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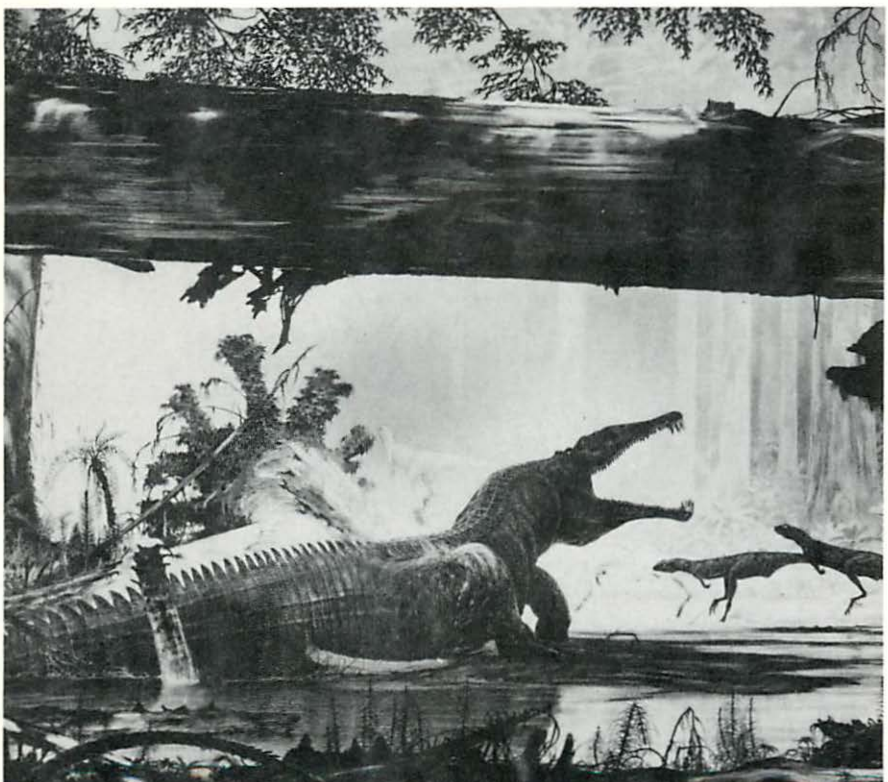

COMMONWEALTH OF PENNSYLVANIA
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ON THE COVER

Rutiodon, a Late Triassic phytosaur (a primitive crocodile-like reptile), hisses at a herd of passing fabrosaurs (primitive ornithischian dinosaurs). See article on page 3. Illustration by Douglas Henderson; used by permission.

PENNSYLVANIA GEOLOGY

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Contributed articles are welcome; for further information and guidelines for manuscript preparation, contact D. M. Hoskins at the address listed above.

VOL. 25, NO. 1 **SPRING 1994**

GUEST EDITORIAL

Geologists from the New School: Students, Science, and the Environment in the '90's

The 1990's is a time of increased environmental awareness when students and professionals focus on "saving the earth." Environmentalism has been around for quite a few years; however, the environmental movement of the '90's seems to have given a new sense of responsibility to the field of science. Environmental scientists today realize that a multidisciplinary approach is necessary to understand and stabilize the effects of human activities on the biosphere; it is not enough merely to save the whales, beaches, or forests to save the earth.

It is within this school of thought that young environmental scientists entering college begin to explore the earth sciences. Here the ambitious pursuers of "earth saving" stumble upon the curious subject of geology. Although geology is defined as the study of the earth, most people first think of it only as the study of rocks. Yet, many students who have environmental interests choose geology as their field of study because it offers a greater challenge and broader perspective than other earth sciences. Environmental geology, hydrogeology, and geochemistry are demanding subdisciplines that focus on environmental issues.

Environmental geology is the study of the application of geologic principles to the interaction between the human race and the physical environment. This theme includes a diverse range of subjects dealing primarily with the interrelationships among geologic processes, earth materials, and humanity. Common topics include waste disposal, geologic hazards, mining and reclamation, and urban geology.

Hydrogeology is another subdiscipline in geology that has an environmental focus. The study of the hydrologic cycle and water chemistry enables the evaluation of water quantity and quality. Understanding groundwater dynamics is important in waste disposal and aquifer contamination issues.

Geochemistry provides some understanding of natural chemical systems. The study of the abundance and distribution of the elements in earth systems furnishes a baseline for an examination of changes in earth chemistry through time. Although it is more abstract than other topics in geology, geochemistry supplies data for the analysis of fundamental environmental issues such as the effects of pollution on the chemical systems of the atmosphere and the oceans.

Geologists play an important role in the multidisciplinary approach to problem solving. Geology provides a unique point of view to the scientific understanding of environmental problems. Most environmental science subdisciplines focus on the present; however, geology includes the study of the earth's 4.6 billion years of history. Not only is the present the key to the past, but the past gives insight to the present. Many earth events and processes are cyclic; thus, understanding the processes of the past aids in the interpretation of today's problems. For example, warming of the atmosphere may be a part of a thermal cycle of global warming and cooling and not due to the greenhouse effect. This perspective gives the geologist additional insight to problems that might be overlooked by scientists in other disciplines.

A new generation of scientists is emerging from colleges and universities around the country. Products of the environmental movement of the 1990's, these scholars bring to the scientific community a fresh sense of responsibility and purpose. These new environmental scientists are armed not only with an education and the voice of a generation, but a few also carry a rock hammer and a Brunton.

—Thomas R. Wyland, Jr.

STATE GEOLOGIST'S NOTE: *Tom Wyland is an undergraduate student at The Pennsylvania State University and has been employed by the Pennsylvania Geological Survey as a student intern. While at the Survey over the 1993 winter break, Tom submitted the above commentary, which reflects at least one student's perspective of the changing nature of geologic education and its applications to solving present-day problems. I found his comments refreshing, indicative of the caliber of future professional geologists and worthy of publication for your consideration. I invite other authors to submit commentary on current issues of concern in geology for publication as a guest editorial.*

Donald M. Hoskins

Donald M. Hoskins
State Geologist

Finding Phytosaurs in Pennsylvania: the Story of Stahle, Sinclair, and Zions View

by William E. Kochanov, Pennsylvania Geological Survey, and
Robert M. Sullivan, The State Museum of Pennsylvania

Serendipity is a normal part of fossil collecting, as any seasoned paleontologist will attest. Recently, during paleontological reconnaissance of Upper Triassic rock exposures in southeastern Pennsylvania, at a small roadside exposure of the Brunswick Formation (Figure 1), we found a strangely shaped shiny black "pebble" about three fourths of an inch long. Examination of the specimen under magnification quickly established that it was a tooth (Figure 2) because it was pointed at one end, blunt at the other, and had minute striations along the entire length of the visible crown edge. Upper Triassic strata commonly contain isolated teeth of extinct vertebrates. From what sort of animal did this tooth come?

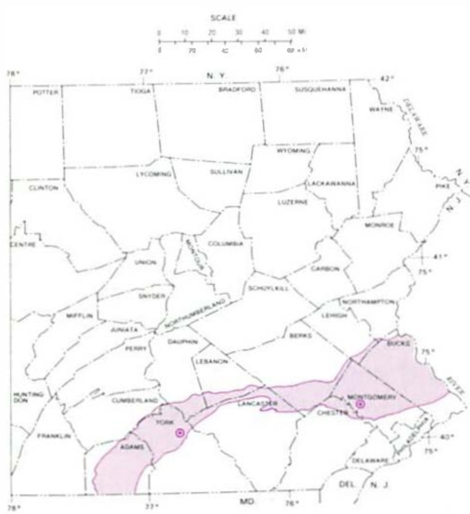

Figure 1. Generalized map showing the extent of lower Mesozoic bedrock (which includes the Brunswick Formation) in southeastern Pennsylvania and the phytosaur sites in Collegeville, Montgomery County, and Zions View, York County.

During the ride home, we talked of the possibility that the specimen was a dinosaur tooth. To date, no fossil bones of dinosaurs have been discovered in Pennsylvania. However, teeth identified as *"Thecodontosaurus"* that were collected in Pennsylvania (Huene, 1921) have recently been assigned to a new dinosaur genus (Hunt and Lucas, 1994). Back at the laboratory in the Paleontology and Geology Section of The State Museum of Pennsylvania, it was determined that the newly col-

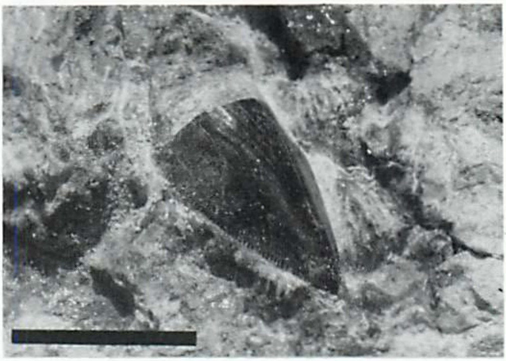

Figure 2. Phytosaur tooth (SMP VP–156) from the Upper Triassic Brunswick Formation, Montgomery County, Pa. Based on the fact that only one species of phytosaur is currently recognized in eastern North America, the tooth probably belongs to *Rutiodon carolinensis*. The scale is 1 cm. Photograph by Claire Messimer.

lected tooth was not from a dinosaur; rather, it belonged to a member of an extinct group of reptiles commonly known as phytosaurs.

THE PHYTOSAURIA. Phytosaurs are a group of archaic thecodont reptiles that looked like modern crocodiles. They were semiaquatic and grew to lengths of up to 15 feet. Like modern crocodiles, their mouths contained numerous sharply pointed teeth, which indicates that these animals were carnivorous. Unlike crocodiles, which have the external nares (nostrils) at the tip of the rostrum (nose), their external nares were located on the top of the skull, just in front of and between the eyes. The phytosaur skeleton was very primitive and superficially resembled that of a crocodile, with the back and tail covered by numerous bony plates called osteoderms. Phytosaurs preceded true crocodilians but were not ancestral to them. However, because they share many primitive features and had a similar overall body form, phytosaurs may be considered the ecological equivalent of crocodiles.

Four genera of North American phytosaurs are currently recognized: *Angistrorhinus, Paleorhinus, Pseudopalatus,* and *Rutiodon*. Emmons (1856) was the first to name a phytosaur from eastern North America and coined the name *Rutiodon carolinensis* for teeth from the Triassic of North Carolina. This species is the only known phytosaur from the East Coast (Ballew, 1989).

STAHLE, SINCLAIR, AND ZIONS VIEW: EARLY DISCOVERIES IN PENNSYLVANIA. Phytosaur remains (teeth and bones) were first reported from the Upper Triassic of Pennsylvania by Lea (1856). Additional material was cited by Rogers (1858) from the Phoenixville Tunnel (Montgomery County). But one of the earliest, and most significant, discoveries of phytosaur material in Pennsylvania occurred more than 80 years ago, in the York County hamlet of Zions View.

In 1909, Dr. Robert Spangler Stahle (Figure 3), a York medical doctor, discovered a concentration of fossilized bone in Triassic rocks (New Oxford Formation) that crop out in the streambed of Little Conewago Creek. The discovery, and the eventual disposition of these Zions View vertebrate fossils, are revealed in a series of letters written from 1910 to 1912 between Stahle and Professor William J. Sinclair of Princeton University (Figure 4). Although we have only copies of Sinclair's letters, we can piece together an interesting sequence of events ranging from the thrill of discovery to devastating disappointment.

Late in 1909, Stahle apparently wrote a letter of inquiry to the University of Pennsylvania announcing his discovery of fossilized bones in York County. This letter was forwarded to Sinclair at Princeton, who expressed deep interest in examining the specimens. Believing that the material was that of a dinosaur, Sinclair offered to purchase it from Stahle for the outrageous sum (compared to today's standards) of $75, with a one-time bonus of $50 for the rest of the skeleton if

Figure 3. Dr. Robert Spangler Stahle sitting atop his bone bed at Zions View, York County, Pa., in 1910. The bone bed was rediscovered in 1970, and fossils were collected by Donald Hoff (former Earth Science Curator of The State Museum of Pennsylvania) and crew. A skull of the phytosaur *Rutiodon carolinensis* and a skull of the labyrinthodont amphibian *Buettneria perfecta* were collected along with other bones. Photograph courtesy of Harolld [sic] J. Stahle.

it turned up "in the course of future excavation." Sinclair wrote to Stahle (February 1911), "New knowledge cannot be valued in terms of dollars and cents, and these discoveries of yours are the newest and most important regarding Triassic dinosaurs which have been made in many years. I feel that the species should be named in your honor, ...*stahlei* [italics are ours], a name by which your dinosaur would be known for all time to come...." This was an enticing lure that no doubt baited Stahle. Sinclair also promised to have the species described at the April meeting of the American Philosophical Society in Philadelphia and to place it on exhibit in the new Geological Museum at Princeton.

Figure 4. Princeton University paleontologist William J. Sinclair in 1923. Photograph courtesy of the Princeton University Geological Archives, Guyot Hall.

More correspondence ensued before any action was taken. We infer that Stahle was asking for more money because of the importance that Sinclair attached to this "dinosaur." Arguing that the material collected by Stahle was incomplete and that the fossil had limited research and exhibition value, Sinclair steadfastly held to the original negotiated price of $75. Realizing that no additional funds would be forthcoming, Stahle finally agreed to the original terms and sent the material to Princeton. With great anticipation, Sinclair waited to receive his "dinosaur" from the Triassic of York County.

The "paleontological bomb" dropped in March 1911, when Sinclair wrote to Stahle informing him that the specimen was not a dinosaur but was a phytosaur! Moreover, he referred it to the phytosaur genus *Rutiodon* and noted that it was similar to material found in North Carolina, except that it was larger. In his letter, Sinclair enclosed a tracing of McGregor's (1906) illustration (Figure 5) of *Rutiodon* (=*"Rhytidodon"*) *carolinensis* and colored in some of the bones corresponding to those that Stahle had found. These bones included both ilia (bones of the pelvis), left femur (thigh bone), two sacral vertebrae (vertebrae of the pelvis), anterior caudal (tail) vertebra, part of a trunk vertebra, a rib, rib fragments, osteoderms (bony plates), and fragmentary bones; numerous teeth were also found. The Stahle specimen (YPM PU–11544) belongs to the Princeton Collection, now housed at the Peabody Museum of Natural History of Yale University. It was, in part, incorporated into a panel mount of *Rutiodon* and is presently on loan to Rutgers University (Mary Ann Turner, personal communication, 1994).

The final disappointing blow was delivered in a subsequent letter, when Sinclair informed Stahle that his specimen was not a new species of phytosaur but belonged to the same species that had been described from the Palisades region of the Hudson River valley in New Jersey and named *Rutiodon manhattensis* (Sinclair, 1918). Shortly after that letter, collecting activities must have been suspended. We know from a letter from Sinclair to Stahle that there were some "legal or political complications" regarding the Zions View locality. We can only speculate about what precisely occurred. But we do know that the site fell into obscurity until 1970, when it was

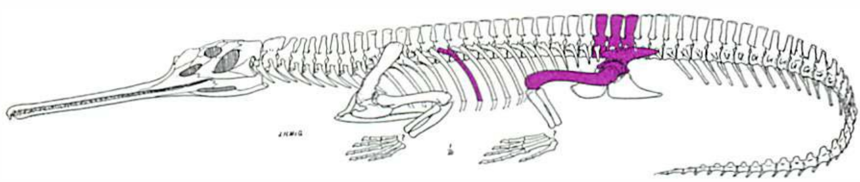

Figure 5. ***Rutiodon*** **(="*Rhytidodon*") *carolinensis* as drawn by McGregor (1906) and as colored by Sinclair in his March 1911 letter to Stahle.**

rediscovered and fossils were collected by personnel of The State Museum of Pennsylvania.

Under the direction of former Earth Science Curator Donald Hoff, the Zions View locality (the "Stahle Bone Bed") was worked from September 1970 through the fall of that year, and then again in the summer of 1971. Numerous disarticulated skeletal elements belonging to *Rutiodon carolinensis* (and the labyrinthodont amphibian *Buettneria perfecta*) were recovered during this time. The specimens collected are from more than one individual and represent a number of phytosaurs of different ontogenetic (growth) stages. Notable *Rutiodon* specimens from Zions View, housed in the collections of The State Museum, include a right ilium, numerous isolated teeth, osteoderms, a partial skull, parts of two lower jaws, and other skeletal elements.

It should be noted that, although the Zions View site was lost for more than a half century, other *Rutiodon* localities were discovered downstream along Little Conewago Creek, and fossils were collected from them between the time that Stahle abandoned Zions View and the early 1970's, when excavation was resumed there (Wanner, 1921, 1926). In addition, Huene (1921) reported other occurrences of phytosaur teeth from Pennsylvania at about the same time. It is likely that with continued interest and prospecting, we will find more phytosaur specimens, and perhaps one day, Pennsylvania's first dinosaur skeleton.

We thank Jon Inners of the Pennsylvania Geological Survey and Donald Hoff for reviewing this article; Mary Ann Turner of the Peabody Museum of Natural History, Yale University, for additional information about the original phytosaur specimen obtained by Princeton University; and Peggy Cross of Princeton University for the photograph of W. J. Sinclair. Special thanks are extended to Douglas Henderson for sending us a photograph of his phytosaur illustration and for allowing us to use it in this publication.

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Volcanic Ash Beds: One Person's Junk Is Another's Treasure

by Robert C. Smith, II
Pennsylvania Geological Survey

Depending on which person you ask, volcanic ash might be described as a treasure or junk. An agronomist might note the fertile soils that tend to form from volcanic ash after a few years of weathering releases plant nutrients such as potash, phosphorus, and sulfur. A climatologist might extol how volcanic sulfur dioxide gas protects the earth's atmosphere from warming caused by greenhouse gases. An aquatic biologist might describe damage to fisheries via hot volcanic mud in streams. An artist might be inspired by the enhanced color and beauty of sunsets caused by fine suspended ash. However, an astronomer might be disturbed by the reduced clarity of that same atmosphere a few hours later. A civil engineer might state the risks to life and property from mudslides of newly deposited ash. Finally, a geologist might tout the mineral-resource uses of ancient, now altered ash. Altered volcanic ash called bentonite has varied commercial uses, such as in well-drilling mud, in grout to seal water out of basements, or in impermeable barriers to toxic waste (Lefond, 1983). Bentonites also are commonly used as food additives (though they are not listed as ingredients in my favorite brands).

In several fields of geologic research, the occurrence of volcanic ash layers as time-line markers makes them very useful (Figure 1). Because the ash of a particular eruption fell over a wide area simultaneously, the ash layers can be used to correlate distant rock sections with accuracies as good as a few days, an unusual situation in geology, where uncertainties of a few million years are considered to be quite acceptable.

In Pennsylvania, the practical use of volcanic ash beds as marker layers is believed to have begun in the early 1930's, when the Tioga gas field of north-central Pennsylvania was developed. Fettke (1952) noted that the presence of a brown micaceous volcanic ash,

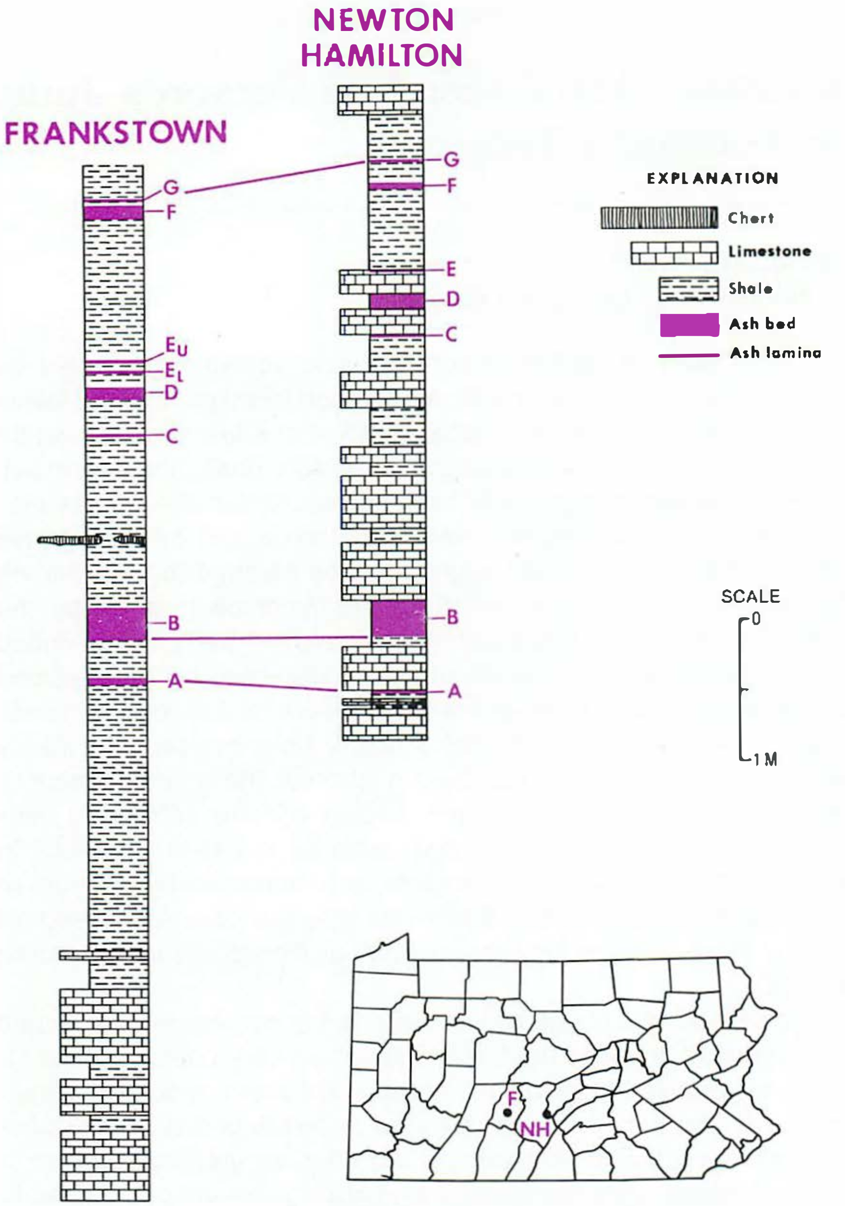

Figure 1. Example of the correlation of geologic time from Frankstown (F), Blair County, to Newton Hamilton (NH), Mifflin County. The match of seven ash layers, several having their own diagnostic properties, provides moderately strong scientific evidence that the two sections formed at corresponding times despite the much greater abundance of limestone at Newton Hamilton (modified from Way and others, 1986).

recovered during deep drilling, could be used to distinguish Onondaga limestone, which occurs just above the natural-gas-producing horizon, from similar-appearing Tully limestone, which occurs stratigraphically much farther above the producing horizon.

More recently, a pair of prominent volcanic ash beds near the contact between the Nealmont and Salona Formations in central Pennsylvania has served as a convenient reference point for locating samples from lower in the geologic section that are being studied for high-calcium-limestone potential. Once again, their value as marker layers is proven, even to being easily followed during quarrying or deep mining.

Short-range correlation problems on the scale of a few counties or states have largely been resolved for the Upper Ordovician, Lower Devonian, and Middle to Upper Devonian rocks by several geologists studying ash beds in Pennsylvania over the years. These were done mainly by verifying the identification of characteristic biotite crystals in the ash using a hand lens or by panning out unusually needlelike zircons from the altered ash layers. Intercontinental correlations of the Upper Ordovician bentonites are now in progress by W. Huff, S. Bergström, and D. Kolata. In a paper in the October 1992 issue of *Geology,* they suggested that the Millbrig ash bed that occurs in central Pennsylvania and large areas of central to eastern North America is the same as the "Big Bentonite" of Scandinavia. This correlation was based in large part on their chemical fingerprinting of scores of samples. What makes this correlation so interesting is that the eruption that produced the "Big Bentonite" redefines the term "large" when applied to a volcanic eruption. The authors reported that this eruption covered a few million square miles with a yard or two of ash. Altogether, the "Big Bentonite" eruption produced about 250 cubic miles of ash versus the recent eruption of Mt. St. Helens, Washington, which produced only 0.04 cubic mile of ash. Curiously, despite the burial of huge areas under ash, no significant extinction of fossil species has been recognized at the time of the "Big Bentonite" eruption.

Some other notable studies presently being done on ash beds in Pennsylvania include those by U.S. Geological Survey geologists, who are attempting to trace tonsteins (volcanic ash beds associated with coal measures) to help unravel Carboniferous stratigraphy in southwestern Pennsylvania; those of bentonites below the Tioga Ash Beds by Chuck Ver Straeten of the University of Rochester to refine Lower Devonian correlations; those by Mary Roden of Union College, Schenectady, N.Y., on regional erosion rates; those by George Shaw, also of Union College, on rare-earth fingerprinting to correlate apatites from bentonites; and analyses of volcanic melt trapped and preserved by growing quartz crystals recovered from several ash beds by John Delano and students at the State University of New York at Albany to correlate beds and locate source volcanoes.

In all, there are probably over a dozen researchers now studying volcanic ash beds in Pennsylvania. Exciting results are sure to follow!

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EARTH SCIENCE TEACHERS' CORNER

Fossils, Rocks, and Time

by Anne B. Lutz
Pennsylvania Geological Survey

The U.S. Geological Survey has published a 24-page booklet titled **Fossils, Rocks, and Time** by Lucy E. Edwards and John Pojeta, Jr., and a related poster, **Fossils Through Time,** by Pojeta and Edwards. Both the booklet and the poster were published in 1993 as part of a series of general interest publications. The authors introduce some of the basic concepts of biostratigraphy (the study of sedimentary rocks based on the fossils they contain) for a general audience. These publications would appeal to teachers who want to introduce students to fossils and sedimentary rocks, or to anyone new to this branch of geology.

The text of the booklet flows smoothly from topic to topic, and a wide range of concepts is introduced. It begins with a description of the development and use of the relative geologic time scale. A discussion of rock age determinations using radioactive isotopes comes later, when the authors add numeric ages to the relative scale.

Another part of the booklet contains a description of how sedimentary rock layers, which preserve earth history, were formed. This explanation includes the names of scientists who derived some of the principles of biostratigraphy, which contributes to the reader's awareness of the historical development of this field.

The discussion of fossils includes the idea that there is a changing succession of fossils in the rocks, indicating that life on earth has changed through time. Other concepts, such as correlation, are presented in the illustrations and their accompanying captions. At the end of the booklet, a list of books for further reading is provided.

The booklet is filled with drawings and photographs, many of the photographs showing geologists at their jobs in both the laboratory and the field.

The poster by Pojeta and Edwards is a collage of photographs of fossils. The photographs are arranged by period along the geologic time scale, starting at 600 million years ago. Thus, the diversity and evolution of life on earth are represented. The first appearances of some fossil groups, the dominant organisms, and extinctions are explained in short texts that accompany each time period. However, the poster may give an unbalanced picture of the fossil record because it does not indicate which fossil groups were the most common in each geologic period.

Both the booklet **Fossils, Rocks, and Time** and the poster **Fossils Through Time** are available free of charge from Book and Open-File Report Sales, U.S. Geological Survey, Federal Center, P.O. Box 25425, Denver, CO 80225.

ANNOUNCEMENTS

New Editions of Bushkill and East Stroudsburg Topographic Maps Are Issued

The National Mapping Division of the U.S. Geological Survey (USGS–NMD), in cooperation with the Pennsylvania Geological Survey, has issued the first completely new editions of 1:24,000-scale topographic quadrangle maps of Pennsylvania with the 1993 release of the Bushkill and East Stroudsburg quadrangle maps of Monroe and Pike Counties (see back cover).

In 1973, the USGS–NMD completed 1:24,000-scale (7.5-minute) topographic map coverage of Pennsylvania through a 50/50 federal/state cooperative funding program. The state funds were provided by the Pennsylvania Geological Survey and the Pennsylvania Department of Transportation. This program began in 1946 and required 27 years before the last quadrangles (Canton in Bradford County and Union City in Erie County) were compiled, field checked, and printed. The 1:24,000-scale mapping program replaced an earlier topographic mapping program, never fully completed, that began in the 1880's to produce 1:62,500-scale topographic quadrangle maps (the 15-minute map series).

Of the 872 quadrangles that include significant areas within Pennsylvania, 824 (94 percent) have been revised, mostly as photorevisions, since 1973. These maps are familiar to users because of the purple overprint that indicates new roads, building structures, lakes, disturbed lands, and other features that have changed the appearance of the land area of the quadrangle since its original publication. With the release of the two new quadrangle maps, the Pennsylvania cooperative topographic map revision program, now funded by the Department of Environmental Resources, has reached a new milestone in its continuing efforts to maintain modern accurate standard-scale topographic maps of Pennsylvania.

The Bushkill and East Stroudsburg quadrangle maps were selected along with six other quadrangles (Pittsburgh East, Pittsburgh West, and four quadrangles in Clearfield County) for revision by replacement mapping either because there had been many changes to surface features or because the accuracy of the original map was no longer sufficient for modern-day usage.

For Pennsylvania, these two maps are also the first to be printed using the new North American Datum of 1983 (NAD83) to adjust the latitude and longitude position of the quadrangle map features and map corners. Modern use of satellites designed for locating geographic positions requires a more accurate, earth-centered, mathematical model to calculate site locations. This new model has resulted in shifting the former locations of corners (and depicted features) of quadrangle maps by various amounts. In Pennsylvania, the shift of quadrangle features and corners has been principally to the west and, to a lesser extent, south, by distances of from about 65 feet in western areas of the state to about 100 feet in eastern areas. A more detailed article on the shifting effect of the NAD83 on Pennsylvania quadrangle maps will appear in a future issue of *Pennsylvania Geology*.

Not all Pennsylvania quadrangles will be replaced in the manner of the new Bushkill and East Stroudsburg maps. Under the continuing map revision program, most quadrangle areas are photoinspected on a regular schedule and revised when necessary. "Limited update" (photorevision) is the most economical method of modernizing maps and suffices for most map revisions. Some maps that require more extensive revision, but for which most originally compiled information is accurate, are revised through the "standard" revision method, in which new features are added and contour changes are included in selected areas. Map feature changes normally shown in purple on a limited update map are depicted in standard map colors on standard revision maps. "Replacement" mapping is done only in areas where limited update or standard revision products do not meet user needs or accuracy requirements; it is the most expensive revision method. At the end of 1993, approximately 150 Pennsylvania quadrangles were in various stages and methods of revision.

Future joint revision program plans include modernization of Pennsylvania quadrangle maps using digital mapping techniques. At present, digital revision mapping projects are active for 29 Pennsylvania quadrangles, and the York quadrangle map will soon be released.

The new maps may be obtained for $2.50 each from the U.S. Geological Survey, Map Distribution Center, Federal Center, P. O. Box 25286, Denver, CO 80225 (please make checks payable to *Department of the Interior*), or by contacting one of the over 125 local Pennsylvania distributors of quadrangle topographic maps. More information on distribution may be obtained by calling 1–800–USA–MAPS. A list of local Pennsylvania distributors may be obtained by writing to the Pennsylvania Geological Survey, P. O. Box 8453, Harrisburg, PA 17105–8453.

Field Conference of Pennsylvania Geologists

The 59th Annual Field Conference of Pennsylvania Geologists, "Some Aspects of Piedmont Geology in Lancaster and Chester Counties, Pennsylvania," will be held from Thursday, September 29, through Saturday, October 1, 1994. The conference center will be in Lancaster, Pa. Attending geologists will consider these aspects of Piedmont geology: (1) facies relationships on the early Paleozoic carbonate shelf edge; (2) nature and provenance of the Peters Creek sediments; (3) implications of the geochemistry of the metabasalts; (4) patterns of regional metamorphism; (5) regional Alleghanian shear zones; (6) origin and transformation of the Cream Valley fault; (7) evolution of surficial deposits in southern Chester and Lancaster Counties; and (8) Late Cenozoic terraces along the lower Susquehanna River.

Thursday evening's activities will include registration, an introductory talk, and a reception. Friday will be spent mainly in Chester County. Saturday will be devoted mostly to visiting outcrops along the lower Susquehanna River. At least one preconference trip is planned.

A formal announcement of the conference, along with preregistration and hotel information, will be mailed in early August. If you have not attended a previous Field Conference and wish to receive the announcement for this year's meeting, please send a request to Field Conference of Pennsylvania Geologists, P. O. Box 1124, Harrisburg, PA 17108–1124.

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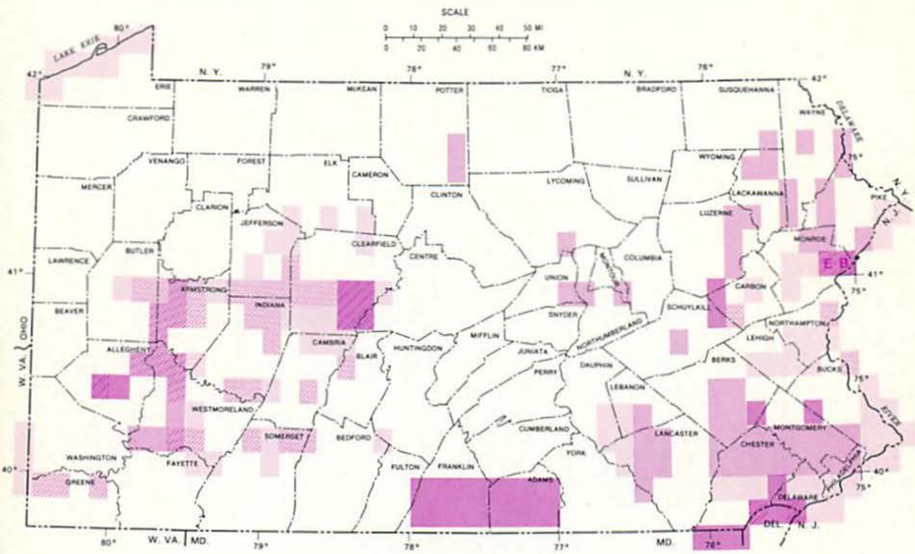
IN COOPERATION WITH THE U.S. GEOLOGICAL SURVEY

TOPOGRAPHIC MAPPING
GROUNDWATER-RESOURCE MAPPING

STATUS OF TOPOGRAPHIC MAP REVISIONS

(see article on page 14)



EXPLANATION

RECENTLY PUBLISHED	IN PROGRESS	
		Replacement-map projects (B, Bushkill quadrangle; E, East Stroudsburg quadrangle)
		Standard-update revision projects
		Limited-update revision projects

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