 COMMONWEALTH OF PENNSYLVANIA
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TOPOGRAPHIC AND GEOLOGICAL SURVEY
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ON THE COVER: Chimney Rock, part of a ridge of Hellam conglomerate, one mile north of Hellam Borough, York County, Pennsylvania. Photo courtesy of William H. Bolles.

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OCTOBER 1978
WHY NOT SUPPORT THE BASICS?

A few weeks ago a staff member of one of the federal agencies came up from Washington. He had called previously to invite our Survey to apply for federal money which was available for a specified type of research. My phone reply was apparently so incredulous to him that he asked to come and explain in person the available monies. After hearing him (and his two colleagues) out, I again replied that the type of exotic research he was urging us to undertake was extremely unlikely to be fruitful within the geological framework of Pennsylvania and, therefore, my responsibility as State Geologist and my conscience as a taxpayer would not permit me to go after this earmarked federal money. The expression on their faces was worth the time I lost.

This is not to say that the Pennsylvania Survey is not in need of additional funding, or that we are averse to accepting federal money. There is so much that remains yet to be done in our programs of geological mapping, coal and oil investigations, ground-water inventories, and geologic hazard delineation. But there's the "rub"! While there seems to be federal money available for exotic research projects, there is little or none available for basic resource mapping and data collection. Yet in geology, as in other sciences, the fact is that major advances and breakthroughs have to be built on a base of hard data, accumulated through years of tedious, non-glamourous field and laboratory work. The history of science is replete with examples of unfortunate ventures and conclusions for lack of proper data bases.

The wide use of our Survey reports and maps by research consultants to industry and government agencies, by college researchers, by fellow state agencies, and by industry and the public, all serves to indicate that we are producing needed and appropriate products. I would hope that as they move to dispense their available monies, federal agencies as well as endowment funds recognize that we too serve as we systematically conduct geological surveys and develop the geologic data base of our region. These mundane efforts are important and are as worthy of financial support as the "exotics." And all who struggle with state budgets will readily attest to the critical need for outside financial support of these worthy programs.

Arthur G. Boccon
The Lancaster County

Earthquake of July 16, 1978

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About 2:40 a.m. on Sunday, July 16 many residents of Lancaster County were awakened by what they thought was an explosion.

"I was awakened by what I thought must be a house exploding about five miles away. I lay there waiting for sirens to begin and I was amazed that [they] didn’t."

"The earthquake felt like an extremely large amount of dynamite was being used at the nearby quarry . . . Our house vibrates slightly and the steel beams ring when the quarry is dynamiting. During the earthquake exactly the same things happened; however, it was much more intensified."

These were the responses of persons living in the Millersville area to a questionnaire which the Lancaster New Era carried four days after the earthquake. About 65 questionnaires were returned. These and an additional score of reports received by telephone and direct conversation were the basis for preparation of the earthquake intensity map shown in Figure 1. The questionnaire was designed to correlate the effects of the earthquake with the Modified Mercalli (or Wood-Neumann) scale of earthquake intensity.

The intensity map of Figure 1 is, of course, rather crude. Most information was received from the city of Lancaster and its suburbs. Here the isoseismal lines are well determined. Elsewhere, however, the lines are only approximate and dashed lines are used where no information was forthcoming, or where it proved impossible to separate areas of different intensity. It seemed clear, despite the uncertainties, that the maximum intensity was experienced around the small village of Smithville, south of Lancaster. Some of the effects in the area identified as Intensity V include: a cracked window, cracks in a basement wall, a night table overturned, objects rolled off tables, and a small slump along a creek bank.

In Conestoga, just beyond the intensity V area, very strong vibrations were felt and many people were frightened. Near the outside
edge of the intensity IV area, curiosity rather than fear was the usual reaction. In the intensity III belt the noise was described as a low rumble, like distant thunder, and a mild vibration was felt. Two reports from the intensity III area described two rumbles a few seconds apart each accompanied by vibration. Both of these reports of a "double rumble" came from the same neighborhood north of Lancaster, located on a quartzite ridge.

A few other anomalous reports were received. A window was reported broken in the extreme southern part of the county, where the intensity should have been no greater than II or III. Respondents from the vicinity of Mount Joy and from northeastern York County reported vibrations stronger than those experienced by persons located closer to the intensity center. On the other hand, in Martic Forge, a village between Conestoga and Pequea, a weak vibration was felt and only a faint noise heard.

There may have been some precursory events to this quake. A resident of Pequea reported that his dog woke him up about 15 minutes before the earthquake, whining and evidently very disturbed. A woman living almost at the center of the area of inferred maximum intensity reported that in late May she and a neighbor had felt a vibration of the ground and heard a low gurgling sound coming from

Figure 1.
underground. She could not be certain of the exact date and examination of seismograms recorded at Millersville during the second half of May disclosed nothing unusual. Whatever this phenomenon was, it was not a foreshock in the usual sense because it persisted for about an hour.

The United States Geological Survey's Earthquake Information Center reported the magnitude of the quake to be 2.9-3.0. The epicenter was placed at latitude 39.93° N., longitude 76.34° W., and the focal depth was estimated to be 5 km. This epicenter is shown in Figure 1. The intensity study suggests an epicenter slightly southeast of that of the U.S.G.S., but considering the uncertainties in both the intensity study and the instrumental epicenter location, there is no significant difference between the two.

The timing of this event was unfortunate, for none of the nearby stations of the developing Pennsylvania Seismic Network (including Millersville's) were operating at that early hour of Sunday. Once the network is fully operational (perhaps within a year) better epicenter locations and possibly fault-plane solutions will be available for earthquakes of this size.

This was not the first earthquake to have its epicenter in or near Lancaster County. On December 7, 1972 a tremor of maximum intensity V shook the area. The epicenter was apparently in the northeastern part of the county, probably in or near the Triassic outcrop belt of the Furnace Hills. A similar event occurred on March 8, 1889, with the strongest effects being felt in Berks County, east of Lancaster County. A somewhat stronger earthquake (magnitude 4.5) was centered near Cornwall, also in the Triassic belt, on May 12, 1964. (von Hake, 1977). The recent earthquake seems to be the first to have an epicenter not associated with the Triassic basins.

It is tempting to make certain correlations between the July 16 earthquake and geologic features of southern Lancaster County. These are tentative, but interesting nonetheless. The most obvious correlation is with the Martic Line, a prominent topographic feature separating the Martic Hills, underlain by late Precambrian or Cambrian Wissahicken Schist, from the Cambro-Ordovician phyllitic marble of the Conestoga Formation. The interpretation of this line has been the subject of controversy. Most recent work suggests that it is a folded thrust fault (Wise, 1970), although probably not with the large amount of displacement at one time thought. The July 16 earthquake seems to have been centered near a short north-trending segment of the line. This is significant in view of the fact that most earthquakes in the northeastern United States are asso-
ciated with reverse faulting on north-trending faults. The regional stress field is one in which the axis of maximum compression is oriented east-west to northeast-southwest. (Sbar and Sykes, 1973).

Another possible correlation could be with the 40°N fault zone (or the Transylvania Fault) described by Root and Hoskins (1977). This fault zone is best exposed west of the Triassic basins, but if it is a major crustal fracture, perhaps related to the oceanic Kelvin fracture zone, then it could exist beneath southeastern Pennsylvania as well. However, there has been no historic seismicity on this fault zone.

Whatever the geologic origins of the earthquake, the people of Lancaster County do not appear to be excessively concerned about earthquake hazard. Surprise seems to be the most common response because "we don't have earthquakes here" (this despite the events of 1972 and 1964). There has been some apprehension about the danger to nuclear power plants along the Susquehanna River, but intensity V is not damaging to even moderately well-built structures. Yet the earthquake does show that the faults in the area are not completely dead, and no one could say with complete assurance that there will be no larger earthquake in the future.

REFERENCES


Miles And Miles Of Pipelines

According to the Department of Energy, Pennsylvania has 8,097 miles of installed, underground petroleum pipelines. This ranks the Commonwealth seventh largest amongst all states. These serve variously to collect petroleum from the producing fields of western Pennsylvania and to carry petroleum and refined products across the state to distribution centers.
‘Nature To Be Commanded Must Be Obeyed’

A new book showing how earth-science maps are helping people make the best use of land and water resources in urban and suburban areas, even in the face of such geologic hazards as landslides and earthquakes, has been published by the U.S. Geological Survey.

“Nature To Be Commanded...” is the title of the illustrated 95-page, atlas-sized book. The title is taken from a translation of a 1620 quotation by Francis Bacon an English philosopher and essayist: “Nature to be commanded must be obeyed.” “If we do not work with nature, but work against her, we may cause endless trouble for ourselves and sometimes invite disaster. To be obeyed, nature must be understood — which is where earth scientists come in.”

The book says “Much can be done to stop or reduce losses from geologic hazards. Armed with information that indicates the kind, degree and location of potential hazards, planners and decision-makers can forestall or relocate new developments in areas where lives and property would be imperilled, they can propose appropriate design precautions in developments that cannot be placed elsewhere, and they can alert inhabitants of imperilled developments to seek protection through engineering or insurance.”

Earthquakes, floods, landslides, coastal erosion and other geologic hazards cause an estimated $4.9 billion in damage in the United States each year, and take nearly 1,000 lives.

“Neglect of earth-science information is evident also in the mounting losses of mineral, water and agricultural resources due to inadequately controlled urbanization,” it says. “When sand and gravel or coal deposits, groundwater recharge areas or prime agricultural lands are built over, the inevitable result is rising cost of basic construction materials, of fuels, of potable water, of food.”

“Finally,” the book adds, “failure to use earth-science information is apparent in the rapid growth of man-made and man-aided geological hazards; collapse of slopes due to excavation for structures or roads; subsidence of land due to mining or to the withdrawal of water or gas or oil; and contamination of ground water and surface water due to improper waste disposal.”

The Rogers Brothers
And Lyell

by
Norman A. Pierce

A recent issue of *Pennsylvania Geology* (v. 9, no. 2, April 1978) contained an article entitled, "Charles Lyell and Pennsylvania," by Professor William R. Brice. The year of Lyell's arrival in the United States coincided with the last year of full, uninterrupted field work for the state surveys of Pennsylvania and New York, two of the best surveys financed by governments in ante-bellum America. The man directing the survey in Pennsylvania was Henry D. Rogers (1808-1866) who guided the Lyells along the hills and valleys in the eastern part of the state. This article will view Lyell's visit and related developments as recorded by Henry Rogers and his brother, William B. Rogers (1804-1882).

The Rogerses were two of a family of four brothers who were prominent members of the nation's scientific community in the Nineteenth Century. At the time of Lyell's early visits William was Professor of Natural Philosophy at the University of Virginia and Director of the Virginia Geological Survey; Henry was teaching at the University of Pennsylvania, had made his final report as Director of the New Jersey Survey, and was engrossed in the Pennsylvania Geological Survey. These two men were as close in their thinking and harmony of spirit as two persons could be. Although their interests had been similar early in their careers, William's predominant attention stayed with chemistry while Henry moved into structural and dynamic geology. During the winter of 1832-1833, nine years prior to Lyell's first journey to this continent, Henry had spent several months in England during which time his interest shifted to geology. This was influenced by his participation in the meetings of the Geological Society of London. At that time Henry Rogers was introduced to Charles Lyell.

The decade of the 1840's, when Lyell came to North America, were fruitful years for Henry and William Rogers: they travelled extensively on geological explorations outside as well as inside their states; they were among the founders and active participants in the Association of American Geologists and Naturalists. Before the decade ended, this Association, with continued strong support from these two men, was transformed into the American Association for the Advancement of Science.
In the spring of 1841 Henry and William had been busy lobbying in the capital cities of their respective states for appropriations to continue the surveys in Pennsylvania and Virginia. After much effort each man was successful in gaining a year’s extension. Henry at Harrisburg had to wait until the bitter end, at which time a general bill with a section to include the Survey was passed by the General Assembly over the veto of Governor David Potter.4 In the spring, too, the second meeting of the Association of American Geologists and Naturalists was held in Philadelphia. Besides entering into the discussions, Henry served as an interim presiding officer. Because William was struggling with the Virginia legislature that week, he could not attend.

During the summer of 1841 the two men made a geological reconnaissance to Niagara, New York and the nearby territory in Canada and Ohio. They came eastward in time to meet Charles Lyell in Albany on August nineteenth. At this meeting, a projected trip into Pennsylvania was arranged. A month later Lyell wrote to Henry to make more definite the time he planned to spend in Pennsylvania. Lyell suggested that he wanted to study the higher elevations which later would be covered by snow. Also in that letter Lyell, after viewing some terrain along the border of New York and Pennsylvania, admitted that the formations below “the Coal and
Old Red” (Carboniferous and Devonian) were better developed in the United States than in Europe and “it will take years before justice can be done to it.” This is along the same line of comment that Professor Brice quoted from Lyell’s *Travels* . . . page 70. This statement only echoes an earlier one made by Henry in his *Second Annual Report* . . . dated January 27, 1838. In this report Henry had written:

> In the general review of the extensive series of our Appalachian formations now for the first time systematically classified and described, our attention is forcibly arrested by their vast thickness, the immensity of their range and the inexhaustible stores of mineral treasures which they contain . . . . Viewing the majestic scale of our formations, and the combined grandeur and simplicity of structure of the enormous Geological basin which they embrace, we turn with grateful satisfaction to the peculiar position which Pennsylvania occupies, in this vast area. Lying on the margin of the great secondary basin of the United States and traversed as it is, for nearly three hundred miles through its center, by the whole broad belt of the Appalachian or Allegheny chain, in which a system of gigantic anticlinal elevations, brings the entire series of formations, several times in succession to the surface, it holds in combination with . . . [other Appalachian states], the key to the Geology of many other states, where but a part of the same strata are spread out in a nearly horizontal attitude, and exhibited in but a single belt.”

It is unlikely that any man, not even brother William or those concurrently studying the terrain of New York, Tennessee, or other states, grasped so completely at this early date the big picture of the structure of eastern America. No one but Henry is likely to have considered it simple.

After Mr. and Mrs. Lyell had come to Philadelphia and completed their excursion into New Jersey under the guidance of Timothy A. Conrad (1803-1877), they were conducted into the anthracite coal area by Henry Rogers and William McLlvaine, who can be identified only as a friend of the Rogerses and who assisted them in coining names for geological periods. Before this guided tour was undertaken Henry must have inquired from his brother as to how much Lyell should be taken into their confidence regarding their knowledge and theories. William, responding but not in time to reach Henry before he left up the Schuylkill Valley, wrote: “. . . I entirely concur with you in the plan of your proposed journey and your scientific intercourse with Mr. Lyell. My own reflections for a week past on this subject have impressed me with the importance of securing his good will, and if possible his friendship, by showing him the high philosophical import of our labours, and informing him frankly of our scientific plans. I feel as much or more than ever, the necessity of devoting some time this fall to the preparation of a memoir setting forth our leading views and discoveries, . . . .”

Lyell had the reputation of gleaning information from local sources
with his “absorptive power and plastic mind” and subsequently presenting such gleaned data into his books and articles without always giving proper credit. 9

A letter from Henry to William upon returning from his swing around eastern Pennsylvania with the Lyells related his general impressions of the Britishers. He stated, “If Lyell has been half as well pleased and satisfied with me as McIlvaine and I have been with him and his accomplished wife, I shall congratulate myself. I deem him a man quite too high-minded to encroach on the literary rights of others, and have many feelings towards him for the friendly interest he has shown in our future scientific progress.” 10

Henry then indicated that the Lyells planned to concentrate on the Tertiary deposits along the Atlantic coastal region as they journeyed south; and in this connection Lyell verified as Miocene a bed which Henry and his brother had earlier identified as such. As for the older strata, Henry wrote that Lyell indicated that fossils which he had collected in the Appalachians were similar to European Silurian specimens. Lyell was holding off a positive description of such specimens “which might be common to those in the New York rocks until Conrad’s labours were published, unless, indeed, these were so delayed as to impede the progress unnecessarily.” . . . 11

Lyell’s reliance on Conrad’s identification must have irked Henry who had referred to Conrad as a “closet” geologist in this letter. Conrad had brought Henry to task for confusing a gray sandstone with the Hudson River sandstone in his Second Annual Report. In an article in the American Journal of Science and Arts for 1839 Conrad admonished, “Not a single species of shells or plants is common to both . . . . This shows the great danger of error in endeavoring to identify strata over large areas, if we neglect to appeal to the evidence afforded by palaeontology, and rely too exclusively upon the ever varying mineral composition of rocks, which it is obvious may present similar features in groups of widely different age.” 12

Although Lyell did not have to wait too long for Conrad’s descriptions of Silurian fossils, the results were not in the form expected. Conrad, the palaeontologist of the New York Natural History Survey of 1836-1845, resigned in June 1842 without submitting a final report. He summarized his findings of the Silurian and Devonian systems in a paper to the Philadelphia Academy of Natural Sciences in January 1842. 13

By the time of Lyell’s visits Henry and William were planning a paper on the structural geology of the Appalachian region, an idea they had been mulling over since at least 1838. Three days after his description of travelling with Lyell, Henry wrote to William, “I
did not state in my last [letter] how greatly I astonished Lyell at the breadth of some of our results and doctrines connected with structure. Though incredulous for the first day or two, even as to the thickness of our rock, I quite made a convert of him before we parted." He then suggested to William that he collect his ideas and notes on slaty cleavage, "for as a part of structure we ought to treat of it..." Later in October 1841 Henry commented that Lyell relied too much for identifying formations by their fossils and added, "But it is in the department of dynamic geology that, being foremost, we ought to be especially prompt in publishing. Reading Darwin on volcanic phenomena in the Andes... I have been particularly struck with conformitory evidence of the soundness of our idea of a pulsation having caused anticlinal axes. I am sure the doctrine will meet with acceptance."15

That winter the brothers discussed by letter the comparative relationship and nomenclature of formations in the Appalachians. At times Conrad’s and Lyell’s observations came in for comment and use. Fossil fish, which Benjamin Silliman (1779-1864) of Yale had uncovered in Connecticut and identified with Lyell’s aid, appeared to Henry to verify his observation that "our red shale (Triassic) began directly after the upheaval of the coal."16 So much for scoffing at the use of fossils in identifying formations!

Lyell wrote to William after Christmas, 1841 from Charleston, South Carolina to say that information supplied by William had assisted Lyell in collecting and identifying Tertiary beds. Lyell inquired whether William could return to Virginia with him after the Boston meeting of the Association of American Geologists and Naturalists and accompany him around the coal areas of Richmond and over the Allegheny Plateau to the Ohio River.17 There is no record that William was able to oblige Lyell.

Henry in February 1842 showed some uneasiness about Lyell’s use of information discussed between themselves as they examined the deposits in the anthracite region. In a letter to William he wrote that an abstract of a letter on the anthracite coal area from Lyell had been published by the Geological Society of London in such a way as to make Lyell the originator of its facts and ideas. Henry had thought that he had assurances from Lyell that any letter would be submitted as reflecting assistance and ideas from Henry.18 But neither brother had time to fret over that matter because preparation for the Boston meeting of the Association of American Geologists and Naturalists took much of their attention. Both men participated actively in giving papers and in discussions of other topics. Their most important effort was their joint paper, "On the Physical Struc-
ture of the Appalachian Chain..." After providing a detailed description of the Appalachians, the brothers argued that the chain was formed by the oscillation of a thin crust riding on pulsating, subterranean lava in combination with pressure from the northwest. They also tried to place the rise of this chain in geological time and compared it with mountains elsewhere.19

Lyell was the big drawing card at the Boston meeting. While the Rogerses had plenty of opportunity to converse with him, it remains unknown whether the subject of authorship of ideas expressed in his letter to London arose. Whether Henry refrained or not from raising the issue, a similar situation between Lyell and James Hall (1811-1898) of the New York Natural History Survey had been stirred up in public by a rumor that Lyell intended to incorporate information received from Hall and other geologists into a new edition of his Elements of Geology. Hall, who had contributed much time, knowledge, and the use of an unpublished map to Lyell, was aroused enough to write an anonymous letter, later acknowledged as his, to a Boston newspaper. This letter protested the Britisher’s method of absorbing information from geologists of local regions for possible personal gain.20 Lyell, therefore, was very aware of and alert to the general feeling about his use of information obtained from fellow scientists.

Less than a month after the Boston meeting Lyell wrote to Henry apprehensively from Marietta, Ohio about an article in The Athenaeum, a British Publication, which attributed to a third person statements about Appalachian structure which Henry had expressed to Lyell in the previous October. To forego further chances for others to claim credit for the ideas presented by the Rogerses at Boston, Lyell urged Henry to submit an abstract of their paper on the Appalachian chain to the British Association for the Advancement of Science in time to be read at the 1842 summer meeting. Henry heeded this advice and submitted an abstract which generated a lively discussion at the Association’s meeting in Manchester. Three leaders of British geology commented on the paper at this session. Roderick Murchison (1792-1871), while agreeing with the demarcation between the Palaeozoic series and later deposits, “was not prepared to give any opinion upon Prof. Rogers’s undulatory theory.” Sir Henry De la Beche (1796-1855) did not think that pulsation was necessary, only the lateral pressure. Adam Sedgwick (1793-1873), although not willing to accept the theory, complimented the United States “for the elaborate surveys they have published” and which will “serve along with similar phenomena to form the base of legitimate theory.”21 The theory based on pul-
sation was not as quickly accepted by notable geologists as Henry had predicted. Nor was it to be generally accepted later.

During the Lyells's second trip to this continent they do not appear to have made contact with the Rogers brothers. This seems a bit strange, especially in the case of Henry who had moved to Boston by 1846 and was seeking a professorship at Harvard College as well as lecturing in that area. It should be added, however, that at this time Henry was experiencing frustration in getting his final report for the Pennsylvania Survey published. William, in the meantime, was becoming discontented with the intellectual atmosphere of Charlottesville and his thoughts were turning to the means of producing a better environment for scientific and technical training than most colleges offered. In due course William would move to Boston and become the dominant person in the founding of the Massachusetts Institute of Technology. Both brothers were located in Boston for only a few years as Henry moved to Edinburgh, Scotland to supervise the printing of his final report of the Pennsylvania survey and in 1857 he received an appointment as Regius Professor of Natural History at the University of Glasgow.²²

FOOTNOTES

2 Ibid., 1: 98.
8 Ibid., pp. 193-4.
11 Ibid., p. 195.
13 T. A. Conrad, "Observations on the Silurian and Devonian Sys-

15 Ibid., p. 199.
17 Ibid., p. 204.
18 Ibid., p. 207.
19 William B. Rogers and Henry D. Rogers, "On the Physical Structure of the Appalachian Chain, as Exemplifying the Laws which have Regulated the Elevation of Great Mountain Chains, Gener­ally," Report . . . of the Association of American Geologists and Naturalists (Boston: Gould, Kindall and Lincoln, 1843), pp. 474-531. See Kohlstedt, Formation of American Scientific Community, p. 69 for the comment that this paper was the most significant one ever given before a meeting of the A.A.G.N.


New Pennsylvania Mineralogy Book

Friends of Mineralogy, Pennsylvania Chapter, announces the availability of Mineralogy of Pennsylvania, 1966-1975 by R. C. Smith, II. This new book describes 62 previously unreported mineral species found in Pennsylvania during the ten-year period 1966-1975. Detailed descriptions and data are provided, plus precise directions to locate the locality of each of the new minerals.

The book contains many photographs and drawings, maps illustrating localities and a comprehensive glossary. A history of Pennsylvania mineralogy is included.

Mineralogy of Pennsylvania 1966-1975 can be obtained by writing to Bryon Brookmyer, Blue Ball, Pennsylvania, 17506. Make check or money order payable to Friends of Mineralogy, PA Chapter, in the amount of $14.95 plus 60¢ postage = ($15.55).
NEW GEOLOGIC ATLASES ISSUED

Two new geologic atlases have been issued by The Pennsylvania Geologic Survey for portions of Adams, Columbia, Franklin and Luzerne counties. Each of the atlases contains detailed, full-colored geologic maps of the bedrock as well as the unconsolidated surficial deposits. The detailed maps (scale 1:24,000) and accompanying reports pay particular attention to the economic importance of the various geologic formations, as well as the engineering and environmental characteristics which will affect development and land-use planning. These atlases will be of importance to residents of the areas, planners, local officials, industry, and conservationists.


Atlas 174c, Geology and Mineral Resources of the Berwick Quadrangle, Luzerne and Columbia Counties, Pennsylvania, by J. D. Inners, is available for $12.00 (plus tax for Pa. residents).

The above publications should be ordered from the State Book Store, P.O. Box 1365, Harrisburg, Pa. 17125.

GROUNDWATER REPORT ISSUED

A new groundwater report has been published by the Pennsylvania Geologic Survey, dealing with Northern Berks County. This report provides basic data and descriptions and detailed hydrogeologic maps of the availability of subsurface water in the area investigated. With a growing population and an expanding consumption of water by industry, this report serves to focus attention on one of Pennsylvania’s important, underdeveloped sources of quality water. This report will be of assistance to planners, developers, and all future water users.

This report is the product of an ongoing cooperative program with the Water Resources Division of the U.S. Geological Survey.

Water Resources Report 44, Ground-Water Resources of Northern Berks County, by Charles Wood and David MacLachlan, is available for $12.00 (plus 6% tax for Pa. residents) from the State Book Store, P. O. Box 1365, Harrisburg, Pa. 17125.
The record of oil and gas drilling, production, and reserves for Pennsylvania in 1977 is presented in a report newly released by the Pennsylvania Geologic Survey. The 39-page book, entitled "Oil and Gas Developments in Pennsylvania in 1977", is co-authored by Louis Heyman and Cheryl Cozart. This latest annual report on the subject provides data for the year as well as comparisons with activities in prior years. Particularly noteworthy was the drilling of 1372 new oil and gas wells, an increase of 167 over 1976, and the production of 2.7 million barrels of crude oil and 92.3 billion cubic feet of natural gas.

Progress Report 191, Oil and Gas Developments in Pennsylvania in 1977, is available for $1.40 (plus 6% tax for Pa. residents) from the State Book Store, P. O. Box 1365, Harrisburg, Pa. 17125.

**BIBLIOGRAPHY OF GEOLOGIC FIELD TRIP GUIDEBOOKS RELEASED**

This bibliography compiled by Sandra Blust strives to gather the published guidebooks for field trips to 1977 which took place within the geographic boundaries of Pennsylvania and to briefly annotate each.

The guidebooks are categorized into four groups: 1. Those published by the Pennsylvania Geological Survey, 2. Guidebooks from the Annual Meetings of the Field Conference of Pennsylvania Geologists, 3. Guidebooks prepared by the Geological Society of America, and 4. Guidebooks prepared by other geological societies. Following the written descriptions for each field trip category is an index map tracing the road log for each excursion.

Copies of the bibliography are available at no charge from Pennsylvania Geological Survey, Department of Environmental Resources, P.O. Box 2357, Harrisburg, Pennsylvania 17120.

**NEW PARK GUIDE AVAILABLE FREE**

The geology of Gifford Pinchot State Park, York County, is described in a fold-out pamphlet issued as Park Guide 10. The brochure illustrates the geology through map, sketch, and photographs with selected localities described where the predominant rock type, diabase, may be examined. Copies of Park Guide 10 may be obtained at Gifford Pinchot State Park or by writing to the Bureau of Topographic and Geologic Survey, P.O. Box 2357, Harrisburg, PA 17120.
GROUND-WATER LEVELS
FOR
SEPTEMBER 1978

Bureau of Topographic and Geologic Survey
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Address Corrections Requested