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ON THE COVER

The contact between Vintage dolomite (left) and black Conestoga phyllite (right) at the entrance to the Pequea silver mine in Lancaster County, Pa. The hammer in the center of the photograph indicates scale. Quartz veins can be seen at this contact. Silver-bearing galena was mined from similar quartz veins (see article on page 2). Photograph from Pennsylvania Geological Survey files.

PENNSYLVANIA GEOLOGY

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An Excellent Geologist— Don Wise

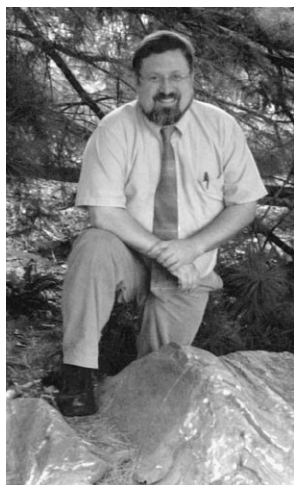
In this issue, you will find an article written by Dr. Donald Wise (now a Professor Emeritus at the University of Massachusetts at Amherst, who previously taught at Franklin and Marshall College in Lancaster, Pa.) about the Pequea silver mine in Lancaster County. As you will see, he has a talent for drawing illustrations. His ability to capture three dimensions in a two-dimensional drawing is phenomenal. Generations of geologists have seen his illustrations and been able to grasp a geological idea that was otherwise obscure.

Don is a remarkable person. He is also a freethinking and creative geologist. He is always open to new ideas and is famous for his sense of humor. In his treatise on “linesmanship,” or the tendency of some geologists to see linear features in any dataset, he wrote that a lineament is “a line that is longer than it is wide.”

Don is also one very smart man. He is a graduate of Franklin and Marshall College, California Institute of Technology, and Princeton University, and finished his degrees in a breathtakingly few years. When Don tells me something, I listen. I may not always agree with him, but he is usually right.

You may ask why I am writing such a tribute to a geologist. For one thing, he is a dying breed. There are very few structural geologists who do field mapping any more. And we are in need of them. It is our job to map the geology of the state, and there are very few candidates when we have a job opening. People like Don train the future geologists of the Survey.

Finally, to quote Don's web page, “He is the holder of a valid birth certificate,” something we can all appreciate.



Jay B. Parrish
State Geologist

The Pequea Silver Mine of Lancaster County, Pennsylvania

by Donald U. Wise
Department of Geosciences, University of Massachusetts at
Amherst, Amherst, MA 01003

INTRODUCTION. The Pequea silver mine, located about 10 miles south of Lancaster just west-northwest of the crossing of State Route 324 over Pequea Creek (Figure 1), is a well-exposed case study of structural and hydrothermal localization of ore bodies, and was discussed by Wise (1960) and Loose (1972). The ore was argentiferous galena hosted by quartz veins in Cambrian Vintage dolomite just below its contact with Cambrian-Ordovician Conestoga phyllite.

Structurally, this contact was repeated by a minor compressional or thrust fault north of the major Martic zone of thrust faults, about 1.2 miles to the south. During multiple folding of this doubled contact, ore-forming solutions were trapped just below the impermeable phyllite in fractures

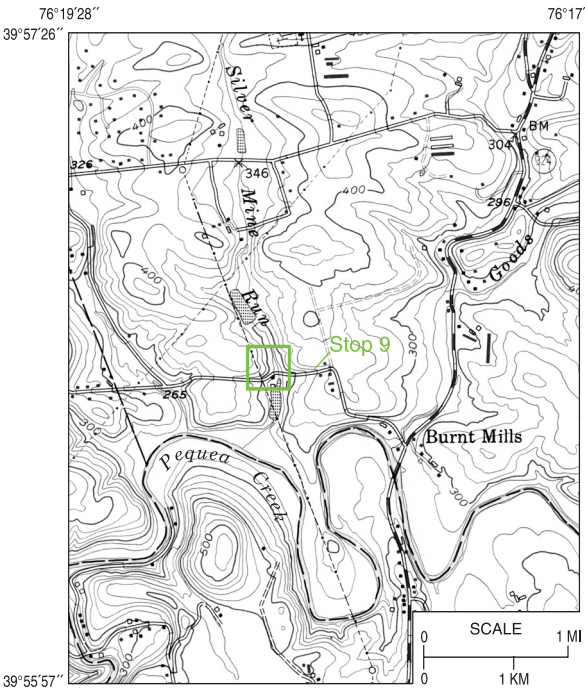


Figure 1. Location of the Pequea silver mine, about 10 miles south of Lancaster, Pa. (the mine area is indicated by a green rectangle). Index map of Lancaster County shows Lancaster (dot) and mine location (X).

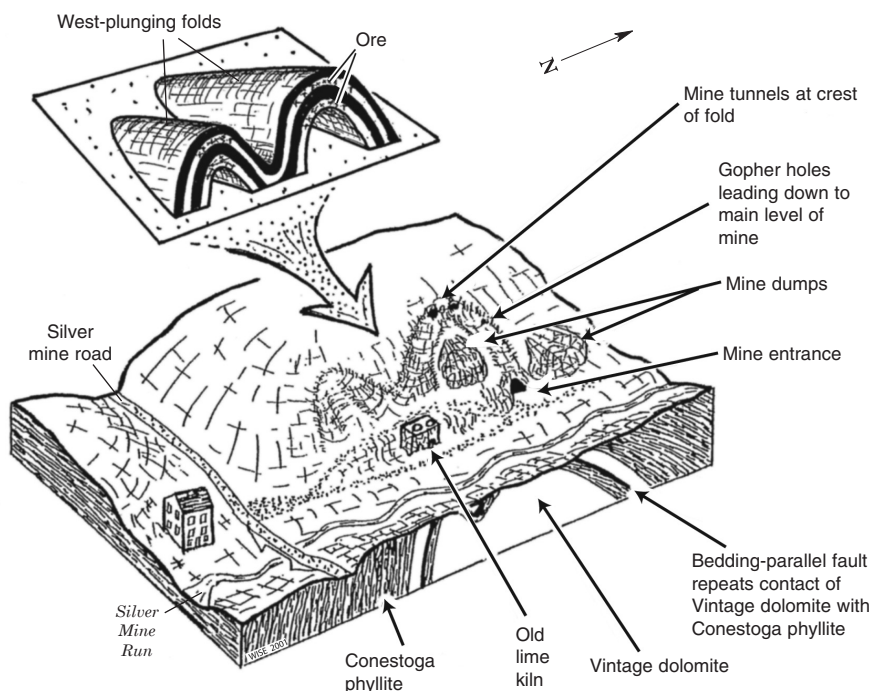


Figure 2. Block diagram of the silver mine area. The surface workings follow the outcrop of ore in the valley wall through two anticlines (upfolds) separated by a syncline. The upper part of the diagram shows the appearance of the folds without the overlying material. The view is from the southeast. Compare with Figure 3, which shows the underground workings of the area as viewed from the northeast.

of the underlying brittle dolomite. Optimum hydrothermal fluid flow and/or trapping conditions occurred in the crests of anticlines, as evidenced by more extensive mine workings at those locations. It is possible to see this relationship along nearly continuous surface stripings of the ore zones through two anticlines and an intervening syncline (Figure 2). Underground workings, now gated shut, also followed both ore horizons along the major (northern) anticlinal axis just above the water table as well as to deeper, now flooded, levels (Figures 3 and 4).

The general mine area is open to the public as a Pequea Township park. Geologic field trips to the surface workings are welcome, and frequent police patrols monitor against vandalism of the area. A telephone call to the Pequea Township office (717-464-2322) prior to a field trip is advisable. Mineral collecting is both prohibited and

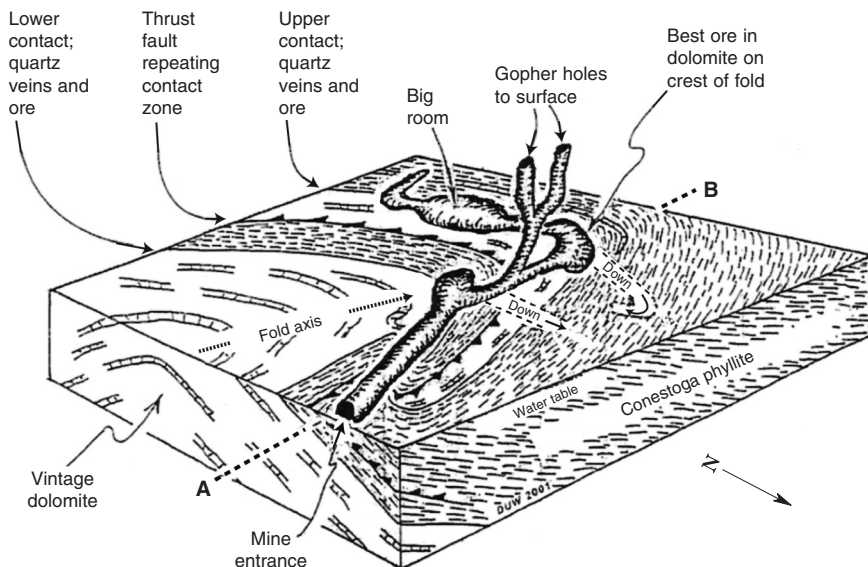


Figure 3. Block diagram of underground workings. The workings follow the double or repeated contact of the Vintage dolomite with the Conestoga phyllite. Ore-bearing quartz veins were localized on these contacts near the crests of anticlines. The view is from the northeast, whereas Figure 2 is a view from the southeast. Line A-B (representing about 200 feet) is the line of cross section shown in Figure 4.

unproductive; the entire area, including the dumps, has been so thoroughly picked over that finding even a tiny piece of galena is rare.

In 2001, after the township took over the park, and as part of his Eagle Scout requirements, Paul Helwig (of Conestoga) orchestrated the clearing and marking of a geologic trail. He worked under my guidance and that of Dr. Alan Peterson of Lancaster. His father supplied metal plaques along the trail to identify the outcrop stops discussed below. The trail runs counterclockwise up Silver Mine Run and around the surface workings. The geologic illustrations and descriptions were designed both as a field laboratory exercise for high school students and teachers and as a self-guiding trip for the interested layman.

(Hint to teachers: having students find and record progressive changes in strike and dip of bedding around the plunging folds provides an excellent hands-on exercise.)

HISTORY. The existence of ore in the Pequea area was known in colonial times, but the bulk of the workings visible today probably dates from around the time of the Civil War. An 1863 stock prospectus for the “Lancaster Lead Company” was issued in an attempt to

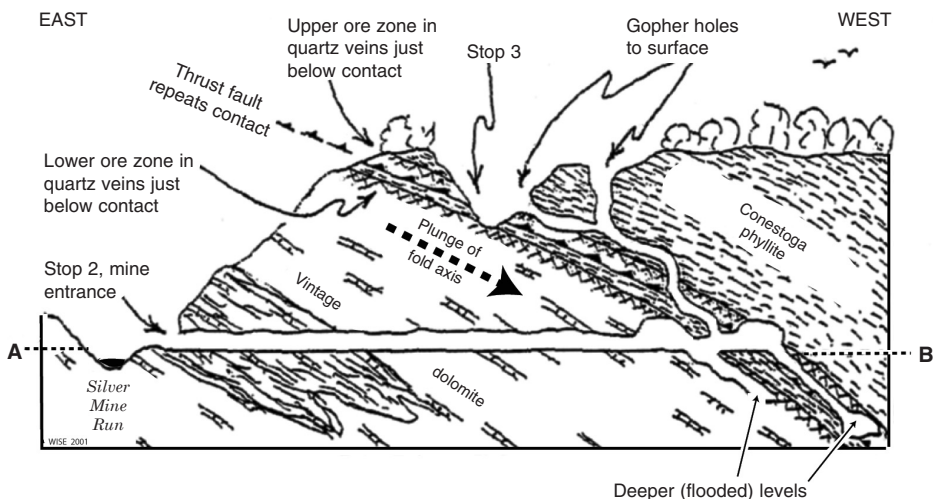


Figure 4. Idealized cross-section (about 200 feet long) of the mine workings along line A-B of Figure 3.

raise \$250,000 to begin major mine operations. Extensive and ongoing exploration in 1863 by the sinking of a number of surface shafts was described in the prospectus, but no mention was made of the main underground workings or of the open-cut excavations. Only the northerly dip or inclination of the veins was mentioned, indicating that folding had not been recognized as of that date. Apparently, the stock was sold and most of the present underground workings as well as the surface strip mining around the folds were completed soon thereafter, possibly as part of the lead supply for Civil War musket balls.

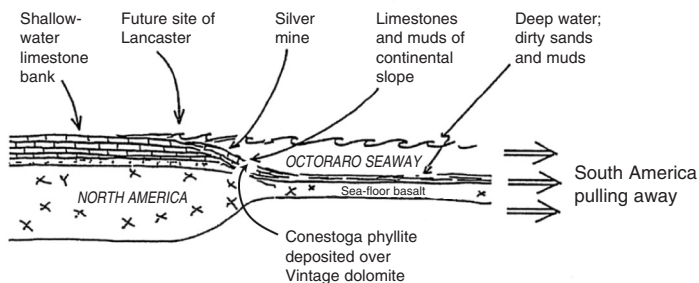
MINERALS. Around the mine, the most abundant mineral is milky-white vein quartz, the host material for the ore, which consisted of a lead sulfide called galena and small amounts of sphalerite (zinc sulfide). The physical properties of galena include a high specific gravity, a silvery metallic luster, and a cleavage resulting in fracturing into tiny cubes along crystallographic planes. Galena from this mine had many silver atoms substituting for those of lead in its crystal structure. These silver atoms warped the internal structure to cause pronounced curvature of the galena's cleavage surfaces. When the Pequea ore was smelted, a significant amount of this silver was recovered. Analyses are reported to have shown 10 to 16 ounces of silver to the ton, or about \$80 to \$160 per ton at present prices.

ROCKS. The two most abundant host or country rocks are the following: (1) massive, light-gray dolomite (magnesium-rich limestone)

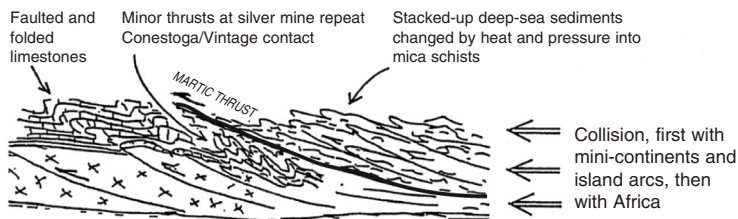
of the Vintage Formation; and (2) black, limy phyllites (recrystallized shale) and limestones of the Conestoga Formation (see front cover). Both formations were deposited in a sea between about 540 and 450 million years ago. From about 450 to 250 million years ago, the dolomite and shale formations were buried, then faulted, folded, heated, and fractured at depths on the order of 5 miles within an evolving mountain range. During this time, hot waters moved through the rocks and emplaced quartz and galena. During deformation, the dolomite was brittle and therefore fractured, which provided openings for the hot waters to flow through, whereas the shale, which had been changed to phyllite, flowed plastically and acted as a seal. For this reason, the galena-bearing quartz veins are now concentrated in the dolomite, especially along the crests of upfolds (anticlines) where the hot waters were trapped just beneath the impermeable phyllite cover. Since then, erosion has removed the former mountains and exposed these deeper roots of the once mighty Appalachians.

MINE WORKINGS. The walking tour follows the surface outcrop of the ore veins along the old surface strippings. The block diagram in Figure 2 shows how the east-west-trending, westward-tilted (or plunging) fold hinges crop out in curving exposures in the valley wall.

Digging along the area of outcrop was a simple and cheap way of mining the ore but was obviously limited in how deep it could be extended. Ultimately, underground workings along a horizontal tunnel or adit were required in order to follow the veins. To get under the maximum amount of ore, this adit would be driven as low as possible on the valley walls but just high enough to be above the water table. Such considerations probably determined where to start the underground workings (Figures 3 and 4). Apparently, the localization of ore in the fold hinges was recognized by the time underground workings began, because the mine adit does not start at the logical location of the vein outcrop but is in the black phyllite heading directly toward the hinge zone. All these details of the underground workings show signs of sophisticated knowledge both of site geology and mining methods, presumably by the “Mr. F. P. Herington, an experienced and highly skillful mining engineer” described in the 1863 stock prospectus. Several other mine shafts in the local area support the interpretation that these ores occurred in very irregular small and discontinuous pods and pockets. The abandonment of the main mine workings probably resulted from the removal of all the ore in the visible pockets as well as from decreasing demand for lead with the end of the Civil War.



A. CAMBRIAN TO MID-ORDOVICIAN



B. LATE ORDOVICIAN TO PERMIAN

Figure 5. Geology of the area from about 500 to 250 million years ago. A. The edge of North America lay to the present north in the Lancaster area as a shallow-water limestone bank. The mine area was located in submarine slopes leading off into deeper water toward the present south. **B.** Subsequently, the collision of island arcs and ultimately of Africa telescoped these rocks and folded them several times.

GEOLOGY. Three chapters in the geologic history of this area must be considered to understand the formation of these deposits, as discussed next.

Stage 1. The story begins about 500 million years ago in Cambrian times when this area was at the edge of an ancient ocean (Figure 5A) that lasted for about 50 million years. The location of what is now Lancaster lay at the sea's edge on a great limestone bank, somewhat similar to the barrier reefs of Australia today. North of Lancaster, the thick-bedded shallow-water limestones that we see today were being deposited in quiet marine backwaters. In and to the south of Lancaster, thin-bedded sandy and muddy limestones and black shales from a somewhat stagnant ocean became the Conestoga Formation. These rocks represent continental-slope deposits, material washed or collapsed from the limestone bank into deeper waters. (The roadcut at Stop 9 [see below] exposes one of these

submarine slides.) In the mine area, the Vintage dolomite represents shallow-water deposits from the very edge of the shelf. The deepening sea then overwhelmed and covered these beds with Conestoga black shales. The deeper ocean waters were rather stagnant so that organic carbon was preserved, causing the deep-blue to black color of the limestones and shales or phyllites of the Conestoga Formation. Primitive animals living in those seas accumulated and preserved small amounts of sulfur, iron, lead, zinc, and silver. Subsequently, hot waters acquired these elements along with silica and calcite and re-deposited them as pyrite cubes (iron sulfide) as well as minor ore minerals in quartz and calcite veins throughout the region.

Stage 2. About 450 million years ago, in Ordovician time, the sea began to close because two tectonic plates were moving toward each other. Bits and pieces of oceanic islands were mashed into the continent for about 200 million years (Figure 5B), and the later part of this cycle involved the impact of Africa itself. (The collision zone separated again starting at about 225 million years ago, producing the still-opening modern Atlantic Ocean.) As these pieces docked and ground into North America, the Appalachian Mountains were produced. These were high, rugged alpine ranges comparable to the Himalayas; they were quite different in appearance from their modern eroded roots. The collision telescoped the edge of the continent, piling sheet after sheet of rock onto the continent. Deep-water sediments were thrust northward onto the slope and limestone bank along the Martic Line, now recognizable about 2 miles to the south as the front of the Martic Hills. Slabs of slope deposits peeled off, to be stacked one on top of another. In the mine area, this caused a doubling or repeating of a thin slab of the contact zone of Vintage dolomite with overlying Conestoga phyllite (Figure 6). As deformation continued, the stack was folded into the geometry we see today. All of these processes took place at elevated temperatures and pressures several miles beneath the surface. Temperatures around 300°C (572°F) caused the recrystallization of many of the rocks, including some of the shales, into shiny black phyllites or even schists in which fine flakes of micas are visible. As part of this stage, hot waters were forced through the rocks, dissolving mineral materials at some places and redepositing them elsewhere as quartz, calcite, and galena. Wherever there were traps for these hot waters or open spaces for them to move through or fill, vein deposits were likely to occur. Here in the mine area, the dolomite was quite brittle and opened up with great gashlike and bedding-parallel fractures, whereas the Conestoga black phyllites merely stretched and flowed and provided an

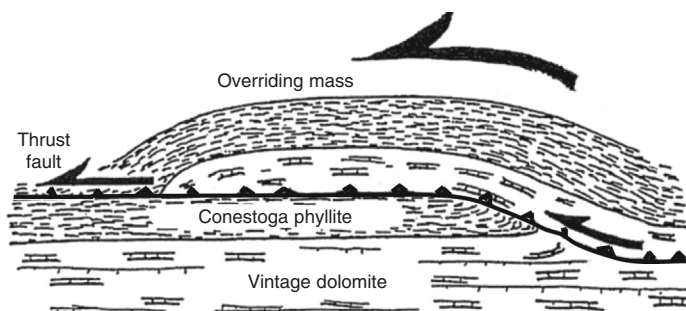


Figure 6. Illustration showing how the contact of Conestoga phyllite over Vintage dolomite was repeated by a bedding-parallel thrust fault. Thickness is about 16.5 feet.

overlying seal for the hot waters. The result was the deposition of material in veins concentrated in the repeated dolomite beds just below their contacts with the black phyllite. Such ore deposits, localized in the hinge zones of folds, are sometimes called “saddle reefs.”

Stage 3. Erosion of the former mountains to their deeper roots produced the topography of today. This erosion proceeded in several steps, and most of it took place in the last 5 to 10 million years. All the rocks were eroded to a nearly flat surface near sea level, which was later uplifted to a 400-foot elevation, producing the Lancaster surface, visible throughout the region as flat-topped hills of that elevation. After uplift, streams began to cut down through the old surface and formed the deep valleys of today, including Pequea Creek and Silver Mine Run. Remnants of that old surface survive as the present flat-topped 390- to 400-foot-high hills on either side of the run (Figure 1).

SELF-GUIDED TOUR. Numbered steel markers are keyed to the descriptions below. They lead due north along Silver Mine Run and then loop around to the west or left-hand valley wall. The final marker (Stop 9) is located at a roadside outcrop east of the stream and halfway up Silver Mine Road (Figure 1). For the tour, reference to the block diagram of Figure 2 would be helpful. Also note that geographic north is directly up the valley, with east to the right and west to the left.

Stop 1. Old Lime Kiln. This is a two-kiln structure typical of those that dotted the region in the 1800s and early 1900s. Collapse of the north kiln allows inspection of the inner cruciblelike shape. In operation, the kiln was filled with alternating layers of wood and limestone or dolomite (Figure 7). This was ignited and allowed to burn

freely for a brief time before air flow was restricted by a cover of ash at the top and a pile of dirt at the bottom. For about a week, this burn was watched constantly to maintain intense heat inside the kiln with just the right amount of air for combustion and escape of carbon dioxide from the burning wood and decomposing lime-

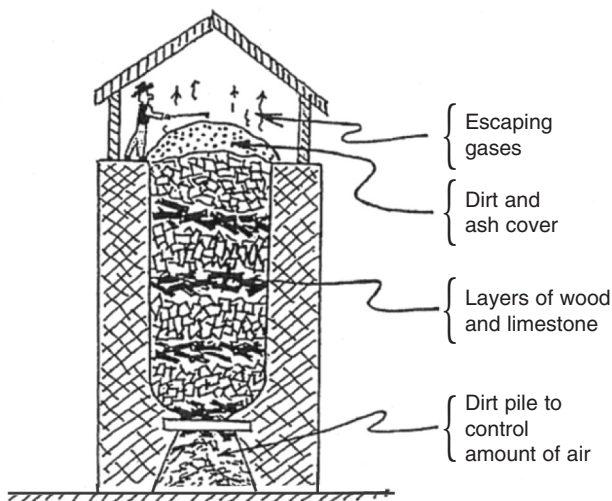


Figure 7. Operation of a typical lime kiln similar to that at Stop 1.

stone (calcium carbonate). (As a boy, I saw one of the last of these burns in the 1930s with a half dozen old timers sitting around the hot ash pile mostly loafing and telling tall tales while they roasted apples and potatoes.) After about a week, all the wood was burned and all the carbon dioxide was driven out of the limestone, leaving the contents as quicklime, a white, powdery form of calcium oxide. This was removed through the opening at the bottom, to be used to disinfect the ubiquitous privies of that time, to be mixed with water, sand, and rock to produce mortar and cement for walls, or to be mixed just with water for whitewash paint for barns and houses. Most of the limestone used in the kiln probably came from the large quarries visible eastward through the trees just across Silver Mine Run.

Stop 2. Entrance to the mine adit. This entrance is now closed by an iron gate for safety purposes. Note that you are looking west into the mine and that the rocks are inclined to the north, or right. The mine begins in the black phyllite of the Conestoga Formation and heads directly toward the main fold hinge, suggesting that the mining engineer knew exactly what he was doing. The block diagram (Figure 3) shows how he drove the adit westward for 200 feet to intersect the hinge. There, a large room resulted from the removal of significant amounts of ore, and a now-flooded incline follows the hinge downward for about 30 feet. The mining engineer then turned the

main adit westward, past a “gopher hole” leading to the surface at Stop 3, which is probably a remnant of earlier exploration attempts. The main adit continues for 50 feet and intersects the upper vein at the hinge zone, which was again a concentrated pocket of ore that is now marked only by the large room that was excavated. A second now-flooded incline again follows the fold hinge downward to depths of 60 feet and continues along a deeper level, looping back along the vein for about 70 feet. (These details are from sketches and word-of-mouth reports by local divers.) At the main level, the adit continues along the upper ore zone into a small secondary fold hinge that must have contained a localized rich ore pocket, judging by the tunnel widening to a room that is 10 feet in diameter (“big room” on Figure 3). The final 40 feet of the adit hooks toward the west and passes through one more minor fault repetition of the Vintage dolomite-Conestoga phyllite contact. Much of the waste rock from this extension was piled in the new opening created by ore removal. Unfortunately, the contact of this third repetition of Vintage with Conestoga was unmineralized at this location.

One cannot fail to be impressed by the intelligence with which the mining engineer followed the ore pockets through this complex geology. Even today, with modern structural geology and the hindsight available from all the exposures, I could not have designed a better exploration plan.

From Stop 2 on the walking tour, proceed 100 feet to the north, then cut back along the trail to the next stop nearly directly above the adit. As you proceed, you will be passing over and beside piles of waste rock.

Stop 3. Open cut next to the gopher hole. Stops 3 through 8 follow the ore veins through several folds that crop out in the valley wall. These include two upfolds, or anticlines, separated by a downfold, or syncline. Stop 3 is probably the best surface location for viewing both the upper and lower ore veins. (The cross section of Figure 4 includes this location as its upper portion.) At this stop, the lowest place on the south wall of the cut exposes Vintage dolomite overlain by Conestoga phyllite. The top of the cut exposes a bit of the upper dolomite. Here, the path is in the excavated mass of that upper dolomite, visible in the gopher hole along with its north-dipping cover of black Conestoga phyllite. The gopher hole connects with the rear portion of the mine, as discussed above and shown in Figure 4. Note the localization of quartz veins near the contacts. Also, note that the dip of the beds is toward the north, similar to that of the mine adit,

indicating our location on the north limb of the northernmost fold, an anticline (Figure 2).

Stop 4. Short mine tunnel at the crest of the northernmost anticline. The path extends through the tunnel in a steep but short climb. When one thinks of trying to cut even this little tunnel with today's pneumatic drills and dynamite, one realizes that the task is nontrivial. In Civil War and older times, it was done by handheld steel drills driven by someone swinging a heavy sledgehammer. Holes were filled with black powder, blasted, and muck removed, and the process was repeated.

Note that the beds are now tilted off to the west, a change of 90 degrees from Stop 3 as these beds curve over the top, or crest, of the fold. These folds do not have horizontal hinges but are tilted, or plunging, westward at about 30 degrees (Figure 2). If they were not plunging, the beds here on the crest would be perfectly horizontal.

This exposure is in the upper dolomite at its contact with the overlying black phyllite. The best place to see how the quartz veins were localized within the brittle dolomite and trapped along the contact of the two rock types is the view back from the far side of the tunnel.

Stop 5. Gentle south limb of an anticline. The same contact as that seen at Stop 4 is visible in the rock face at Stop 5. Note that it now has curved across the anticline to dip off to the southwest. The old miners were clearly removing dolomite and vein quartz at this level to expose the rock face. On the other (east) side of the path are mine dumps of waste rock removed from the excavations.

Proceed along the path down over the hillside. The trench (excavation) on the left (east) side of the descent resulted from removal of rock and exposes the same contact as that seen at Stops 4 and 5. The trench was made directly down over the slope and reveals the steepness of the dip of the beds. Small weathered outcrops of the dolomite are visible and have the same steep dip to the south.

Stop 6. Across the axis of the syncline. Careful examination of the outcrop reveals beds dipping to the north, a reversal of direction from the two previous stops and an indication that we have crossed the bottom (the axis) of a synclinal fold. The same contact of the upper ore level that we have been following since Stop 4 is visible here.

Stop 7. North-dipping rock face. This large exposure shows the veins at the contact of the upper ore zone with the phyllite. Dips to the north indicate that we are still on the same limb of the fold as that at Stop 6.

Stop 8. Reversed dip on the other side of an anticline. This exposure is in another trench cut steeply downhill. It is now poorly exposed, but I was once able to trace the contact of the upper ore zone from Stop 7 over the top of an anticline and down along this trench. The poor outcrop shows that the dips have again reversed to the south.

Proceed back to the road and turn left (east) for about 200 yards to the roadside outcrop of Stop 9.

Stop 9. Submarine landslide deposit. The large limestone boulders sticking out of this outcrop had their origin in the vicinity of Lancaster. They are part of the thick beds of the limestone bank (Figure 5A), the edge of which collapsed and slid down into the deeper water of the submarine slope to become interbedded within the sediments that become the Conestoga Formation.

More knowledgeable geologists may look around the left side of the outcrop and note that true bedding has a steep dip, whereas the apparent bedding on the main face of the outcrop is defined by flat cobbles rotated into the plane of cleavage. Further, the cleavage dips to the north, which, if one uses standard cleavage arguments, would incorrectly indicate tectonic transport toward the south. Actually, this is part of a cleavage pattern that was once nearly horizontal, with proper south to north transport, but was later upended and tilted to the north by the uplift of Mine Ridge. Details are given in Wise (1970).

SUMMARY. The major points of this article can be summarized as follows: (1) the rocks and minerals that occur in the area of the Pequea mines are quartz, dolomite, and black shale or phyllite; (2) the rocks have been folded, as can be seen by walking along their outcrop; (3) there are geologic reasons for ore to occur where it does, in this case involving hot waters that deposited the veins and the ore; (4) a geologic history of ancient events can be determined from careful observation; and (5) the old-timers who worked this mine had a rather sophisticated idea of where the ore lay and how to get at it.

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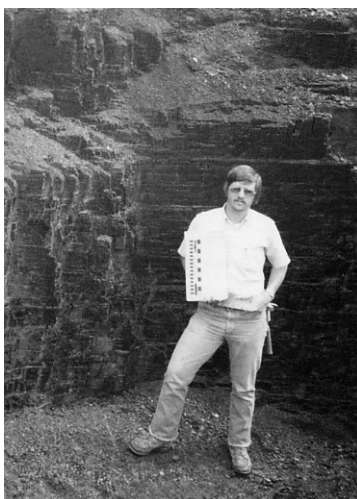
Meet the Staff—Part 1

In the last issue of *Pennsylvania Geology*, we recognized several recently retired staff members. In this issue, we start a series of articles that will introduce you to our current staff (new hires and old hands) and to the work areas of the Bureau. We will begin with the Director, Assistant Director, Administrative Services, and Library Services.

DIRECTOR. The Director of the Bureau of Topographic and Geologic Survey, also known as the State Geologist, is charged with making it possible for the Survey to fulfill the legislative mandate of Act 18, Section 305, which begins “To undertake, conduct and maintain the organization of a thorough and extended survey of this Commonwealth for the purpose of elucidating the geology and topography of this Commonwealth.” It is the current State Geologist’s goal to make the Survey indispensable to the people of Pennsylvania as a source of pertinent geologic, topographic, and associated data.

Jay B. Parrish. Jay began his tenure as State Geologist in June 2001. He came with a variety of experience in the geosciences and GIS. Jay holds a Ph.D. in geophysics, and he has worked as an oil explorationist, a remote-sensing specialist, a geologic NASA contractor using radar geobotany, a geophysics professor, a forensic remote-sensing/GIS specialist, and a county GIS director. But ironically, Jay began his career at the Pennsylvania Geological Survey some 30 years ago as a geologic intern.

Jay provides the vision for the Survey and represents the organization at many meetings. You will read about part of Jay’s vision as you explore the other work areas of the Survey; it includes such projects as PAMAP, the geologic core library, and online, historic aerial photography. In the future, Jay hopes to provide a living geologic map (an online map that is continuously updated) and to expand geophysical mapping of the state.



Jay Parrish the intern, June 1976, standing in a strip mine in Mount Pleasant, Pa. Jay Parrish the State Geologist can be seen on page 1. Photograph by Mark A. Sholes.

ASSISTANT DIRECTOR. The primary function of this position is to integrate science and policy at various levels of government. In the absence of the Director, the Assistant Director assumes the responsibilities of directing the Bureau's programs and resources and promoting the use of earth science for informed decision making. This encompasses, but is not limited to, budget recommendations, enactment, and oversight; project proposals and implementations; assessing societal needs for earth-science information; exploring various avenues for earth-science dissemination and translation; and meeting agency expectations for sustainable land-management practices, including recreational or educational use of state lands.

Samuel W. Berkheiser, Jr. Sam assumed the role of Assistant Director in June 2001. Before that time, Sam was a Division Chief and then the Acting Director of the Bureau. He began working at the Survey as a geologist in April 1981. Sam earned an M.S. in geology in 1974, and energy, mining, resource mapping, and economic geology have been the focus of his work since that time. He has found a lifelong involvement with industrial minerals to be particularly rewarding and challenging.



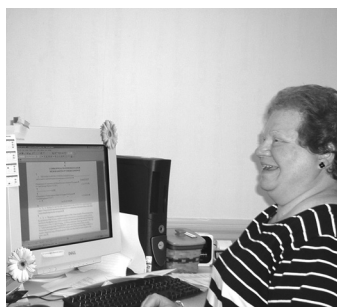
Sam Berkheiser

Sam is constantly communicating the Survey's role to the public. As an organization and individually as geologists, he sees that we need to do a better job of explaining what we do, why we do it, and the importance of our work to society and our neighbors. Geologists are uniquely qualified to address sustainability issues and should be the sustainability experts of the future. It is imperative that the complexities and insights of geology be conveyed in ways that the public can comprehend and relate to. Along these lines, Sam has been overseeing staff work on the development of a water plan for lands managed by our department (DCNR), assessment of the potential for geologic carbon sequestration (the capture, utilization, and storage of carbon dioxide) in the commonwealth, and characterization of the Trenton/Black River gas play in the northern Appalachian basin.

ADMINISTRATIVE SERVICES. The Administrative Services area oversees the day-to-day operations of the Survey. This includes preparing and monitoring the budget, processing contracts, purchasing equipment and supplies, handling personnel transactions, and many other

related tasks. The people in this section act as liaisons with other bureaus in the department and other state and federal agencies to fulfill their obligations. Their duties also require constant interaction with Bureau staff, during which they demonstrate much patience and good humor.

Lynn M. Goodling. Lynn was hired as the Bureau's Administrative Officer in August 2002. She came to our agency after 22 years with the Pennsylvania Bureau of State Parks, Division of Park Operations, Program Services Section. One of her main functions is to keep track of the Bureau's spending, balancing our budget. She also handles the contracts for laboratory tests and equipment, the PAMAP program, and the fiscal part of the federal STATEMAP grant program.



Lynn Goodling

Lynn is the Bureau representative for the DCNR Safety Committee and the Bureau training coordinator. She processes the paperwork to fill our vacant positions and performs other personnel services as needed.

Elizabeth C. Lyon. In June 1997, Elizabeth began her stint as an Administrative Assistant with our Bureau. She came to us from the Department of Public Welfare, where she had been employed for 17 years.

Elizabeth is responsible for Bureau purchasing, which includes transmitting orders for supplies and publications, and maintaining appropriate vendor relationships. She also processes travel requests from staff. Her duties make Elizabeth our go-to person. If something breaks, if we need



Elizabeth Lyon

an item, or if there is a question about a purchase or related paperwork, we go to Elizabeth. She is well versed in the SAP Workplace, an internet transaction server used by Pennsylvania government, and often is called upon to show other staff how to maneuver through the system. Among her more notable accomplishments, Elizabeth is known for "thinking green," and she can be credited with inspiring staff to do the same.

LIBRARY SERVICES. The purpose of the Survey library is to assist Survey, DCNR, and other department staff, legislators, the general public, and individuals from private industry by providing research materials related to the geology and topography of Pennsylvania. The library houses a large collection of geologic texts, maps, and journals, which includes all of the Pennsylvania Geological Survey publications (First through Fourth Surveys). In addition, it is the only library in the state that has a collection of topographic maps and aerial photographs. The topographic maps were published by the U.S. Geological Survey and may be viewed in the library; they are not for circulation. The aerial photograph collection in the library includes photographs from the U.S. Geological Survey and the U.S. Department of Agriculture that date back to 1946. More information on the library collection and hours of operation can be found on the Survey web site at www.dcnr.state.pa.us/topogeo/library/index.aspx.

Richard C. Keen. The library is run by Rick Keen, who became the Bureau's Librarian in September 1992. Prior to his position with the Survey, Rick worked at West Chester University's F. H. Green Library. Rick holds an M.A. in history and an M.S.L.S. (Master of Science in Library Science). His duties include acquisitioning print and nonprint materials, cataloguing, cooperating with other libraries, assisting visitors, and maintaining an archival collection.

During the past year, Rick has been overseeing or involved with several special projects. These include contributing to an online catalog, adding a geologic core library, and scanning aerial photographs for online accessibility. As of this year, most of the library's holdings are listed in Access Pennsylvania, an online catalog for participating Pennsylvania libraries, which is accessible at www.accesspa.state.pa.us. The library is also expanding to include a geologic core library. Geologists on staff have been busy evaluating our present drill-core holdings from the bituminous coal fields of western Pennsylvania for inclusion in the new library. Rick is working with the geologists to create a database to catalog the additions to the new library, which he hopes to have up and running in the months ahead. Finally, the Survey, in cooperation with the Center for Environmental Infor-



Rick Keen

matics, Earth and Environmental Systems Institute, Pennsylvania State University, has been converting its historic aerial photograph collection to digital images. To date, this includes approximately 40,000 photographs held by the State Archives that were taken between 1937 and 1942. These photographs had originally been purchased from the U.S. Department of Agriculture. They can be viewed and downloaded from the online library, Penn Pilot, at www.pennpilot.psu.edu.



Lewis Butts

Lewis L. Butts, Jr. Lewis is a relatively new employee at the Survey. He started in November 2002 as a Library Assistant, coming to us from the Land Office of the Bureau of Archives, where he learned some important document preservation and conservation techniques.

In the past few years, Lewis has become familiar with the operation and maintenance of our several different library collections. He has been involved in the special projects mentioned above and in assisting visitors to the facility.

One of his most common duties is maintenance of the heavily used aerial photograph collection (pulling and refiling photographs, scanning photograph indexes for online use, and related tasks). Lewis is known for his consistently upbeat and helpful attitude towards coworkers and the public.

ANNOUNCEMENT

71st Field Conference of Pennsylvania Geologists

The 71st Field Conference of Pennsylvania Geologists will concentrate on the geology around Ricketts Glen and Worlds End State Parks, in Luzerne, Sullivan, and Columbia Counties, Pa. It is being hosted by the Pennsylvania Geological Survey, Bloomsburg University, and Ricketts Glen State

Park. The conference will be held October 6 and 7, 2006, and will be headquartered in Ricketts Glen.

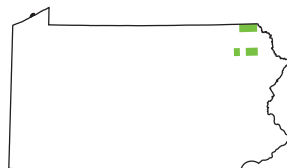
At present, there are two pre-conference trips and 16 conference stops being considered. The pre-conference trips include (1) the Loyalsock Creek Haystack sandstone site, and (2) a hike of Ga-

noga Glen and Glen Leigh in Ricketts Glen State Park. The planned conference stops are listed in the adjacent table. Current information and registration material can be found at www.paonline.com/gfleeger/fcpg. Registration forms may also be obtained from Field Conference of Pennsylvania Geologists, c/o Pennsylvania Geological Survey, 3240 Schoolhouse Road, Middletown, PA 17057–3534.

DAY ONE	DAY TWO
Ricketts Glen Area	Worlds End Area
1. Lake Jean, east dam	9. Glacial pavement—striations
2. Lake Jean, west dam	10. Haystacks sandstone
3. Upper Ganoga Glen hike	11. Till dam, north end of Eagles Mere Lake
4. Till outcrop in “till shadow”	12. Worlds End overlook and Pottsville rock city
5. Waterfall in Duncannon Mbr., Catskill Fm.	13. Trace fossils and sedimentary structures
6. Lower Kitchen Creek waterfalls and potholes	14. Lungfish burrows
7. Red shale pit—upper Huntley Mountain Fm.	15. High Knob overlook—glaciation, stratigraphy, and structure
8. Grand View overlook	

NEW RELEASES

Surficial Geologic Maps in Northeastern Pennsylvania



The Bureau of Topographic and Geologic Survey has released six surficial geologic maps by Duane D. Braun of Bloomsburg University as online, open-file reports. Like their recent predecessors (see *Pennsylvania Geology*, v. 36, no. 3/4, p. 14–15), the maps were funded by the STATEMAP component of the U.S. Geological Survey’s National Cooperative Geologic Mapping Program. The PDF map images are presented in full color at 1:24,000 scale and are included in the following reports: **OFSM 06–01.0, Surficial Geology of the Ransom 7.5-Minute Quadrangle, Lackawanna, Wyoming, and Luzerne Counties, Pennsylvania; OFSM 06–02.0, Surficial Geology of the Olyphant 7.5-Minute Quadran-**

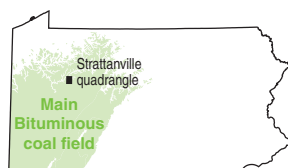
gle, Lackawanna County, Pennsylvania; OFSM 06–03.0, Surficial Geology of the Great Bend 7.5-Minute Quadrangle, Susquehanna County, Pennsylvania; OFSM 06–04.0, Surficial Geology of the Susquehanna 7.5-Minute Quadrangle, Susquehanna County, Pennsylvania; OFSM 06–05.0, Surficial Geology of the Starrucca 7.5-Minute Quadrangle, Wayne and Susquehanna Counties, Pennsylvania; and OFSM 06–06.0, Surficial Geology of the Lake Ariel 7.5-Minute Quadrangle, Wayne and Lackawanna Counties, Pennsylvania. The Olyphant and Lake Ariel reports replace open-file reports for the same areas that were released in hard-copy form in 1999. The northernmost areas of the

Great Bend, Susquehanna, and Starrucca quadrangles, which extend into New York state, have also been mapped.

In addition to the surficial geologic maps, each report includes geographic-information-system (GIS) data for the map layers in the user's choice of ESRI shapefiles

or an ESRI ArcGIS 9.x personal geodatabase. Descriptions of the map units, reconnaissance mapping techniques, and the Quaternary history of the mapped area can be found in the text of each publication. To view or download the reports, go to www.dcnr.state.pa.us/topogeo/pub/openfile.aspx.

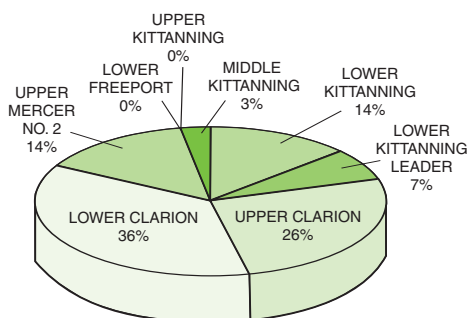
Strattanville Quadrangle Coal Availability Study



OF 06–01, A Study of Coal Availability in the Strattanville 7.5-Minute Quadrangle, Clarion County, Pennsylvania, by staff geologist Clifford H. Dodge, is now accessible as an online, open-file report from the Bureau's list of publications at www.dcnr.state.pa.us/topogeo/pub/openfile.aspx. It is the third in a series of coal availability studies for the Main Bituminous coal field of Pennsylvania to be published in recent months (see *Pennsylvania Geology*, v. 35, no. 3/4, p. 13). Coal available for extraction is that which is accessible within various regulatory, land-use, and technologic constraints.

As in the earlier reports, the author used GIS technology to compare areas of original coal to areas where coal had been mined and where mining is restricted. The Strattanville study indicates that of the estimated 195 million short tons of coal originally present, rep-

resenting eight commercial coal beds of historical significance, approximately 29 million short tons has been mined out and lost in mining. An additional 60 million short tons of coal is excluded due to resource restrictions, leaving only about 106 million short tons available for mining, or about 55 percent of the total original resources.



Pie diagram showing the relative contribution of coal beds (to the nearest whole percentage) to the total original coal resources for the Strattanville quadrangle (modified from OF 06–01, Figure 22, p. 41).

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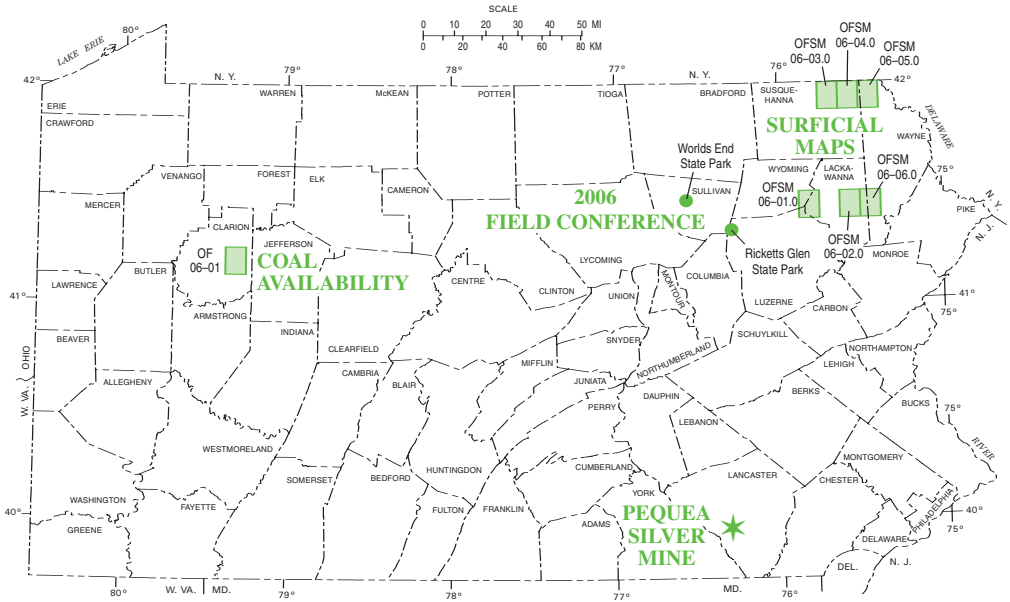
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IN COOPERATION WITH THE U.S. GEOLOGICAL SURVEY
TOPOGRAPHIC MAPPING
GROUNDWATER-RESOURCE MAPPING



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