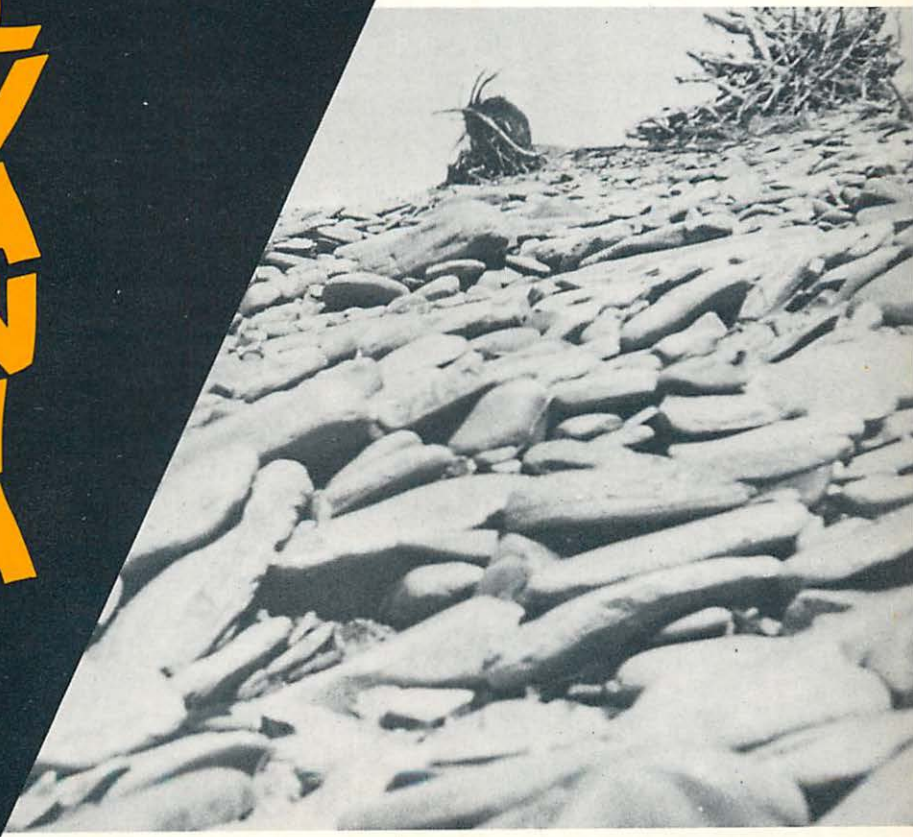
PENNSYLVANIA GEOLOGY



THE PENNSYLVANIA GEOLOGICAL SURVEY
VOL. 5/1

COMMONWEALTH OF PENNSYLVANIA
Milton J. Shapp, Governor

DEPARTMENT OF ENVIRONMENTAL RESOURCES
Maurice K. Goddard, Secretary

TOPOGRAPHIC AND GEOLOGICAL SURVEY
Arthur A. Socolow, State Geologist

CONTENTS

ON THE COVER: Shingled beach, Lake Erie shoreline near Girard, Pennsylvania. Photo courtesy of R. E. Laudenslager.

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FEBRUARY 1974

FROM THE DESK
OF THE
STATE GEOLOGIST...

MANAGING OUR MOST VALUABLE RESOURCE

In a society that generally measures value in terms of dollars, Pennsylvania's most valuable mineral resource is not coal, with an annual production value of $800 million; nor is the highly coveted petroleum, now selling at over $10 per barrel crude; nor is it gold, produced as a byproduct from some of our mines and selling at over $100 an ounce. Our most valuable mineral resource is water. Selling at a typical figure of 70 cents per thousand gallons, water's prime value is demonstrated by the fundamental, basic reality that it is the one resource we absolutely cannot do without.

Blessed as Pennsylvania has been with tens of thousands of miles of flowing streams and rivers, an abundant rainfall of over 40 inches per year, and a ground-water (subsurface) supply that has rarely failed to give us an adequately producing well wherever we have drilled, our appreciation and respect for Pennsylvania's water resources has been meager. It has been taken for granted.

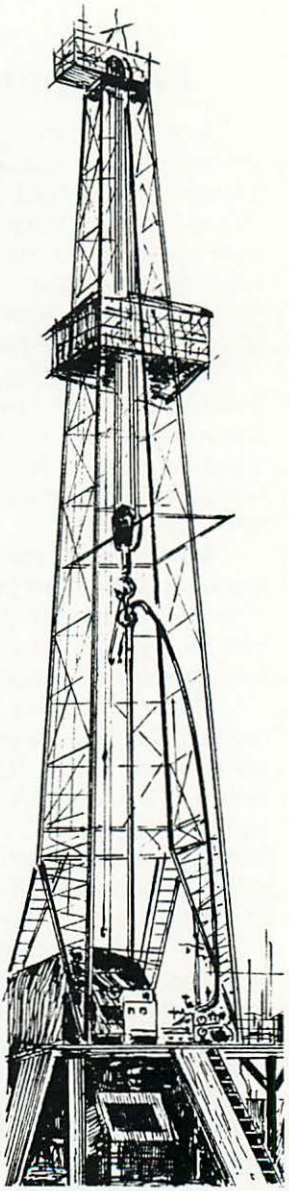
More recently our attention to water has been increasing, partly out of a growing awareness that all is not well with our water resources today, and a recognition that for the future there will have to be advance planning and well thought out management procedures if Pennsylvanians are to have adequate water of acceptable quality.

Primary emphasis to date has been on problems of water quality, in recognition of the need to safeguard the health of man and the biological environment. Thus, the Commonwealth has achieved leadership with its programs for promoting proper sewage treatment facilities and for cleaning up thousands of miles of streams stricken with acid mine drainage pollution. The 500 million dollar bond issue approved a few years ago by the citizens of Pennsylvania, rigorously enforced new mining laws, and the improved Clean Streams Act, were major steps toward water quality improvement.

Still facing the Commonwealth is the need to implement measures to assure our complex society of adequate quantities of water. The demands on Pennsylvania's water quantity have been steadily increasing. We are using more water in our homes. Our industries are increasingly consuming water for sophisticated new processing techniques; central air-conditioning in large public and industrial buildings is consuming huge quantities of water. Our growing number of power generating plants each consumes vast quantities of water, much of which is lost to the atmosphere in the case of nuclear power plants. As we install effective sewage treatment facilities,

Continued on page 16

INCREASED OIL AND GAS EXPLORATION IN PENNSYLVANIA



As a result of increased demand and increased prices, the exploration for new petroleum and the development of known reserves increased considerably in the Commonwealth during 1973. Most of the exploratory effort was for natural gas. A total of 96 exploratory wells were drilled during the year, discovering 17 gas pools, 7 gas fields and extending 17 producing areas. The discovery with the largest initial gas production (15,000 MCF) was the # 1 McLaughlin in Erie County discovering the McKean Field. As yet, this is the only productive Oriskany (Lower Devonian) well in the field. Several wells have been drilled in the area, but they have all been dry. Two Medina (Lower Silurian) sandstone discoveries in the southwest corner of Venango County were probably the most significant discoveries since they opened a large area northwest of a line running through the cities of Mercer, Tidioute, and Warren in northwestern Pennsylvania for possible Medina gas production. Since these discoveries, this area has been leased heavily and several wildcat wells are being drilled. A recent discovery of gas in the Oriskany sandstone in Somerset County by AMOCO's, # 1 R. J. Lambert, might open a large Oriskany producing area, but more drilling must take place before this discovery can be evaluated.

Development drilling in the gas fields increased considerably over that of 1972 with 412 gas wells completed compared to 264 wells in 1972. The average price for new gas is 45 cents per MCF (1,000 cubic feet) with gas in some areas of northern Pennsylvania being purchased for 60 cents per MCF.

Although the total number of successful oil wells drilled in 1973 was 511, or 3 less than in 1972, the current high price of crude oil has already begun to stimulate drilling. The new and stripper well crude oil prices per barrel in the different districts are $10.65 Bradford District, $10.28 Middle District,

$10.13 Southwest District, and $10.00 for a barrel of Corning grade crude in Crawford County, Pennsylvania. These prices should also stimulate additional enhanced recovery of oil in the Commonwealth.

The most promising method for stimulating increased recovery being used in Pennsylvania is the Maraflood process. Two projects are in operation in the Commonwealth. One of the projects started as a pilot project in a watered-out section of the Bradford field, McKean County where the test was conducted in the oil-wet Bradford Third sandstone which contains a paraffinic crude and lies at a depth of about 1800 feet. The pilot project was started in December, 1968 with a pattern of 0.75 acre and was operated until June, 1970. At that time the project was expanded to a 45-acre project consisting of 16 injection wells and 25 producers. Injection started in March, 1971 and is continuing. Although no data has been released on the project, it appears to be at this stage technically, but not economically, successful. With the aforementioned crude prices now in effect, the economics should look more favorable. A long awaited paper on this project is to be presented in the Spring of 1974 in Tulsa at the SPE annual meeting.

A second Maraflood project was started in May, 1971 in the water-wet First Venango sandstone occurring at a depth of about 500 feet below the surface. This project is in the Goodwill Hill area of Warren County. It consists of four one-acre five spots with nine injection wells, four inside producers, and eight outside producers, covering a total of 10 acres. The First Venango sandstone in this area had been gas driven but never waterflooded. The crude oil in the reservoir is also paraffinic. Some problems were encountered and this project was shut down for several months. The project is now again under full operation.

At the writing of this article, several interesting deep tests are drilling in Pennsylvania. In Crawford County 6 wells are testing the Medina 6 miles southwest of Meadville and 12 miles south of the Indian Springs pool which is the nearest Medina production. In Fayette County a deeper pool wildcat is testing the Tuscarora (Medina) 8 miles south of Uniontown. A deeper pool test to the Upper Silurian has been staked in McKean County about 3 miles southeast of Clermont. In Potter County 2 wells are being drilled in the so called Oriskany no sand area to test the Oriskany interval. One is located about 5 miles north of the possible Oriskany pinch-out area and the other about 2 miles north. Two wildcats in Somerset County are going to test the Oriskany. A third wildcat, located about 13 1/2 miles southeast of Connellsville is fishing at 9257 feet and is projected to drill to the Cambrian at 20,500 feet. Another Cambrian test is located in Tioga County about 2 1/2 miles southeast of Marshlands where the well is being reamed at a depth of 13,517 feet. Its projected depth is 5,300 feet. A deeper pool wildcat in Venango County located near Franklin has been drilled to a total depth of 6085 feet and is being tested after fracturing the Medina.

William S. Lytle

BUT IS THERE REALLY A SLIPPERY ROCK?

The fame of the Slippery Rock football team, the Rockets, dates back to 1936, when a playful sports writer "proved" that this team deserved the title of Best in the Nation. The Rockets beat Westminster 14-0, which beat West Virginia Wesleyan 7-6, which beat Duquesne 2-0, which in turn beat Pittsburgh 7-0, which beat Notre Dame 26-0, which beat Northwestern 26-6, which beat Minnesota 6-0.

The question, through the years, as Slippery Rock football scores are broadcast across the nation, has been, "Is there really a Slippery Rock?"

Slippery Rock State College was named for the town of Slippery Rock, which was named for Slippery Rock Creek. Town and college are located about fifteen miles northwest of Butler, Pennsylvania. Slippery Rock Creek originates near Murrinville in northern Butler County, circles around the town of Slippery Rock, is joined by Wolf Creek below Slippery Rock, tumbles down the scenic gorge through McConnell's Mill State Park, joins the Connoquenessing Creek before entering the Beaver River below Ellwood City — a distance altogether of about thirty-five miles.

One morning this spring I asked my husband, "Do you suppose there really is one special slippery *rock,* and, if there is, does anyone know where it is?"

I asked the right person. Bill Lytle is in charge of oil and gas studies with the Pennsylvania Geological Survey. "I have the information at the office," he said. "It's on an old map."

Seeing it on a map is one thing. Seeing it on location is another. On a Sunday in June we drove to Wurtemburg in Lawrence County and walked as close as we could get to the tangle of cliff and brush that lined the eastern bank of the creek just below the map location of "The Slippery Rock" on J. P. Lesley's Slippery Rock Creek map of 1864. Now, more than a century later, the meanders of the creek bed still match those on the map.

Bill approached the owner of the house on the east side of the creek just south of the Slippery Rock location according to the Lesley map. "I have reason to believe that the rock this creek was named for is just a few hundred feet upstream from here," he said to John Eicholtz.

"I've had people come here trying to sell me things, wanting to buy my horses, asking me questions — but you're the first person ever came here to tell me that I own the original Slippery Rock!" Eicholtz replied.

Bill asked if we might walk upstream and check it out by the map.

"The water's too high now. Walking would be plenty slippery. Come

back later — after we've had a spell of dry weather. Come back in September and I'll go along upsteam with you," Eicholtz suggested.

Between June and September Bill and I read all we could find of the area folklore. In Sipe's *History of Butler County, Pennsylvania,* we read of an incident dating back to the American Revolution. "Hassler, in his 'Old Westmoreland,' says that Slippery Rock Creek received its name from an incident that occurred while Brodhead's expedition was crossing this stream. The troops crossed the creek at a place where there were many large, smooth, level rocks in the bed of the stream. On one of these rocks, the horse of John Ward slipped and fell, severly injuring the rider. Then the soldiers are said to have called this 'branch of the Beaver' Slippery Rock."

But John Ward wasn't the first man to find the rocks slippery. Further in the same chapter: "The Moravian missionary, John Heckewelder, who was in the Slippery Rock region many years before the time of Brodhead's expedition, says that the Delaware Indians called this stream 'Wescha-cha-cha-pohka,' that is, a slippery rock."

Reading on, we learned: "On Hector St. John Crevecoeur's "Map of the Old West," published in 1787 — Slippery Rock Creek is designated as Riviere de la Pierre Platte...."

With all three names — Slippery Rock, Wescha-cha-cha-pohka, and

Pierre Platte (Flat Rock) — the singular is used. Is there a particular slippery flat rock, or are the rocks in the creek bed slippery and flat in a general sort of way?

Lesley, whose map and profile of a line of levels along Slippery Rock Creek is appended to the *Second Geological Survey, Special Report J on the Petroleum of Pennsylvania,* was State Geologist at the time of the report's publication in 1874. Lesley's information about the origin of the name of the creek probably came from old-timers in the area.

If it is a particular rock, what makes it so slippery? Ralston, in *Early Life Along the Slippery Rock,* noted that the rocks along the stream tend to collect and hold a quantity of mud — "Some would hold an inch of it, and sloping ice or soft soap was scarcely as slippery. One had to walk circumspectly to avoid falling, It was doubtless always called Slippery Rock. Whatever fanciful meaning someone may have given, it is not an Indian name. It was not named because one of Brodhead's men fell down in its water; the difficulty was to cross it at all without falling down."

So — back where we started — with a hint of an answer to another question. Why, of all the more or less slippery rocks along thirty-five miles of stream — why this particular rock? Brodhead's men were *crossing* the stream. Ralston says "The difficulty was to *cross* it at all without falling down." Could the Slippery Rock have been located at a ford — a place where Indians, early settlers, and soldiers, before there were bridges, crossed the stream on foot or horseback?

What should we expect to find in September when the creek would be low enough to allow passage to the Rock? Lesley, in his report, says: "The Slippery Rock, which gave name to this fine stream at the first settlement of the country, is a plate of sandstone lying in place on the east bank, about a mile above Van Gordon's bridge, where there was a natural exudation of petroleum."

Bill researched the following information: "This "Natural exudation of petroleum" or oil seep, was located in Lawrence County about a mile and a half north of Wurtemburg, along the Slippery Rock Creek, and was the reason the area was drilled originally for oil and gas. The oil seeped out of the Upper Connoquenessing sandstone at stream level. Wells drilled in the area found oil in paying quantities at approvimately 200 feet below stream level in the Shenango sandstone. The productive oil pay in the Shenango sandstone was named the Slippery Rock oil sand. The Lawrence well was probablay the first commercial well in the area, with an initial production of fifty barrels of oil per day, drilled soon after the Drake well. The oil field discovered by the Lawrence well was named the Slippery Rock oil field.

September. With Eicholtz guiding us, we hop carefully from stone to stone along a gently sloping stream bank. The east wall of the gorge rises

abruptly a few feet beyond the shoreline. There is no place to fall except into the creek. It is each-man-for-himself as we pick our footing in quiet concentration. I am carrying the 1874 collector's item, *Report J* with its 1864 map of Slippery Rock Creek — and wishing with all my heart that I had left it in the car.

The main difference in the terrain when we reach the Rock is, to my untrained eye, that, instead of hopping from slippery stone to slippery stone, we are standing now on one flat, gently sloping, moist rock. It is covered (as are the smaller stones) with algae and moss — that glistens with an oily-appearing iridescence. The sloping rock had been resistant to the rushing force of the stream and now provides the creek with a deceptively almost-level bank and bed. The exposed portion of the solid rock extends along the edge of the creek for at least 25 feet. The dampness that covers the rock comes from a trickle of water seeping from between strata of shale and coal along the wall of the gorge. For the length of the exposed slippery rock there is no dry bank to walk on — just the creek, the moist, sloping slippery rock, and the gorge. "Well, what did you expect?" I ask myself. "This is The Slippery Rock!"

"No," I hear Bill saying. "The iridescence adhering to the algae and moss is not oil. When oil on water is disturbed, it re-forms in one mass. The substance here, when disturbed, fragmentizes. This is an iron oxide film — not an oil film."

I've rough-sketched the picture. Bill can fill in the geological details. "Although no oil was seen seeping out of the sandstone, none was expected, since the gas pressure which used to force the oil out had been depleted long ago by the oil wells of the area. A sheen of color now seen near the contact of the Mercer and Upper Connoquenessing, was identified as an iron oxide film. The evidence points to this plate of rock as being that described by Lesley and designated at The Slippery Rock.

"From the description by Lesley of the location of the Slippery Rock, it is determined that it is just above the Glasser bridge on the Van Gorder road about one and a half miles north of its junction, at Wurtemburg, with Route 488. The Van Gordon (Van Gorder) bridge shown on Lesley's map is no longer standing. Above the Glasser bridge, for about three hundred feet, can be seen what appears to be shales and coals of the Mercer formation, extending from the edge of the creek, on up the steep hillside. At one place the underlying Upper Connoquenessing sandstone can be seen at stream level lying under the Mercer. This is apparently the "plate of sandstone lying...on the east bank," described by Lesley. It dips beneath stream level downstream before the stream reached the bridge."

Wallace notes in his *Indian Paths of Pennsylvania,* p. 82, that the Indian path, "the Kuskusky-Ohio Forks Path, from Pittsburgh to New Castle...crossed Slippery Rock Creek in the vicinity of Wurtemburg..."

Could this ford have been at the Slippery Rock described by Lesley? If so, then this particular rock — excessively slippery due to an oil seep at the point where the stream was forded on foot or horseback — could be the name Slippery Rock given to it by Indians and early settlers as a warning, "Cross here but watch your footing!"?

This isn't Plymouth Rock or the Rock of Gibraltar. But how many rocks have named a creek, a town, an oil field, an oil sand, a college, and a favorite football team?

The Rock is on the John Eicholtz property. It can be seen along the east bank of the creek from the Glasser bridge — or from the west bank, looking across and downstream, from the southern tip of Camp Allegheny, the Pittsburgh Salvation Army Camp. Most of the rock is under water. All of it is algae, moss, and mud-covered — treacherous, and beautiful in its rustic setting.

Virginia and William Lytle

GREATER PITTSBURGH AREA MAPS ON OPEN FILE

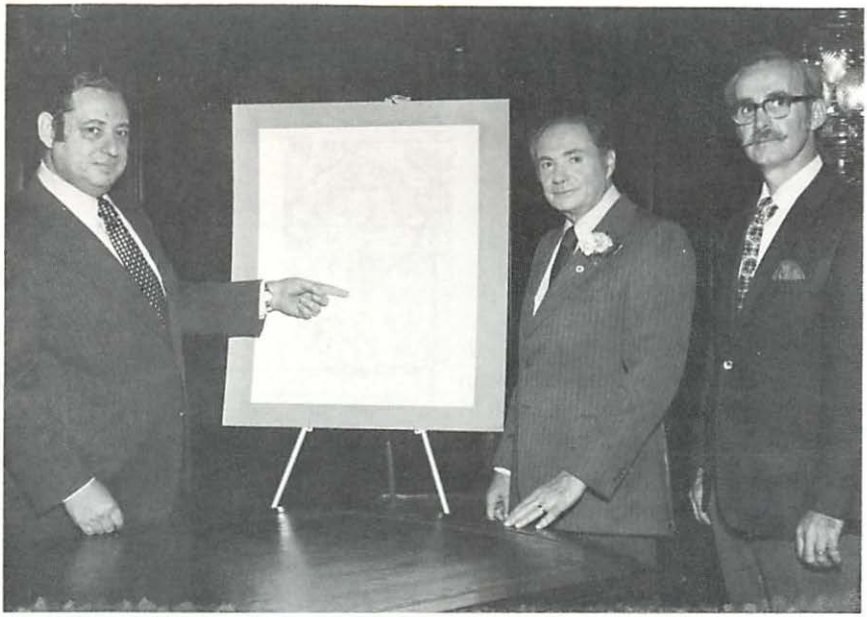
Structure maps, geologic maps, and Pittsburgh coal overburden maps of the greater Pittsburgh region at a scale of 1:24,000 have been placed on open file by the Pennsylvania Geological Survey. The individual maps correspond to the boundaries of the 7 1/2 minute topographic maps of Beaver, Butler, Allegheny, Armstrong, Westmoreland, and Washington counties. These maps have been drawn on mylar and are the work sheets from which regional maps at 1:125,000 will be published at a later date. The structure maps and geologic maps are revisions of published maps, based mainly on data from sub-surface and from surface mining operations indicated on the 7 1/2 minute topographic maps. The maps have *not* been field checked.

The structure maps are drawn on the top of the Vanport limestone in Butler, northern Beaver, northern Allegheny, southern Armstrong, and eastern Westmoreland counties; the base of the Pittsburgh coal in southern Allegheny, western Westermoreland, and Washington counties.

The geologic maps show the high level terrace deposits and the contacts of the Washington Formation, Waynesburg Formation, Monongahela Group, Conemaugh Group, Allegheny Group, Pottsville Group, Mauch Chunk Formation, and Pocono Formation. Discontinuous boundaries are indicated for the Ames limestone of the Conemaugh Group and the Vanport limestone of the Allegheny Group.

The Pittsburgh coal overburden maps show the 100, 200, and 300 foot thickness of rock above the Pittsburgh coal.

The maps may be *examined* at the Pittsburgh office of the Pennsylvania Geological Survey.



CELEBRATING TOPOGRAPHIC MAPPING MILESTONE

State Geologist Arthur Socolow is shown presenting to Governor Shapp the Union City Quadrangle topographic map, as Assistant State Geologist Donald Hoskins looks on. The completion of the Union City quadrangle marked the last of 764 quadrangle maps which now cover the entire Commonwealth of Pennsylvania. These maps are the result of a cooperative program between The Pennsylvania Geological Survey and The U.S. Geological Survey with additional support by the Pennsylvania Dept. of Transportation.

Even as statewide coverage has been completed, a revision program is underway to keep the maps up-to-date, particularly in fast changing urban and suburban areas.

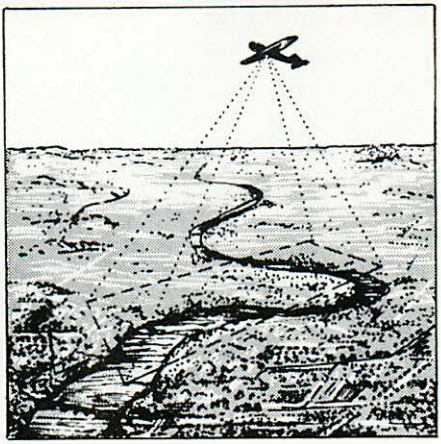
A detailed free index for all the topographic maps is available from:
Pennsylvania Geological Survey
Department of Environmental Resources
Harrisburg, Pa. 17120

U.S. Geological Survey
1200 S. Eads Street
Arlington, Virginia 22202

Topographic maps may be purchased from the U.S. Geological Survey office listed above, or from a number of retail outlets in Pennsylvania which are listed on the above-mentioned index.

SURVEY ANNOUNCEMENTS

AERIAL PHOTOGRAPH LIBRARY AGAIN AVAILABLE FOR PUBLIC USE



The Bureau of Topographic and Geologic Survey is happy to announce that we are again able to lend aerial photographs of Pennsylvania to anyone needing such information.

The library of the Bureau maintains two primary series of photographs for staff and public use. The first series is arranged by county and includes all counties except Philadelphia. Each county is covered by three sets: one flown in the 1940s, a second set flown in the 1950s and a third set flown in the 1960s. The southeastern counties also have coverage flown in the 1970s. All of these photographs are at a scale of 1:20,000 except for a 1:40,000 series flown for the northeastern counties in 1969. All of the county series are now available in the Bureau Library and may be signed out for limited periods through the Bureau Librarian, Mrs. Sandra Blust. These must be secured in person; mail or phone requests cannot be processed.

The second primary series of photographs are 1:30,000 scale photographs flown during the winter for use in preparation of topographic maps of Pennsylvania. These photographs are arranged by 15-minute quadrangle. Currently the Bureau has 70% coverage of the 1:30,000 winter photos and will have 100% coverage within a few months. As each quadrangle is revised, new photography is added to this series.

For those wishing to purchase personal copies of the photographs from the issuing federal agencies, the Bureau will supply ordering information. Photographs should be inspected in person in the Bureau library before ordering in order to get the necessary photograph numbers.

NEW OFFICES OF THE OIL AND GAS DIVISION

The Pennsylvania Survey's Oil and Gas Division has completed its move to new space in the Kossman Building, on Forbes Avenue, Pittsburgh. The Division offices are on the 12th floor, the sample library is on the 5th

floor of the same building, and their new sedimentation lab is on the 6th floor. Due to the weight limitations, the sample library was spread out onto more shelving to hold the well samples. An addition to the sample library is a diamond saw for cutting rock cores. The slabbing of the cores with the saw will reduce considerably the storage space needed for the core library which is located in the basement of the State Building just a block away from the Kossman Building.

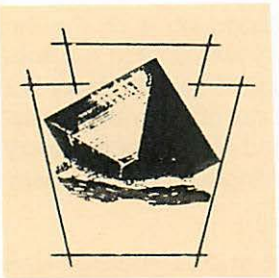
The move to the Kossman Building placed most of the Pittsburgh area units of the Department of Environmental Resources in the same building where intra-unit operation and administration will be handled more effectively and efficiently. The new address: Division of Oil and Gas, Bureau of Topographic and Geologic Survey, Department of Enrironmental Resources, Room 1201 Kossman Building, 100 Forbes Avenue, Pittsburgh, Pennsylvania 15222.

We designed our new quarters to give you better service. We will be glad to help you so let us hear from you by mail or a personal visit.

CHROMIUM AND NICKLE IN SOIL AS GEOCHEMICAL INDICATORS FOR CHROMITE DEPOSITS IN THE STATE LINE DISTRICT, PENNSYLVANIA

During the mid-1800's, chromite deposits of the State Line district in southern Lancaster County, Pa., and adjacent Maryland produced most of the chromite used in North America. The chromite bodies are pod-shaped to sack-form, relatively small in size (up to 100,000 tons) and range from massive chromite to layers of disseminated grains enclosed in a large alpine-type ultramafic body. Much of the chromite is of good metallurgical and refractory grade. Since 1880 the district has produced little chromite, but it seems likely that additional ore bodies exist under the thick soil and dense brush of the region. In order to test the applicability of soil geochemical techniques to exploration for additional chromite bodies, soil profiles and traverses across the mineralized zones have been studied at the abandoned Red Pit and Rock Springs Church mines. Of the elements studied (Cr, Ni, V, Co, Fe, Mg, Al), Cr and Ni show distinctly anomalous values in residual soils over the old workings. Chromium exists in the soil primarily as residual chromite grains with the highest concentration in the upper six inches. The highest nickel occurs in the deeper part of the soil profile and is concentrated in the clay fractions.

D.L. Pennington and A.W. Rose, The Pennsylvania State University



EARTH SCIENCE TEACHERS' CORNER

land-use planning unit at chambersburg area senior high school

INTRODUCTION

There is a serious lack of understanding among students and some teachers regarding land-use planning principles, both their value to the community and to the students who will soon become active citizens of the community. Some examples include: 1) Zoning laws and citizen debates over proposed land changes, 2) School locations selected without emphasis on reasons other than land availability, such as water availability and foundation stability, 3) Improper locations of sewage systems, and sanitary landfills, and 4) Building sites located on flood plains, in areas of major landslides, and over carbonate rocks known to collapse.

In all of the above examples, intelligent decisions need to be based on an understanding of the land's physical parameters.

RESOURCES

There is a wealth of information to assist the science teacher in this unit. The following were used in teaching the activities presented here:

1. Land Resources Map of the Commonwealth
   Published by the Pennsylvania State University, this map presents soil resources in a graphic form and brings together factors such as soil depth, drainage, available moisture, and the soil's productive capacities.
2. Soil Survey Maps
   Published by the U.S. Soil Conservation Service, the maps are often accompanied by a soil interpretation report. The maps are available on a county base and include many interpretations of the soil capabilities. The most valuable part is the section concerned with community development, recreational development, soil suitability for wildlife, and soil interpretations for woodlands.
3. Engineering Characteristics of the Rocks of Pennsylvania
   This is published by the Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geologic Survey. This bulletin used with the State Geologic Map provides an introduction to geology and land-use planning.

4. Environmental Geology for Land-Use Planning
   Published by the Bureau of Topo. and Geologic Survey, written for planners and planning commissions, this publication provides basic geologic principles for planners including geologic hazards, choices and possible alternatives.
5. Additional Sources
   Topographic maps, geologic maps, field investigations, free publications of the Bureau of Topo. and Geologic Survey.

INSTRUCTIONAL PROCEDURES

The time spent on this unit usually averages three to four weeks if classes are scheduled daily. The unit may be introduced by a community resource individual such as a county agent, state geologist, or a regional planner. An alternative or additional procedure is to initiate a discussion of lack of community planning, or bad planning, and poor land-use. Examples may include: a) poor sewage drainage systems of private homes, b) buildings on flood plains, and c) sinkholes that develop on properties.

When the students have had an opportunity to examine their community's errors, they might work in small groups or pairs. Each student, or group, is then asked to identify an area in their county which they will investigate.

Students are then required to compile data concerning the physical properties of the rocks and soils and the suitability of the land for a variety of land-use practices. The following uses must be completed by each student for his identified plot of land.

1. Sewage effluent - disposal, percolation
2. Basement construction
3. Sanitary landfills
4. Recreation
5. Wildlife
6. Woodland
7. One additional land use selected by the student from a chart.

The procedure students follow for each of the above uses is to obtain and complete a small scale map - one for each land use or a total of seven maps. The following colors are used on the maps to code the regions of his selected area:

Red - (stop) - the soil or rocks are not suitable for that land use practice.

Yellow - (caution) - the soils and rocks are marginal for this land use.

Green - (go) - the soils and rocks are acceptable for this land use.

Once students have finished the seven maps, they can lay them out and immediately visualize the suitability (or unsuitability) of a particular portion of their identified land area for the specific land use in question.

The next activity is to complete a large scale map based on the small scale maps. This final completed map should only include those land uses that the

student feels are appropriate for the indentified area according to earlier data collection and map-making.
Evaluation of this project can take many forms but may be based on some or all of the following:

a. Suitability of student land-use recommendations according to the data collected.
b. Accuracy of student summarizations.
c. Neatness.
d. Promptness of effort, and similar considerations.
e. Analysis of current community problems as they can be traced to land-use violations uncovered in this unit of study.

Burt Waite
Former Earth Science Teacher
Chambersburg Area Senior High Sch.

new films

Earthquakes - Lesson of a Disaster (13 min.). The California quake of 1971 and the Gediz, Turkey, quake. AGI Encyclopedia Britannica Educational Corp., 425 North Michigan Ave., Chicago, Illinois 60611

Energy and All That (28 min.). Innovative film to bring out the urgency and complexity of the country's energy problems. American Petroleum Institute, 1801 K. Street Northwest, Washington, D. C. 20006

Geology - Lake Agassiz Region (27 min.). Landscape evolution of the Lake Agassiz Region. Cherry Film Productions, Ltd., 25 Bell Street, Regina, Saskatchewan S4S 4V7 Canada.

Geyser Valley (8 min.). Wide variety of geologic phenomena in Yellowstone National Park. AGI/Encyclopaedia Britannica Educational Corp., 425 North Michigan Avenue, Chicago , Illinois 60611.

Heartbeat of a Volcano (20 min.). Spectacular views of the build-up and eruption of Kilauea Volcano, Hawaii. AGI/Encyclopaedia Britannica Educational Corp., 425 North Michigan Ave., Chicago, Illinois 60611

Legacies of the Ice Age (12 min.). Comparison of continental and mountain glaciers and influence on North American land forms. Indiana University, Audio-Visual Center, Bloomington, Indiana 47401

Pogo. The Search for oil and gas offshore in the Gulf of Mexico. United Gas Pipeline Co., Public Relations Director, 900 Southwest Tower, Houston, Texas 77002

Origins of Man Series. Describing man's search for his beginnings.
1. Early Man in North America (12 min.)
2. From Homoerectus to Neanderthal (18 min.)
3. Ape Men of Africa (20 min.)
4. Civilizations of Ancient America (22 min.)
5. Who Discovered America? (14 min.)

Films, Inc.
1144 Wilmette Avenue
Wilmette, Illinois 60091

The Restless Earth Series. The geologic theory of plate tectonics.
1. Plate Tectonics Theory (58 min.)
2. Evidence from Ancient Life (28 min.)
3. Earthquakes (27 min.)
4. Geology and Man (20 min.)

Indiana University
Audio-Visual Center
Bloomington. Indiana 47401

San Andreas Fault (15 min.). AGI/Encyclopaedia Britannica Educational Corp., 425 North Michigan Ave., Chicago, Illinois 60611.

Santa Barbara - Everybody's Mistake (30 min.). Studies the oil spill at Santa Barbara in 1969. Indiana University, Audio-Visual Center, Bloomington, Indiana 47401.

This Land - Evolution of North America (18 min.). Shell Oil Company, One Shell Plaza, P. O. Box 2463, Houston, Texas 77001.

Volcanoes: Exploring the Restless Earth (18 min.). Spectacular film on volcanoes. AGI/Encyclopaedia Britannica Educational Corp., 425 North Michigan Ave., Chicago, Illinois 60611

Why do we still have Mountains? (20 min.). Struggle between leveling processes and deformation of the Earth's crust. AGI/Encyclopaedia Britannica Educational Corp., 425 Michigan Ave., Chicago, Illinois 60611

PENNSYLVANIA ACADEMY OF SCIENCE CELEBRATES 50 YEARS

The 50th anniversary meeting of the Pennsylvania Academy of Science will be held at Bloomsburg State College April 18-20, 1974. Highlights of the meeting will be sessions on biology, geology, physics, chemistry, and geography. For details, contact George C. Shoffstall, 214 Whitmore Laboratory, University Park, Pennsylvania 16802.

The Pennsylvania Academy of Science provides an opportunity for in-

dustrial, secondary education and collegiate scientific personnel to meet and to share scientific work being conducted in Pennsylvania. Through its junior academy, it also involves high school students in science programs.

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we are imposing additional heavy demands on water supplies. Pennsylvania's farmers are turning more and more to irrigation, calling for large quantities of water. And even in the field of recreation, we are imposing more demands on water quantity as we build more lakes for boating, swimming, and fishing.

As much as Pennsylvania has been blessed with abundant supplies of water, the supply is finite. There are limits within which we can satisfy the growing demands cited above. We now have to recognize and define what those limits are so that we may take the necessary technical and administrative steps to assure adequate water supplies in the right place, at the right time, for the right uses. This means water management, a term we are not yet used to, but one we will have to become more familiar with.

Water management must concern itself not only with the needs imposed by man, but also the catastrophic variations imposed by nature. Water management must cope with droughts, such as Pennsylvania suffered in the late 1960's, and with floods indelibly impressed upon us by Agnes. Man's needs, natural deficiencies, and natural excesses must all be integrated into comprehensive water planning in Pennsylvania.

Pennsylvania has made a start towards water quantity management. Our participation in the Delaware River Basin Commission, Susquehanna River Basin Commission, Ohio River Basin Commission, and Great Lakes Basin Commission is a good beginning. The Department of Environmental Resources is working on a detailed inventory of Pennsylvania's surface and subsurface water resources. Our Commerce Department, Department of Community Affairs, Agriculture Department, Public Utilities Commission, and Office of Economic Planning and Development, are developing data on the needs of Pennsylvania's water consumers.

Ahead lies the task of coordinating our varied needs with our limited water resources and defining the technical installations, practices, and restraints which we have yet to initiate. There will be a continuing need for accurate data and for sophisticated research to cope with the challenge. Pennsylvania is fortunate that it has made a timely start towards satisfying our water needs, and that capable leaders in state government, universities, industry, and private citizens are addressing themselves to the future of our most valuable resource, water.

Arthur G. Taylor

Prepared for Pa. Dept. of Commerce Annual Report on Water

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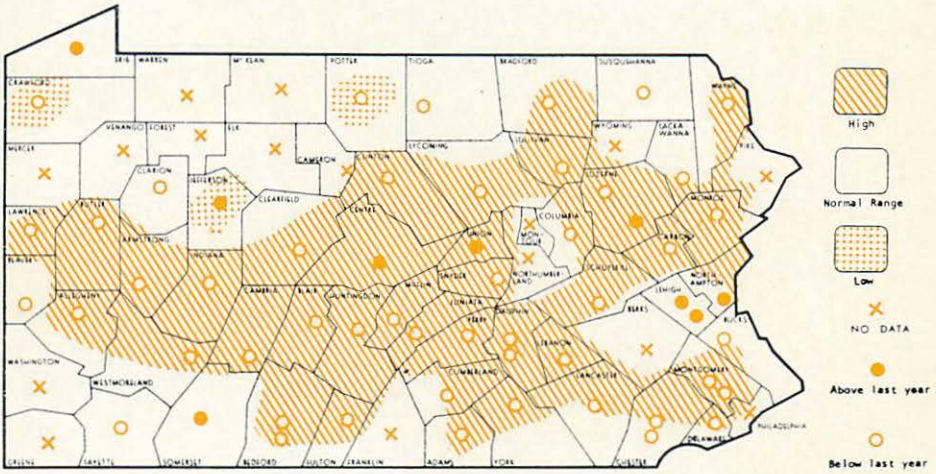
JANUARY 1974

GROUND-WATER LEVELS



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DEPT. OF ENVIRONMENTAL RESOURCES
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