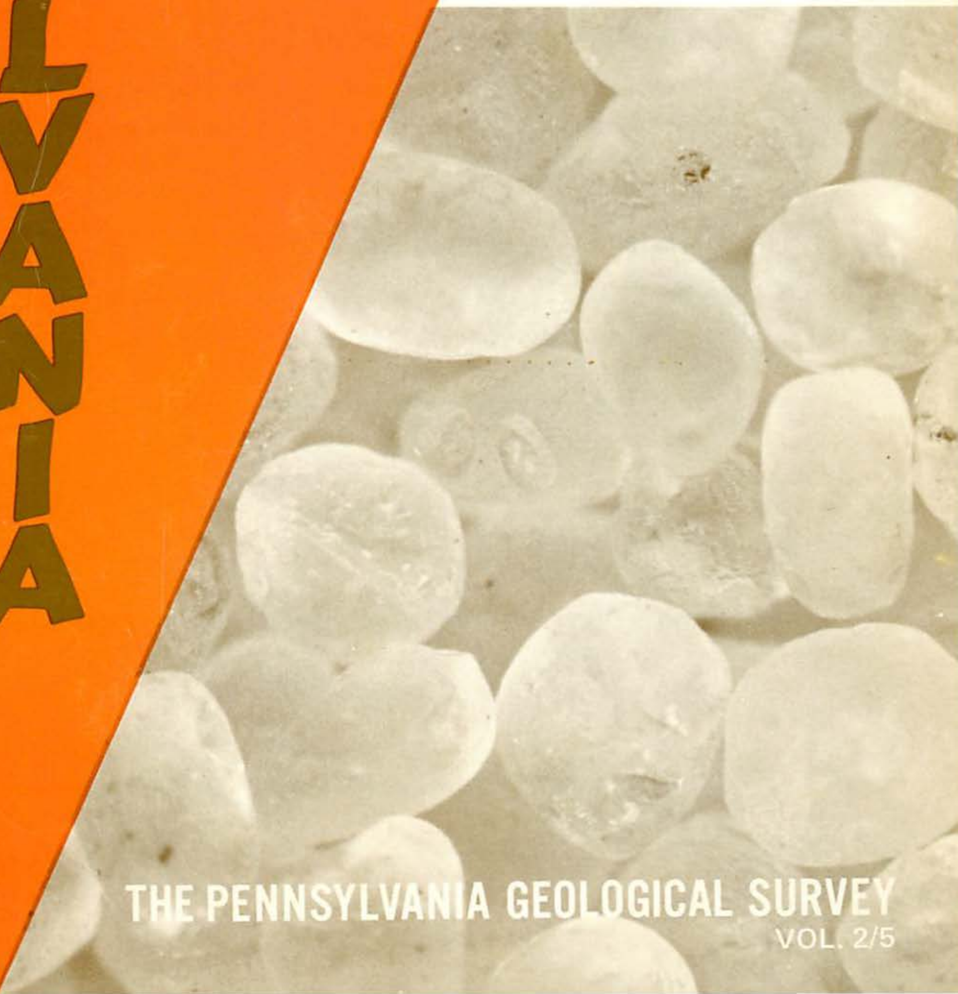
# PENNSYLVANIA GEOLOGY



THE PENNSYLVANIA GEOLOGICAL SURVEY

VOL. 2/5

COMMONWEALTH OF PENNSYLVANIA
Milton J. Shapp, Governor

DEPARTMENT OF ENVIRONMENTAL RESOURCES

**Topographic and Geologic Survey**
Arthur A. Socolow, State Geologist

## CONTENTS



ON THE COVER – Highly magnified sand grains show a high degree of rounding and frosted surfaces indicative of having been transported by wind. Grain shape is a factor which controls the possible economic use for the sand (Photo courtesy of David E. Snell, College of Earth and Mineral Sciences, The Pennsylvania State University.)

**PENNSYLVANIA GEOLOGY** is published bimonthly by the Topographic and Geologic Survey, Main Capitol Annex, Harrisburg, Pennsylvania, 17120.

OCTOBER 1971

## FROM THE DESK
## OF THE
## STATE GEOLOGIST . . .

### WE CAN HAVE OUR CAKE AND EAT IT TOO

This bulletin carries two articles of significant interrelationship: the story of Pennsylvania's high national ranking as a mineral producer and the report on the Commonwealth's membership in the Interstate Mining Compact Commission aimed at guiding the state's development of mining regulations. To these news developments concerning the mining industry might be added the progress of the current All Surface Mining Bill in the Pennsylvania Legislature, and a similar federal bill in Washington which is undergoing committee hearings.

The reports of Pennsylvania's increased mineral production and that of state and federal moves to regulate mineral production suggest opposing economic-social forces. Yet each of these is so vital to our society that it is an urgent necessity that we arrive at a reasonable modus vivendi.

On one hand we have Pennsylvania's annual production of a billion dollars worth of raw minerals each year which not only provides over 10 million man days of work, but also furnishes the vital fuels to heat our homes and drive our machinery, as well as the raw materials to build our houses, factories, roads, and appliances we demand as part of our way of life. More mineral fuels, whether they be coal, oil, gas, or atomic, are needed to keep up with the energy demands by our vehicles, homes, and industries. Industrial minerals are needed to supply our factories so we may continue to have tools, glassware, vehicles, stoves, refrigerators, utensils, drugs, etc. Construction minerals are necessary to supply the concrete, brick, stone, roofing, etc., needed to build our homes, roads, schools and factories.

On the other hand those vital mineral needs cited above must not be accomplished heedless of the environmental impact. We can no longer accept physical and chemical pollution, nor surface degradation as by-products of mining. People in all walks of life, including most of the mineral industry as well as government officials, are recognizing and acknowledging that to maintain the vital mineral industry and our standard of living, we must take the necessary steps to make it compatible with a quality of life that is acceptable.

And so, the stories of Pennsylvania's high mineral production, and of the Mining Compact, and of state and federal mining legislation are not incompatible. We must make them compatible so that responsible mining can continue. We need to have our cake and eat it too.

Arthur A. Socolow

# PENNSYLVANIA MINERAL INDUSTRY CONTINUES GROWTH

The mineral industry of Pennsylvania showed an 8 percent increase in total production value for 1969 over that for 1968. The 1969 mineral production value in Pennsylvania was $976.4 million and accounted for nearly 10 million man days of work during the year. This figure places Pennsylvania as the fifth largest mineral producer in the nation, and the largest producing state east of the Mississippi River. Pennsylvania's mineral production for 1969 was 2.7 times the dollar value of her other major natural resources, forestry and agriculture.

Coal, cement, and stone were the major commodities produced. Mineral fuels (coal, oil, and natural gas), accounted for 63 percent of the overall production value; nonmetals accounted for 34 percent and metals 3 percent. The total annual coal tonnage was greater than the previous year. However, anthracite tonnage decreased by 9 percent but its market value increased from $97.3 million (1968) to $100.8 million (1969). Both the production and value of bituminous coal increased in 1969. The value of all coal mined was $562.4 million, accounting for 58 percent (versus 55 percent in 1968) of the state's mineral income.

Washington County was the leading mineral producer in the state, followed by Greene County. Coal accounted for $95 million worth of Washington County's value plus an undisclosed value for stone and clays. Greene County's $90 million of production all was from coal. Northampton County was third with $61 million production of cement, stone, sand-gravel, and slate. Schuylkill county was the leading producer of anthracite coal and Washington County for bituminous coal.

Nine hundred eighty-six new oil and gas wells were drilled during the year. Indiana County continued to be the most active natural gas area, with 121 successful wells completed. Northampton, Centre, Montgomery, and Bucks counties continued to be the leading producing counties of cement, lime, stone, and sand-gravel respectively. Clay was produced in 28 counties, led by Clearfield and Lawrence counties.

Review of the mineral industries data collected by the U. S. Bureau of Mines for the nation as a whole reveal many interesting facts about Pennsylvania. For example, the anthracite summary pertains exclusively to Pennsylvania, for Pennsylvania is the only state commercially mining anthracite. The only domestic source of cobalt (a by-product from pyrite concentrate) is Pennsylvania. Pennsylvania's only zinc mining district is areally limited to a few square miles, but is has been an intermittent zinc mining district since 1845; presently only one mine is working, the Friedensville Mine, Lehigh County, yet this mine produced nearly 1 percent of all zinc mined in the United States during 1969. Cobalt, copper, gold, and silver, present as accessory minerals in the iron ores being mined in Berks and Lebanon counties, are extracted and contribute to the mineral wealth of the state.

In 1969 Pennsylvania was the nation's leading producer of stone, second among all states in both value and tonnage for lime and cement, second in value of clay mined, and third in total tons of bituminous coal produced.

Detailed data on Pennsylvania's mineral industry is contained in the Pennsylvania Geological Survey's new Information Circular 71, **The Mineral Industry of Pennsylvania in 1969.** This booklet may be obtained at no cost from the Pennsylvania Geological Survey at Harrisburg.

## PENNSYLVANIA IS MINING COMPACT MEMBER

Pennsylvania is a charter member of the newly organized Interstate Mining Compact Commission. The Commission formally came into existence at a meeting at Raleigh, North Carolina, on April 27, 1971. Representatives of the four charter member states were in attendance: Kentucky, Pennsylvania, North Carolina, and Oklahoma. Also present were representatives of eleven non-member states which are considering membership and which contributed to the organizational discussion. At the organizational meeting, Dr. Arthur Socolow, State Geologist and Director of the Pennsylvania Topographic and Geologic Survey, represented Governor Milton Shapp. At the April meeting Governor Louie Nunn of Kentucky was elected Chairman of the Commission for the year, and Governor Robert Scott of North Carolina was elected Vice-Chairman.

At the organizational meeting it was emphasized that the purpose of the Interstate Mining Compact Commission is coordination and exchange of surface mining information and developments among the states. It was stressed that the Commission, patterned after the long-established Interstate Oil Compact Commission, is not intended nor organized as an interstate regulatory body. Rather, each state will have an opportunity to learn and benefit from the experiences of the others, and where practical, the states will strive individually to develop uniform standards and practices. Current emphasis of the Commission, in recognition of needs, is placed on the subject of reclamation of mined lands. However, this will only be part of the overall program of the Commission.

It was agreed at the organizational meeting that for the time being, the secretarial and staff work of the Commission would be performed by the office of the Council of State Governments, located in Atlanta, Georgia, under the direction of Herbert L. Wiltsee, Manager.

## THE EAGLE FLIES AGAIN

Perhaps you have noticed: a new marble eagle is back on the Federal Building in Harrisburg at the Walnut Street entrance. The old eagle never quite took flight. The Pennsylvania Geological Survey had examined the original marble and found that its failure under the sculptor's tools was a result of its coarse grain size and very small fractures. We suggested that the sculptor go to the source (Vermont) to select his marble. He did just that; in fact he sculpted it in the quarry and then shipped it to Harrisburg. Hopefully our new marble eagle will have a flawless flight through the years.

## CHANNEL SANDSTONES IN COAL

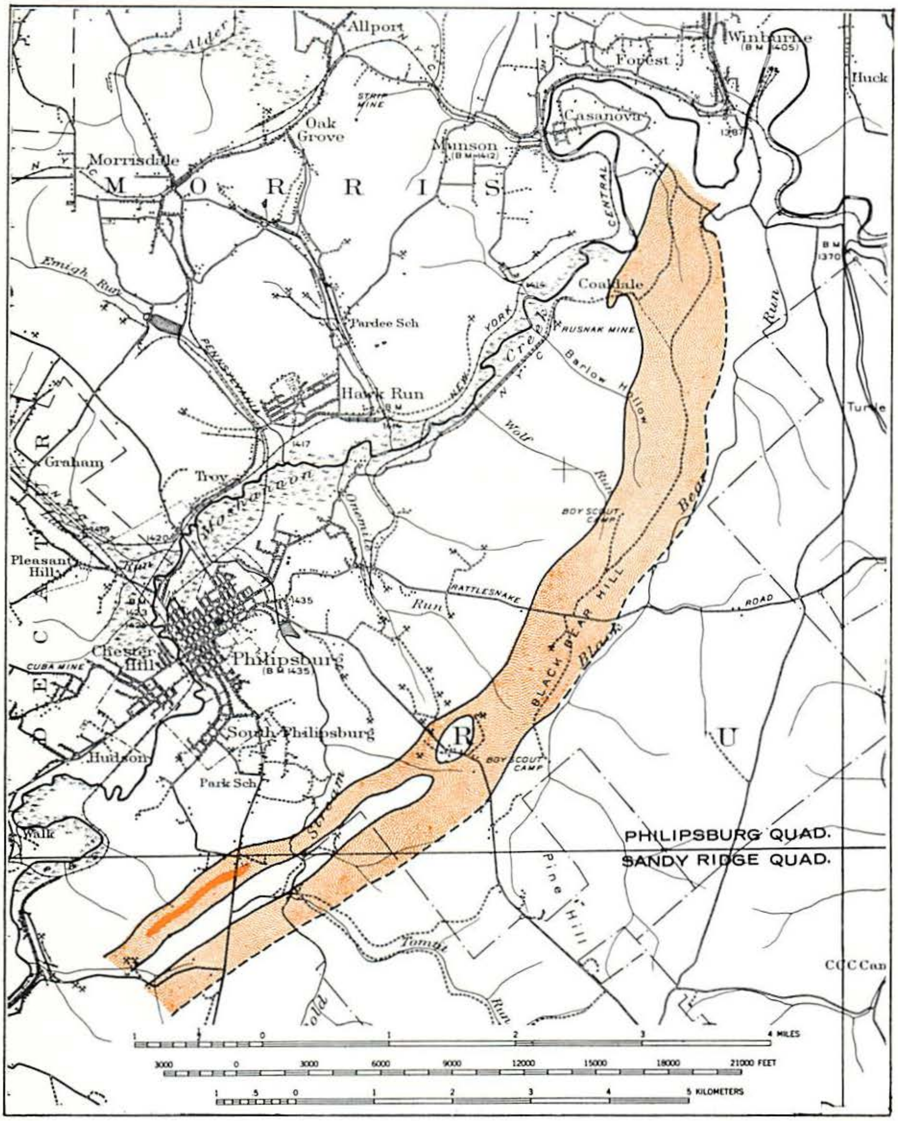
Fluvial sandstones, variously called channel or shoestring sandstones, are quite common in the bituminous coal measures of Pennsylvania. The Kittanning sandstone in a portion of Centre County, provides an excellent example of the basic geometry and behavior of one of these fluvial sandstone units. Geologic mapping of the Philipsburg 7½-minute quadrangle showed that there were enough surface exposures of the Kittanning sandstone to delimit its occurrence and trend in that area.

As the Kittanning sandstone overlies the Clarion coal, the technique used to outline the boundaries of the sandstone required only identification of the rock type immediately overlying the Clarion coal (roof rock). This was done wherever it was exposed in road cuts or strip mines. The stipled pattern on the accompanying map represents that area where the Clarion coal seam is directly overlain by the Kittanning sandstone. Solid colored areas are where the sandstone channel has cut out the coal. Clear white areas east and west of the stipled pattern and at places within it, indicate where the sandstone gradually rises up to 30 feet above the coal. In these white zones, shale occupies the interval between the sandstone and the coal. This shale roof rock thickens rapidly at first then gradually with greater distance from the stipled area at the expense of the Kittanning sandstone which rises and thins as the shale thickens. The extension of this sandstone's occurrence into the Sandy Ridge 7½-minute quadrangle is based on drill hole information supplied by Rushton Coal Mining Company, Inc. which operates the Rushton mine on the Clarion coal in this area.

This narrow, sinuous, northeast-southwest trending sandstone is the remnant of an ancient southerly flowing river through this region. During the process of erosion, this stream cut a 30 to 50 foot deep, relatively flat-bottomed valley into the shales that normally overlie the Clarion seam. The width of the valley ranged from 0.5 miles to 0.8 miles across although in the Sandy Ridge 7½-minute quadrangle, it bifurcated into two narrower channelways that left a shale island between them. The sandstone is known to continue its general trend to the southwest into the Houtzdale 7½-minute quadrangle while its northeastern continuation is less clear but nonetheless predictable.

As this river matured, it deposited sands and gravels in its original valley in place of the eroded sediments. The Kittanning sandstone is the consolidated remnants of those sand and gravel deposits. Its three-dimensional shape reflects the original position and cross-section of the ancient river valley. The outside edges of the stipled area approximate the position of the valley walls.

In the Rushton mine, the main channel of the stream occasionally cuts through the Clarion coal and into the older underlying rocks (solid colored area on map). The width of the cut-out ranged between 100 and 300 feet. Similar




cut-outs of the coal can be expected to occur at other points along the course of the stream. Since the sandstone now fills the ancient river valley from bank to bank, it obviously occupies the original position of the Clarion seam in these cut-outs. The coal is, of course, present at or near the same level on both sides of such a "rock fault".

"Rock Faults" are not uncommon in the mining history of the area or for that matter in Pennsylvania's coal measures in general. Since mechanical mining equipment is not designed to cut through these hard sandstone bodies, the cut-outs pose an especially formidable obstacle to modern underground coal mining. This mechanical equipment is often seriously damaged by impact with unsuspected sandstones of this type. Additionally, costly rock headings (tunnels) often must be driven through the sandstone to reach coal acreage on the other side of a cut-out. Even when a channel sandstone merely overlies a coal seam, it is quite likely to produce adverse roof and water conditions.

Although the fluvial-type sandstone is common, it is not the only type of sandstone unit that occurs in the coal measures. Many sandstones do not occupy old river channels and consequently are not found to replace or cut-out the coal seams as in the above example. A fluvial-type sandstone must be identified as such, whenever possible, so that its potential effects on mining can be anticipated and so that predictions of its course through adjacent properties can be made. Only when the position of such a sandstone body is known in advance can a mine be laid out to minimize the sandstone's effect on the mine's operation and development.

Gary B. Glass

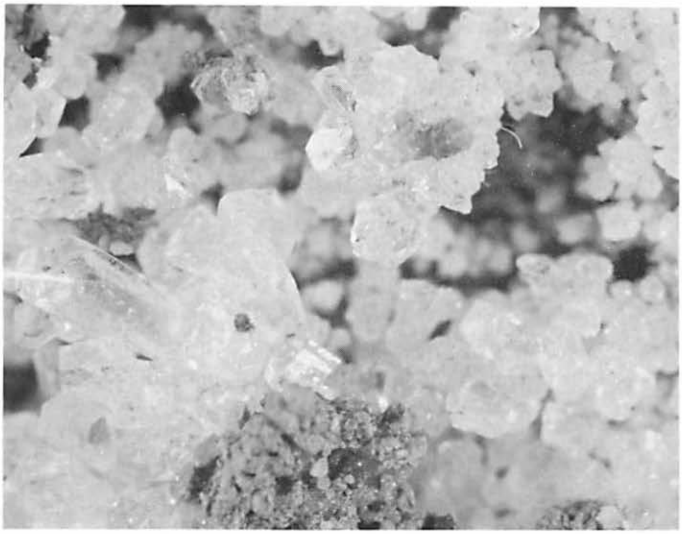
## RARE MINERALS FOUND IN PENNSYLVANIA

A recent article in **Pennsylvania Geology** (Lapham, 1971) described an interesting new occurrence of native sulfur in Schuylkill County at the Kehley's Run Mine, a burning anthracite strip mine near Shenandoah Heights. Additional work has now revealed some exciting finds of rare micro-crystals.

The mineral collector who discovered this sulfur, Mr. Wayne Downey of Harrisburg, has since that time made several more trips to the mine area and has returned with additional specimens for study. These specimens were analized optically and by means of X-ray diffraction by the Pennsylvania Geological Survey. Some of them have never before been reported from Pennsylvania or from eastern North America.

The most common mineral found at Kehley's Run Mine, other than native sulfur, is salammoniac, composed of ammonia and chlorine. This mineral forms as a clear or white crystalline crust on exposed rock surfaces, deposited by fumes from the burning coal. According to Samuel Gordon's **Mineralogy of Pennsylvania** (1922), this mineral has been found previously in Pennsylvania only at the Burning Mine at Summit Hill in Carbon County. Outside the Commonwealth, it is commonly found associated with volcanic fumaroles, and has been found at burning coal mines in Germany, France, and England (Palache et al, 1951).

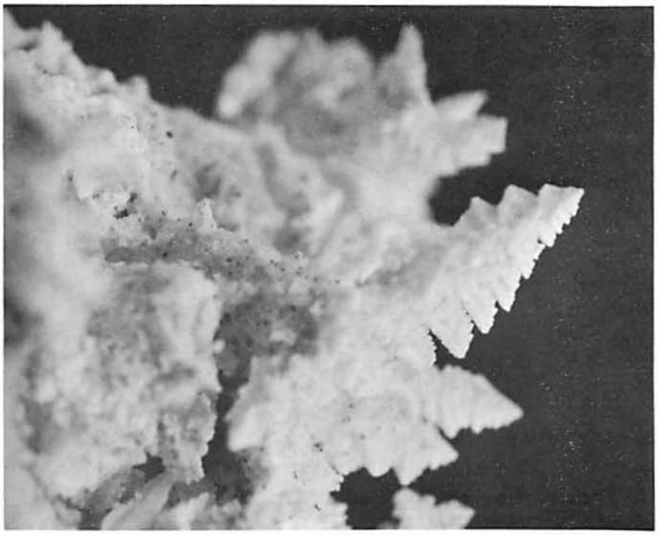
Two less common minerals at this site are cryptohalite and bararite, both of which are forms of ammonium silicon fluoride. The cryptohalite is considerably more abundant than the bararite, and forms crystals similar to salammoniac. Indeed it is almost impossible to tell them apart visually. The bararite is present only as tiny crystals which are usually at least partially enclosed by the cryptohalite crystals. Neither of these minerals has been reported previously from a Pennsylvania locality. According to Palache, et al (1951) the only other known occurrences of these two minerals are at Mt. Vesuvius in Italy, and at burning coal mines in India and Bohemia.



SALAMMONIAC

Still another rare mineral at Kehley's Run Mine is mascagnite, which is an ammonium sulfate. This mineral occurs as small pale-yellowish needles, in small clear needles, and as large, feathery aggregates of crystals. This mineral is another which has not been previously reported from Pennsylvania. Palache, et al (1951) reported that it is found associated with volcanic fumeroles in Italy and the Congo, and at burning coal mines in France, England, Scotland, and Czechoslovakia. In the United States, the only other occurrence is at the Geysers in Sonoma County, California where mascagnite occurs as a thick crust rather than

MASCAGNITE



as individual crystals. This occurrence in Pennsylvania has proven to be of such interest that the Smithsonian Institution in Washington, D.C., has obtained a sample collected by Mr. Downey and identified by the Survey for its collection.

Other material found at Kehley's Run Mine includes small cubes of galena, lead sulfide, which is coated with an irridescent blue film. Other minerals found here are kaolinite, quartz, and hematite. Other rare minerals occur in such small quantities intermixed with those described that their identification has not proved possible.

The Kehley's Run Mine is now closed to mineral collectors as new efforts are under way to extinguish the fires. However, during the short interval from the discovery of this location until it was closed, a rare opportunity was provided for collectors in eastern Pennsylvania to obtain specimens which would be an outstanding addition to any collection and to advance our scientific knowledge of these rare species.

John Barnes
Davis Lapham

## REFERENCES

Gordon, S. G. (1922), **The Mineralogy of Pennsylvania,** Academy of Natural Sciences of Philadelphia Special Publication No. 1, 255 p.

Lapham, D. M. (1971), **Native Sulfur in Pennsylvania.,** Pennsylvania Geology, v. 2, n. 1, p. 14-15.

Palache, C., Berman, H., and Frondel, C. (1951), **Dana's System of Mineralogy, Volume II.** John Wiley and Sons, Inc., New York, 1124 P.

## MINERALS AND MINERAL LOCALITY PRESERVATION

A new international society recently has been establihsed for both professional and amateur mineralogists, with an emphasis on bridging the gap between the scientist and the collector. The society is called the Friends of Mineralogy. Articles and news items are published in the excellent new magazine, the Mineralogical Record (P. O. Box 783, Bowie, Md. 20715). One of the important functions of the new society will be to gather data on and preserve important mineral collecting localities all over the world. The exact locations of some localities have become lost; for others, the mineralogy is not adequately described. Entry to some is not permitted or soon will become closed for a variety of reasons. The Minerals Preservation Committee, presently chaired by Dr. Davis Lapham of the Pennsylvania Geological Survey, is now beginning work on these problems. The ideas and cooperation of all who are interested in mineral and mineral locality preservation are welcomed. Information about the FM Society may be obtained by writing to Mr. Richard Bideaux, 1242 W. Pelaar Street, Tucson, Arizona, 85705.

# STRATIGRAPHIC FRAMEWORK OF PITTSBURGH AREA ON OPEN FILE

In January, 1971, the Pennsylvania Geological Survey in cooperation with the U.S. Geological Survey began a study of the environmental geology of the Pittsburgh area; the Pittsburgh area includes Allegheny County and the five surrounding counties of Beaver, Butler, Armstrong, Westmoreland, and Washington. The initial project of the study was the preparation of a stratigraphic framework of the surface and nearsurface rocks. This will serve two purposes: first, the stratigraphic data on the nature and distribution of the various rock types in the area will be of use in succeeding phases of the environmental study, and second, stratigraphic data in the form of cross sections illustrating the vertical and horizontal relationships of the rock strata will be a valuable guide to anyone engaged in excavation, construction, or drilling in the area.

The part of the stratigraphic framework which has been completed is entitled **Stratigraphic Framework of Greater Pittsburgh Area - Part 1. Allegheny, Washington, Beaver and southern Butler Counties,** by W. R. Wagner, D. R. Kelly, and W. S. Lytle. The report consists of four cross sections (vertical scale 1" = 50') which show the distribution of rock types from the surface to a maximum depth of 2,000 feet. The stratigraphic interval ranges from the Mississippian Burgoon Sandstone Member of the Pocono Formation to the Pennsylvanian and Permian Dunkard Group. The rock types shown are coal, shale, claystone, siltstone, sandstone, and limestone. The data used in assembling the cross sections have been obtained from three main sources: 1) core hole descriptions from coal companies and engineering firms, 2) sample descriptions and gamma-ray logs from wells drilled for oil and gas, and 3) measured outcrop descriptions.

This report, consisting of four cross sections (6 sheets each 36" x 60"), 13 pages of text, five figures, and one table is on open file at the following offices:

Pennsylvania Geological Survey
401 Pittsburgh State Office Building
300 Liberty Avenue
Pittsburgh, Pennsylvania 15222

U. S. Geological Survey
102 East Mall (Second Floor)
P. O. Box 420
Carnegie, Pennsylvania 15106

The report is available for examination at the offices listed above and copies of the report will be made available at the expense of the individual.

Part 2 of the stratigraphic framework covering Armstrong, Westmoreland, and northern Butler County is currently being compiled and will be available late in 1972.

# KINK BAND FOLDING IN CENTRAL PENNSYLVANIA - I. KINK BANDS.

One of the most important responsibilities of survey geologists is to describe the different rocks in project areas and show their detailed distribution on a map. In the course of gathering raw data in the field, a geologist often notices features which may answer more fundamental geologic problems. Solution of these basic problems provides explanations for otherwise perplexing geologic relations, thereby enabling the geologist to make more accurate descriptions of the geology as well as expediting his and other mapping projects. An example of this is the recognition of kink bands in the Valley and Ridge province in central Pennsylvania and their incorporation into a structural geologic model which explains the distinctive fold geometries that are reflected by the long, parallel ridges and valleys in central Pennsylvania. This model revises the existing concepts of the rock deformation that occurred more than 200 million years ago in this part of Pennsylvania. The "Kink band" model will be explained in a series of articles, or which this is the first, which will be continued in future issues of Pennsylvania Geology.

A kink band is a relatively simple geologic structure. It consists of a (usually) parallel-sided zone of rock that has been rotated relative to the rocks outside of the zone (Fig. A, and B). The bending of beds occurs only at the boundaries of the kink band, which are called the kink planes. The beds between the kink planes are not bent, but only rotated, and thus they have remained planar and parallel. The axis around which the beds have been rotated is the kink

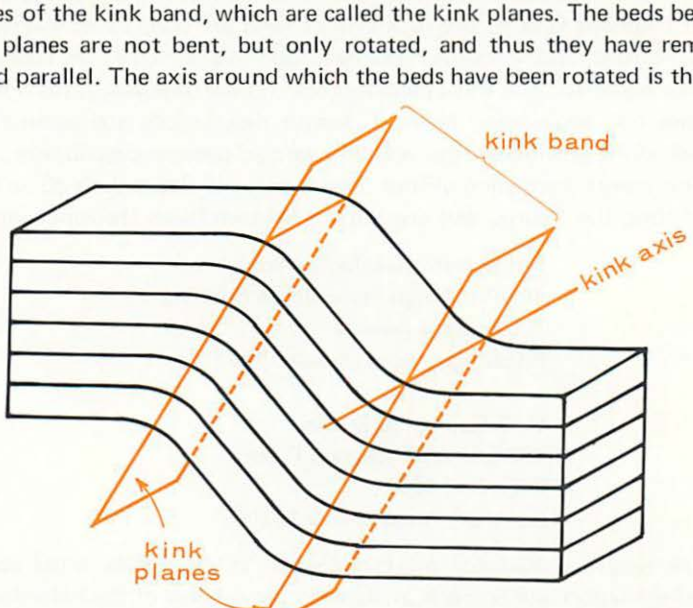



Figure A. Idealized kink band illustrating kink planes and kink axis. Kink band consists of rotated beds between the kink planes.

Figure B. Kink band in Silurian Rose hill Formation, 2 miles southwest of Lewistown, Pa., along Pa. Route 103.

axis, and this axis is analogous to the fold axis of a fold. Although the beds outside the kink planes are not part of the kink band, the kink band exists only in relation to these enveloping rocks, in much the same way that a fault exists only in relation to the rocks on each side of the fault.

Kink bands generally lie at a large angle to the enclosing bedding and represent a shortening of the rocks parallel to the major direction bedding. Experimental work has shown that kink bands develop only when the maximum principal stress is parallel, or nearly parallel, to the bedding.

Previously described kink bands from other areas are small (1 to 2 inches). Kink bands of this size occur in the Valley and Ridge province (Fig. C), but most of them are much larger (Fig. B). The factor that seems to control the size of a kink band is the thickness of the bedding layers. Small kink bands are able to develop in very thin bedded rocks, whereas in thicker bedded rocks, the kink bands are larger. Few very large kink bands are seen because outcrops are generally not large enough to show the entire breadth of the kink band and the enveloping rocks. The occasional exposures of very large kink bands are often impressive (Fig. D).

Figure C. Small kink band in Silurian Wills Creek Formation, in Little Pfoutz Valley, 2 miles north of Millerstown, Pa.

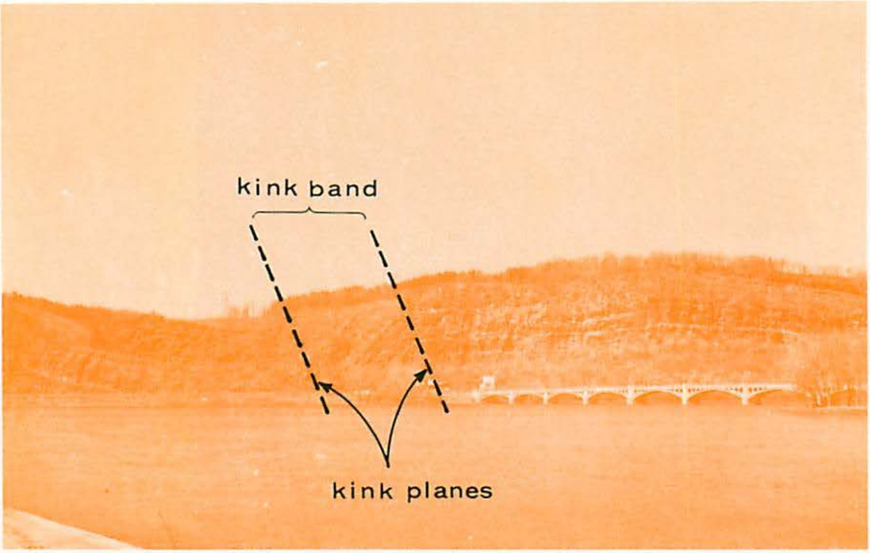


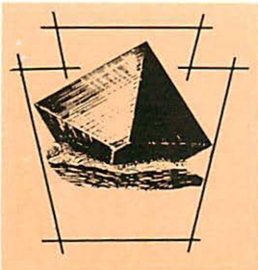

**Figure D.** **Large kink band in Devonian Catskill Formation on west bank of Susquehanna River, opposite Northumberland, Pa.**

Thus kink bands, previously unreported for this area, occur in the Valley and Ridge province ranging in size from small to very large. But the mere presence of kink bands in this folded terrain is not their primary significance. What is significant is that common geometrical elements exist between the kink bands and the folds. Valley and Ridge folds have usually been thought of as concentric folds, but detailed mapping has shown that they possess planar bedding in the limbs and narrow fold hinges, a geometry not consistent with concentric folds. In contrast, the planar geometry of the folds is similar to the planar quality of the kink bands. This, in addition to the large size of many kink bands, suggests that the kink bands and folds are intimately related. Just how folds are generated from kink bands will be discussed in a subsequent article.

Rodger Faill

# NEW SURVEY PUBLICATIONS

IC71 **The Mineral Industry in Pennsylvania in 1969** by C. Gordon Leaf (20 p. 2 figs.) Free



# EARTH SCIENCE TEACHERS' CORNER

## u.s.g.s. leaflet series

Several new U. S. G. S. leaflets have been added to this popular geology series. The emphasis still appears to be on water with the release of two additional pamphlets on the subject:

"the Amazon - measuring a mighty river", 15 p.
"Glaciers - a water resource", 23 p.

These leaflets are available from the U. S. Geological Survey, Distribution Section, 1200 South Eads Street, Arlington, Virginia, 22202, free of charge.

## pennsylvania and apollo 15 moon rocks

Two of the most exciting aspects of the most recent lunar exploration involved the search for rocks older than 3.5 billion years and the search for a coarse-grained igneous rock representing an early magma (molten rock material). The oldest Moon samples which had previously been dated are believed to be about one billion years younger than the earliest formation of rock on the Moon. The hope was that a sample of anorthosite rock from the Highlands would be one of the oldest Moon rocks. Anorthosite, a rock composed almost wholly of plagioclase feldspar, was predicted for the Highlands from a study of Apollo 11 Moon samples. Thus, when Scott and Irwin found what they believed to be anorthosite, excitement on the Moon and the Earth ran high.

Anorthosite is not a common rock. Most occurrences on Earth are very old, an age of about 1.0 billion years or older. Anorthosite occurs in Pennsylvania a few miles north of Coatesville and nowhere else in the state. (Its occurrence is shown on our Pennsylvania State Geology Map). Its exact age in Pennsylvania has not been measured to date. However, it is associated with rocks at least 600 million years old. Indeed, the Pennsylvania anorthosite may be as old as the oldest dated rocks in the state, which are from the Baltimore Gneiss Formation in Chester County, found to be 1.1 billion years old. The old age of Earth anorthosites and their origin by crystallization from a molten magma at depth are prime reasons for believing they will clue us in to the early history of the Moon. Consequently, Pennsylvania rocks have played a small but important part in theories leading to the development of our Moon exploration program.

# MAN AND HIS GEOLOGICAL ENVIRONMENT

Throughout history and throughout the workd there are many examples of geologic hazards which have affected the activities of man. In Quebec recently a housing development subsided and people were killed as the result of building the housing development on sensitive clay. In Italy, Vesuvius exploded nearly 2000 years ago and preserved a city for the ages. In Beaver County, Pennsylvania a housing development was nearly destroyed because a mine subsided. In addition there are many other potential geologic hazards in the world including floods, landslides and water pollution. Most of these disasters could have been avoided with adequate geologic investigation.

The man who can adequately make this investigation is the engineering geologist. A geologist is a man who studies the earth. He is a scientific detective. In order to become a geologist he must have a background in all of the sciences including mathematics, biology, chemistry, physics and geology. He must also be well acquainted with our natural resources including coal, oil, metal ores and natural building materials. With adequate study the geologist is able to help society alleviate the problems of water pollution, mine subsidence and even volcanic eruptions. In many areas there is a need to use the geologist in the evaluation of sites for proposed construction projects.

The geologist investigating a building site must first evaluate all of the geologic information available in the area. For that reason a broad base of geologic information is especially valuable. He can get this information from private sources, the U.S. Geological Survey and state surveys.

After evaluating the available geologic data, the geologist must then evaluate the engineering problems that may be encountered in the construction of the project. How far down will rock be found? Where will groundwater be encountered? Will there be enough good quality groundwater to supply water or must water be supplied from outside the project? What will be the effect of this project on the environment? Will it cause landslides? Will it cause pollution? These are some of the questions that must be answered by the geologist.

After he knows the general geology of the area and the questions that must be answered, the geologist must then plan a way of finding the answers to the questions. He may drill holes to examine the rocks and determine their condition. Once the holes are drilled he may lower a camera into the hole to determine whether or not there are mine voids that will cause problems. He may use electrical methods to determine if limestone sinkholes are present, and if they are present how far they go. He may test the water in the area with chemical methods to determine if it is good enough for use on the project. After he has obtained his information, he will prepare his report for use in the construction of the project. Using the information he has obtained, he can predict and alleviate problems such as mine subsidence, landslides, water pollution, and flooding before construction and before these problems become serious and cause hundreds of thousands or even millions of dollars worth of damage.

What can the average man do? He can support broad geologic research to provide a basis for more detailed studies. He can insist on geologic investigations when projects such as housing developments are built. He can proceed with construction when geologic conditions are favorable or insist that geologic hazards are corrected before construction begins. Ultimately he can, when backed with geologic knowledge, stop the construction of projects which may be ecologically or economically unsound.

John A. Blair
Geologist
Michael Baker, Jr., Inc.

## OVER 2,000,000 TONS OF COAL FROM 8 IN PENNSYLVANIA

Eight of Pennsylvania's bituminous coal mines each produced more than 2,000,000 tons of coal in 1970. United States Steel Corporation's Robena mine in Greene County not only outproduced all other Pennsylvania mines but ranked as the 10th largest in the United States with an annual production of 3,873,000 tons of coal. United States Steel Corporation's Maple Creek mine was the second largest producer with 2,629,000 tons. Arranged in descending order, the remaining Pennsylvania mines producing over 2,000,000 tons of coal were: Rochester and Pittsburgh Coal Company's Jan Nos. 1 & 2 mines with 2,187,839 tons, Duquesne Light Company's Warwick mine with 2,186,453 tons, Consolidation Coal Company's Montour No. 4 mine with 2,176,000 tons, Mathies Coal Company's Mathies mine with 2,060,000 tons, Gateway Coal Company's Gateway mine with 2,049,000 tons and C & K Coal Company's Fox mine with 2,036,000 tons.

C & K Coal Company's Fox mine, which was the only open pit operation to exceed the 2,000,000 ton mark, ranked 40th in production nationally.

Gary B. Glass

## COW DUNG PLUS GLASS EQUALS BRICK!

When California ranchers turned to the University of California to help them find a way to dispose of their cow dung, few would have expected that it would have also resulted in a way to dispose of old bottles as well. J. D. Machenzie of the UCLA School of Engineering's Materials Department found a way to combine these two waste materials to make ceramic planks and bricks. The glass and dung ceramic is like styrofoam in looks and weight, is a good insulator, won't soak up water, won't burn, won't smell, can be painted and glazed, drilled and sawn, and can be glued or nailed together like wood. The mixture is between 5 and 10 percent dried cow dung, and the rest is finely powdered glass. The dung is subjected to a process that reduces it to a fine, black powder, mixed with powdered glass and heated at relatively low temperatures to produce boards or bricks. Machenzie says density can be controlled so accurately that the final product can be made to either float or sink in water.

Since Pennsylvania cows are superior, we foresee higher quality brick here by this method.

# SURVEY ANNOUNCEMENTS

## LYTLE APPOINTED AT PITTSBURGH

William S. Lytle has been appointed as Chief of the Oil and Gas Division of the Pennsylvania Geological Survey as well as geologist-in-charge of the Survey's Pittsburgh Branch Office. Bill Lytle succeeds Dr. Dana R. Kelly, who resigned to do oil and gas geology with private industry.

A graduate of the Pennsylvania State University, Bill Lytle is a veteran staff member of the Pennsylvania Geological Survey, with over 25 years of service. Bill is well known to the Pennsylvania oil and gas industry and is the author of a large number of technical publications on oil and gas in various parts of the state. For many years Bill has been the Pennsylvania representative in the Secondary Recovery and Pressure Maintenance Committee of the Interstate Oil Compact Commission. He is also our representative on the Ohio River Sanitary Commission, the National Petroleum Council, and several others.

In recent years Bill Lytle has been working on updating and revising the petroleum reserve calculations for Pennsylvania. Currently, he is also actively participating in the preparation of a stratigraphic framework for the Pittsburgh Regional Environmental Study Project.

We know that under Bill Lytle's direction the Pittsburgh office of the Survey will continue to effectively serve the needs of the oil and gas industry, as well as the citizens of the Greater Pittsburgh area.

## KUNKLETOWN QUARTZ LOCALITY OPEN TO COLLECTORS

We have been informed that the quartz crystal locality at Kunkletown is again open to mineral collectors. Permission must be obtained at the plant and a release signed. Collectors must then stop in at the quarry office and show that they have obtained permission.

This operation is now under the ownership of the Universal Atlas Cement Co., Mr. R. E. Miller, P. O. Box 29, Northampton, Pa. Initial permission must be obtained from this address before proceeding to the Kunkletown quarry.

The initiative for re-opening this locality was taken by Universal Atlas. We wish to thank them and Mr. Alton Dorshimer, Foreman at Kunkletown, for their courtesy and understanding. We hope all collectors will cooperate, act responsibly while on the property, and at all times take safety precautions to prevent accidents.

# PENNSYLVANIA GEOLOGICAL SURVEY STAFF

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

## ADMINISTRATIVE DIVISION

Shirley J. Barner, *Stenographer*
Linda M. Bechtel, *Stenographer*
Sandra Blust, *Librarian*
Joanne Bowman, *Typist*
Constance Grier, *Typist*
John G. Kuchinski, *Draftsman*
Virginia Milewski, *Draftsman*
Donna M. Snyder, *Stenographer*
Albert Van Olden, *Draftsman*
Vacant, *Stenographer*

John P. Wilshusen, *Editor*

## ENVIRONMENTAL GEOLOGY DIVISION

Alan R. Geyer, *Division Chief*

Mary E. Horne, *Geologist*
Vacant, *Geologist*
Vacant, *Clerk*
William G. McGlade, *Geologist*
Vacant, *Geologist*
Barbara Conrad, *Clerk*

## FIELD GEOLOGY DIVISION

Samuel I. Root, *Division Chief*

Thomas M. Berg, *Geologist*
William A. Bragonier, *Geologist*
William E. Edmunds, *Geologist*
Rodger T. Faill, *Geologist*
J. Douglas Glaeser, *Geologist*
Vacant, *Geologist*
Albert D. Glover, *Geologist*
David B. MacLachlan, *Geologist*
William D. Sevon, *Geologist*
Richard B. Wells, *Geologist*

## MINERAL RESOURCES DIVISION

Davis M. Lapham, *Division Chief*

John H. Barnes, *Geologist*
Karl V. Hoover, *Geologist*
Leslie T. Chubb, *Laboratory Technician*
Deborah Lehmer, *Typist*

## OIL AND GAS DIVISION

(Pittsburgh State Office Bldg.)
William S. Lytle, *Division Chief*

Lajos Balogh, *Draftsman*
Robert Fenton, *Laboratory Technician*
Lillian Heeren, *Draftsman*
Louis Heyman, *Geologist*
Vacant, *Geologist*
Cheryl Jeffries, *Stenographer*
Kathleen McConnel, *Typist*
Walter R. Wagner, *Geologist*

## TOPOGRAPHIC DIVISION

In Cooperation with The U.S. Geological Survey

## GROUND WATER DIVISION

In Cooperation with The U.S. Geological Survey

BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY
MAIN CAPITOL ANNEX
HARRISBURG, PA. 17120

BULK RATE
U. S. Postage
PAID
Harrisburg, Pa.
Permit No. 758

*CORRECT ADDRESS REQUESTED*

---

## SEPTEMBER 1971
## GROUND-WATER LEVELS