PENNSYLVANIA GEOLOGY

THE PENNSYLVANIA GEOLOGICAL SURVEY

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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. The potholes at the Conewago Falls on the Susquehanna River were uncovered again this past summer. Their location is at the northwestern tip of Lancaster County where a Triassic diabase intrusive sheet crosses the river a mile below the Conewago Creek, near the village of Falmouth. *Photo by Wm. H. Bolles.*

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OCTOBER 1977

FROM THE DESK
OF THE
STATE GEOLOGIST . . .

LEAD TIME - RHYMES WITH NEED TIME

In the discussions which have taken place amongst the proponents of various proposals to cope with our nation's energy problems, one aspect frequently tends to be overlooked, namely, lead time. That is the length of time that elapses from the time a decision is made to pursue a certain course of action, until the time when that action can be fully completed and implemented. Thus, for example, the lead time for bringing Alaskan oil into production was over 15 years from the time the decision was made in the early 1960's to explore and drill, then through 1968 when oil was first discovered on the North Slope, until 1977 when the first shipment for market was achieved. Similarly, even now as plans for an Alaskan gas pipeline to the U.S. are in the discussion stage, it will probably be close to 10 years from now before such a pipeline begins to deliver the natural gas.

While there is much talk of greatly expanding coal production, to develop a significant new coal mine from the point when a decision is made to do so until production actually starts generally involves between 5 to 10 years. First there is the need to locate an area of available coal. Then there is the time needed to raise the necessary money to acquire the land and purchase the mining equipment - commonly a matter of millions of dollars. Time is needed to design and engineer the mine layout and to construct the necessary equipment and machinery. Eventually, 5 to 10 years hence, comes the coal production. Even to expand an existing coal mine, is likely to require 3 to 5 years time.

The establishment of a power plant is another major lead time undertaking. A new coal burning plant is likely to take 5 to 8 years to bring into production from the time a decision is made to proceed. A nuclear power plant involves 8 to 12 years of time from the decision to go ahead.

The Alaskan oil production timetable is a good lesson as to what might be involved in the search for oil and gas off the Atlantic Coast. Even though oil companies made the decision several years ago to proceed with exploration, and having already invested several billions of dollars (without any real assurance that commercial quantities of oil and gas will actually be found), even under the best of possible discovery and development conditions in the Atlantic offshore, it will probably be close to 10 years before one or more offshore fields could be defined, financed, engineered, and the product brought ashore.

(Continued on page 16)

DR. JOHN MOSS

It is with profound sadness that we note the passing of a personal friend, a longtime friend of the Survey, and a distinguished scientist, Dr. John Hall Moss of Franklin and Marshall College. Dr. Moss died July 28th while doing geological field work at Phoenix, Arizona. He was mapping geological terraces in preparation for a paper he was to give this fall.

John Moss was very much more than a distinguished scientist. He was an outstanding teacher, a concerned and involved citizen, and a devoted family man. He did not simply teach students; he established a rapport with them, he excited them, and he stimulated them. He was an innovator of educational techniques and experiences and both he and his students were always abreast of the latest concepts and practices in matters pertaining to geology and the environment. It is a small wonder that under his leadership at the F & M Geology Department, so many of the geology majors have gone on to achieve distinguished careers in their own right.

John Moss was extremely interested in our Survey's programs. He recognized that there should be a close relationship between the role of the geologic educator and the role of a government geologist--both must be prepared to serve the public and the needs of our society.

John Moss recognized that geology is an active science that plays a vital role in today's society. He served on the Pennsylvania Environmental Council, the Pennsylvania Environmental Education Advisory Committee, the Geological Society of America's Committee on Environment and Public Policy, and the Lancaster Environmental Action Federation, to name just a few.

John Moss took his undergraduate education at Princeton University, his master's degree at Massachusetts Institute of Technology, and his doctorate at Harvard. He came to Franklin and Marshall College in 1948 and served as Chairman of the Geology Department from 1958 to 1971.

The Pennsylvania Geological Survey extends its sympathy and respects to Mrs. Margaret Moss and their six children.

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Pennsylvania State Geologist Heads National Association

Pennsylvania State Geologist, Arthur A. Socolow, has been elected President of the Association of American State Geologists at the 48th Annual Meeting of the Association, held at Rehoboth Beach, Delaware. The Association of American State Geologists consists of the Directors of each of the 50 State Geological Surveys and that of the Commonwealth of Puerto Rico. The Association serves to share and coordinate geologic policies and procedures, as well as to exchange the latest in geologic techniques. The aim is to effectively meet the geologic needs of the respective states and to cope with the geologic problems of the public and the nation.

Dr. Socolow previously served the Association as its Vice President, as Statistical Officer, and as Chairman of the Liaison Committee, designated to establish coordination of the activities of the state geological surveys with the programs of the various federal agencies involved with geological and mineral resource matters. The State Geologists Association has been effective in conveying local needs to federal agencies and expediting federal assistance and the development of federal programs.

Dr. Socolow joined the Bureau of Topographic and Geologic Survey in 1957 as Chief Economic Geologist, to conduct mineral resources investigations within the Commonwealth. In 1961 he was designated State Geologist and Director of the Bureau of Topographic and Geologic Survey. Dr. Socolow received his B.S. degree in geology from Rutgers University, and his M.A. and Ph.D. degrees from Columbia University. Prior to joining the Pennsylvania Geological Survey, he was a professor of geology at Boston University and at Southern Methodist University; during those years he was involved in mineral resources investigations in many parts of the United States, as well as Canada and Mexico. His background also includes service with the U. S. Geological Survey's Topographic and Geologic Divisions, including work in Alaska. During nearly four years of service in the U. S. Army Air Force, Dr. Socolow was engaged in photogrammetric mapping and air photo interpretation.

Dr. Socolow serves on many national and state committees and task forces, both as a representative of the Commonwealth, and as a member and officer of numerous national geological societies.

Living with our Stone Industry

by Joan J. Sevon

We, the citizenry, and our Pennsylvania stone industry are frequently at loggerheads over quarrying. How much better to live in mutual agreement than to battle one another! I propose that this mutual agreement is possible, but it takes understanding. Understanding on our part includes knowledge of the stone industry's employment potential and economic support to our community, the everyday essential uses of stone, the reasons for quarry location, and the industry's environmental plans. Understanding on the stone industry's part includes dealing with air, water, and noise pollution, and the general eyesore its operations create for those living near a quarry or along a hauling route. Together we can build a satisfying environment in which to live.

The stone industry is one of our major industries. It employs an estimated 6,000 persons in Pennsylvania. Preliminary data from the United States Bureau of Mines show that the value last year of our basic aggregate production was $196.3 million and that we ranked fifth nationwide in production. Limestone dominates these figures. The largest use of crushed limestone in Pennsylvania is for dense-graded road-base stone, followed by stone for Portland cement, and stone labeled "other construction aggregate and roadstone." Production of crushed limestone and dolomite is also important in our commonwealth for use as agricultural lime.

These are major uses of limestone and are important to us. For example, the Pennsylvania Department of Transportation (PennDOT) used approximately 1.2 million tons of plain aggregate, plus the aggregate in 2.1 million tons of other asphalt road material, for just maintenance last year, and every building in our capitol complex is made of either stone or concrete. The importance of agricultural lime is well documented. Studies by The Pennsylvania State University show higher crop yields following applications of lime on acid soils, a vital concern for us in this day of increasing food demand.

Some of the other uses of limestone may not be quite as familiar as these major ones, but they are just as important to us because we use them every day. For example, limestone is used in paper, glass, paint and varnish, soap and detergents, textiles, refractories,

baking powder, milk of magnesia, bicarbonate of soda, and toothpaste. It is finely ground and used to control coal-mine dust and to purify power-plant exhaust gases of sulfer dioxide. The new power plant at Shippingport, Pennsylvania, is estimated to need 6,000 tons of limestone per day for this latter purpose alone, and limestone is also used in other purification processes, such as water and sewage treatment and acid-waste neutralization. An old and important use of limestone and dolomite is for flux in making steel; about one-half ton of limestone is used to make one ton of steel.

These are truly a great many uses for limestone; we would seriously miss our quarries if they should go out of business. The problem is for us to live with the necessary quarrying operations. The stone industry is a very localized business operation; the quarry *must* be close to its market, usually an urban center, to remain economically viable and, therefore, in business. The unit price of stone is very low, the lowest of any mineral mined in Pennsylvania. The price varies from $2.00 to $3.00 per ton, depending on the type of stone, its use, and the need for crushing. An operator must do a large volume of business to make a profit. This makes transportation costs and distances critical to his business. The difference between trucking stone five miles and 20 miles at $0.13 per ton mile (PennDOT's established hauling figure) means a difference in cost of $1,950,000 for a million tons. At only $2.00 to $3.00 per ton, increasing distances from source to user quickly become uneconomical.

The other critical factor for a quarry's location, of course, is geology: a company can only mine limestone where the limestone occurs. We must, therefore, guard against zoning our stone industry out of business. The danger is that we will force the industry out of its economic transportation range and prematurely build over the mineable site, completely losing the stone resource.

Our Pennsylvania stone industry is increasingly correcting air, water, and noise pollution and the general appearance of its operations. Almost all quarry operators now cover conveyor belts and practice wet stone crushing or use suppressant sprays to keep down the dust. Some enclose crushers to insulate against noise, and many operators construct berms, fences, and plantings to make quarries easier on the eye and safer for visitors or trespassers.

All currently active quarries now comply with our Pennsylvania regulations which require a reclamation plan for eventually mined-out properties. The minimum requirement is to reduce any steep slope to 35° or less and to backfill and reseed disturbed areas. Many of our Pennsylvania operators, however, are going far beyond the minimum. For example, a reclamation plan drawn up in 1967 for a large Hummelstown quarry is already being implemented while the

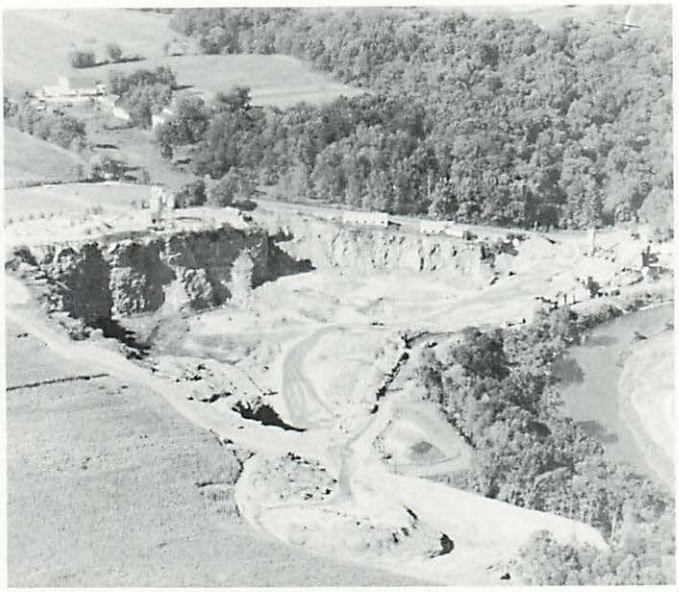

Fig. 1 A Lancaster County quarry as it looks today.

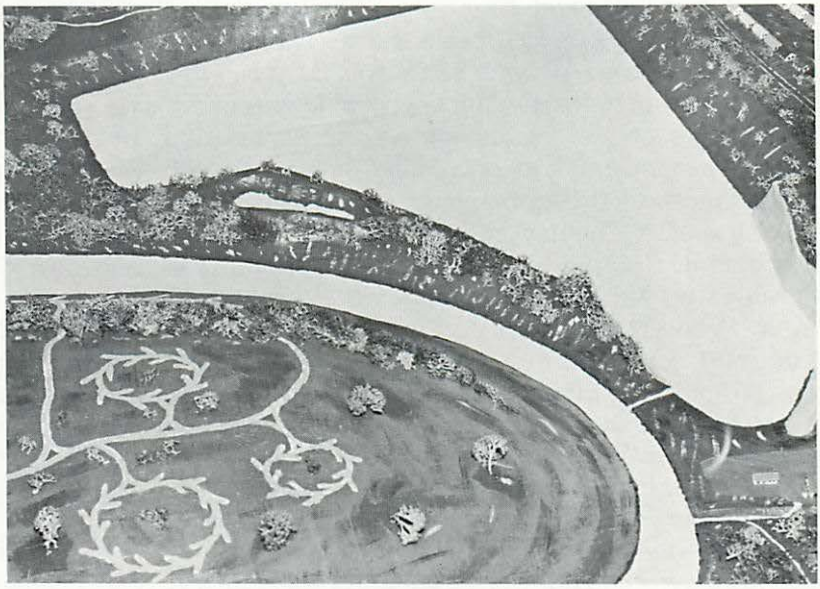

Fig. 2 A model of the reclamation plan for the above Lancaster County quarry, showing the area when the 38-acre park and 50-acre lake is completed.

quarry is still operating. Stripped overburden is dumped where it will eventually be used in the construction of a 19 hole golf course and a residential community.

An elaborate reclamation plan has been worked out for a Lancaster Township quarry. After mining is complete, they plan to make a 50-acre lake and landscape 38 acres around it for a park which they propose to give to the township (Figures 1 and 2). The company also proposes to put money aside every year in an escrow account for maintenance of the park. Their quarry is in a highly populated area; a park would be a great addition to the Township's facilities.

The rub is that many of our townships are rezoning quarry property and discontinuing nonconforming use which keeps some companies from mining their reserves - and we, the citizens of Pennsylvania, from using their product. Here is an excellent example of the need for understanding compromise. Our stone industry shows it can live peacefully with its neighbors by covering conveyor belts and crushing stone wet or using suppressant sprays (not to pollute the air with dust), keeping its used water in a closed system (not to pollute surface or ground water), blasting with only a few holes and double delay (not to shake nearby houses), and in some instances, giving the neighborhood a park.

What will *we* do? Will we understand that our Pennsylvania Stone Industry is mining a resource we *need*? Will we let them continue to mine? Will we continue to benefit from the many uses of their product and ultimately enjoy their parks? The choice is ours, but a wrong choice could drastically affect our life style.

A GUIDE FOR SOUTHWESTERN PENNSYLVANIANS

The Pittsburgh Geological Society has issued a book entitled *"Lots of Danger -- A Property Buyers Guide to Land Hazards in Southwestern Pennsylvania."* The illustrated 85-page book identifies and describes the various types of geologic conditions and hazards which affect construction in southwestern Pennsylvania. They include landslides, subsidence over mined-out areas, and flood plains.

"Lots of Danger" may be purchased for $3.85 from Pittsburgh Geological Society, P.O. Box 3432, Pittsburgh, Pa. 15230.

Pennsylvania Iron: Foundation of the American Revolution

by Charles H. Shultz, Professor of Geology
Slippery Rock State College

The role played by geology in the conduct of the American Revolutionary War is generally not appreciated by laymen or geologists. One of the more important aspects of this role is the occurrence of iron ore deposits that were hidden in the forested wilderness of colonial southeastern Pennsylvania. It is probably fair to state that the Revolutionary War occurred by the consent of Pennsylvania geology. That is not to say that the war would not have taken place without Pennsylvania's resources, but rather that the character of the conflict would have differed markedly and may have taken much longer without the cannon, shot, and other material supplied by Pennsylvania ironmasters.

The importance of Pennsylvania iron ore deposits was not early recognized. In fact, Pennsylvania was about the last colony to begin the manufacture of iron. The first iron-making in the new world probably occurred near Jamestown, Virginia in 1608 and there was a vigorous industry around Lynn and Saugus, Massachusetts in the mid-1600's. The first iron works in Pennsylvania was Poole Forge in Berks County, established by Thomas Rutter in 1716. This rather primitive facility was a bloomery forge, very similar to the hearths used by blacksmiths. The first charcoal blast furnace, which was the principal technology used in the manufacture of iron at the time of the Revolutionary War, was Colebrookdale furnace founded in 1720 near Boyertown. From this small and rather tardy beginning the manufacture of iron blossomed in Pennsylvania to become the foundation stone in the production of the means of war at our country's birth.

What were the requisites for the making of iron using the charcoal blast furnace? Abundant forests for the manufacture of charcoal and rapidly flowing streams to power the water wheels that created the air blasts for the furnaces were very important. So were capital and human resources, such as skilled labor possessing know-how and determination. But there were two indispensible ingredients: iron ore and limestone (that serves as a flux) with which Pennsylvania was well endowed.

There are three principal types of iron-ore deposits in the southeastern part of this state. These are residual limonite and hematite deposits, magnetite-bearing Precambrian gneisses of the Reading Prong, and Cornwall-type contact-metasomatic magnetite deposits. Of these, the Cornwall-type deposits were clearly the most important during the Revolutionary War. They are associated with Triassic diabase intrusions that produced iron-rich solutions as the diabase crystallized. These chemical solutions partially replaced chemically favorable adjacent rocks, primarily limestone, with a mixture of magnetite, pyrite, chalcopyrite, and numerous other minerals. The type-locality for these deposits is the famous Cornwall mine in southern Lebanon County (then part of Lancaster County) discovered in 1732 by Peter Grubb. Besides Cornwall itself, similar ore deposits that were utilized during the Revolutionary War and that are still recognizable, are the Hopewell Mines and the Jones "Good Luck" Mine in Berks County, and the Warwick Mine in Chester County. There were undoubtedly many other active mines during the war and many that were opened in the years following the war. The only currently active mine on Cornwall-type ore deposits is the Grace Mine at Morgantown. This deposit was completely unknown to 18th century miners, however, since its closest approach to the surface is about 1500 feet below ground level and was discovered only about 20 years ago. All iron mining during the Revolutionary War was of the open-pit type on ore deposits exposed at the surface, although some minor experimentation had taken place with underground mining.

Most blast furnaces in colonial Pennsylvania were built in remote wilderness areas associated with self-sufficient villages or plantations that reportedly resembled benevolent feudal manors of medieval Europe. Besides the manufacture of iron, farming, spinning, weaving, candlemaking, wagon making, and food preservation were among the important activities in these isolated villages. Hopewell Village, which is now a National Historic Site, is the only surviving example of the 16 blast-furnace plantations believed to have been in operation in Pennsylvania during the Revolutionary War. Hopewell was founded in 1770 by Mark Bird and has been restored by the Federal government to its condition of the period of 1820 to 1840, a time of great prosperity for the furnace. Thousands of visitors tour the facility each year and during the summer months one may observe individuals in period dress performing tasks similar to those of long ago.

It required about 5,000 to 10,000 acres of forest to support a blast furnace. One acre of forest produced about 21 to 24 cords of

wood, which yielded the charcoal necessary to make one ton of pig iron. More than 6,000 cords of wood were consumed by a typical furnace each year, requiring a large number of wood cutters and colliers (charcoal makers). In contrast, two or three miners could supply a single blast furnace from open pits with all the iron ore and limestone needed. About two tons of ore were required to make one ton of pig iron, which required 12 hours to make. Most of the iron was poured into molds to make stove plates, hollowware, cannon, and shot. Some was poured into ingots called "pigs" and turned into wrought iron for tools and swords in forges at the furnaces or nearby.

Of the furnaces that made cannon, shot and other tools of war, only a few remain and none of the forges have survived. Besides Hopewell, Cornwall Furnace at Cornwall in Lebanon County is well preserved and is open to visitors under the auspices of the Pennsylvania Historical and Museum Commission. Some of the other surviving relicts of the Revolutionary War iron industry include Durham Furnace and mines in northern Bucks County, Hopewell Forge

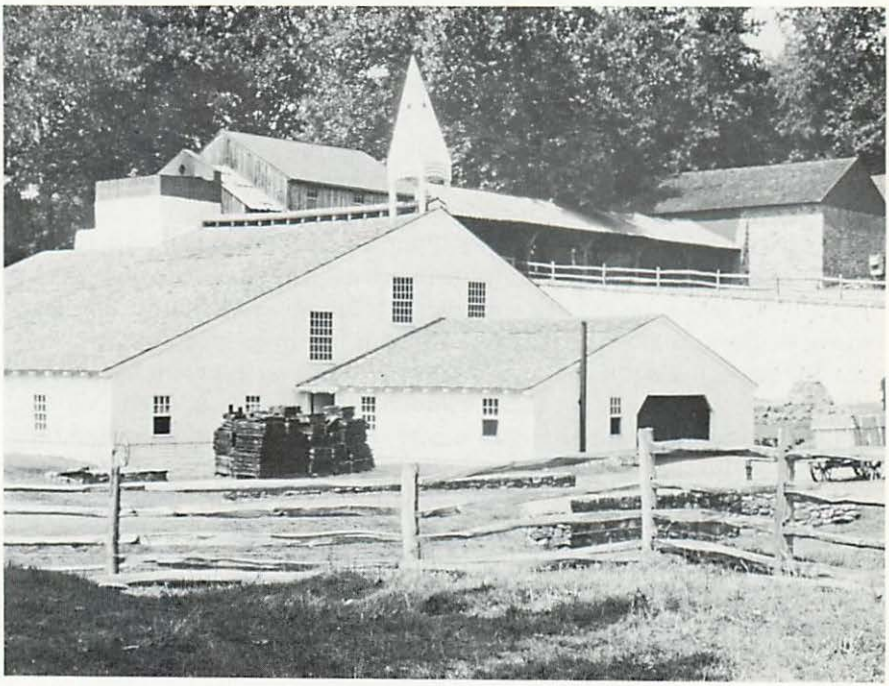

Fig. 1 Overview of Hopewell Furnace showing the casting house, furnace, connecting shed and charcoal house.

Fig. 2 Remnants of Codorus in York County.

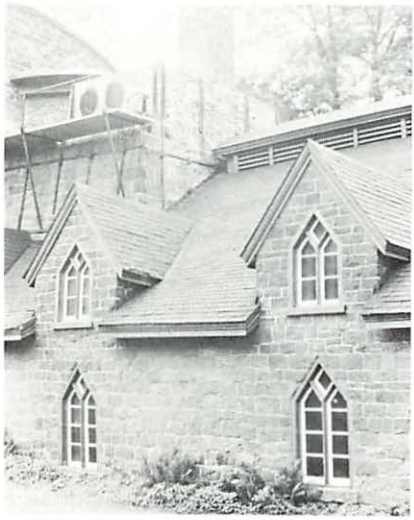

Fig. 3 Casting house and furnace at Cornwall.

mansion in Lancaster County, Pottsgrove mansion in Pottstown, Codorus Furnace in York County, Martic Forge mansion in Lancaster County, and Oley Furnace and Joanna Furnace in Berks County. Most of the mines, furnaces, and forges exist only in history books or as obscure slag and gob heaps beneath forest litter.

Since Pennsylvania was not alone among the colonies in possessing significant iron-ore deposits, forests, and water resources, why does it stand out as a keystone in the war effort? One explanation lies in the character of early European immigrants into southeastern Pennsylvania, especially the Welsh, English, and Germans. Among those people were individuals who possessed a knowledge of iron making and who either had sufficient capital to start a furnace or enough business sense, perseverence, and determination to promote support. Once the resources were recognized, the industry developed rapidly. The ironmasters were an independent lot and were particularly angered by the British Iron Act of 1750. This law was typical of the restrictive and repressive measure taken against the colonists by the British and should rank with the Tea Tax Act as one of the principal causes of the move toward independence. The iron act sought to guarantee a source of pig iron for British manufacturers and to prevent colonists from developing the skill and where-with-all to make articles out of iron such as nails, stoves, and cannon. For

numerous reasons, in Pennsylvania the thrust of the law was a total failure, not the least of which was the remoteness of the iron industry. This isolation allowed the Pennsylvania iron industry to develop in freedom without interference or harrassment by British officials or troops.

Unfortunately for the British, the principal consequence of the Iron Act was to alienate the ironmasters who, to a man, worked vigorously for the cause of independence. The involvement included direct military service, politics, and the manufacture of weapons for Washington's army. During the war labor was in short supply and the iron industry was so important to the war effort that deferments to military service were enforced on Pennsylvania iron workers. The extent and diversity of the involvement of Pennsylvania ironmasters and their industry can only be aluded to here, but a few examples will suffice:

—George Ross was a signer of the Declaration of Independence,

—John Potts was a member of the State Constitutional Convention of 1776.

—Issac Potts, his son, was the owner of Valley Forge, which was burned by the British two months before the encampment of the continental army, and his house served as Washington's headquarters in the bitter winter of 1777.

—Mark Bird was the commander of the 2nd Battalion of the Berks County Militia and led into battle 300 men, which he provided with arms, uniforms, food, tents, and so forth at his own expense.

—Washington crossed the Delaware to the Battle of Trenton on December 26, 1776 in freight boats built at Durham Furnace to haul iron products to Philadelphia.

—It is reported that cannon cast at Cornwall possessed a greater range than those used by Cornwallis at the Battle of Yorktown, thus significantly speeding the defeat of the last British army.

One is compelled to agree with Arthur Cecil Binning (1938) who said that if the iron industry in Pennsylvania had not reached such a high stage of development, the colonists would have been helpless in the revolutionary war conflict. Of course, geology was the foundation of that industry.

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PLENTY of FOREWARNING

"I conceive that it is totally unnecessary for me to make any comment upon the great advantage it would be to this country to be supplied with all the useful metals from its own mines; to purchase which, an immense sum, everyone knows, is annually sent to Europe."

The above statement appears to be very timely, in view of a growing national concern over the U. S. imbalance of foreign payments related to growing U. S. dependence on foreign sources for minerals and oil.

It is ironic that the above quotation was written in 1797 by Benjamin Renfrew as the opening statement in his Preface to *A Plan With Proposals for Forming a Company to Work Mines in the United States.* Renfrew went on to state:

"Americans are an enlightened people and very capable of judging of what is calculated to promote the true interest of their country."

"The greatest difficulty, that I see will attend it, is, that mining is a business, that people in general are afraid of being concerned in."

We certainly cannot say that we were not forwarned! Benjamin Renfrew aptly described our present situation 180 years ago!

STATE MAP COMPILATION – OPEN FILE

The Pennsylvania Geological Survey is placing on open file the completed compilation sheets prepared for the new state geologic map. The majority of these compilations are hand drawn on 1:24,000 quadrangle sheets. A portion of northwestern Pennsylvania was revised at 1:62,500 scale; there are twenty-four such quadrangles.

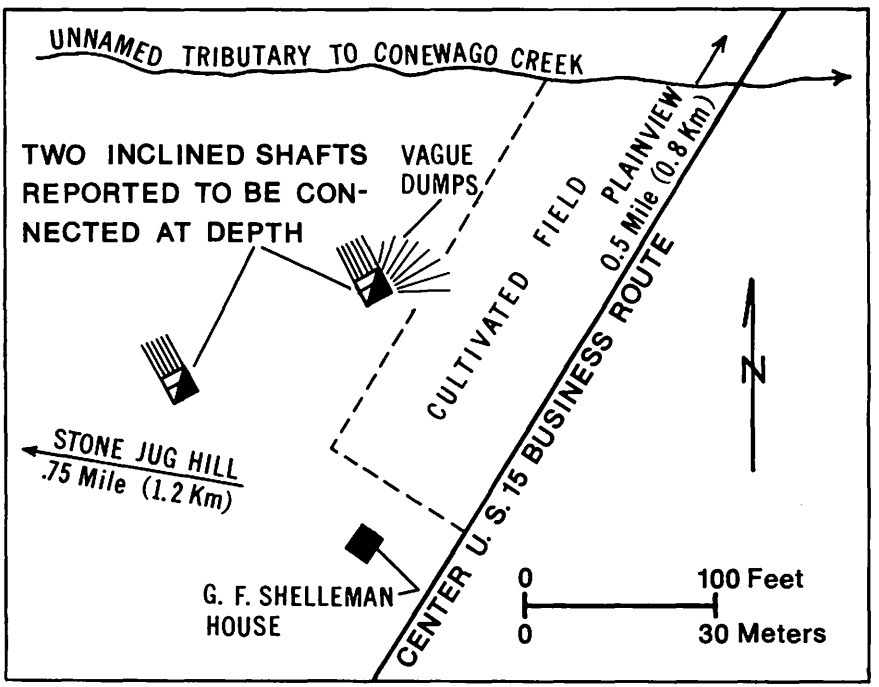
These new maps may be examined only in the library of the Harrisburg office of the Pennsylvania Geological Survey, Executive House, 101 S. Second Street, Harrisburg, Pennsylvania 17101. Questions regarding the maps should be directed to Thomas M. Berg, who is in charge of the new state map project.

Newly Discovered Minerals At Stone Jug Copper Prospect, Adams County

by Robert C. Smith, II and Donald T. Hoff

Re-examination of the Stone Jug copper prospect shows it to be of geologic and mineralogic interest, and perhaps a clue to economic mineralization. Recovery of several specimens of molybdenite by Lloyd Shelleman, the owner's son, prompted our re-examination.

When visited, numerous small mineralized chips were found in a field east of two water-filled, inclined shafts reported to be connected at depth (G. F. Shelleman, personal communication, 4/10/76). Unlike Stose (1932, p. 139), who found only rock discolored by copper carbonate but no copper ore, the authors found common bornite as well as malachite with minor to trace amounts of chalcocite, djurleite (the second reported locality in Pennsylvania), chalcopyrite, molybdenite, powellite (also second reported locality in Pennsylvania), azurite, and chrysocolla. Analyses of a ten-pound bulk sample of small chips selected to show at least a speck of malachite showed the presence of 6.0% Cu, 2.97 oz Ag/ton, 0.048 oz Au/ton, and 180 ppm Mo. At present (low) prices, this would



be $70.00 per ton for copper, $13 for silver, and $7.00 for gold for an impressive total of $90.00 per ton. However, this represents a somewhat high-graded sample and the ore zone may have been only a few inches thick. For Pennsylvania, the calculated gold content of about 0.5 oz/ton (and 30 oz Ag/ton) in a bornite concentrate containing 60% Cu is still impressive because of the general rarity of gold in the state.

Two exploratory holes are reported to have been drilled approximately 200 yards north of the northern shaft in 1955 or 56. In 1959 (?), four or five additional test holes were drilled about 1/2 mile (0.8 km) southeast of the prospect. The exploration companies did not release logs of the cores (L. Shelleman, personal communication, 3/1/77).

The area of the prospect was mapped by Stose (1932) as a Triassic hornfels, and indeed the ore seems to be localized in baked calcareous sandstone within dark shale. The gangue minerals, andradite-grossular, epidote, heulandite, hornblende (?), schorl, and stilbite, also suggest a hornfels. The source of heat for the baking, and perhaps also the source of the metals, was intrusion of Triassic diabase magma to the west. This is evidenced by Stone Jug Hill, a diabase intrusion rising 120 feet (37 meters) above the surrounding area.

Stone Jug Hill, with a 1280 gamma aeromagnetic anomaly above the regional background, was noted by Bromery and Griscom (1967) as being favorable for a magnetic body within 1500 feet (460m) of the surface. Stone Jug Hill was drilled for magnetite in 1950 by the Bethlehem Steel Corporation. Cores from three test holes suggested that the local magnetic high might be caused by accessory magnetite in the diabase and granophyre (a pinkish, coarse-grained diabase differentiate). Appreciable magnetite replacement of the sediments lying immediately above the intrusion, a favorable place for Cornwall-type iron-copper ore bodies, was lacking in the area tested. The observed sulfide mineralization was limited to local pyrite in granophyre fracture fillings and disseminations. None of the core material was assayed for Cu, Ag, Au, or Mo (S. J. Sims, Bethlehem Steel Corp., personal communication, 2/10/77). Because the copper occurrence has unusual amounts of Ag, Au, and Mo, limited geochemical and geophysical exploration in the Stone Jug intrusion area may be warranted. A second diabase sheet with its own contact metamorphic zone may exist at depth, similar to the situation at Dillsburg, 16 miles (25 km) to the northeast (Smith, 1975, p. 948 and Hotz, 1950).

Sheely (1886) notes that a Stone Jug copper mine, opened about 1845, is located seven miles from Gettysburg on the Harrisburg-Gettysburg road. A Maj. Robert Bell was responsible for hauling the first load of ore, weighing three tons gross, to Baltimore in 1846. Sheely makes the dubious statement that the mine was ". . .worked actively for several years, during which time large quantities of good ore were taken out and sold, . . ." Shortly after 1846, the miners were transferred to certain of the Lake Superior district copper mines managed by the same company. Operations were resumed several times at the Stone Jug mine during the latter half of the 19th Century, with stockholders of the different auspices suffering financial embarrassment. "Old timers" have reported [additional] copper prospects about 3/4 mile northwest and ¼ to ½ mile southeast of the Shelleman prospect.

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(FROM THE DESK Continued)

The point to this discussion is simply that there are no quick solutions to drastically improve the nation's energy self-sufficiency. Particular caution is directed to those who hope for major new energy sources via techniques which have either not yet been invented, or scientifically resolved, designed, or engineered. Thus, any really major energy contributions from wind, geothermal, tidal, space stations, fusion, or even solar techniques are likely to involve a lead time of 20 to 25 years. They all should be considered and pursued, but let us not delude ourselves on the delivery time.

Arthur G. Sacklow

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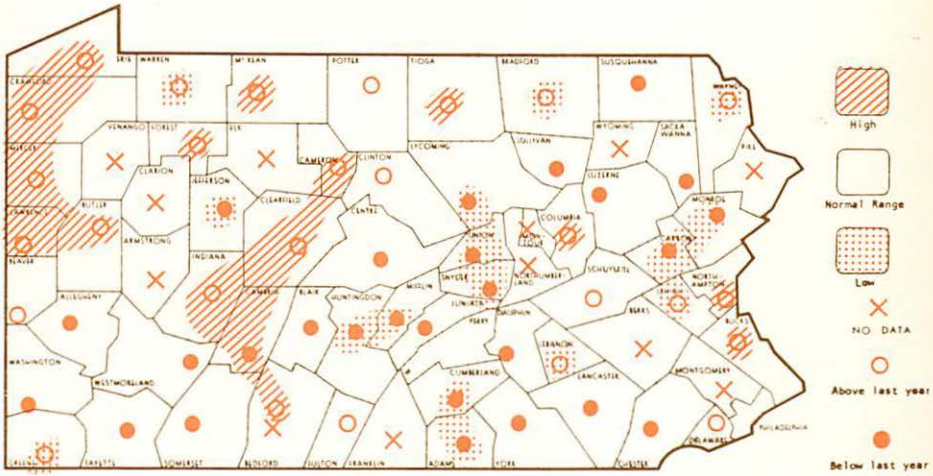

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