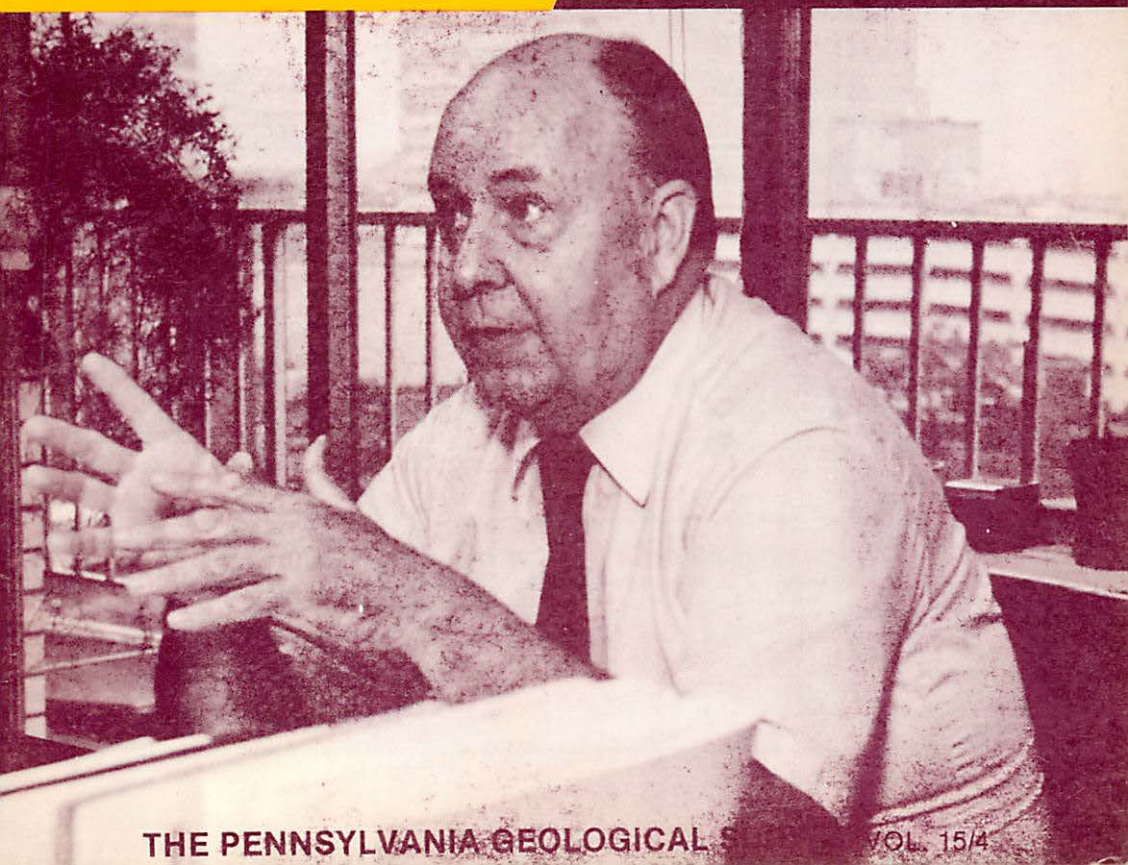


G PENNSYLVANIA O L O G Y



COMMONWEALTH OF PENNSYLVANIA

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TOPOGRAPHIC AND GEOLOGIC SURVEY

Arthur A. Socolow, State Geologist

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ON THE COVER: Alan R. Geyer, retiring Chief of the Environmental Geology Division of the Pennsylvania Geological Survey, typically responding to a visitor's geologic question. Photo courtesy of Geary Sarno.

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FROM THE DESK
OF THE
STATE GEOLOGIST



A NICE GUY WHO IS FINISHING FIRST

A shining example of a person who belies Leo Durocher's classic pronouncement that "Nice guys finish last" is Alan Geyer, who has chosen to retire as Chief of our Environmental Geology Division after a span of service that extends back to 1951. Al's list of activities, accomplishments, and publications is long and significant. But I want to focus here on Al, the person. Here is a true gentleman; unassuming, overwhelmingly considerate of others, kind, and gentle. And on top of those qualities there has also been a dedication to serve the citizens of the Commonwealth and a professional competency that will long serve as a model here at the Pennsylvania Geological Survey.

Al Geyer has over the years demonstrated an outstanding ability to unravel and describe highly complex geologic structures, as is exhibited in many of his published reports identified in the accompanying article. But Al has also shown an ability to understand and apply the relationship of geology to man, so that he has been extremely effective and ready to respond to the geologic problems and needs which so many of our citizens have placed before him. Furthermore, Al Geyer has been in the forefront, both on the state and national level, in recognizing the importance of developing geological education for all levels of the school curriculum.

For his countless professional contributions and assistance, the Pennsylvania Geological Survey and the citizens of Pennsylvania owe a great debt of gratitude to Al Geyer. For his warm comradeship and support, we of the Survey, as well as his legion of friends throughout the country, extend our deep appreciation. We join together in extending to Al our heartfelt wishes for long years of good health and happy retirement.

Arthur G. Socolow

Alan R. Geyer Retires

Alan R. Geyer, longtime Chief of the Environmental Geology Division of the Pennsylvania Geological Survey, announced his retirement effective September 19, 1984. Al Geyer, a native of Lancaster, Pennsylvania, did his undergraduate studies in geology at Franklin and Marshall College and his graduate studies at the University of Michigan. He first started work with the Pennsylvania Geological Survey on a part-time basis in 1951, then full time in 1953. After two years of military duty, Al Geyer returned to the Pennsylvania Survey in October of 1955 and was appointed Assistant State Geologist in 1957. In 1961 he served for several months as Acting State Geologist and in 1967, at his request, he was appointed Chief of the newly created Environmental Geology Division.



Under Al Geyer's direction the Environmental Geology Division developed many innovations, including a computerized water well data system, a landslide and sinkhole response program, a series of geologic park guides, and numerous field and laboratory guides for Pennsylvania's Earth Science education programs. Geyer's geologic Atlases of the Lebanon and the Womelsdorf Quadrangles are recognized for their scientific contributions and unique format, making them meaningful to both scientists and layman. His report on the "Engineering Characteristics of the Rocks of Pennsylvania" was a nationally innovative and functional presentation of the state's rock formations and his massive volume on "Outstanding Scenic Geologic Features of Pennsylvania" has become a best-seller by all standards. Tens of thousands of young and old Pennsylvanians have benefited from Geyer's input in "Common Rocks and Minerals of Pennsylvania" and the best-selling "Mineral Collecting in Pennsylvania". Geyer has been an active participant and officer of the National Association of Geology Teachers, as well as numerous Boy Scout, conservation, and Science Fair activities.

Space does not permit complete enumeration of all of Geyer's publications, technical services, lectures, committees, and counselling over the years. All this has been done with grace, enthusiasm, and highest standards. Alan Geyer has made an outstanding contribution to the geologic community and to the public at large.

GEOLOGICAL RESEARCH IN PENNSYLVANIA

1984

INTRODUCTION

This publication is the twenty seventh annual report on Geological Research and Publications in Pennsylvania. It is an attempt to list all current geologic research in Pennsylvania and includes persons and projects other than those of the Pennsylvania Geological Survey. Because of the large number of projects reported to us, we exercise editorial license to reduce the description of the research projects to fit our available space.

We have also attempted to determine an anticipated completion date (ACD) for each project. The anticipated completion date is the estimate of the date when the author will complete his report; additional time should be anticipated until the report is published. *If you wish more information on a project described herein, please write directly to the author; most of these projects will not be published by the Pennsylvania Geological Survey inasmuch as most are not Survey sponsored projects.*

The listings are grouped into major categories of research to facilitate your search for information on a particular subject. Reports published are listed alphabetically by author.

As with all compilations, there may be omissions; this is unintentional. Additional copies of this report may be obtained by writing to the Bureau of Topographic and Geologic Survey, Department of Environmental Resources, P.O. Box 2357, Harrisburg, Pennsylvania 17120.

AREAL GEOLOGY

T. M. BERG and **W. D. SEVON**, Pa. Geol. Survey, and **ROBIN ABEL**, Defense Mapping Agency. Rock Types of Pennsylvania. This map is a simplified version of the State Geologic Map and will be issued at the scale of 1:500,000. It will show the distribution of 19 different

categories of rock in the Commonwealth. It will be useful for schools, tourists, and lay persons not familiar with the intricacies of stratigraphy. ACD: 1984.

BRUCE CUSHING and **G. H. MYER**, Temple Univ. The Martic Line, Coatesville, Unionville, and Norristown Quads. ACD: Dec. 1985.

A. J. FROELICH, Project Chief, U.S. Geol. Survey. Early Mesozoic Evolution of the Eastern U.S. During FY 1984, maps showing the following features of exposed early Mesozoic basins of the eastern U.S. will be compiled: distribution, lithology, and age of sedimentary rocks (Triassic-Jurassic), igneous rocks, Mesozoic and younger faults, and thermally metamorphosed rocks. Existing large-scale (1:24,000-1:62,500) geological and geophysical maps within the study area will be identified and evaluated and a list of references compiled. ACD: FY 1987.

J. D. INNERS, Pa. Geol. Survey. Geology and Mineral Resources of the Allenwood and Milton Quads., Union and Northumberland Cos., Pa. ACD: 1984.

T. J. KUNTZ and **N. K. FLINT**, Univ. of Pitt. A Regional Study of the Vanport Limestone in Elk Co. Miscorrelations of the Vanport in Elk County are being resolved while the extensiveness of it is becoming realized. A petrographic study reveals a heavy concentration of fossil algae in this limestone. ACD: Sept. 1984.

B. P. KOHN, Ben Gurion Univ./Univ. of Pa., and **M. E. WAGNER** and **T. M. LUTZ**, Univ. of Pa. The Cooling and Uplift History of the Central Appalachian Piedmont as Revealed by Fission-Track and Rb-Sr Studies of the Crystalline Basement [Piedmont from Baltimore area to Reading Prong and N.J. Highlands—includes all of Del. and Pa. Piedmont]. We plan to determine fission-track ages on apatite, zircon, and sphene and Rb-Sr ages on micas and whole rock from metamorphic basement rocks of the Piedmont of Pa.-Del.-Md. and the Reading Prong of N.J. and Pa. Since the minerals have different closure temperatures they are expected to yield discordant ages that can be interpreted in terms of uplift and cooling rates of the host rocks. ACD: Fall 1985.

P. T. LYTTLE, Project Chief, U.S. Geol. Survey. Newark 2-Degree Quad. This project was completed in FY 1983; a bedrock geologic map of the Newark 2-degree quadrangle is in press.

PETER LYTTLE and **J. B. EPSTEIN**, U.S. Geol. Survey, and **GARY LASH**, S.U.N.Y., Fredonia. New Tripoli 7-½' Quad. Great Valley section has been mapped; Valley and Ridge mapping is underway on a part-time basis. ACD: 1986.

M. L. O'NEILL, Shippensburg Univ., and **T. M. BERG**, Pa. Geol. Survey. Geologic Map of Tidioute 15-Minute Quad. Recompilation

of bedrock geology in Tidioute 15-minute quadrangle, being done as a graduate internship project. Aerial photo interpretation and evaluation of geophysical logs are being used to compile the geology at 1:24,000 scale.

ECONOMIC GEOLOGY

S. W. BERKHEISER, JR., Pa. Geol. Survey. High-Silica Deposits in Pennsylvania. Potential high-purity silica sources from nine Paleozoic formations and six quartz veins were sampled, chemically analyzed, and described from 30 locations representing 14 counties in central and eastern Pa. Percent Al_2O_3 and Fe_2O_3 are reported for as-collected and beneficiated splits. Beneficiation consisted of hot acid baths and magnetic separation. Potential resources for various manufactured silica products have been identified.

S. W. BERKHEISER, JR., Pa. Geol. Survey. Pa.'s Slate Industry: Alive and Well [Lehigh, Northampton, and York Cos.]. The Lehigh-Northampton slate district is unique in that in addition to producing flagging, flooring tiles, blackboards, roofing, and structural slates, it is the only U.S. producer of electrical and billiard slates. This district produces over \$4 million worth of slate products annually while the Peach Bottom district remains idle. The geology, mineralogy, mining, milling, and marketing of Pa.'s slate industry is summarized. ACD: 1984.

S. W. BERKHEISER, JR., Pa. Geol. Survey. Some Fetid Barite Occurrences in Berks Co., Pa. Float mapping of about 6 sq mi (15 km²) has resulted in identification of fetid, dark-gray, nodular-like barite mineralization and host rock relationships. Interpretations of paragenesis, age, exploration geochemistry, and environments of deposition are presented. Reconnaissance geologic maps are included.

S. W. BERKHEISER, JR., Pa. Geol. Survey, and **J. A. AMES**, Consultant. Chapter 42D, Limestone-Dolostone: Specialty Uses, in *The Geology of Pennsylvania*. The carbonate rocks of Pa. have played a long and historic role in the industrial and agricultural development of the state and nation. Limestones and dolostones represent about 80 percent of all rocks currently mined in the Commonwealth. The distribution and uses of the carbonate rocks will be summarized by physiographic province, and a brief historical perspective of carbonate mining in Pa. will be presented. High-purity carbonates will be emphasized.

S. W. BERKHEISER, JR., and J. H. BARNES, Pa. Geol. Survey. Directory of the Non-Fuel Producers in Pa. This compilation will provide a directory of the approximately one-half billion dollar non-fuel mineral industry in Pa. Mineral commodity, county, and producer listings are anticipated which would include addresses, telephone numbers, list of products, producing formations, and lithologies. A location map at a scale of 1:500,000 is proposed. ACD: 1985.

S. W. BERKHEISER, JR., and J. H. BARNES, Pa. Geol. Survey. Chapter 42B, Clay and Shale, *in* The Geology of Pennsylvania. The geology, mineralogy, and distribution of Pa.'s clay and shale mining industry will be summarized. Construction markets for this resource include impermeable barriers, pottery, bricks and tile, lightweight aggregate, borrow and fill material, and sources of Al_2O_3 for cement manufacture. Pa.'s high-alumina clay is noted for its refractory qualities. A compilation of white-clay sources is anticipated. ACD: 1985.

R. M. BORKOWSKI, Pa. State Univ. Facies Relationships and Associated Reservoir Characteristics of the Lower Devonian "Oriskany Sandstone" in the Appalachian Basin. The project consists of petrographic analysis of facies variations as well as porosity and permeability relationships. Samples have been obtained from 57 wells to date, mainly consisting of cored intervals along with a few cable tool cuttings. ACD: Aug. 1985.

E. C. T. CHAO, Project Chief, U.S. Geol. Survey. Coal Petrochemistry and Related Investigations. The development of methods to provide the most rapid, precise, and accurate quantitative petrographic description of coal samples will continue in FY 1984. Preparation of a report on the micro-characterization of arsenic- and selenium-bearing pyrite in the Upper Freeport coal, Indiana Co., Pa., is planned. ACD: FY 1985.

S. H. B. CLARK, Project Chief, U.S. Geol. Survey. Geology and Resources of Barite. Barite nodules in shales of the Appalachian basin were studied in FY 1983 in Bedford County, Pa., and west-central Va. These studies will be expanded to include similar localities in W.Va. and additional localities in Pa. A map showing the zinc, lead, and barite deposits in Paleozoic sedimentary rocks of the east-central U.S. has been completed and is currently in review. ACD: FY 1987.

WALLACE DE WITT, Project Chief, U.S. Geol. Survey. Stratigraphy of Devonian Black Shales in the Appalachian Basin. Oil samples will be collected in FY 1984 from the Lower Mississippian Berea Sandstone, which overlies the Devonian black shale sequence in

Ky., Ohio, and W.Va., and from Upper Devonian sandstones in N.Y., Pa., and W.Va. These samples will be compared with the hydrocarbons in black shales from cores cut by the Dept. of Energy to determine by chemical analyses if the shales were the source beds for the oils in the adjacent sandstones. ACD: FY 1986.

A. D. GLOVER, C. H. DODGE, J. G. PHILLIPS, D. R. SANDS, J. R. SHAULIS, and V. W. SKEMA, Pa. Geol. Survey. Coal Resources of Western Pa. Data for coal-bearing strata in Fayette, Westmoreland, Cambria, Blair, and Butler Cos. have been submitted for entry in the National Coal Resources Data System (NCRDS). Information for Clarion, Venango, Mercer, and Somerset Cos. is currently being assembled for entry into the system. This program will result in computer-generated resources maps and tables for western Pa. ACD: Data entry, 1987.

J. A. HARPER, Pa. Geol. Survey. Lineaments and Shale Wells: Another Look at the Devonian Shale Potential of Northern Erie Co. Plotting of Devonian shale wells in and around Erie indicates the highest open flows occur along well-defined linear trends—but not the lineament intersections recommended by a federally sponsored project. ACD: 1984.

J. A. HARPER and C. D. LAUGHREY, Pa. Geol. Survey. Geology of the Oil and Gas Fields of Southwestern Pa. [all of the Commonwealth south of the Ohio River and west of the Monongahela River]. Stratigraphy, structure, petrography, geochemistry, and engineering aspects of the oil and gas fields of Beaver, Allegheny, Washington, and Greene Cos. A summary history of the fields is included. ACD: 1984.

D. H. KRINSLEY, Ariz. St. Univ., **JACK DONAHUE**, Univ. of Pitt., and **C. D. LAUGHREY**, Pa. Geol. Survey. Application of Backscattered Electron Microscopy in Tight Sandstone Reservoir Characterization. Lower Silurian and Upper Devonian tight gas sands from western Pennsylvania have been examined in thin section by scanning-electron microscopy using backscattered electrons. Using backscatter, it is possible to identify individual rock constituents by their atomic number (z) contrast and differential hardness (relief). Information relating to texture, pore geometry, internal structure, and diagenetic history of the rock can be correlated to producing characteristics. ACD: June 1984.

C. D. LAUGHREY and R. M. HARPER, Pa. Geol. Survey. Atlas of Pa. Oil and Gas Reservoirs [covers all oil- and gas-producing areas of the state]. An illustrated compilation of geologic, engineering, and production data on the various petroleum reservoirs developed in

Pa. Reservoirs within different geographical areas will be grouped into plays on the basis of stratigraphy and structure. ACD: June 1986.

D. B. MacLACHLAN, Pa. Geol. Survey. (A) Anthracite Resources of Conyngham Quad.; (B) Computer Program for Anthracite Resources Computation and Reporting. Conyngham quadrangle anthracite resources are on open file at the Pa. Geol. Survey. The computer program running under CP/M (about 300K of disk space required) will be open filed when complete. ACD: Program, Aug. 1984.

G. R. ROBINSON, Project Chief, U.S. Geol. Survey. Metallogeny of the Early Mesozoic Basins of the Eastern U.S. An annotated bibliography for eastern U.S. Mesozoic basins will be completed during FY 1984. A data file on Mesozoic rock samples and locations that have been characterized (petrology, mineralogy, chemistry, isotope study, age dating, etc.) by various researchers in the U.S. Geological Survey will be developed. Compilation of mineral occurrence/ore deposit maps at 1:125,000 scale covering the exposed eastern U.S. Mesozoic basins will begin. Studies of mineralization associated with Mesozoic fault zones will be initiated. The geochemical signatures of eastern Mesozoic basalts will continue to be investigated. ACD: FY 1988.

J. B. ROEN, Project Chief, U.S. Geol. Survey. Source Bed Evaluation of Middle and Upper Ordovician Black Shale Facies of the Appalachian Basin. Collection of Paleozoic black shales from the Appalachian basin for geochemical analysis for source bed potential will continue in FY 1984. Devonian shales and oil samples will be collected for geochemical fingerprinting to determine oil source and migration paths. Subsurface data will be evaluated and used to determine the stratigraphy and distribution of Ordovician shales. ACD: FY 1985.

F. E. SENFTLE, Project Chief, U.S. Geol. Survey. Magnetic and Luminescence (DC). A magnetic technique has been developed to study the oxidation of coal. It has been found that by heating coal in an anoxic atmosphere, the pyrite can be partially converted to magnetite, thus making the grains magnetic. Tests have been made primarily on Pa. coals. In FY 1984, this work will be continued in cooperation with the U.S. Dept. of Energy Research Center in Bruceton, Pa. Along with the magnetic measurements, sulfur dioxide and oxygen evolution will be monitored to better establish the chemical changes during pyrite and coal oxidation. Most of the tests will be done with Pa. coals. ACD: FY 1985.

W. D. SEVON, Pa. Geol. Survey. Sand and Gravel Resources of North-Central Pa. [Potter, Tioga, Bradford, Susquehanna, and

Sullivan Cos.]. Mapping, sampling, and testing of sand and gravel deposits. ACD: Dec. 1986.

R. C. SMITH, II, and **J. H. BARNES**, Pa. Geol. Survey. Geologic and Mineralogic Interpretation of Gamma-Ray Reconnaissance for the Reading Prong, Eastern Pa. [portions of Berks, Bucks, Lehigh, and Northampton Cos.]. Study of the petrologic and geographic distribution of uranium and thorium mineralization is continuing, with several relationships emerging. ACD: Late 1984.

R. W. STINGELIN, Resource Technologies Corp., and **D. M. BARR**, Consultant. User's Manual for the Remaining Anthracite Coal Resources Computer Program (CALCOAL) [Pa. anthracite region]. Companion volume to "Defining the Anthracite Resources of Northeastern Pennsylvania" presents the methodologies and instructions for exercising the remaining coal resources algorithms (CALCOAL) and documents access to the anthracite data base. Describes how to prepare remaining anthracite coal resource estimates and how to distribute these spatially and by depth categories, and includes estimates of stripping ratios to 300 feet. ACD: Aug. 1984.

R. W. STINGELIN and **J. R. KERN**, Resource Technologies Corp. Defining the Anthracite Resources of NE Pa. ACD: Aug. 1984.

ENGINEERING GEOLOGY AND ENVIRONMENTAL GEOLOGY

ROY BLICKWEDEL, U.S. Geol. Survey. Ground-Water Quality as Related to Land Use Near Philadelphia, Pa., and Camden, N.J. This project will be conducted under the U.S. Geol. Survey national ground-water quality appraisal program. Emphasis will be to develop a data base for trace elements and organics. The information will be used to explain the chemistry by land use and local hydrology. ACD: Mar. 1985.

ROY BLICKWEDEL, U.S. Geol. Survey. Neshaminy State Park Soil Rejuvenation Study. In cooperation with the Pa. Bur. of State Parks, the U.S. Geol. Survey is conducting monthly ground-water quality sampling and analysis to determine the environmental effects of a synthetic soil application using mixtures of Delaware River dredge material, Philadelphia sewage sludge, and wood chips. ACD: Nov. 1984.

J. A. CICIARELLI, Pa. State Univ. Decay Rates of Carbonate Dimension Stone in SW Pa.

A. R. GEYER, Pa. Geol. Survey, and **W. H. BOLLES**, Pa. Dept. of Education, Bur. of Curriculum and Instruction. Outstanding Scenic Geological Features of Pennsylvania, Part 2. More than 150 new geologic features of outstanding significance will be included in Part 2. ACD: 1985.

J. V. HAMEL, Hamel Geotechnical Consultants, **H. M. FAUSOLD** and **C. E. STEVENSON**, Pbg. District, U.S. Army Corps of Engineers. Bank Instability on the Monongahela River, Pa. Bank instability and erosion are being investigated at six sites along the Monongahela River 92 to 103 km upstream from Pittsburgh. Bank degradation is a complex process involving numerous geotechnical and hydraulic interactions in bank soils. ACD: 1985.

J. D. INNERS, Pa. Geol. Survey, **J. H. WILLIAMS**, U.S. Geol. Survey, and **A. M. STERNAGLE**, Pa. Dept. of Transportation. Environmental Effects of Abandoned Clinton Iron-Ore Mines in Central Pa. ACD: Fall 1984.

STEVE OBERMEIER, Project Chief, U.S. Geol. Survey. Slope Movement and Drainage, Appalachians. A report on slope stability in the Appalachian Plateau will be submitted for review. ACD: FY 1986.

A. A. SOBEK and **J. P. SCHUBERT**, Engineers International, Inc. Pre-Mine Prediction of Acid Drainage Potential. Determination of which overburden analysis techniques commonly used can best be employed to predict water quality on reclaimed surface mines. Thirty research sites in bituminous fields of Pa. and four other states have been included. Correlation between overburden analysis data and post-mining water quality will be attempted. ACD: July 1985.

ROBERT WEISS and **N. K. FLINT**, Univ. of Pitt. Landslide Hazards in Penn Hills Twp., Allegheny Co. ACD: Fall 1984.

E. G. WILLIAMS and **JOEL MORRISORI**, Pa. State Univ. Relation of Pyrite Morphology to Production of Acid Mine Drainage [western Pa.]. Pyrite morphology is related to paleoenvironments as follows: brackish shales—all framboidal; freshwater shales—all euhedral; marine—both euhedral and framboidal. ACD: Dec. 1985.

J. P. WILSHUSEN, Pa. Geol. Survey. Subsidence in Carbonate Terrain, in *The Geology of Pennsylvania* [limestone regions of Pa.]. Carbonate rock, carbonate rock weathering, and foundation problems associated with carbonate terrain will be described. ACD: 1984.

J. P. WILSHUSEN and **H. L. DELANO**, Pa. Geol. Survey. Landslide Susceptibility in the Williamsport 1° x 2° Map Area, Pa. A map and text outlining landslide occurrences in the project area and relating them to geologic and topographic conditions. Through a computer program, 17 aspects of each landslide will be analyzed to determine relationships among causes. ACD: 1984.

GENERAL GEOLOGY

JACK DONAHUE and **J. M. ADOVASIO**, Univ. of Pitt. Archaeological Mitigation of Bridge Pier, Catawissa Creek, Columbia Co. Areal geology, sedimentation, soils, and archaeology of material found at site. ACD: Summer 1984.

JACK DONAHUE and **J. M. ADOVASIO**, Univ. of Pitt. Archaeological Mitigation of Texas Eastern Pipeline Corridor, Berks Co., Pa. Areal geology, soils, and archaeological sites along pipeline corridor. ACD: Summer 1984.

C. H. SHULTZ, Pbg. Geol. Soc./Slippery Rock Univ., and **R. P. BRIGGS**, Pbg. Geol. Soc./Geomega, Inc., eds. The Geology of Pennsylvania. More than 70 geoscientists have agreed to write for this encyclopedic compilation of the known geology of Pa. Manuscripts are to be submitted for review and editing by Aug. 1984. ACD: Jan. 1987.

GEOCHEMISTRY

CHARLES CRAVOTTA and **A. W. ROSE**, Pa. State Univ. Lateral and Temporal Variability of Pb, Zn, SO_4 and Other Elements in Ground Water in the Vicinity of Pb-Zn Prospects in Sinking Valley, Blair Co., Pa. Water from all available wells and seepages in upper Sinking Valley has been analyzed for major constituents, Pb, Zn, SO_4 , F, Ba, Sr, and other properties, and two wells have been sampled weekly for a year, in order to understand the extent and variability of water anomalies. ACD: Dec. 1984.

B. C. HEARN, Project Chief, U.S. Geol. Survey. Geology of Kimberlite. Reconnaissance study and sampling of eastern U.S. kimberlites and alkalic intrusions in Md., Va., Pa., W.Va., and Ky. will continue.

J. M. McNEAL, Project Chief, U.S. Geol. Survey. Geochemical Studies in Eastern Triassic Basins. Preliminary work of the project will be to assess the use of the sulfur isotope composition of both diabase and evaporite deposits in Triassic sediments in the eastern U.S. as a potential geochemical exploration tool. In addition, the trace-element chemistry of the diabase will be examined. Particular attention will be paid to the Gap Nickel deposit, which may be a Noril'sk-type deposit, and to Cornwall-type deposits. ACD: FY 1988.

J. E. TILLMAN, Target Exploration, Inc. Surface Techniques for the Direct Detection of Oil and/or Gas Reservoirs [Pa. Appalachian Plateaus and Valley and Ridge provinces].

GEOMORPHOLOGY

K. F. CONNORS and **T. W. GARDNER**, Pa. State Univ. Use of Simulated-SPOT Data for the Study of Hydrologic Transport Processes in a Region Disturbed by Coal Mining [remote sensing, central Pa.]. Simulated-SPOT (Système Probatoire d'Observation de la Terre) imagery is being used to discriminate between coal mine spoil types and vegetative covers, and to identify acid mine drainage in central Pa. ACD: Jan. 1985.

J. J. GRUTA and **T. W. GARDNER**, Pa. State Univ. Erosion and Drainage Development on Reclaimed Coal Strip Mines in Central Pa. Gullies and accelerated erosion on reclaimed strip mines occur on convex-outward slope shapes. The amount of sediment eroded largely depends upon gully channel slope and both intensity and timing of storm events. ACD: Aug. 1984.

TERESA KAKTINS and **T. W. GARDNER**, Pa. State Univ. Fluvial Terraces of the Juniata River, Central Pa. [main river below Alexandria, Pa.]. Fluvial gravel deposits up to approximately 180 feet above the river will be correlated and their geomorphic expression described. An effort will be made to explain the origin of the diamicton texture generally observed in the deposits. ACD: 1984-85.

G. H. THOMPSON, JR., Elizabethtown Coll. Geomorphic Changes in the Lower Susquehanna River System. Presumed high discharges from Pleistocene glacial melting are hypothesized to have obliterated a falls/rapids stretch near Holtwood, Pa. "Hanging" tributaries and "deeps" are analyzed and compared with those at The Great Falls of the Potomac. ACD: Spring 1985.

W. B. WHITE, Pa. State Univ. Caves of Pa. The ultimate objective is a complete compilation of descriptions and maps of all caves in Pa. The past year was devoted to the cave survey of Bedford Co. ACD: 1984.

W. B. WHITE and **E. L. WHITE**, Pa. State Univ. Karst Landform Development in the Appalachian Highlands. Objective is to describe karst landforms (closed depression features, deranged drainage systems, and caves) by mathematical models and to interpret the descriptive models by geochemical models based on mass transport and dissolution kinetics. ACD: Ongoing.

GEOPHYSICS

J. M. DE NOYER, Project Chief, U.S. Geol. Survey. State

Geophysical Maps. Preparation of gravity and magnetic maps of Pa. and N.J. will be initiated. ACD: FY 1987.

JEFFREY PHILLIPS, Project Chief, U.S. Geol. Survey. Geophysical Mapping of Early Mesozoic Basins. Digital magnetic, aeroradiometric, and gravity data for the exposed early Mesozoic basins of the eastern U.S. from the U.S. Geological Survey, other federal agencies, state governments, and university sources will be assembled during FY 1984. Preliminary gravity anomaly map for the Gettysburg basin is among those being prepared. ACD: FY 1987.

R. E. SHERIDAN and **M. W. EISNER**, Univ. of Del. Geophysical Modeling of "Martic Line" and "Mine Ridge" Regions: Lancaster Co., Pa. Gravity and magnetic measurements will be analyzed and computer models made. For the Martic Line and Mine Ridge structures, structural interpretations will be made in light of new concepts of a rootless Piedmont. ACD: Aug. 1985.

GLACIAL GEOLOGY

D. D. BRAUN, Bloomsburg Univ. of Pa., and **WILLIAM BRENNAN**, Geneseo St. Coll. Development of a Record of Secular Variation of Geomagnetic Declination to Test the Age of the Kent Moraine [northern Potter and Tioga Cos. and southern N.Y.]. Glacial-deposit mapping, sampling of rhythmites, and determination of geomagnetic declination is being carried out to correlate ice-margin positions from one major valley to the next. The Genesee Valley was mapped in 1983 and the Cowanesque Valley will be mapped in 1984. ACD: Mid-1985.

D. D. BRAUN, Bloomsburg Univ. of Pa., and **J. D. INNERS**, Pa. Geol. Survey. Pre-Wisconsinan Glacial Deposits and Ice Margin Positions in the Valley and Ridge Province of Eastern Pa. Examination of strip mine exposures and seismic refraction work are being used to delineate areas of anomalously thick drift. Work to date suggests an ice margin running parallel to but a few tens of kilometers in front of the Woodfordian margin. ACD: 1987(?).

BENJAMIN LESLIE-BOLE, Univ. of Del. A Depositional Analysis of Deltaic and Lacustrine Sediments from Glacial Lake Sciota, Monroe Co., Pa. ACD: Nov. 1984.

W. D. SEVON, Pa. Geol. Survey. Glacial Geology of the Upper Susquehanna River [Potter, Tioga, Bradford, Susquehanna, and Sullivan Cos.]. Project involves detailed reconnaissance mapping of the surficial geology at a scale of 1:24,000. ACD: Dec. 1986.

HYDROLOGY

GERT ARON, E. L. WHITE, D. F. KIBLER, DAVID WALL, and GARY BRUNNER, Pa. State Univ. Comparison of Rainfall/Runoff Simulation Model Performance [Brandywine Creek (Pa.), Fletcher Creek (Tenn.), Wye and Severn Creeks (England)]. Three hydrologic models for simulating runoff hydrographs from rainfall—PSRM (Pa. State Runoff Model), HEC-1 (Hydrologic Engineering Center, Davis, Calif.), and MILHY (Military Hydrologic Model, Corps of Engineers)—are being tested on four major river systems. ACD: Mar. 1985.

A. E. BECHER, U.S. Geol. Survey. Ground-Water Resources of Cambrian and Ordovician Carbonate Rocks in the Valley and Ridge Province in Pa. [700 sq mi]. Detailed hydrologic information is being gathered to evaluate the ground-water resources of the carbonate valleys on the west side of the Valley and Ridge province. Objectives also include evaluation of nitrate contamination and estimation of drought effects on water levels. ACD: June 1986.

W. F. EBAUGH, W. R. GOUGH, and B. A. WAITE, Moody and Associates, Inc. Aquifer Dewatering for Control of Drainage into a Deep Coal Mine [Indiana Co.]. Goal is to reduce water drainage through the mine roof by pumping of wells sited on fractures which act as avenues along which vertical flow is concentrated. ACD: Sept. 1984.

J. M. GERHART, P. L. LIETMAN, and D. K. FISHEL, U.S. Geol. Survey. Effects of Agricultural Best Management Practices on Nonpoint-Source Discharges in the Conestoga River Basin above Lancaster, Pa. The effects of agricultural best management practices on the concentrations and loads of sediment and nutrients in both ground and surface waters will be evaluated on regional, small watershed, and field scales. ACD: 1991.

D. W. JORGENSEN and T. W. GARDNER, Pa. State Univ. The Runoff Potential and Hydrologic Character of Reclaimed Coal Surface Mines in Central Pa.; Measurement and Simulation. ACD: Jan. 1985.

J. E. MANDUKE, III, Pa. Dept. of Environmental Resources, Bur. of Solid Waste Management. Contaminant Transport in Land Disposal Facilities [southeastern Pa.]. Study of delineation of contaminant plumes and species variability relationships spatially in an aquifer—including industrial solvents, hazardous constituents, and priority pollutant behavior in the subsurface. ACD: Jan. 1985.

T. A. McELROY, Pa. Geol. Survey. Groundwater Resources of Cambria Co. The project will provide a description and inventory of groundwater resources in Cambria Co. Two stream stage gages have been installed and well inventory is complete. ACD: June 1985.

T. A. McELROY, Pa. Geol. Survey. Groundwater Resources of Fayette Co. The project will provide a description and inventory of groundwater resources in Fayette Co. ACD: 1984.

R. T. PAULSEN, U.S. Geol. Survey. A Model of Ground-Water Flow in the Carbonate Rock of the Little Lehigh Creek Basin, Lehigh Co., Pa. A 2-D digital ground-water flow model of the carbonate aquifer system in the Little Lehigh Creek basin will be calibrated and, if possible, verified. ACD: Sept. 1986.

R. A. SLOTO, U.S. Geol. Survey. Effect of Urbanization on the Water Resources of Eastern Chester Co., Pa. ACD: Sept. 1985.

D. W. SPEIGHT, U.S. Geol. Survey, and hydrologists. Chemistry of Precipitation and Its Impact on Quality of Storm Runoff in Pennypack Creek, Phila., Pa. ACD: Sept. 1985.

D. W. SPEIGHT, U.S. Geol. Survey, and hydrologists. Water Resources of the Furnace Creek Basin, Berks, Lebanon and Lancaster Cos., Pa. ACD: Sept. 1985.

D. W. SPEIGHT, U.S. Geol. Survey, and hydrologists. Water-Table Contour Map of the Carbonate Rocks of Southern Chester Co., Pa. ACD: Dec. 1984.

MATTHEW WERHNER, Northampton Co. Area Comm. Coll. Summary Groundwater Resources of Northampton Co., Pa. ACD: Aug. 1984.

D. R. WILLIAMS, **T. F. BUCKWALTER**, **J. K. FELBINGER**, and **K. L. PATTISON**, U.S. Geol. Survey, and **V. W. SKEMA**, Pa. Geol. Survey. Washington Co. Water Resources Study. A comprehensive appraisal of both ground-water and surface-water resources throughout the county. To date, approximately 400 wells have been inventoried and six stream gaging stations are in operation. ACD: Mar. 1986.

J. H. WILLIAMS and **KENN PATTISON**, U.S. Geol. Survey, **R. R. PARIZEK** and **JEFF HENKE**, Pa. State Univ., and **ROGER HORN-BERGER**, Pa. Dept. of Environmental Resources, Bureau of Mining and Reclamation. Evaluation of the Surficial Application of Limestone Quarry Waste in the Abatement of Acidic Drainage from a Coal Strip Mine Site, Clarion Co., Pa. ACD: 1987.

J. H. WILLIAMS, U.S. Geol. Survey, and **L. E. TAYLOR** and **W. D. SEVON**, Pa. Geol. Survey. Hydrogeology of the Glaciated Valleys of North-Central Pa. ACD: 1986.

IGNEOUS AND METAMORPHIC PETROLOGY

PAT BAKER and **G. H. MYER**, Temple Univ. The Martic Line, Parkesburg Quad. (Octoraro Creek "Type Section"). ACD: Dec. 1985.

A. L. HOERSCH, LaSalle Coll., and **W. A. CRAWFORD**, Bryn Mawr Coll. The Geology of the Mine Ridge, Southeastern Pa. ACD: Sept. 1986.

M. S. RUTSTEIN and **D. CONRAD**, S.U.N.Y., New Paltz. Thermal Maturation Patterns of Ordovician Miogeosynclinal Flysch of the N. Appalachians [Ordovician shales of eastern Pa.]. Authigenic "illites" provide a measure of the degree of thermal maturation. Preliminary work in eastern Pa. indicates a sharply westward flexure of regional thermal patterns. This most likely represents the transition from Lower Paleozoic to Alleghanian orogenic effects. ACD: Fall 1986.

PALEONTOLOGY

J. R. ANDERSON, JR., Univ. of Pitt. Microgastropod Biofacies of the Upper Carboniferous System in the Northern Appalachian (Dunkard) Basin. Objective is to update the taxonomy and determine the paleogeographical range of each microgastropod species, and to construct microgastropod biofacies maps. This is one step toward understanding the centers of origin and dispersion of Upper Carboniferous microgastropods. ACD: June 1985.

P. S. BOYER, Fairleigh Dickinson Univ. Scolecodonts from the Silurian-Devonian Formations of Eastern Pa. [Monroe Co.] and Northern N.J. [Sussex Co.]. Preliminary collections have uncovered well-preserved and abundant scolecodonts in several formations spanning the Silurian-Devonian boundary. Further collecting and laboratory work is underway in Monroe County. ACD: Spring 1986.

D. K. BREZINSKI, Univ. of Pitt. Carboniferous Trilobites from the Appalachian Basin [Ohio, Pa., W.Va., Md.]. The Appalachians represent the last region in the U.S. in which Carboniferous trilobites are poorly known. Their stratigraphic and paleoecological distribution is to be studied. ACD: May 1985.

D. K. BREZINSKI, Univ. of Pitt. Epizoan Ecology in the Wymys Gap

Limestone of SW Pa. [Indiana, Westmoreland, and Fayette Cos.]. The relationship between epibionts and their hosts will be studied. Also to be examined is the relationship of the different epibionts to depositional environment. ACD: June 1984.

R. M. BUSCH, Univ. of Pitt. New Trilobites from the Shriver Formation (Lower Devonian) of Central Pa. Ten species of nine different trilobite genera are described from the richly fossiliferous Upper Shriver trilobite beds of central Pa. There are new species of *Proetus*, *Harpidella*, *Trimerus*, *Odontochile*, *Synphoroides*, and *Leonaspis*. ACD: 1985.

W. F. KLOSE, II, Paleontological Research Inst. Contributions to the Pennsylvanian Age Flora and Fauna of the Anthracite and Semi-Anthracite Coal Fields of NE Pa. Collection of Pennsylvanian-age flora and fauna with deposition of prepared specimens in the William Penn Memorial Museum, Harrisburg. ACD: Ongoing.

W. F. KLOSE, II, Paleontological Research Inst. Fossil Flora and Fauna of the Ross Anthracite in the Northern Anthracite Basin, Pa. Specimens from the Larksville mine fire and Loree Colliery, Larksville, Pa., and Alden Mountain, Glen Alden, Pa., have been collected and prepared for study and illustration. ACD: July 1985.

W. A. OLIVER, Project Chief, U.S. Geol. Survey. Upper Silurian/Lower Devonian Biostratigraphic Framework of the Central Appalachians. Laboratory studies on the biostratigraphy and systematics of corals in the Decker-Helderberg interval of N.J. and Pa. and ostracodes of the Decker-Keyser interval in Md., Pa., and N.J. will be completed. Reports will be prepared on the Keyser-Helderberg interval in Pa., Md., Va., and W.Va., and on the Manlius and Coeymans ostracodes of N.Y. ACD: FY 1985.

W. A. OLIVER, JR., and **J. M. BERDAN**, U.S. Geol. Survey. Uppermost Silurian-Lower Devonian corals and ostracodes of the central Appalachians [N.Y. to Va.]. Pennsylvania part of project is a study of the systematics and distribution (stratigraphic and geographic) of corals and ostracodes in the Keyser, Decker, and Helderberg Limestones. ACD: 1986.

ALFRED TRAVERSE and **N. G. JOHNSON**, Pa. State Univ., and **P. K. STROTHER**, Boston Univ. Plant Fossils of Lower Silurian Rocks of Pa., Especially of the Tuscarora Formation [central Pa.]. Continuation of a long-term project on early Silurian land-plant evidence in Pa. Most of this year's work has dealt with the extensive Tuscarora outcrop near Mill Hall, on the geology of which Prof. Edward Cotter, Bucknell Univ., has also published. Detailed studies of sporelike bodies, including masses of tetrads, are providing interesting insights into the early stages of land plant evolution. ACD: Ongoing.

SEDIMENTOLOGY

J. S. BRIDGE and graduate students, S.U.N.Y., Binghamton. Sedimentology of Upper Devonian Catskill Clastic Wedge in N.Y. and Northeastern Pa. (1) Quantitative reconstruction of paleochannel geometry and hydraulics in fluvial Catskill magnafacies; (2) interpretation of depositional environments of Upper Devonian coastal lithofacies.

J. A. CONRAD, Univ. of Del. Shelf Sedimentation Above Storm Wave Base in the Upper Ordovician Reedsville Formation in Central Pa. Outcrop data on sedimentary structures, lithology, and fossils indicate that most fining-upward beds were deposited from suspension under conditions of strong but waning bed shear. Storm wave influence on a shallow, open shelf is inferred. ACD: Sept. 1984.

EDWARD COTTER, Bucknell Univ. Middle Silurian Depositional History, Central Pa.

BOB GALLAGHER, Lehigh Univ. Depositional Environments of the Loyalhanna Formation, Centre Co., Pa. ACD: June 1984.

B. V. GLOHI and **JACK DONAHUE**, Univ. of Pitt. Petrography of Upper Devonian Gas Bearing Sandstones in Well #1 1237 Ind 25084, Indiana Co., Pa. Petrographic analysis of gas-bearing Upper Devonian sandstones, including grain size, composition of grains and cement, and variation in void space. Analysis of geophysical logs in adjacent wells was also covered. ACD: Completed.

A. L. GUBER, Pa. State Univ. Facies Analysis of the Middle and Upper Silurian Formations of Central and Western Pa. A geochemical, paleontological, and sedimentological approach is being used to define facies sequences, prepare facies maps, and develop facies models for the Mifflintown, Wills Creek, and Tonoloway Formations. ACD: Continuing.

R. B. HOFFMAN, Susquehanna Univ. Depositional Environment and Regional Correlation of the Ridgeley Member of the Old Port Formation [Pa., Md., N.J., and N.Y.]. ACD: May 1984.

G. G. LASH, S.U.N.Y., Fredonia. Sedimentology of an Ancient Subduction Complex—Greenwich Slice of the Hamburg Klippe [eastern Pa.]. Results of recent DSDP (Deep Sea Drilling Project) transects across active subduction complexes are being applied to the study of the Greenwich slice. ACD: Early 1985.

G. G. LASH and **JEFFREY FILOCK**, S.U.N.Y., Fredonia. Late Cambrian Carbonate Submarine Fan Deposits—Sedimentology and Significance [eastern Pa.]. Sedimentologic analyses of the Onyx Cave Member (Hamburg klippe) suggest it was deposited as part of

a submarine fan complex during a Late Cambrian-Early Ordovician regressive event. ACD: Late 1984.

C. D. LAUGHREY, Pa. Geol. Survey. Storm-Surge Genesis of Quartzose Turbidites in Upper Devonian Deltaic Deposits, Southwestern Pa. Complete and incomplete Bouma sequences have been recognized in association with Upper Devonian rocks of paralic on-delta origin. The sequences are common at outcrop localities and in subsurface cores. The sequences are interpreted as storm deposits. ACD: Aug. 1984.

TIM MURIN and **JACK DONAHUE**, Univ. of Pitt. The Upper Devonian First Bradford Sandstone of Southwestern Pa.: Environment of Deposition and Factors Affecting Gas Production. ACD: Spring 1985.

STRATIGRAPHY

T. M. BERG, Pa. Geol. Survey. The Devonian-Mississippian Transition in Pennsylvania, *in* The Geology of Pennsylvania. The chapter will summarize the Specht Kopf, Huntley Mountain, and Rockwell Formations and their relationships to the marine Mississippian succession in western Pa. It will also summarize current understanding of the position of the Devonian-Mississippian systemic boundary in Pa. ACD: Mid-1984.

D. K. BREZINSKI, Univ. of Pitt. Dynamic Lithostratigraphy and Paleoecology of the Mauch Chunk Formation of Pa., W.Va., and Md. The depositional environments of the Mauch Chunk clastics and the associated marine tongues can be related to eustatic sea-level changes, variations of subsidence, and rates of clastic influx. ACD: May 1984.

R. M. BUSCH, **H. B. ROLLINS**, **K.E. WELLS**, and **D. K. BREZINSKI**, Univ. of Pitt. Correlation of Appalachian Carboniferous Strata Using a Hierarchy of Transgressive-Regressive Units [western and northeastern Pa.]. Carboniferous strata can be very accurately correlated relative to six scales of transgressive-regressive units (T-R units). ACD: 1984-85.

ROBERT CANACE, **RICHARD DALTON**, and **FRANK MARKEWICZ**, N.J. Geol. Survey, and **JOHN REPETSKI**, U.S. Geol. Survey. Stratigraphy of Cambro-Ordovician Kittatinny Supergroup in [northwestern] N.J. The New Jersey Survey is working with the U.S. Geol. Survey in an attempt to correlate Cambro-Ordovician carbonate units in Pa. with those in N.J. In order to do this, we will be

examining and collecting carbonates in N.J. and Pa. in an attempt to relate conodont zonation to lithostratigraphy. ACD: Ongoing.

A. D. GLOVER, C. H. DODGE, J. G. PHILLIPS, D. R. SANDS, J. R. SHAULIS, and V. W. SKEMA. TASIC (Temporarily Available Stratigraphic Information Collection) [western Pa.]. A continuing program for recording stratigraphic data on active coal and clay strip mines and collecting coal samples for analysis. The project will provide data for future mapping and regional resource evaluation. ACD: Ongoing.

J. A. HARPER, Pa. Geol. Survey. Tully, or "Tully"—A Stratigraphic Problem. A review of the controversy surrounding the so-called Tully Limestone, especially in northwestern Pa., and an attempt to provide evidence for NOT rejecting the name Tully in that area. ACD: 1984.

K. E. WELLS, Univ. of Pitt. Detailed Correlation and Paleogeographic Development of the Upper Pennsylvanian Woods Run and Carnahan Run Marine Units in Pa. [central and southwestern Pa.]. Detailed facies analysis and correlation indicate that the Woods Run and Carnahan Run marine units are actually correlative, intertonguing facies of the same marine unit. They are not separate marine invasions as originally thought. ACD: 1984.

E. G. WILLIAMS, Pa. State Univ. Diagenesis of Upper Paleozoic Sandstones in Pa.

D. E. WISSINGER and R. M. GOODSPEED, Susquehanna Univ. Determination of Color Genesis in the Bald Eagle and Lower Juniata Sandstones in Blair Co., Pa. ACD: May 1984.

STRUCTURAL GEOLOGY

R. M. BOND, Lehigh Univ. Regional Tectonic Relations and Metamorphic Grade of the Martinsburg Formation in Eastern Pa. and N.J. [Northampton Co., Pa.]. Fluid inclusions in quartz from faults and veins were used to define the thermobarogeochemical conditions present during mineralization. Thrust faults and regional slaty cleavage appear to be Alleghanian structures. ACD: June 1984.

WAYNE BREWER, Allegheny Coll. Strain Measurement in the Appalachian Plateau, Northwestern Pa. ACD: Open-ended.

WALLACE DE WITT, JR., and K. C. BAYER, Project Chiefs, U.S. Geol. Survey. Thrust Plate Models of the Appalachian Orogen. A chapter on the structure under the Appalachian Plateaus of Pa. will be prepared for *The Geology of Pennsylvania*, a book sponsored by the Pittsburgh Geol. Soc. A chapter on the hydrocarbon resources

of the Appalachian orogen, coauthored with R. C. Milici, State Geologist of Va., will also be prepared. ACD: FY 1985.

LARRY DUFFY and **G. H. MYER**, Temple Univ. The Martic Line, Malvern and Valley Forge Quads. ACD: Dec. 1984.

R. T. FAILL, Pa. Geol. Survey. Tectonic Map of Pa. Delineation of anticlines, synclines, and faults; portrayal of all igneous rocks; basement contours; structure contours on top of Onondaga in Plateau; delineation of lithotectonic units; tectonic provinces and age of deformation; unconformities; major fracture orientations; metamorphic isograds; radiometric dates; earthquake epicenters; cross sections. ACD: 1984.

P. GEISER, Univ. of Conn. Determination of Complete Displacement Field, Valley and Ridge and Plateau Provinces. ACD: 1987.

P. GEISER, Univ. of Conn., and **D. DALLMEYER**, Univ. of Ga. Collaborative Structural and Geochronologic Investigation of Alleghanian Deformational Events in the Central and Northern Appalachian Foreland. ACD: 1985.

R. M. HARPER, Pa. Geol. Survey. Subsurface Structure of the Plateau Region of North-Central and Western Pa. on Top of the Oriskany Formation. An update of Addison S. Cate's 1962 map (Mineral Resource Report 9 of the Pa. Geol. Survey). ACD: 1984.

MARK LUCAS and **WARREN MANSPEIZER**, Rutgers Univ. Fracture and Joint Patterns in the Mesozoic Jacksonwald Syncline of Berks Co., Pa. Field mapping of fracture patterns in the Jacksonwald Syncline may yield a viable model for the origin of deformation of this area. ACD: Dec. 1984.

D. B. MacLACHLAN, Pa. Geol. Survey. Tectonic Synthesis of Southeastern Pa. Project is in initial stages; input from outside is invited.

V. J. PFAFF, Univ. of Conn. Mechanisms of Folding in the Central Appalachians, Pa. ACD: June 1985.

H. A. POHN, U.S. Geol. Survey. Structure of the Valley and Ridge Province Using Field and Remote Sensing Techniques. Lateral ramps (perpendicular to the fold belt) are strongly suspected along the Susquehanna River and at the Pa.-Md.-W.Va. borders. These ramps manifest themselves as abrupt changes in wavelength of folds along strike. ACD: Oct. 1984.

S. I. ROOT, Coll. of Wooster. Structural Geology of the Gettysburg Basin. ACD: Late 1984.

R. E. SHERIDAN, Univ. of Del. Structural Studies of Iapetus Continental Margin in Lancaster Co., Pa. Restoration of the Iapetus continental margin will be made based on structural and stratigraphic analysis of rootless and telescoped Piedmont rocks in light of new concepts of Appalachian structure. ACD: Aug. 1985.

D. W. WATSON, Slippery Rock Univ. Fracture Study of the McConnell's Mill Gorge, Lawrence Co., Pa. ACD: 1985.

REPORTS PUBLISHED

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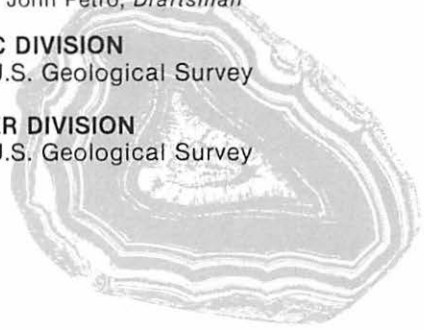

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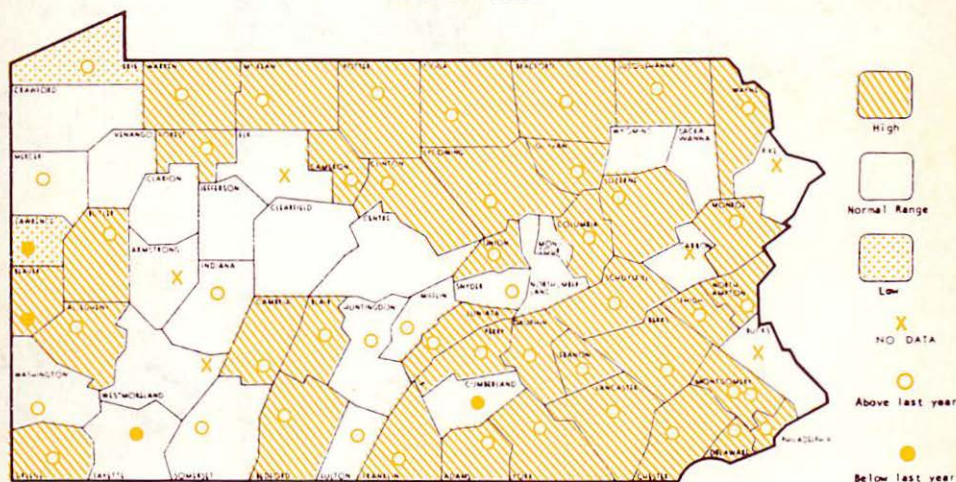
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