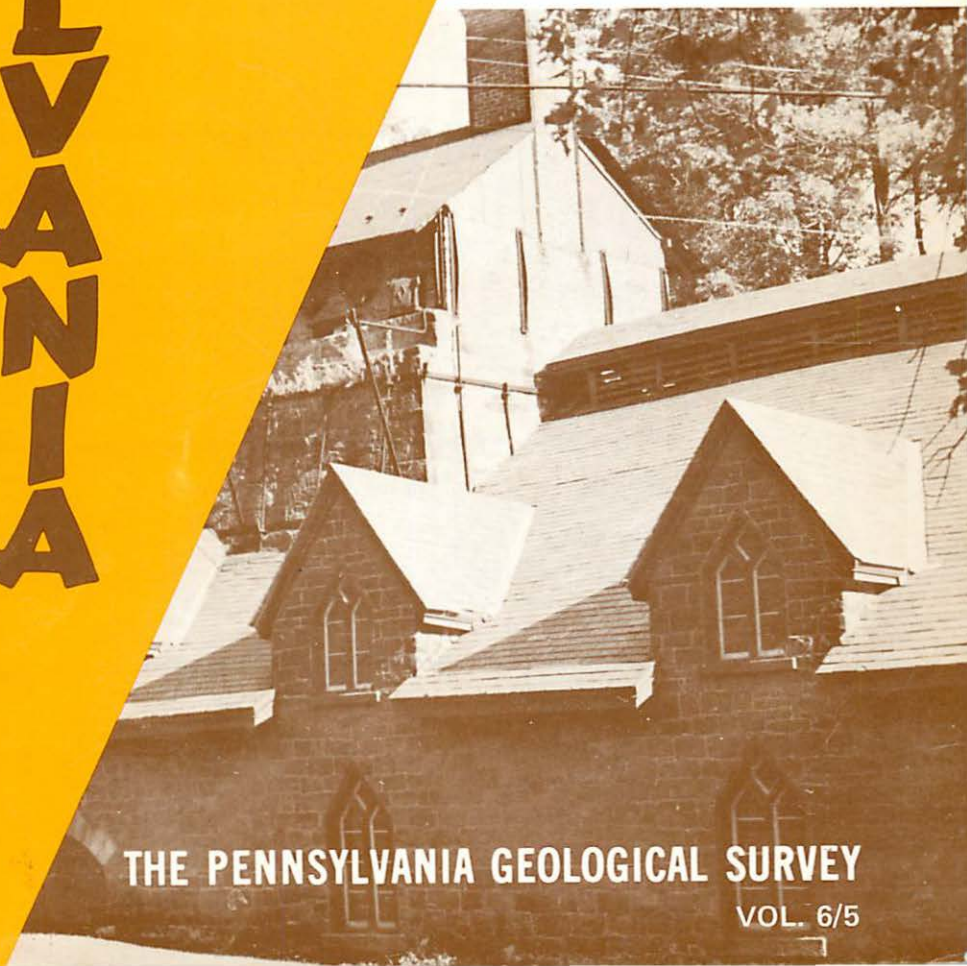
PENNSYLVANIA GEOLOGY



THE PENNSYLVANIA GEOLOGICAL SURVEY
VOL. 6/5

COMMONWEALTH OF PENNSYLVANIA
Milton J. Shapp, Governor

DEPARTMENT OF ENVIRONMENTAL RESOURCES
Maurice K. Goddard, Secretary

TOPOGRAPHIC AND GEOLOGICAL SURVEY
Arthur A. Socolow, State Geologist

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ON THE COVER: Cornwall Furnace and Museum along Route 322 at Cornwall, Pa. Open to the public and maintained by the Pennsylvania Historical and Museum Commission, this is the site of an iron mining and smelting operation dating back to pre-Revolutionary War years. Photo courtesy of Alan Geyer.

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OCTOBER 1975

FROM THE DESK
OF THE
STATE GEOLOGIST . . .

LEARNING TO LIVE WITH NATURE'S VAGARIES

Now that there has been another Susquehanna River flood three years after the so-called "100-year" Agnes flood, the message is getting through that those statistical designations of 50, 100, and 200-year flooding do not prevent the possibility of repeated flooding every few years, or even oftener. And so it appears some sort of flood plain management bill may finally pass our state legislature. Such a bill could result in alleviating hardships of existing flood area installations and curtail potential new victims in flood-prone areas not yet developed.

But flooding is not the only natural hazard which Pennsylvanians have been facing in recent years. In southwestern Pennsylvania more and more cases are coming to light of home and business installations being damaged by landsliding. The topography (slope conditions) and physical nature of the rock formations of that area combine to result in large numbers of landslides. Recent mapping by federal, state, and university geologists indicates that there are thousands of recognizable landslides which have occurred in southwestern Pennsylvania, most before man even inhabited the area.

In south-central Pennsylvania we are hearing of more and more cases of damage resulting from new sinkhole collapses where development has taken place on top of limestone formations.

The increased incidence of landslide and sinkhole damage is largely the result of increased land development. Thus, in southwestern Pennsylvania previously untouched slope areas are now being disturbed by home, highway, or business construction—and landslides result. In south-central Pennsylvania some of our prime farmland, underlain by limestone which yields the good soil, is being overrun by housing developments; concentrated housing expedites sinkhole collapses; buildings suffer more from sinkholes than does tilled farmland.

As with flood-prone areas, we owe it to our fellow citizens to delineate the problem areas, and by education or some sort of local action, to control construction on areas prone to landslides or sinkholes. If it is possible to forestall new damage and hardships by landslides or sinkhole collapse, we would be doing a service not only to the potential victims, but also to all Pennsylvania residents. Each of us is affected in one way or another when some of our fellow citizens are hit by one of nature's disasters.

Arthur A. Socolow

The State Line District's Many Rock Types

by D. M. Lapham*

The Commonwealth of Pennsylvania can be divided into different geological areas, each with its own characteristic group of rocks (Fig. 1). Where among all our geologic diversity can the greatest number of different rock types be found? The Plateau with its dominant shale, siltstone and coal and the Triassic basin with its red shale, siltstone, conglomerate and diabase are perhaps the most uniform. The Great Valley and the Valley and Ridge, which lie between the Plateau and the Triassic rocks, exhibit a similar range of rocks. The old Piedmont in the southeast part of Pennsylvania contains many more rock types than any of these areas, perhaps even more than the Reading Prong, a narrow belt of Precambrian and Cambrian rocks that outcrop eastward from Reading.

One very complex area in the Piedmont lies just west of Philadelphia. Here, there are Precambrian-age mafic and granitic gneisses folded with Wissahickon Schist along with some Cockeysville Marble, amphibolite, and serpentinite. A few pegmatites and diabase dikes intrude the schists and gneisses and not far away is the eastern termination of the Peach Bottom Slate. Another area that includes a wide

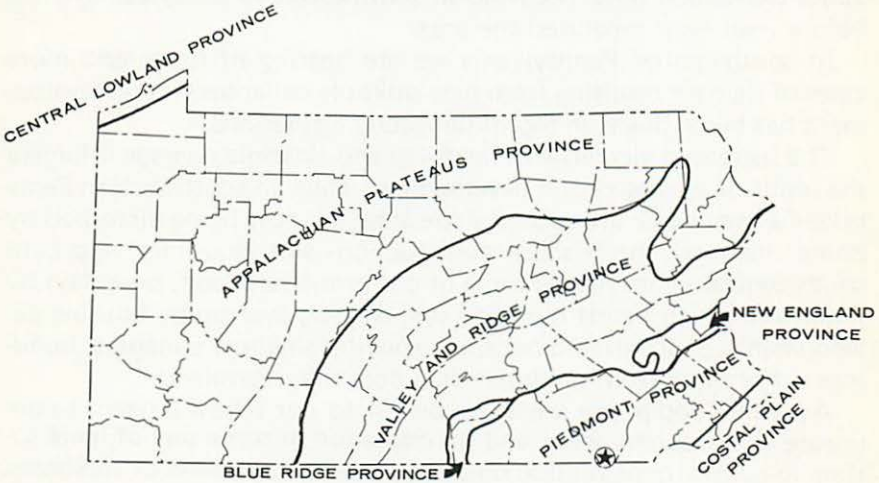

Fig. 1. Province map of Pennsylvania illustrating area of Lancaster County that is illustrated by more detailed map of Figure 2.

* This was the last article written by Dr. Lapham prior to his death in December, 1974.

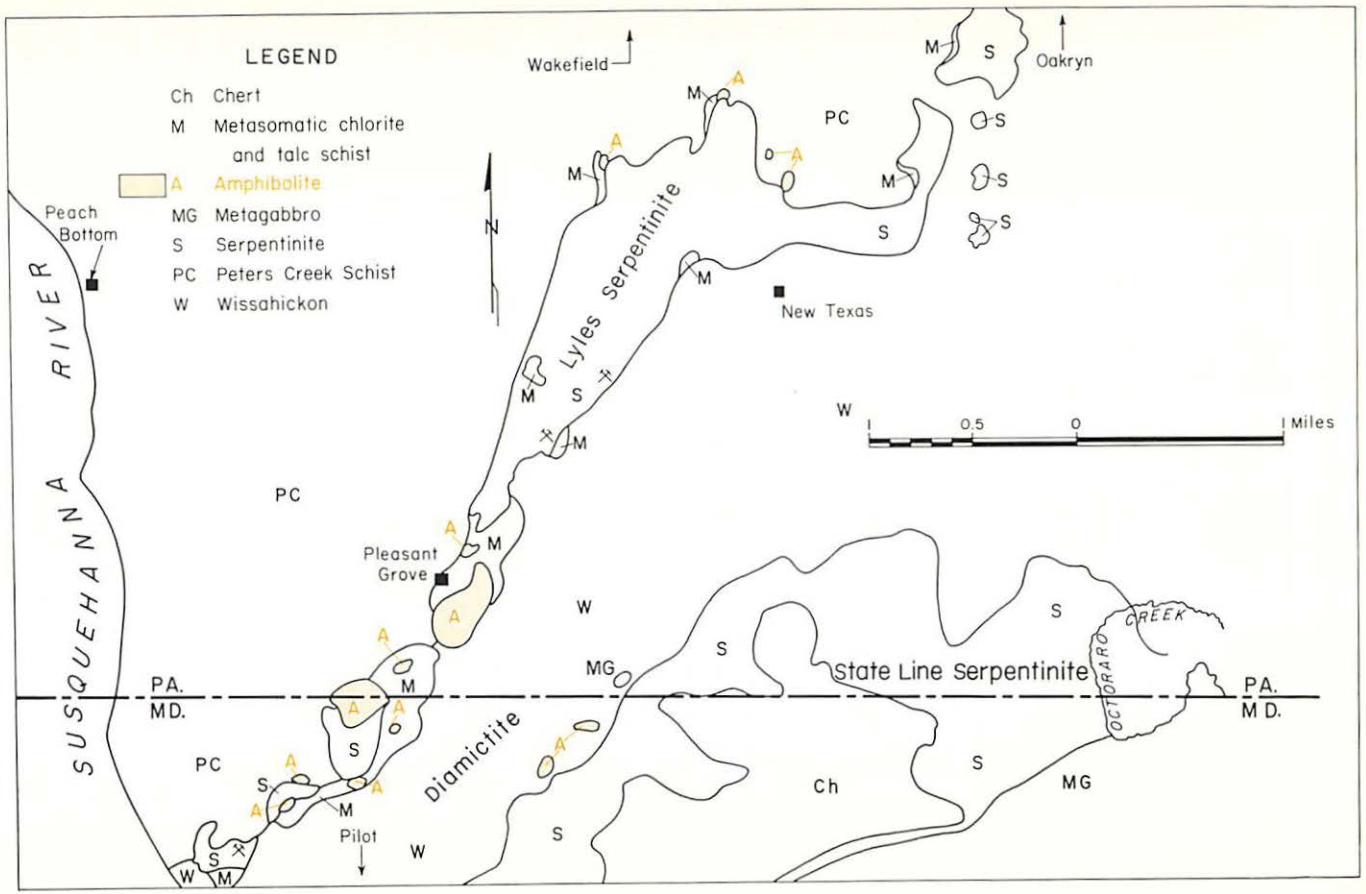

Fig. 2. Generalized lithologic map of southwestern Lancaster County illustrating major rock types of the area.

range of rock types is near Honeybrook. Here there are granitic to mafic schists, gneisses, and amphibolites of several varieties along wtih igneous pegmatites, anorthosite (plagioclase-rich rock), and diabase dikes. Serpentinites, quartzites, and limestones are nearby. However, mapping and petrography by D. M. Lapham of the Survey Staff has revealed another area that may have an even greater number of rock types in just a very few square miles, perhaps more than anywhere else in the state: the so-called State Line District of southern Lancaster County (Fig. 2). Among the igneous, meta-igneous, and metasedimentary rock groups so common throughout the Piedmont, more than 35 different rock types have been recognized from the Susquehanna River east to Octoraro Creek and from Wakefield south to the Maryland Line!

An almost endless subdivision of the rocks can be made for this area, although some of the finer points of distinction become rather arbitrary because of numerous gradations from one rock type (or facies) into another. Beyond the three major groups noted above, there are six large sub-groups: 1) metamorphosed sedimentary rocks, 2) metamorphosed volcanic rocks, 3) ultramafic igneous rocks, 4) mafic rocks both metamorphosed and some essentially unaltered, 5) granitic rocks, both of metamorphic and igneous origin, and 6) a large variety of highly altered (metasomatic) types generally along the margins of the igneous plutons. Almost all of the original rocks have been metamorphosed several times during the Paleozoic era and some have been further altered by heat and chemical reaction where they are in contact with surrounding rocks of different composition. The result has been an almost bewildering complexity, one made more difficult to decipher by a lack of good outcrops and a commonly dense vegetation in the area. In fact, much of the area is referred to as "the Barrens" because of its inhospitable nature:a thin, high-magnesium and low-potassium soil overgrown with cedars, scrub pine, and brambles.

Within the six sub-groups of rock types, there are approximately 23 different major rock types, excluding hybrids that resulted from an intermixing of two or more rock types. Among the metamorphosed sedimentary rocks, sequences of lithologies referred to as the Wissahickon and Peters Creek formations, are many quartz-mica schists. Some are fine-grained (to phyllitic) and some are coarse-grained; some are rich in biotite or chlorite; others contain some feldspar. Garnet and limonite pseudomorphs are sporadically abundant. All are well-foliated with good cleavage. Beds of these units are separated by metamorphosed sub-graywackes (quartz-rich with feldspar, mica, some

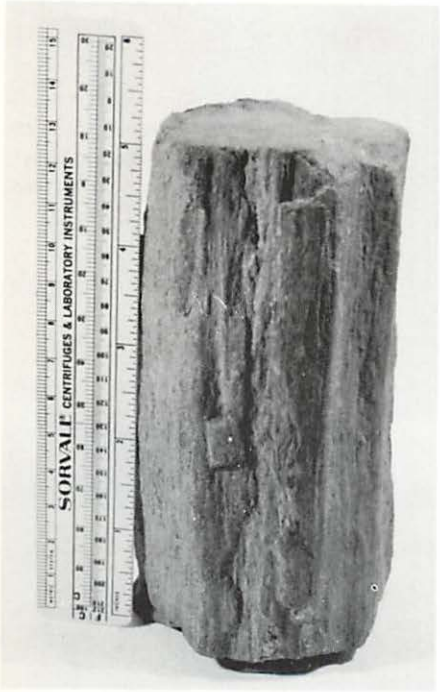

Fig. 3. Rolled quartzite, south of Pleasant Grove, Lancaster County.

chlorite, and rarely carbonate) and some quartzites (Fig. 3). These quartz-rich lithologies commonly exhibit graded bedding that indicates both overturned and right-side-up beds. Other units present include a quartz breccia, a quartz-pebble conglomerate, marble, slate (the Peach Bottom Slate just north of Wakefield), and a meta-sediment called a diamictite that contains metamorphosed fragments of other sedimentary rocks. This latter unit is the southern-most of the metasediments in Lancaster County and, where present, lies along the north edge of the State Line serpentinite near the Maryland border.

Volcanic rocks of extrusive origin can be difficult to recognize after the several stages of metamorphism such as occurred here in the Piedmont. For example, a pyroclastic tuff can resemble other schistose metasediments; in addition, volcanic rocks of basic composition such as basalts may become altered to amphibolites that closely resemble amphibolites of metasedimentary origin. Relicts of an original pillow lava have not been recognized here, although they do occur further south in the Maryland Piedmont. To date, the thin greenstones within the Wissahickon and Peters Creek formations probably are the most likely candidates for an originally volcanic rock, although all primary textures such as vesicular or flow structures are now missing. These thin greenstone interbeds (Fig. 4) essentially are composed of epidote, chlorite, and quartz. Another possibly volcanic rock is amphibolite. However, mapping has shown that these bodies are lenticular, not sheet-shaped as are most extrusive flows, and hence they probably are altered intrusive igneous plutons.

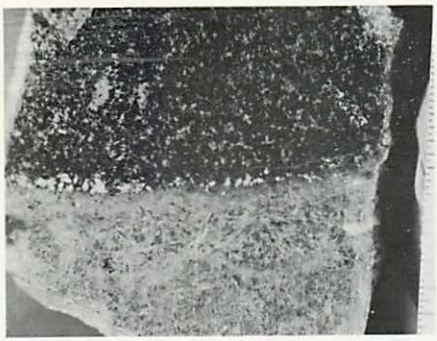

Fig. 4. Apatite at contact of hornblendite (black) and epidotite (gray), south of Pleasant Grove, Lancaster County.

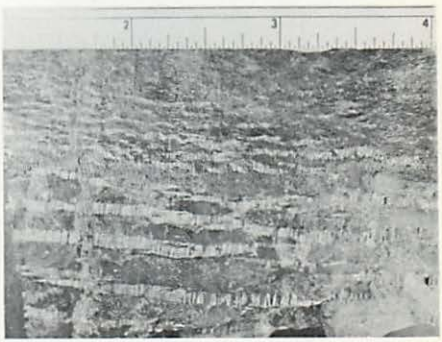

Fig. 5. Chrysotile veinlets in serpentinite, northwest of Line Pit, at north contact of State Line Serpentinite, Lancaster County.

Fig. 6. Metamorphosed granitic breccia, north of New Texas, Lancaster County.

The ultramafic igneous rocks are varieties of serpentinite such as serpentinized dunite (Fig. 5) and harzburgite or, less commonly, altered pyroxenite (wherlite). All of these ultramafites occur in a band along the Pennsylvania-Maryland state line, on the south edge of the metasediments. Within this ultramafite band, the serpentinites form the north margin (along with chromite pods and bands) and the

pyroxenites lie to the south of them. Still farther south, rarely extending from Maryland into Pennsylvania, are the metamorphosed mafic rocks: gabbro, norite, and amphibolite (a gabbro altered to amphibole minerals; Fig. 4). Amphibolites (primarily hornblende or actinolite-rich rocks with epidote) also occur farther north at the contacts of serpentinite with country rock, particularly just south of Pleasant Grove, Lancaster County. Some amphibolites are rich in apatite. Igneous Triassic diabase dikes only a few tens of feet thick cut all these units and are the youngest (about 195 million years old) igneous rocks in the area. Finally, as a result of more recent alteration, all the serpentinites above an elevation of about 400 feet have been weathered to a red chert, principally by the loss of magnesium from serpentinite.

Rocks of granitic composition are not widespread but do occur here. Igneous pegmatites, commonly with black tourmaline (schorl), transect both the country rock and the serpentinite. Most pegmatites are simple quartz-plagioclase (albite-oligoclase)—muscovite pegmatites, some with chlorite or ilmenite present. Other granitic-appearing rocks probably are metamorphic in origin. These latter types occur in chloritic schists near Pleasant Grove and north of New Texas (Fig. 6), principally between the two belts of serpentinite (the northern Lyles serpentinite and the southern State Line serpentinite).

Finally, there are the metasomatic rocks along the margins of igneous bodies. All of them are gradational, indicative of an origin by chemical reaction between the igneous and metasedimentary rocks, but most tend to exhibit one dominant mineral. Thus, the most abundant are chlorite schist ("blackwall"), talc schist (steatite), tremolite schist and graphite schist. The tremolite schist always contains some talc and is most prevalent between Pilot, Maryland and Pleasant Grove, Pennsylvania. Some chlorite is unusually interesting because of concentrations of radioactive zircon, rutile, or magnetite. Graphite schist is rare and has only been identified from a serpentinite contact south of Oakryn, Pennsylvania and near the Peach Bottom Slate contact with the Peters Creek Formation.

Anyone interested in building up a collection of different, even strange, rock types should visit this area. Each rock that is broken open with a hammer will yield its own story and most samples will be as different from each other as these rocks are from the more common limestones, dolomites, shales, and sandstones that comprise so much of Pennsylvania's geological terrain. Furthermore, a geological look at this area affords a rare opportunity: few areas in the world are as complexly interesting as this, and it's right in our own backyard.

Invertebrate Fossils in the Upper Mahantango Formation, Suedberg, Schuylkill County, Pennsylvania

by
Jon D. Inners and
Eugene D. Hess

As part of an effort to assemble a Paleontologic Reference Collection which might prove useful to geologists working on projects within the state, the Pennsylvania Geological Survey is presently cataloging numerous new fossil collecting localities. One of the most accessible and interesting of these new sites is a borrow pit within the bounds of proposed Swatara Gap State Park, on the south side of Township Road 365, 0.75 miles southwest of Suedberg, Schuylkill Co. (Fig. 1). (Lat. 40°31'18"N, Long. 76°28'45"W, southwest portion of Pine Grove 7½' Quad.). Ample parking space is available on the floor of the pit.

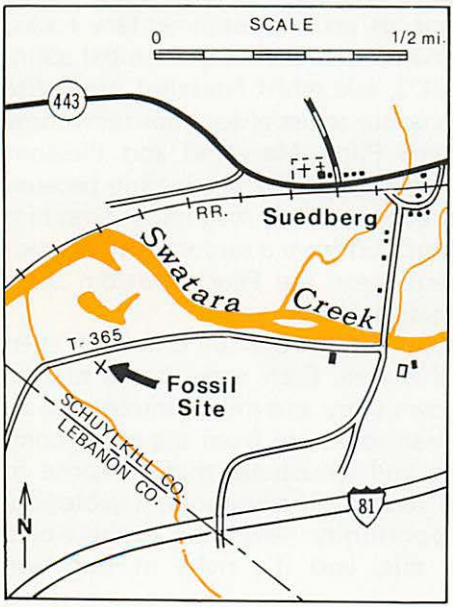

Fig. 1. Location of fossil collecting site.

The beds exposed in the borrow pit are intensely jointed, olive gray, fossiliferous, silty claystones and clayey siltstones of the upper Mahantango Formation (Middle Devonian) (Wood and Kehn, 1968). Fossils are most abundant in several deeply weathered, coquinite bands 2 to 3 inches thick that crop out at the western end of the pit. The attitude of these fossiliferous layers shows that bedding strikes north 65° east and dips 80° to the northwest. Spheroidal structures that are prominently developed on the steeply dipping bedding surfaces are weathering phenomena caused by exfoliation along closely spaced joint, fracture, and bedding planes. (See Sevon, 1974, p. 137).

Fossils in the weathered coquinites consist predominantly of internal and external molds of brachiopods and bryozoans. Pelecypods preserved as delicate white casts can be found in silty clay shales on the east side of the borrow pit (at a somewhat lower stratigraphic horizon than the coquinites). Material in these casts has been identified by X-ray diffraction as a mixture of very fine grained quartz and muscovite (John H. Barnes, Jr., personal communication). Species which have been identified include the following (a = abundant; c = common; unc = uncommon; r = rare):

Bryozoans
- *Fenestella* cf. *F. emaciata* Hall (a)

Brachiopods
- *Tropidoleptus carinatus* (Conrad) (unc)
- *Leptaena "rhomboidalis"* (Wilckens) (c)
- *Douvillina (Douvillina) inaequistriata* (Conrad) (unc)
- *Retichonetes vicinus* (Castelnau) (unc)
- *Spinatrypa spinosa* (Hall) (a)
- *Tylothyris pauliformis* (J. S. Williams) (a)

Pelecypods
- *Nucula* sp (c)
- *Paleoneilo* sp. (unc)
- *Modiomorpha concentrica* (Conrad) (unc)
- *Cypricardinia indenta* (Conrad) (r)

Crinoids
- Unidentified columnals (a)

Ostracodes
- *Hibbardia lacrimosa* (Swartz and Oriel) (r)
- Unidentified valves (c)

Figure 2. Worm (?) boring preserved as cast in external mold of pedicle valve of *Spinatrypa spinosa*. Note colony of *Fenestella* cf. *F. emaciata* (external mold of obverse side) in upper left. (Photo by L. Chubb.)

This fauna is typical of the *Sulcoretepora* cf. *S. inciscurata* Assemblage Zone of Ellison (1965), the uppermost biostratigraphic unit in the Mahantango Formation of central Pennsylvania. The occurrence of *Spinatrypa spinosa* and *Tylothyris pauliformis* (a small spiriferid) is also suggestive of the Tully Fossil Zone of Sevon (1974) in the Lehigh River Valley. (See Heckel, 1969, p. 10.)

The fossiliferous claystones and siltstones of the upper Mahantango Formation were deposited in a sublittoral marine environment. Recurrent communities of filter-feeding invertebrates, particularly bryozoans, brachiopods and crinoids, proliferated on the sea floor in areas of gentle wave or current agitation. The death of these organisms and the post-mortem concentration of their hard parts resulted in the formation of thin, lenticular shell beds (the coquinites at Suedberg). Demise of some individuals of *Spinatrypa spinosa* may have been hastened by the occurrence of parasitic worms (?) within their shell substance (Fig. 2).

Alan R. Geyer, Evan T. Shuster, and John H. Barnes, Jr., generously provided the writers with information concerning this site.

References cited are available upon request.

Oil Well Drilling in 1974

The petroleum industry drilled 16 new-field wildcat wells in Pennsylvania during 1974, of which 14 were dry holes, according to the Associated Petroleum Industries of Pennsylvania. The two successful drillings were both producers of oil but not gas.

Frank J. Bowden, Jr., APIP executive director, said the final 1974 drilling figures recently published by the American Petroleum Institute show a 10 percent increase in drilling activity in Pennsylvania during 1974, with a total of 1,208 wells drilled as compared to the 1973 total of 1,099.

Nationally there was a 19 percent increase, with the total number of wells completed during the year reaching 31,698, compared to 26,592 in 1973. Of the total, 5,652 were new-field wildcats—wells drilled in areas or formations never before productive—and of those, 4,847, or nearly 86 percent, proved to be dry holes.

current status of bureau's water well inventory

Evan T. Shuster

With two exceptions, computerized water well data now exists at the Pennsylvania Geological Survey for all counties of Pennsylvania. The exceptions are Philadelphia County for which no wells have been reported and Crawford County which is to be done by the U.S.G.S. The computerized data comes as a packet of four separate printouts. The first printout, called "Report Type A" shows the township, well number, owner, well location by latitude and longitude and the well use. The second printout is called "Report Type B" and lists the total depth of the well, casing length, screening, drilling method, water level, yield and drawdown. "Report Type C" identifies the topographic setting, the major and minor aquifers, depth to bedrock, type of bedrock and type of surficial material. The fourth set of printouts is "Report Type P" which adds the depths and yields of the water-bearing zones. The township and well number are used as the cross reference between the printouts. The following table lists, for each county, the number of wells currently in the computer system, the total number of printout pages (includes all four report types), and the approximate number of unprocessed well completion cards. The latter are the raw data as supplied by the well driller.

The water well data which is in the computer, as well as the unprocessed well cards, are on open file at the Survey's Harrisburg office, Room 901 Executive House, 2nd and Chestnut Streets. The printouts are also available to the public on request. If ten or fewer sheets are desired, there is no charge. Because of the cost factor, it may be beneficial for those requesting the data to be specific about the township as well as the type of data needed, i.e. Report Types A, B, C or P. All wells are grouped by township with the township arranged alphabetically. Photocopies of the unprocessed well completion cards may also be requested at the same charge per sheet as the printouts. Three well completion cards will copy onto one legal-size sheet. All requests for well data should be sent to Mr. Eugene Hess, Environmental Geology Division, Bureau of Topographic and Geologic Survey, Room 901 Executive House, Harrisburg, Pennsylvania 17101.

Our current activities in the water well inventory program are directed at updating some of the older county printouts, reducing the backlog of unprocessed well completion cards, and correcting, where

TABLE 1. WATER WELL INVENTORY SYSTEM

	County	No. of Printout Sheets	No. of Wells in Computer System	No. of Unprocessed Wells		County	No. of Printout Sheets	No. of Wells in Computer System	No. of Unprocessed Wells
1	Adams	18	202	190	35	Lackawanna	16	116	450
2	Allegheny	32	204	50	36	Lancaster	160	1145	2700
3	Armstrong	32	204	550	37	Lawrence	12	65	375
4	Beaver	40	281	100	38	Lebanon	104	731	600
5	Bedford	184	1333	900	39	Lehigh	152	1084	600
6	Berks	68	469	1350	40	Luzerne	44	300	615
7	Blair	52	355	1200	41	Lycoming	64	442	510
8	Bradford	44	319	1275	42	McKean	16	89	345
9	Bucks	244	1762	2000	43	Mercer	24	170	75
10	Butler	64	439	1000	44	Mifflin	68	466	160
11	Cambria	68	474	1200	45	Monroe	276	1989	2000
12	Cameron	12	77	25	46	Montgomery	92	647	900
13	Carbon	32	205	800	47	Montour	20	128	210
14	Centre	24	171	375	48	Northampton	76	540	460
15	Chester	192	1375	1425	49	Northumberland	52	357	190
16	Clarion	12	69	275	50	Perry	16	104	400
17	Clearfield	12	59	130	51	Philadelphia	N/W	N/W	N/W
18	Clinton	20	124	400	52	Pike	28	188	360
19	Columbia	28	201	25	53	Potter	40	275	375
20	Crawford	N/A	N/A	2925	54	Schuylkill	60	448	580
21	Cumberland	64	449	1100	55	Snyder	16	92	525
22	Dauphin	40	273	1275	56	Somerset	241	166	580
23	Delaware	12	77	100	57	Sullivan	32	217	75
24	Elk	8	41	100	58	Susquehanna	12	71	360
25	Erie	40	274	1075	59	Tioga	20	140	300
26	Fayette	8	36	180	60	Union	68	475	300
27	Forest	12	80	375	61	Venango	48	323	500
28	Franklin	92	646	225	62	Warren	12	66	150
29	Fulton	8	33	30	63	Washington	52	355	900
30	Greene	8	55	100	64	Wayne	40	285	390
31	Huntingdon	12	62	285	65	Westmoreland	36	237	975
32	Indiana	44	300	750	66	Wyoming	4	21	225
33	Jefferson	40	272	190	67	York	104	746	750
34	Juniata	12	73	180		TOTAL	3,376	23,482	39,595

possible, the original computerized data. We are now trying to get the well drillers to submit more accurate and detailed well location descriptions so that overall use and confidence in the program is increased. Also available with the computer printouts is a recently revised guide which describes and translates the different entries on the printout. This guide is supplied free of charge.

Data from our water well inventory are increasingly popular. Planners, engineers, geologists, well drillers and developers are making more and more use of the data. The water well information can be used to define some engineering characteristics of different rock units such as depth to competent bedrock water levels, and rock type or lithology. Hydrologic parameters, of course, are either listed on the printout or can be easily derived. Among these are well yields, specific capacities, depth to water-bearing zones, static water levels, expected well depths in an area or rock unit, etc. Although the well location and the rock unit are given, the computerized data are not directly adaptable to detailed geologic mapping; however, the actual well completion cards with the complete driller's log are of considerable help to geologic mappers.

Honors to Professor Edgar T. Wherry

Professor Edgar T. Wherry has been elected to the Honorary Life Presidency of the Mineralogical Society of America. We extend our congratulations to Professor Wherry for this well deserved recognition. Professor Wherry is an outstanding scientist who has made many distinguished contributions to geology and botany. His bibliographic citations number in the hundreds. Pennsylvania can truly be proud of this distinguished scientist. We congratulate him and wish him well.

Volunteer Work on Fossil Collections

Mr. Thomas Seaker, a second-year student from Bishop McDevitt High School in Harrisburg, has kindly volunteered his time and talent for one and one-half months during this summer, working on the Survey's fossil collections. He has carefully completed unwrapping, repairing, and relabeling specimens that were damaged during the 1972 flood. Our fossil collections are now completely stored in metal cabinets, but much organizational work and cataloguing still needs to be done. Mr. Seaker has also prepared a large supply of specimens for trading and free distribution to the public. The Survey is indebted to Tom for his conscientious volunteer work. We wish him the best of luck in his scientific endeavors.

SURVEY ANNOUNCEMENTS

COAL DATA PUBLISHED

Having sampled and recorded the geology at several hundred coal localities of western Pennsylvania, the Pennsylvania Geological Survey has reported its data and findings in Mineral Resources Report M 69, *Analyses and Measured Sections of Pennsylvania Bituminous Coal.*

This publication is part of a continuing investigation of coal resources in the bituminous coal region of Pennsylvania by the Pennsylvania Geological Survey. A similar report, Mineral Resource Report 66, containing data collected in prior years, was published earlier.

These reports are of benefit to all concerned with coal development and land-use planning of coal-bearing areas. The data on coal, particularly thickness, chemical analysis, and coking and fusibility characteristics, should be helpful for preliminary evaluation of the potential use of specific coal seams and for planning the development of the seams. The lithologic, paleontologic, mineralogic, and structural information will be useful to geologists for stratigraphic correlation and for sedimentary, structural, and other studies. The report also contains information relevant to environmental and engineering studies, dealing with such problems as pollution control, engineering construction, efficient mining technology, and urban or rural planning.

Bulletin M 69 is available for $4.00 (plus sales tax) from the Pennsylvania Bureau of Publications, P.O. Box 1365, Harrisburg, Pa. 17125.

STATE MAP AGAIN AVAILABLE

We are pleased to announce that the large Geologic Map of Pennsylvania is again available at the State Book Store. Due to a surge in demand, the supply of the map was exhausted for several months. We have reprinted and restocked this basic map. This is Map #1, 1960 edition, scale 1:250,000 (1 inch = 4 miles) and sells for $3.75 plus tax from Pennsylvania Bureau of Publications, P.O. Box 1365, Harrisburg, Pa. 17125.

A REPORT ON SUBSURFACE WATER IN LACKAWANNA COUNTY

A detailed inventory and evaluation of the subsurface water resources of Lackawanna County is presented in the Pennsylvania Geological Survey's new publication, Water Resources Report W 41, *Ground Water Resources of Lackawanna County.*

The development of water resources to meet increasing demands requires knowledge of the availability, distribution, quality, and use of water. Such information is essential to the orderly and economical planning, construction, and operation of facilities that will provide water to satisfy increasing needs. This study was made to provide such information on the available ground water in the county. The report also describes the distribution and movement of water in the underground mines and also the effect mine-water discharge has upon the Lackawanna River.

Many water-related problems exist in the county that inhibit, and in some places prevent, ground-water development. The four major problems of low-yielding wells, inadequate supplies for public water companies, poor-quality water, and pollution are discussed in detail. These results should be of assistance to planners, construction people, industry, and homeowners, all of whom at various times deal with or are affected by the occurrence and quality of the subsurface water in the area. This investigation is part of a continuing study of groundwater resources of Pennsylvania by the U. S. Geological Survey in cooperation with the Pennsylvania Geological Survey.

Water Resources Report W 41 is available for $11.65 (plus sales tax) from the Pennsylvania Bureau of Publications, P.O. Box 1365, Harrisburg, Pa. 17125.

SPELEOLOGICAL RELEASE

The first volume of a new series on caves throughout the Commonwealth has recently been published by the Pennsylvania Geological Survey. *Caves of Southeastern Pennsylvania,* compiled by J. R. Reich, Jr., lists over 90 caves in Adams, Bucks, Chester, Delaware, Lancaster, Montgomery, Philadelphia, and York Counties. The report lists the cave locations and summarizes some of the history, geology and characteristics of the individual caves, including plan and cross-sectional map views of most caves described. With the aid of this guide the reader will recognize the delicate and fragile beauty that this under-

ground world holds in store. General Geology Report 65, with 120 pages of text, 47 figures, and 17 plates, sells for $5.30, plus 6% tax, and is available at the Pennsylvania Bureau of Publications, P.O. Box 1365, Harrisburg, Pennsylvania 17125.

ERIE COUNTY YIELDS ANCIENT ROCKS

Applied and academic geologists will benefit from the Pennsylvania Geologic Survey's new Information Circular 79, *Interpretation of Isotopic Dates from a Precambrian Core in Erie County.*

A well drilled near Lake Erie in Pennsylvania penetrated Precambrian rocks at a depth of 5952 feet and provided an excellent opportunity to describe in detail these rock types that up to now have been inaccessible. Included in the new report are petrographic descriptions, radiometric age dates and a description of the complex events which, at least locally, have affected the rocks.

The oldest rock found in the core is a gneiss at least 1100 million years old and perhaps older; it is believed to have been an ancient lava flow. The youngest recorded alteration occurred about 550 million years ago and is believed to have been a chemical leaching.

The results of this study are significant: Precambrian rocks now definitely have been identified from beneath the plateau of northwestern Pennsylvania; their exact depth is known and the rocks here can be compared with similar subsurface samples from Ohio and with samples of exposed Precambrian rocks to the east throughout the northern Appalachians. Events and processes that affected these rocks can be placed within a regional framework for a better understanding of the geologic history of the area, as well as its resources.

Information Circular 79 is available for $1.00 (plus sales tax) from the Pennsylvania Bureau of Publications, P.O. Box 1365, Harrisburg, Pa. 17125.

THE GROUND-WATER PROGRAM FOR PENNSYLVANIA

The Pennsylvania Geological Survey has published a new edition of Information Circular 7, *The Ground-Water Program for Pennsylvania.* The 13-page pamphlet explains the history and purpose of the cooperative ground-water program between the Pennsylvania Geological Survey and the U. S. Geological Survey. Pennsylvania Survey publications that have resulted from the program are listed, and current and future projects are discussed briefly. IC 7 is available upon request from the Pennsylvania Geological Survey, Executive House Apartment Building, Second and Chestnut Streets, Harrisburg, Pennsylvania 17101.

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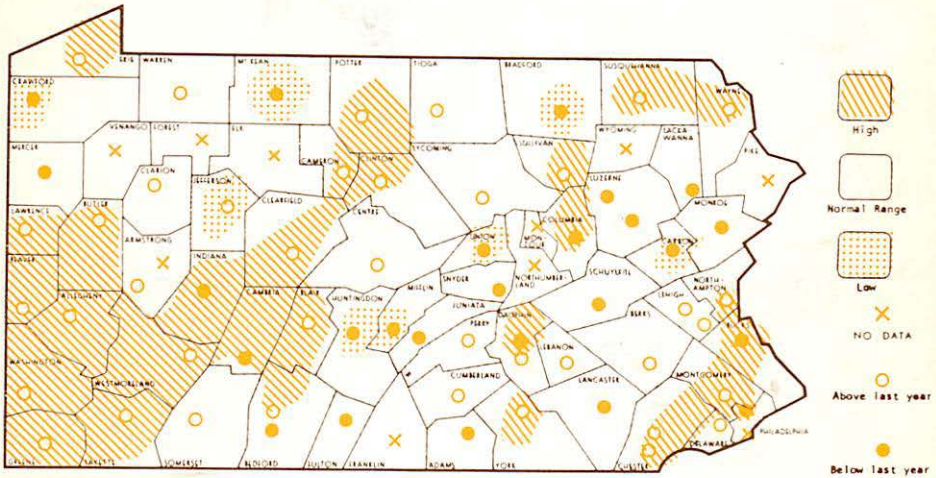
GROUND-WATER LEVELS



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