrared photography are produced. The black-and-white photographs are used in map-making, as well as in geologic and land-use analyses. Color infrared photographs are useful in resource inventories, agricultural monitoring, and pollution detection.

The photographs are in a 9-by-9 inch format. The black-and-white print has a scale of 1:80,000 or 1 inch equals 1.25 miles. One black-and-white print covers nearly 130 square miles. Usually 3 exposures are needed to cover the area of a 7½′ quadrangle map. The color-infrared product has a scale of 1:58,000 or 1 inch equals 0.9 mile. Each color-infrared print covers nearly 68 square miles. Four exposures are needed to cover the area of a 7½′ quadrangle map.

Film transparencies or photographic reproductions of black-and-white and color-infrared photographs are available in a 9-by-9 inch contact print size, as well as in standard enlargement sizes of 2X, 3X, and 4X.

As a special feature, all aerial mapping photographs acquired under the NHAP-I Program can also be ordered at a 1:24,000 scale, making them ideal for use with USGS 7½′ topographic maps. Two types of products, black-and-white and color-infrared paper prints, are available. The 1:24,000 black-and-white print is enlarged 3.33X. The 1:24,000 color-infrared enlargement is 2.43X.

Film Size	B & W Scale	B & W Price	CIR Scale	CIR Price
9″ x 9″	1:80,000	$ 5.00	1:58,000	$15.00
18″ x 18″ 2x)	1:40,000	$20.00	1:29,000	$35.00
27″ x 27″ (3x)	1:26,666	$25.00	1:19,333	$50.00
36″ x 36″ (4x)	1:20,000	$35.00	1:14,500	$70.00
22″ x 22″ (2.43x)			1:24,000 appx.	$50.00
30″ x 30″ (3.33x)	1:24,000 appx.	$25.00		

To obtain NHAP photography, determine the geographic coordinates of the specific area and, if possible, delineate it on a map. E-NCIC will select the proper roll and frame numbers to cover your area and advise you of ordering procedures. To obtain further information, or to place an order, please contact the following office.

U.S. Geological Survey
Eastern Mapping Center
536 National Center
Reston, VA 22092
Telephone: (703) 860-6336

NHAP color-infrared products are also available from the Agricultural Stabilization and Conservation Service (ASCS). To obtain ASCS photography determine the geographic area, including county, township, and latitude and longitude. If possible include a map of the area of interest.

Paper Size	Scale Ft/In	Price
10″ x 10″	1:58,000	$ 8.00
12″ x 12″	1:48,000	$25.00
24″ x 24″	1:24,000	$35.00

Address orders for photographs to:

Aerial Photography Field Office
P. O. Box 30010
Salt Lake City, UT 84130

mineral collector's open house

Faylor-Middlecreek, Inc. is holding an "open house" this year on Saturday, September 21st, from 8:00 A.M. to 4:00 P.M. for our rock hound friends.

The 1984 operating season was the last year for the old Winfield quarry since the quarry is worked out. The bottom of this quarry is now flooded. A new quarry is being developed to the west and approximately 2500 feet from the old quarry in the same rock. The open house will include this new quarry. Mineral collectors and clubs are invited to explore the unflooded parts of the old quarry as well as the new quarry. There will continue to be $1.00 per adult person charge for registration.

All persons planning to attend should be aware that there is a steep climb into and out of the old quarry and anyone not physically able to climb steep hills coming out of the old quarry on their own should not walk down. Automobiles, trucks, vans, motorcycles, etc., are not allowed at any time in the quarry, but a place to park your vehicle close to the quarry rim is provided. Hard hats, safety shoes, and safety glasses or goggles are required for all collectors.

For more information contact M. Lee Eberhart, Jr., President, Faylor- Middlecreek, Inc., P.O. Box 177, Winfield, Pennsylvania 17889, telephone (717) 524-2251.

HARRISBURG AREA GEOLOGICAL SOCIETY HOLDS 4TH ANNUAL FIELD TRIP

Old and new concepts of Pennsylvania landscape evolution were the focus of the 4th Annual HAGS field trip led by William D. Sevon on April 27, 1985. Thirty four attendees visited 8 localities which il-

lustrated various geomorphological features including: structural control of water gap location, stability and longevity of colluvial deposits, mechanical disintegration of ridge crests, saprolite, and dissected erosion surface (the Harrisburg), old alluvial-fan deposits, and chemical weathering of carbonates. The geomorphic model discussed at length in the guidebook "Pennsylvania's Polygenetic Landscape," proposes that the present landscape of Pennsylvania, and the Appalachians as a whole, is the result of tectonically uninterrupted, climatically controlled weathering and erosion operating continuously since at least the Permian Period. Other concepts held by many, such as peneplains (Davis), a Cretaceous transgression (Johnson), and repeated uplifts of the Appalachians are considered untenable by Sevon.

Two generations of colluvium exposed along the north side of PA Route 74 on the south slope of Blue Mountain, Cumberland County, Pennsylvania. Stop 4 of the 4th Annual Harrisburg Area Geological Society Field Trip.

References

Davis, W. M. (1889), *The rivers and valleys of Pennsylvania:* The National Geographic Magazine, v. 1, no. 3, p. 183-253.

Davis, W. M., and Wood, J. W., Jr. (1890), *The geographic development of northern New Jersey:* Boston Society of Natural History Proceedings, v. 24, p. 365-423.

Johnson, D. (1931), *A theory of Appalachian geomorphic evolution:* Journal of Geology, v. 39, p. 497-508.

_____ (1931), *Stream sculpture on the Atlantic slope:* New York, Columbia University Press, 142 p.

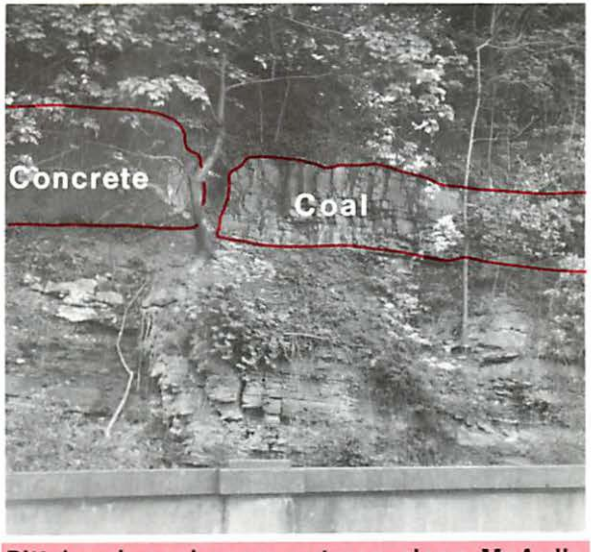
FIRST MINING OF THE PITTSBURGH COAL

"The State's bituminous coal industry was born about 1760 on Coal Hill, now Mt. Washington. Here the Pittsburgh coal bed was mined to supply Fort Pitt. This was eventually to be judged the most valuable individual mineral deposit in the U.S."

A historical marker with this text was dedicated on April 18, 1985. The site is on Grandview Avenue, atop Mount Washington, overlooking downtown Pittsburgh. The exact location of the first mines along the hillside is unknown, so the marker is placed just above the outcrop of the coal along McArdle Roadway.

The following is an excerpt from "History of Allegheny County, Pennsylvania," 1889.

> It was regularly mined as early as 1760, and according to tradition was first tied up in rawhides and tumbled down Coal Hill, now known by the more ambitious title of Mount Washington. The first manufactories started here were supplied from the same source, but the method of transportation was improved. It is said that



Pittsburgh coal seam outcrop along McArdle Roadway, Mt. Washington in Pittsburgh, approximately 50 feet below the marker location. The concrete to the left of the outcrop is probably sealing an old mine opening.

"coal was hauled down the hill on a sled-car, made of two oak saplings formed as shafts for a horse to work in, and a box fastened onto the outer end of the shafts that would contain fifteen bushels. The road was made with a rut each side about ten inches deep for the ends of the saplings to run in.

Since 1760, more than 1,000,000,000 (one billion) tons of coal have been mined from the Pittsburgh seam in Allegheny County alone. This quantity of coal:

Is equal to the volume of about 3,000 U.S. Steel Buildings (about 550,000 acre-feet);
Would fill 12,000,000 standard rail coal cars, enough to make a train extending about 6 times around the earth;
Has enough heating value to bring Lake Michigan to a boil (about 1,100 cubic miles of water).

Placement of the marker was through the joint efforts of the Pennsylvania Historical and Museum Commission and the Pittsburgh Geological Society. The dedication occurred on the date of the 40th anniversary of the founding of the Pittsburgh Geological Society.

Helen L. Delano

USGS ISSUES ADDITIONAL SMALLER SCALE MAPS FOR PENNSYLVANIA

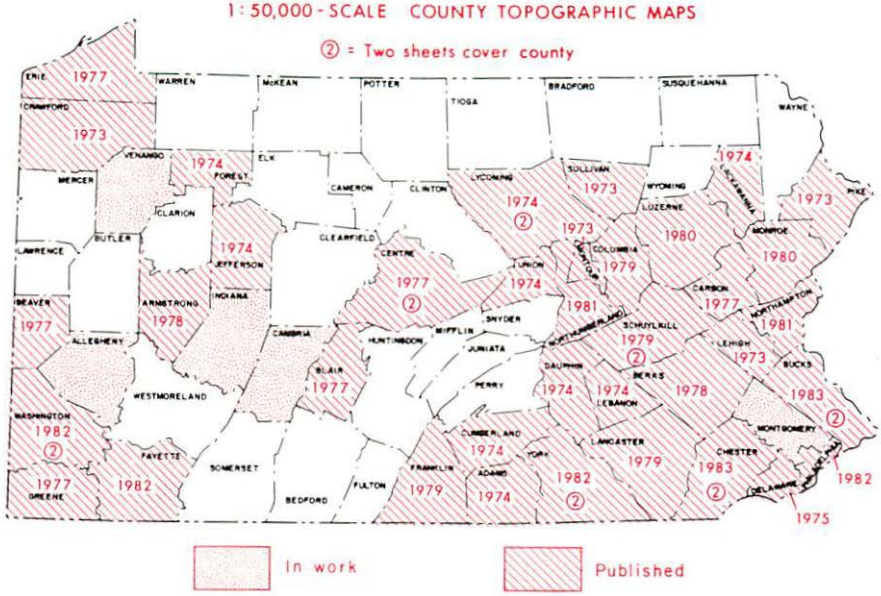
In an effort to meet the continuing need for smaller scale maps, the USGS has published six new maps in the 1:100,000 scale quadrangle series and eight in the 1:50,000 scale county topographic series since our last report.

Chester County is the most recent addition to the list of completed maps in the 1:50,000 county topographic map series. Because of size, the county is divided into two sheets, north and south. Since our last notice in April 1983, additional counties released by the USGS are: Bucks (2 sheets), Fayette, Monroe, Northampton, Northumberland, Philadelphia, Washington (2 sheets), and York (2 sheets). Maps for 36 Pennsylvania counties are now available from the USGS.

Five maps newly completed in the 1:100,000 scale topographic series include: Clearfield, Indiana, Oil City, Trenton, and Warren. Eleven maps at this scale are now available for Pennsylvania. In addition, York and State College have been recently issued in the planimetric edition (planimetric maps are those which lack contours).

1:50,000-SCALE COUNTY TOPOGRAPHIC MAPS

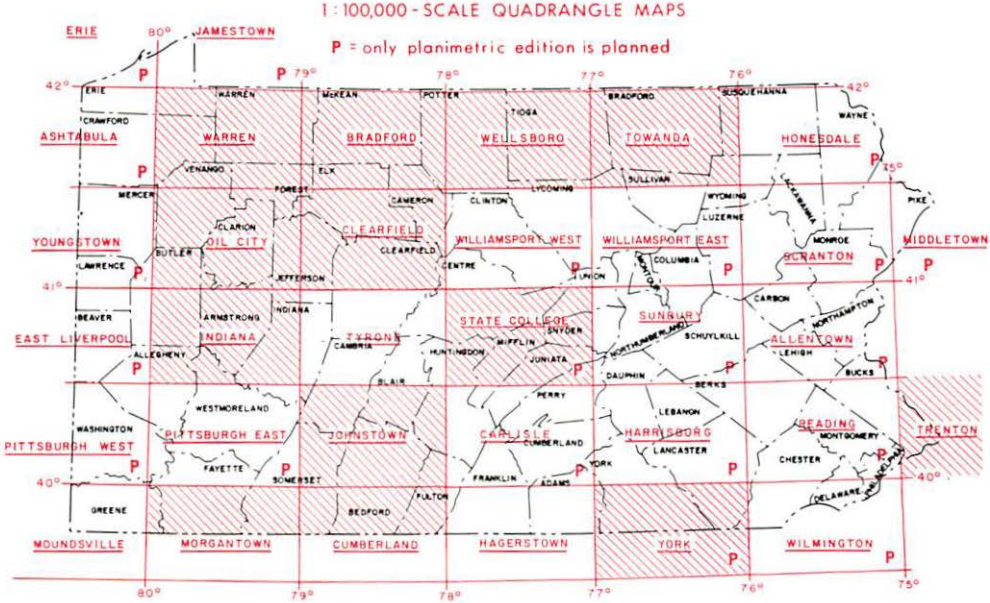
② = Two sheets cover county



In work Published

1:100,000-SCALE QUADRANGLE MAPS

P = only planimetric edition is planned



SUNBURY — In work

TOWANDA — Published

Published maps in both series are available at $4.00 each sheet from Eastern Distribution Branch, U.S. Geological Survey, 1200 South Eads Street, Arlington, VA 22202.

The Lehigh County 1:50,000 map (Map #39) costs $1.65 and is available by writing to the State Book Store, P.O. Box 1365, Harrisburg, Pennsylvania 17105 (prepayment is required, Pennsylvania residents should add 6% sales tax, and make check payable to the "Commonwealth of Pennsylvania").

STATE BOOK STORE MOVES

The State Book Store has moved to 20 South Third Street, Harrisburg. The mailing address (P.O. Box 1365, Harrisburg, PA 17105) and telephone number (717-787-5109) remain the same.

NEW RELEASES FROM THE U.S.G.S.

White Clays of Pennsylvania, USGS Bulletin 1558-D, by John W. Hosterman. Price $2.00 (includes postage).

Storm Induced Slope Movements at East Brady, Northwestern Pennsylvania, USGS Bulletin 1618, by John S. Pomeroy. Price $1.50 (includes postage).

The Richmond and Greenwich Slices of the Hamburg Klippe in Eastern Pennsylvania—Stratigraphy, Sedimentology, Structure, and Plate Tectonic Implications, USGS Professional Paper 1312, by Gary G. Lash and Avery A. Drake, Jr. Price $2.25 (includes postage).

These publications may be ordered from Eastern Distribution Branch, Text Products Section, U.S. Geological Survey, 604 S. Pickett Street, Alexandria, VA 22304.

Geologic map of the Kutztown quadrangle, Berks and Lehigh Counties, Pennsylvania, USGS Geologic Quadrangle Map GQ-1577, by Gary G. Lash. Price $3.60 (includes postage). This publication may be ordered from Eastern Distribution Branch, U.S. Geological Survey, 1200 South Eads Street, Arlington, VA 22202.

Make checks payable to *U.S. Geological Survey.*

OIL AND GAS RESERVOIR ROCKS OF PENNSYLVANIA

Work is in progress in the Pittsburgh office of the Pennsylvania Geological Survey to compile a handbook of the petrologic and petrophysical data of the various hydrocarbon reservoir rocks of the Commonwealth. The report, being compiled by Christopher D. Laughrey and Robert M. Harper of the Oil and Gas Geology Division, is intended to be used in context with the recently issued Oil and Gas Fields Map of Pennsylvania (Pennsylvania Geological Survey Map #3). Every effort is being made to obtain and organize sample information from the oil and gas fields of the state into a format compatible with the objectives of the compilation. These objectives are:

1) To outline the chemical and physical properties (mineralogy, texture, diagenesis, porosity, and permeability) of the principal reservoir rocks in each of five general productive areas of western Pennsylvania (northwest, north-central, southwest, central-west, and south-central).

2) To explain the variations from low-permeability ("tight") to high-permeability ("sweet") zones in seemingly similar reservoir situations.

3) To relate the chemical and physical properties to depositional environments and reservoir configurations of the gas and oil pools in Pennsylvania.

4) To discuss the potential reservoir and completion problems operators may expect due to variations in chemical and physical properties.

The study entails the compilation of thin-section and scanning electron microscope (SEM) data, core analyses, X-ray diffraction data, and geophysical (wire-line log) information. The report will be in the form of a book of summarized data, photographs, and line drawings similar to the Survey's previously published Engineering Characteristics of the Rocks of Pennsylvania (Environmental Geology Report #1). Laughrey and Harper are tentatively calling their study *Oil and Gas Reservoir Rocks of Pennsylvania.* It is scheduled to be completed by December, 1986, with probable publication in 1987. The book should provide operators with a comprehensive guide to geological appraisal of Pennsylvania's reservoir rocks and make available fundamental data for planning profitable exploration and expoitation programs.

Mahantango Conulariid Considered a Hyolithid

by Loren E. Babcock
Department of Geology
Kent State University

An unusual fossil shell from the ancient seas that once covered central Pennsylvania is now believed to have been misidentified. Proper identification will provide a more accurate interpretation of the oceanic and geologic conditions which existed at the time that the particular life form roamed the sea bottom.

Conulariids, which are invertebrates of uncertain affinities, are among the most unusual of Paleozoic fossils found in Pennsylvania. Although they are known from nearly all marine facies types, their remains are generally scarce. Moreover, because of morphological similarities to other organisms, they are easily confused with other fossils, giving us a false impression of their stratigraphic and geographic distributions.

Ellison (1965, p. 48, pl. 4, fig. 1) figured and described a small conoidal fossil from the Frame Shale Member of the Mahantango Formation (Middle Devonian: Givetian) at Huntingdon, Pennsylvania. The specimen was described as "*Conularia* sp." As far as I can determine, it is the only published record of a conulariid from the Mahantango Formation. The specimen (Figure 1) is in the United States National Museum of Natural History (USNM 173928). Reexamination of this specimen shows that it is a hyolith rather than a conulariid. Hyoliths are conical-shaped Paleozoic mollusks.

The fossil has a compressed conical shape, 14 mm in length, and is preserved in dark gray shale. The apex is slightly rounded, and the edges diverge at 26 degrees. Marginal areas are flattened and separated from the more convex central region by narrow grooves. An irregular line is prominent along most of the specimen near the line of bilateral symmetry. This feature seems to be a crack resulting from compression, not a median groove as interpreted by Ellison. Ornamentation consists of fine smooth lines that are closely spaced and uniformly curved, concentric about the apex.

I interpret the specimen as a hyolith having the dorsal side exposed. Compaction of the sharp carina has cracked the specimen, but because the specimen expands aperturally, the apical region

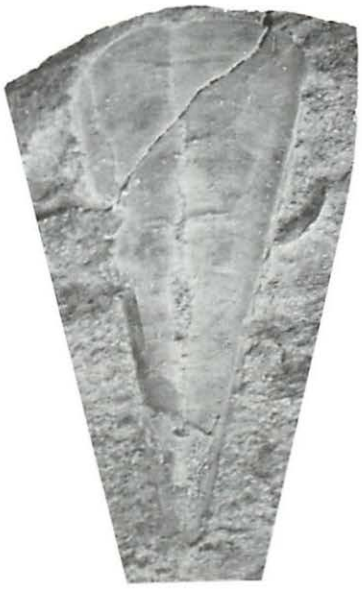


Figure 1. *Hyolithes* sp. from the Frame Shale Member, Mahantango Formation (Middle Devonian) at Huntingdon, Huntingdon Co., Pennsylvania. View of dorsal side, x5. USNM no. 173928.

Figure 2. Hypotypes of *Conularia congregata* Hall from the "Ithaca Beds"(Upper Devonian) near Ithaca, New York, x1. New York State Museum no. 3483. Inarticulate brachiopods are attached to the integuments of the conulariids.

does not show as much crushing. There is no evidence of a "corrugated" pattern of transverse lines, an important characteristic of conulariids (Figure 2). Interspaces are not crossed by bars or striae. The aperture is intact, and forms a broad arcuate ligula; conulariids typically show bluntly subtriangular terminations on each face.

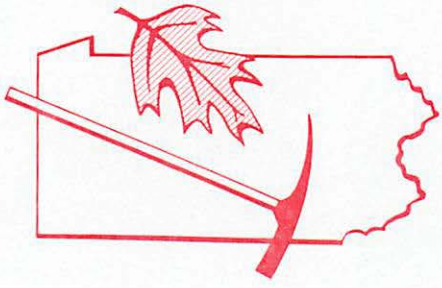
On the basis of general size and shape, it is easy to imagine how this particular fossil might be identified as a conulariid. Because the specimen has been broken by compaction, this individual even appears to have a median line, a feature which would have suggested that the animal was four-sided. Moreover, the ligula, which is the curved apertural extension of the dorsal side of a hyolith, mimics the so-called "apertural lappets" of a conulariid.

Although this reported occurrence of a conulariid has turned out to be spurious, conulariids may be present in the Mahantango Formation, as they are in other Paleozoic strata of Pennsylvania. Much remains to be learned about the nature of the conulariids of Pennsylvania and elsewhere; little is known with certainty about the biology and stratigraphic distribution of this group of animals.

Reference

Ellison, R. L. (1965), *Stratigraphy and paleontology of the Mahantango Formation in south-central Pennsylvania,* Pennsylvania Geological Survey, 4th ser., General Geology Report 48, 298 p.

REMEMBER THE 50th FIELD CONFERENCE OCTOBER 3-5, 1985



PENNSYLVANIA GEOLOGICAL SURVEY STAFF

Arthur A. Socolow, *State Geologist*
Donald M. Hoskins, *Assistant State Geologist*

TECHNICAL SERVICES

Shirley J. Barner, *Stenographer*
Sandra Blust, *Librarian*
Christine M. Dodge, *Geologist Supervisor*
James H. Dolimpio, *Draftsman*
Mary A. Ingream, *Stenographer*
John G. Kuchinski, *Draftsman*
Denise W. Royer, *Geologist-Editor*
Geary L. Sarno, *Draftsman*
Marjorie Steel, *Stenographer*
Janet L. Wotring, *Clerk Typist*

ENVIRONMENTAL GEOLOGY DIVISION

John P. Wilshusen, *Division Chief*
Mari G. Barnhart, *Clerk*
Helen L. Delano, *Geologist (Pittsburgh Office)*
Thomas A. McElroy, *Hydrogeologist*
Nikki L. Shatto, *Clerk Typist*
Michael W. Smith, *Hydrogeologist*
Donna M. Snyder, *Stenographer*
Larry E. Taylor, *Hydrogeologist Supervisor*

GEOLOGIC MAPPING DIVISION

Thomas M. Berg, *Division Chief*
Clifford H. Dodge, *Geologist*
Rodger T. Faill, *Geologist*
Albert D.Glover, *Geologist*
Jon D. Inners, *Geologist*
David B. MacLachlan, *Geologist*
James G. Phillips, *Geologist*
Linda Polk, *Clerk Typist*
William D. Sevon, *Geologist*
James R. Shaulis, *Geologist*
Viktoras W. Skema, *Geologist*
John H. Way, Jr., *Geologist*

MINERAL RESOURCES DIVISION

Robert C. Smith, *Division Chief*
John H. Barnes, *Geologist*
Samuel W. Berkheiser, Jr., *Geologist*
Leslie T. Chubb, *Laboratory Technician*

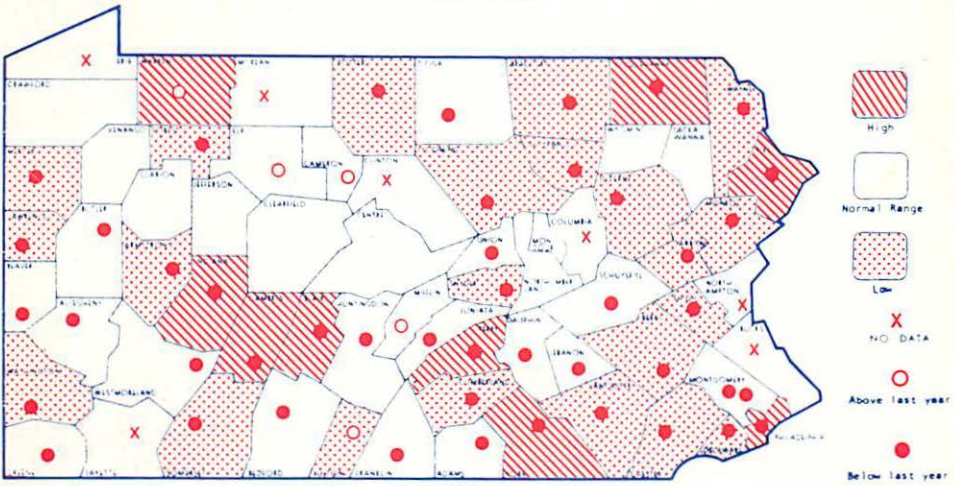
OIL AND GAS GEOLOGY DIVISION

7th Fl., Highland Bldg.
121 S. Highland Ave.
Pittsburgh, PA 15206
John A. Harper, *Division Chief*
Lajos Balogh, *Draftsman*
Cheryl Cozart, *Statistical Asst.*
Robert Fenton, *Laboratory Technician*
Robert M. Harper, *Geologist*
Joseph E. Kunz, *Clerk Typist*
Christopher D. Laughrey, *Geologist*
John Petro, *Draftsman*

TOPOGRAPHIC DIVISION
In Cooperation with The U.S. Geological Survey

GROUND WATER DIVISION
In Cooperation with The U.S. Geological Survey

GROUNDWATER LEVELS
FOR
MAY 1985



Bureau of Topographic and Geologic Survey
Dept. of Environmental Resources
P.O. Box 2357
Harrisburg, Pa. 17120

Address Corrections Requested