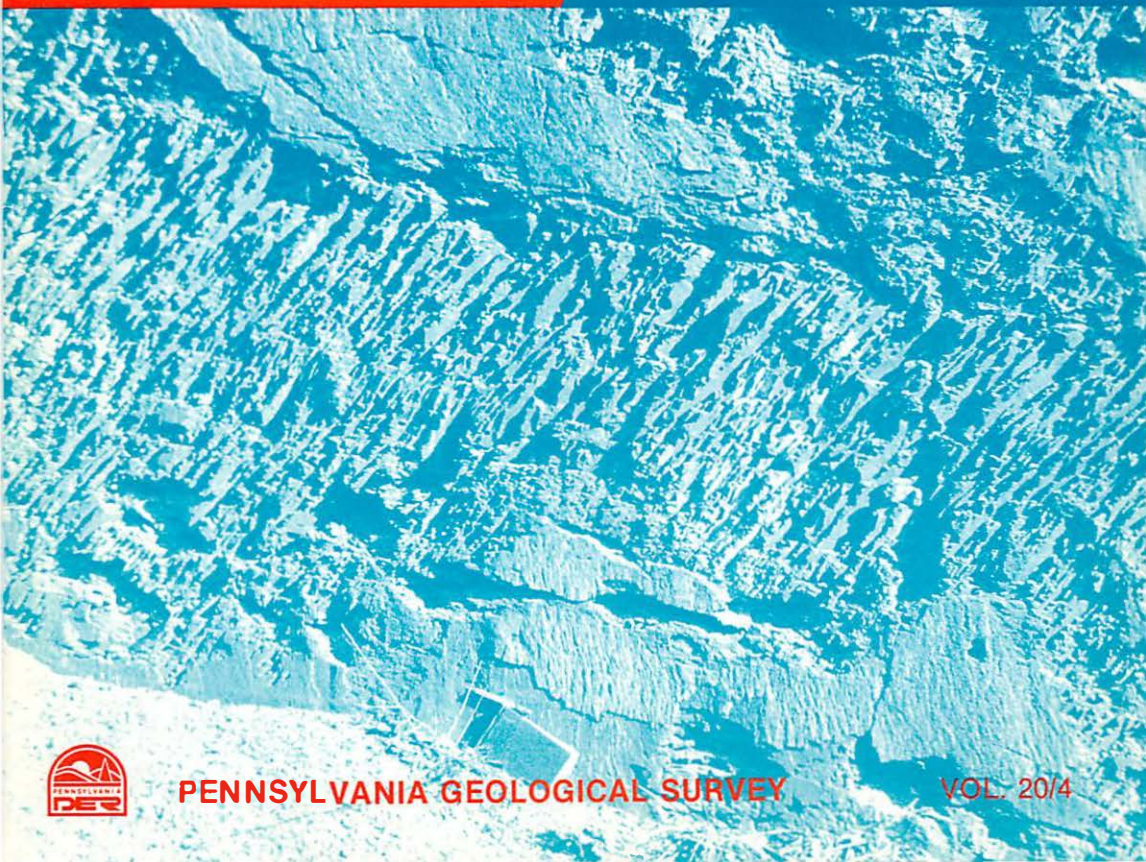


G PENNSYLVANIA O L O G Y



PENNSYLVANIA GEOLOGICAL SURVEY

VOL. 20/4

COMMONWEALTH OF PENNSYLVANIA

Robert P. Casey, Governor

DEPARTMENT OF ENVIRONMENTAL RESOURCES

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OFFICE OF RESOURCES MANAGEMENT

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TOPOGRAPHIC AND GEOLOGIC SURVEY

Donald M. Hoskins, Director

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ON THE COVER: Pinnate (feather) fractures in siltstone of the Middle Devonian Mahantango Formation, along U.S. Route 22 in Huntingdon. Bedding dips gently to the right, although this is not evident in the photograph. The face of the exposure is a large planar fracture, a master fracture that pervades much of the outcrop. The set of closely spaced pinnate fractures is at an angle of 25 degrees to the master fracture. The notebook in the lower center is 21 cm long. Photograph by R. T. Falli.

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AUGUST 1989



Geology, Art, and Vandalism

Recently, the Geological Society of America published Special Paper 225, *The Art of Geology*. The colorful images of worldwide and world-class geologic features in this volume would grace any coffee table and would be appreciated by anyone who values the beauty of nature. These images illustrate both the art appreciated by all and the geology understood only by the trained viewer. Thus geologic art is doubly valued.

Pennsylvania is not represented in *The Art of Geology*. Yet our Commonwealth possesses much great geologic art of world-class stature. At the recent meeting of the International Geological Congress, 49 images of Pennsylvania geology were one of the main focuses of a large display seen by over 2,000 visitors. These photographs will be on display at the 1989 meeting of the Field Conference of Pennsylvania Geologists and the 1990 meeting of the Northeastern Section of the Geological Society of America. I hope that you will be able to see these exhibits. They include photographs that are the serendipitous result of such research into Pennsylvania's geology as is listed in this issue.

There is, however, a danger in portraying the art of geology, particularly of objects that are collectible. Vandalism (geovandalism) is taking its toll of geological features. Recently, mendacity and greed were exhibited by vandals who, using excavating equipment, removed footprints of Mesozoic dinosaurs from a site near Allentown. At many localities in Pennsylvania, holes have been drilled into rocks to extract specimens for magnetic analyses. These cores have permanently disfigured outcrops that otherwise are sometimes excellent examples of geologic art. The amount of outcrop defaced with spray-painted names and obscenities is legion.

Both geological researchers and collectors must recognize that an outcrop best used for teaching or of unique artistic value, once destroyed, is lost to immediate and future generations. Thus, painting markers on rocks with nearly nondegradable pigment is both objectionable and egotistical.

We need to preserve our geologic art and our outcrops used for teaching. We need to teach our students that soon they will see these with eyes and understanding that only a geologist possesses. All of us have an obligation to preserve our geologic art for others to enjoy.

Donald M. Hoskins

Donald M. Hoskins
State Geologist



Introduction

Additional copies of this report may be obtained by writing to the Pennsylvania Geological Survey, P. O. Box 2357, Harrisburg, PA 17105.

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T. M. BERG, Ohio Geol. Survey, M. E. MOORE, Pa. Geol. Survey, and M. L. O'NEAL, C. B. CUBBISON, JACQUELINE LUNDY, and J. B. LESSMAN (all student interns, Pa. Geol. Survey). **Geologic Map of Warren County.** This map is being prepared for the Warren County groundwater report, a cooperative project of the Pennsylvania Geological Survey and the U.S. Geological Survey, Water Resources Division. ACD: 1989.

ALAN DAVIS and ETUAN ZHANG, Pa. State Univ. **Causes of Regional Coal Rank Patterns** [western Pa.]. ACD: Dec. 1989.

J. B. EPSTEIN and P. T. LYTTLE, U.S. Geol. Survey, and G. G. LASH, State Univ. of N. Y. at Fredonia. **Geologic Map of the New Tripoli 7.5-Minute Quadrangle.** Mapping of bedrock and surficial deposits and structural geology in the Hamburg klippe, Shochary Ridge sequence, Martinsburg Formation, and Silurian-Devonian rocks of the Ridge and Valley province. ACD: Dec. 1989.

R. T. FAILL, Pa. Geol. Survey. **Geological Investigations in the Pennsylvania Piedmont: Susquehanna River Transect.** Detailed examination of the Peters Creek, Peach Bottom, and Cardiff Formations exposed along the Susquehanna River (east bank) between Drumore and Peach Bottom and evaluation of the Peach Bottom structure as a cryptic suture. ACD: July 1989.

D. B. MacLACHLAN, Pa. Geol. Survey. **Geology of the Freeburg Quadrangle, Snyder County.** Mapping of Tuscarora-to-Catskill section and pre-Wisconsinan glacial and loess deposits, predominantly on the plunging nose of Shade Mountain. The area contains some exposures of the Ridgeley Sandstone and Tully Limestone near the limits of their respective ranges. ACD: 1989.

D. B. MacLACHLAN, Pa. Geol. Survey. **Lower Paleozoic Rocks of Platform to Marginal Facies in the Pennsylvania Piedmont.** The project, which will include a stratigraphic study and remapping of rocks primarily in Chester and Montgomery Counties, is in the reconnaissance phase, and a site for initial detailed work has not been established.

L. B. PLATT and J. J. SCHAEFER, Bryn Mawr Coll. **Geology Around Little Mountain, Lebanon County.** A continuing project to determine stratigraphy and structure in the Lebanon County part of the Hamburg klippe and related rocks. ACD: May 1989.

W. D. SEVON, Pa. Geol. Survey. **Surficial Geology of the Conestoga, Holtwood, Quarryville, and Wakefield Quadrangles, Lancaster and York Counties.** ACD: 1990.

E. R. SLUCHER, Ohio Geol. Survey. **Bedrock Geology of the East Liverpool North 7.5-Minute Quadrangle, Ohio-Pennsylvania-West Virginia.** ACD: Mid-1989.

E. R. SLUCHER and GLENN E. LARSEN, Ohio Geol. Survey. **Bedrock Geology of the East Palestine 7.5-Minute Quadrangle, Ohio-Pennsylvania.** ACD: Mid-1989.

D. W. VALENTINO, Pa. Geol. Survey. **Geological Investigations in the Pennsylvania Piedmont: Susquehanna River Transect.** Detailed examination of the Wissahickon Schist, Conestoga Formation, and Peters Creek Formation along the Susquehanna River between Washington Boro and Drumore, Lancaster County. The Tucquan-Mine Ridge structure is a possible transpressional antiform. ACD: June 1989.



ECONOMIC GEOLOGY

S. W. BERKHEISER, JR., and R. C. SMITH, II, Pa. Geol. Survey. **Additional Occurrences of Specialty-Use Silica in Pennsylvania.** The purpose of the investigation is to identify and characterize Cambrian-age clastic resources within the South Mountain area of Adams, Cumberland, and Franklin Counties. Additional data concerning the thickness and quality of selected quartz veins and a few other sandstones will also be included. A core hole drilled during the past year penetrated about 700 feet of clastics in Adams County. Chemical analyses will be reported. ACD: Late 1989-early 1990.

S. W. BERKHEISER, JR., and R. C. SMITH, II, Pa. Geol. Survey. **Mineral Fillers of the Piedmont Physiographic Province of Pennsylvania.** Reconnaissance investigations of potential mica, talc, silica, and carbonate mineral fillers in the Piedmont province. These studies are preliminary in nature and support anticipated new mapping programs in the region. ACD: Ongoing.

S. W. BERKHEISER, JR., and R. C. SMITH, II, Pa. Geol. Survey. **Reconnaissance Investigations and Analyses of High-Purity Carbonate Resources in Pennsylvania.** Preliminary reconnaissance investigations with the object of updating and identifying new high-purity carbonate resources for use in the acid-mitigation fields. The Ridge and Valley physiographic province contains numerous carbonate sequences of Cambrian through Devonian age. ACD: Ongoing.

C. H. DODGE, Pa. Geol. Survey. **Coal Resources of Elk County—Part 1, Coal Crop Lines, Mined-Out Areas, and Structure Contours.** Detailed geologic mapping of the coal-bearing strata (Pottsville, Allegheny, and Glenshaw Formations) of Pennsylvanian age. Emphasis is on the major coal-bearing structural basins. A series of maps will be prepared including (1) separate crop-line maps for each principal coal seam showing areas of strip and deep mining, and (2) composite maps showing the crop lines of major and minor coals, as well as structure contours and fold axes. ACD: 1992.

A. D. GLOVER, Pa. Geol. Survey. **Coal Resources of Jefferson County—Part 1, Coal Crop Lines, Mined-Out Areas, and Structure Contours.** Published and unpublished data will be used to prepare a series of maps including (1) separate crop-line maps for each principal coal seam showing areas of strip and deep mining, and (2) composite maps showing the crop lines of all principal coals, as well as structure contours and fold axes. ACD: 1992.

A. D. GLOVER, Pa. Geol. Survey, and W. A. BRAGONIER, Rochester and Pittsburgh Coal Co. **Coal Resources of Armstrong County—Part 1, Coal Crop Lines, Mined-Out Areas, and Structure Contours.** Published and unpublished data will be used to prepare a series of maps including (1) separate crop-line maps for each principal coal seam showing areas of strip and deep mining, and (2) composite maps showing the crop lines of all principal coals, as well as structure contours and fold axes. ACD: 1990.

A. D. GLOVER, Pa. Geol. Survey, and W. A. BRAGONIER, Rochester and Pittsburgh Coal Co. **Coal Resources of Indiana County—Part 1, Coal Crop Lines, Mined-Out Areas, and Structure Contours.** Published and unpublished data will be used to prepare a series of maps including (1) separate crop-line maps for each principal coal seam showing areas of strip and deep mining, and (2) composite maps showing the crop lines of all principal coals, as well as structure contours and fold axes. ACD: 1989.

J. D. INNERS, Pa. Geol. Survey. **Geology of Anthracite in the Hazleton Quadrangle, Luzerne, Schuylkill, and Carbon Counties.** Project mainly involves preparation of 1:12,000-scale coal-bed outcrop and structure-contour (Buck Mountain/Mammoth seams) maps of the anthracite basins in the Hazleton area of the Eastern Middle Anthracite field. ACD: July 1990.

L. J. LENTZ, Pa. Geol. Survey. **Coal Resources of Greene County—Part 2, Overburden Thickness, Coal Quality, and Coal-Reserve Estimates.** Computer compilation and manipulation of coal data for Greene County continues. Data base includes point and line data, stratigraphic data, and chemical data in files managed by the U.S. Geological Survey in Reston, Virginia. ACD: Ongoing.

L. J. LENTZ, Pa. Geol. Survey. **Coal Resources of Washington County—Part 2, Overburden Thickness, Coal Quality, and Coal-Reserve Estimates.** Computer compilation and manipulation of coal data for Washington County continues with the entry of new records and the updating of others. Data base includes point and line data, stratigraphic data, and chemical data in files managed by the U.S. Geological Survey in Reston, Virginia. ACD: Ongoing.

A. K. MARKOWSKI, Pa. Geol. Survey. **Preliminary Feasibility Study of the Coal-Bed Methane Resource in Pennsylvania.** Data were obtained from exploratory coreholes in Armstrong, Cambria, Somerset, and Greene Counties, from pre-mining degasification holes, and from methane-recovery test projects. Variations in gas content with other geologic controls are used in assessing economic viability. ACD: 1989.

R. F. MAST, G. L. DOLTON, R. RYDER, J. B. ROEN, W. DE WITT, and others, U.S. Geol. Survey. **National Petroleum Assessment—Appalachian Basin.** Petroleum geology and assessment of Appalachian basin; part of a study of the entire United States. ACD: Ongoing.

G. R. ROBINSON, Project Chief, U.S. Geol. Survey. **Metallogeny of the Early Mesozoic Basins of the Eastern United States.** Field work and other geologic studies in the Newark basin of New Jersey and Pennsylvania, the narrow neck area between the Newark and Gettysburg basins of Pennsylvania, and the Culpeper basin of Virginia are continuing. We are in the process of bringing to completion many of the ongoing topical studies. Preliminary versions of a suite of maps covering all of the exposed early Mesozoic basins of the eastern United States should be ready for review in the near future.

J. B. ROEN, U.S. Geol. Survey. **Petroleum Geology Research, Appalachian Basin.** Petroleum geology and geochemistry of the Ordovician and Devonian black shales of the Appalachian basin. ACD: Ongoing.

J. R. SHAULIS, Pa. Geol. Survey. **Coal Resources of Somerset County—Part 1, Coal Crop Lines, Mined-Out Areas, and Structure Contours.** Published and unpublished data will be used to prepare a series of maps including (1) separate crop-line maps for each principal coal seam showing areas of strip and deep mining, and (2) composite maps showing the crop lines of all principal coals, as well as structure contours and fold axes. ACD: 1990.

A. K. SINHA, Va. Polytechnic Inst., and R. C. SMITH, II, S. W. BERKHEISER, JR., and J. H. BARNES, Pa. Geol. Survey. **Trace-Element Content of Some Pre-Mesozoic Basaltic Rocks in Pennsylvania.** A test will be made to determine if the trace-element content of pre-Mesozoic basalts can be used to establish possible mineralization and affinities.

V. W. SKEMA, Pa. Geol. Survey. **Coal Resources of Clearfield County—Part 1, Coal Crop Lines, Mined-Out Areas, and Structure Contours.** Detailed geologic mapping of the coal-bearing strata of Pennsylvanian age. Emphasis is on the major coal-bearing structural basins. A series of maps will be prepared including (1) separate crop-line maps for each principal coal seam showing areas of strip and deep mining, and (2) composite maps showing the crop lines of major and minor coals, as well as structure contours and fold axes.

R. C. SMITH, II, and S. W. BERKHEISER, JR., Pa. Geol. Survey. **Precious Metals Reconnaissance in Southeastern Pennsylvania.** We are conducting whole-rock and stream heavy-mineral reconnaissance to determine preferred methods for the area. ACD: Ongoing.

ENVIRONMENTAL GEOLOGY

WOLFGANG BAUM, Pittsburgh Mineral and Environmental Technology, Inc. **Mineralogical Characterization Methods for Soil Contaminations and Waste Rock/Process Tailings from Various Mining Operations.** ACD: 1989.

F. J. BRENNER, Grove City Coll., J. J. MONDOK and ROBERT McDONALD, Mercer Co. Conservation Dist., and RICHARD STEINER, Univ. of Akron. **Role of Ground and Surface Water Flow in Nonpoint-Source Pollution.** Investigation of the relationship between groundwater and surface-water flows and nonpoint-source pollution parameters. Study is concerned with the effect of soil type, land use, and subsurface and overland flow on water quality in an agricultural watershed. ACD: 1992.

F. J. BRENNER, Grove City Coll., and M. P. STEINER and T. M. SHAW, Univ. of Akron. **Relationship Between Surface Coal-Mine Lakes and Surrounding Water Wells.** Investigation of the relationship between water chemistry of surface coal-mine lakes and the chemistry of surrounding water wells. The object is to determine if a knowledge of the water chemistry of wells enables a prediction of water chemistry of surface-mine lakes after mining. ACD: 1990.

P. H. DOUGHERTY, Kutztown Univ. **Utilization of Karst Concepts in Zoning Ordinances** [Lower Macungie Twp., Lehigh Co.]. A survey of Pennsylvania municipalities has shown a paucity of zoning ordinances that include karst subsidence precautions. The aim of this project is to create a model ordinance for use by Lower Macungie Township and other similar localities. ACD: 1989-90.

P. H. DOUGHERTY, Kutztown Univ., and MICHAEL PERLOW, VFC, Inc. **The Macungie Sinkhole, Lehigh Valley: Cause and Repair.** An ongoing program to determine the occurrence and cause of karst subsidence in

the Lehigh Valley. This particular study documented the history of an 81-foot-wide by 41-foot-deep sinkhole that formed in Macungie.

W. E. KOCHANOV, Pa. Geol. Survey. **Karst, Sinkholes, and Engineering Considerations in the Carbonate Terrains of Pennsylvania**. ACD: Spring 1990.

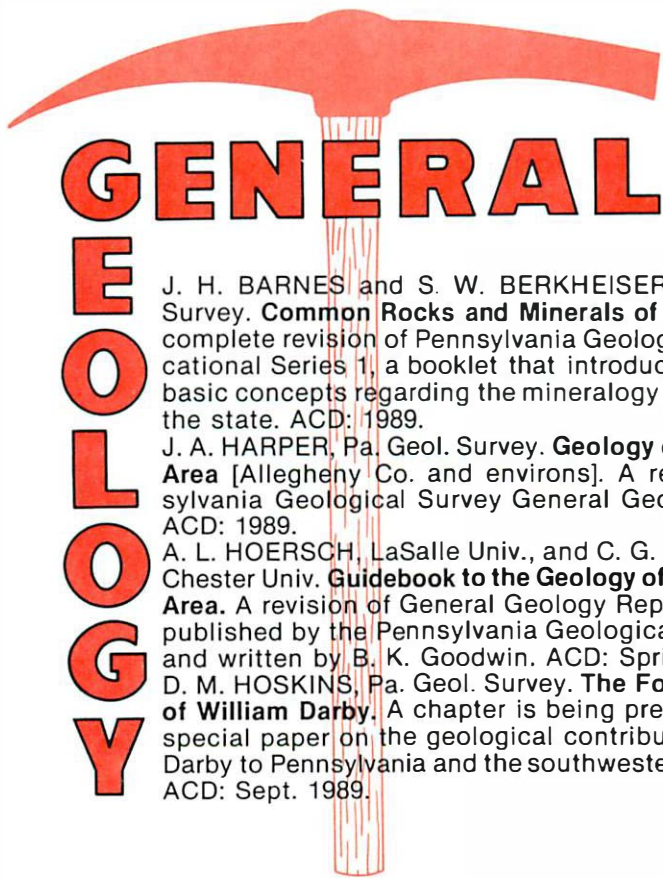
W. E. KOCHANOV, Pa. Geol. Survey. **Sinkholes and Karst-Related Features of Franklin County**. ACD: Fall 1989.

W. E. KOCHANOV, Pa. Geol. Survey. **Sinkholes and Karst-Related Features of Lancaster County**. ACD: Fall 1989.

A. W. ROSE, JOHN WASHINGTON, DANIEL GREEMAN, EDWARD CIOLKOSZ, and WILLIAM JESTER, Pa. State Univ. **Generation and Mobility of Radon in Soils** [eastern U.S.]. The abundance and behavior of radon and radium are being investigated in 12 soils, seven of which are in Pennsylvania. Large changes in radon with time and some enrichment of radium in the A soil horizon are observed. ACD: March 1990.

A. A. SOCOLOW, Consulting Geologist. **Screening for Potential Waste-Disposal Sites** [eastern Pa.]. Identification of sites potentially usable for various types of waste-disposal facilities. Screening is based on geologic, hydrologic, topographic, seismologic, and soils criteria. ACD: On-going.

KEITH WILLIAMS, Kutztown Univ. **Radon Concentrations and Microclimatic Factors in Shofers Cave, Berks County**. ACD: Dec. 1989.



J. H. BARNES and S. W. BERKHEISER, JR., Pa. Geol. Survey. **Common Rocks and Minerals of Pennsylvania**. A complete revision of Pennsylvania Geological Survey Educational Series 1, a booklet that introduces the reader to basic concepts regarding the mineralogy and petrology of the state. ACD: 1989.

J. A. HARPER, Pa. Geol. Survey. **Geology of the Pittsburgh Area** [Allegheny Co. and environs]. A revision of Pennsylvania Geological Survey General Geology Report 59. ACD: 1989.

A. L. HOERSCH, LaSalle Univ., and C. G. WISWALL, West Chester Univ. **Guidebook to the Geology of the Philadelphia Area**. A revision of General Geology Report 41, originally published by the Pennsylvania Geological Survey in 1964 and written by B. K. Goodwin. ACD: Spring 1990.

D. M. HOSKINS, Pa. Geol. Survey. **The Forgotten Geology of William Darby**. A chapter is being prepared for a GSA special paper on the geological contributions of William Darby to Pennsylvania and the southwestern United States. ACD: Sept. 1989.

J. M. HUSCH, Rider Coll., P. E. OLSEN, Columbia Univ., and M. J. HOZIK, Stockton State Coll. **Geology of the Newark Basin: A GSA Memoir in Honor of Franklyn B. Van Houten.** Approximately 30 manuscripts covering all aspects of the geology of the basin will be included along with an updated map (1:250,000) and stratigraphic column. ACD: June 1991.

E. F. KOPPE, Consulting Geologist. **Coal Geology and Resources Between the Northern Anthracite Field and the Western Bituminous Coal Region of Pennsylvania** [Lycoming, Tioga, Bradford, and Sullivan Cos.]. ACD: Ongoing.

G. H. MYER, Temple Univ. **General Geology of Valley Forge State Park.** Results will include geologic map, schematic cross sections of geology, topographic sections of streams, various photographs, and credits to students (1982-86 summer camp). ACD: Dec. 1989.

GEOCHEMISTRY

FRED BALDASSARE, Pa. Dept. of Environ. Resources, Bur. of Oil and Gas Mgmt., and C. D. LAUGHREY, Pa. Geol. Survey. **^{13}C and Hydrogen (Deuterium) Signatures of Methane from Various Sources in Southwestern Pennsylvania.** The purpose is to determine if methane from different sources exhibits unique stable isotope signatures. Samples will be analyzed for ^{13}C and hydrogen (deuterium) isotope composition. Study is in the early stages. Sampling is to begin in early summer 1989. ACD: Spring 1990.

W. A. CRAWFORD, Bryn Mawr Coll., and J. W. VALLEY, Univ. of Wisconsin. **Origin of Graphite in the Pickering Gneiss and the Franklin Marble, Honey Brook Upland, Pennsylvania Piedmont.** $\delta^{13}\text{C}$ values in graphites from fine-grained Pickering gneiss indicate an organic source for the carbon. $\delta^{13}\text{C}$ values from Franklin marble indicate a sedimentary carbonate protolith. $\delta^{13}\text{C}$ values from anatectic pegmatites in Pickering gneiss indicate an exchange of carbon isotopes during anatexis between gneiss and marble. Calcite-graphite thermometry gives temperatures of 680°C for upper amphibolite facies and 748°C for granulite facies metamorphism. ACD: 1989.

R. K. KOTRA, Project Chief, U.S. Geol. Survey. **Organic Geochemistry.** A set of black shale samples from Bucks County (Lockatong Formation, Newark basin) supplied by the Pennsylvania Geological Survey was analyzed for source rock potential. Pyrolysis data indicated that the samples are beyond a stage of metamorphism where any meaningful organic geochemical data could be obtained. This completes project work involving material from Pennsylvania.

P. C. LYONS, Project Chief, U.S. Geological Survey. **Late Paleozoic Depositional and Coalification Processes.** Regional coalification and diagenesis in the Pennsylvanian of the northern Appalachian basin are being studied using vitrinite reflectance, H:C and O:C atomic data, illite crystallinity, conodont coloration, and argon geochemistry of feldspar from carboniferous sandstone. Coalification and diagenesis will be related to structure, deposition, and tectonics.

J. M. McNEAL, Project Chief, U.S. Geol. Survey. **Geochemical Exploration Techniques for the Eastern Triassic Basins.** No new work will be initiated in Pennsylvania. The NURE data for the geochemical maps of the Newark and Gettysburg basins have been compiled. All that remains is to prepare a formal publication. ACD: 1990.

M. L. MORGART, Pa. Dept. of Environ. Resources, Bur. of Oil and Gas Mgmt. **The Effects of Water Flooding for Enhanced Oil Recovery on Groundwater Aquifers in Washington County.** Organic and inorganic samples are being collected from 23 water wells over a 12-month period. Analyses will be interpreted to determine geochemical effects of water flooding on local aquifers. Sampling is nearing completion. ACD: 1990.

M. K. RODEN and D. S. MILLER, Rensselaer Polytechnic Inst. **Apatite Fission-Track Thermochronology of the Pennsylvania Appalachian Basin.**

C. B. SCLAR and P. H. BENOIT, Lehigh Univ. **A Comparative Chemical Study of the "Vein" Chromite and the Massive Chromite from the Wood's Chrome Mine, Southeastern Pennsylvania.** Electron-microprobe analyses of the "vein" and massive chromite from the Wood's mine show that the "vein" chromite has a unique chemical signature. The genetic significance of this signature is now being evaluated. ACD: June 1990.

F. E. SENFTLE, Project Chief, U.S. Geol. Survey. **Neutron Activation.** Our previous research with hydrothermal pyrite heated to less than 410°K in an oxygen-stained atmosphere shows that the surface oxidation takes place forming small superparamagnetic particles of magnetite on the pyrite surface. Similar experiments with pyrite in a coal from Washington County show that a similar mechanism takes place when pyritic coal is heated, even though reducing coal decomposition gases are formed in the vicinity of the pyrite grains.

E. C. SPIKER, Project Chief, U.S. Geol. Survey. **Environmental Isotopic Geochemistry.** A study of organic matter in shales of the eastern Mesozoic basins, including a few samples from Pennsylvania.



GEOMORPHOLOGY

T. W. GARDNER, K. F. CONNORS, and R. L. DAY, Pa. State Univ. **Variation of Geomorphometrics with Digital Elevation Data Resolution Across the Physiographic Provinces of Pennsylvania.** An investigation of the effects of digital elevation data resolution on geomorphometrics across different physiographic provinces in Pennsylvania. Authors will quantify how measures of landscape features vary as scale varies from 1:24,000 to global. ACD: 1991.

T. W. GARDNER, J. B. RITTER, T. W. BELL, K. F. CONNORS, N. M. PINTER, and C. A. SHUMAN, Pa. State Univ. **Grèzes Litées in the Valley and Ridge Province of Central Pennsylvania, USA: Regional Distribution, Morphology, and Depositional Processes.** Characterization of grèzes litées on highly fractured, fissile Ordovician, Silurian, and Devonian

shales includes stratigraphy, sedimentology, geomorphic attributes, and a depositional model. ACD: Winter 1989.

J. V. HAMEL and E. A. HAMEL, Hamel Geotechnical Consultants. **Depositional Chronology of Surficial Soils, G.R.O.W.S. Landfill Vicinity, Bucks County, Pennsylvania** [along Delaware River in Falls Twp.]. G.R.O.W.S. landfill is situated on a terrace complex consisting of braided outwash that was deposited and then eroded by the Delaware River in late Wisconsinan glacial time. Subsequent fluvial deposition on the terrace complex has been insignificant. ACD: Dec. 1989.

J. B. RITTER and T. W. GARDNER, Pa. State Univ. **Temporal Variation in Water and Sediment Discharge During Drainage Network Evolution in Disturbed Surface Mine Watersheds** [Centre and Clearfield Cos.]. ACD: Jan. 1990.

W. D. SEVON, Pa. Geol. Survey. **Pennsylvania's Polygenetic Landscape—Revisited** [Dauphin and Cumberland Cos.]. Guidebook to accompany field trip at 20th Annual Geomorphology Symposium, Carlisle, Pa., October 20–22, 1989. ACD: Oct. 1989.

RUDY SLINGERLAND and KEVIN FURLONG, Pa. State Univ. **Geodynamic and Geomorphic Modelling of the Late Paleozoic Ancestral Appalachians** [Middle Atlantic States]. We are using critical-wedge theory in conjunction with a flexural-loading model to estimate the mean elevation and width of the Carboniferous and Permian Alleghanian Highlands. ACD: Fall 1990.

G. H. THOMPSON, JR., Elizabethtown Coll. **Geomorphology of the Lower Susquehanna River Valley**. ACD: Ongoing.

W. B. WHITE, Pa. State Univ. **Caves of Pennsylvania**. The objective is to prepare a complete catalog of the caves of Pennsylvania including maps and descriptions of the caves. Work on the counties of the Ridge and Valley province is about 80 percent complete. ACD: 1990.

W. B. WHITE and E. L. WHITE, Pa. State Univ. **Studies of the Appalachian Karst**. A comprehensive investigation of karst landforms and karst drainage basins includes studies of basin morphology and evolution, processes of sinkhole development, and the role of caves in paleohydrology in the entire Appalachian Highlands. ACD: Ongoing.

GEOPHYSICS


E. R. KING, Project Chief, U.S. Geological Survey. **Development of Geophysical Techniques for Investigating Occurrence of Polymetallic Sulphides in the Eastern United States**. The project includes the Blue Ridge and Piedmont provinces of Pennsylvania.

K. P. KODAMA and JOHN STAMATAKOS, Lehigh Univ., and ART GOLDSTEIN, Colgate Univ. **The Effects of Simple Shear Strain on Remanence**. A detailed rock magnetic/paleomagnetic study of Silurian units in central Pennsylvania. We are trying to determine if remanence rotates as a passive line or as if carried by rigid particles during noncoaxial strains. ACD: June 1990.

J. D. UNGER, Project Chief, U.S. Geol. Survey. **Seismic-Reflection Investigations of Mesozoic Basins, Eastern United States**. Research to date

has resulted in promising possibilities for displaying interpreted seismic-reflection data along with gravity, magnetic, and refraction information as three-dimensional models of the crust in and around the Mesozoic basins.

GLACIAL GEOLOGY



D. D. BRAUN, Bloomsburg Univ. **Correlation of Late Wisconsinan Recessional Ice Margins Across North-Central and Northeastern Pennsylvania.** Ice-margin positions can be determined from the sequence of proglacial lakes and sluiceways in north-central Pennsylvania and from outwash morphosequences in northeastern Pennsylvania. ACD: Potter-Tioga Cos., 1989; Bradford-Sullivan Cos., 1990; Pocono region, 1992-95.

D. D. BRAUN, Bloomsburg Univ. **Pre-Wisconsinan Glacial Geology of Eastern Pennsylvania.** Mapping of the distribution and extent of pre-Wisconsinan glacial margins is being extended to the southeast and northwest of the Anthracite region. ACD: 1991-92.



HYDROLOGY

T. F. BUCKWALTER, U.S. Geol. Survey, and M. E. MOORE, Pa. Geol. Survey. **Groundwater Resources of Warren County.** Countywide groundwater conditions will be evaluated. Extensive water-quality data will be used to determine impacts of oil and gas production on the resource. A revised geologic map will be included. ACD: Dec. 1989.

D. M. DIODATO, Argonne Nat. Lab., and R. R. PARIZEK, Pa. State Univ. **Quantitative Characterization of Unsaturated Fluid Flow Behavior in Disturbed Mine Spoil: Two Nuclear Methodologies** [Clarion, Pa.]. The project involved two subexperiments associated with a field-scale acid mine

drainage abatement demonstration project. One subexperiment characterized moisture content, bulk density, total porosity, and unsaturated hydraulic conductivity using nuclear-probe methodologies. The other determined unsaturated hydraulic conductivity using a tracer study and post-sampling neutron-activation analysis. ACD: Completed.

M. D. GUEBERT and T. W. GARDNER, Pa. State Univ. **Measurement of Shallow Subsurface Water Movement on a Disturbed Land Watershed** [Centre Co.]. Purpose is to determine the volume and timing of through-flow in reclaimed surface-mined land, and the relationships of water movement to various measured properties, such as hydraulic conductivity, soil moisture, bulk density, and soil texture. ACD: Fall 1990.

PATRICIA LIETMAN, EDWARD KOERKLE, KEVIN KOSTELNIK, DOUGLAS CHICHESTER, DAVID FISHEL, MICHAEL LANGLAND, DAVID HALL, and LINDA GUSTAFSON-MINNICH, U.S. Geol. Survey, and M. J. BROWN, Pa. Dept. of Environ. Resources. **Conestoga Headwaters Rural Clean Water Project** [Upper Conestoga River basin, Lancaster Co.]. Water-quality changes resulting from the implementation of agricultural best management practices were evaluated for nonpoint-source contaminants. Agricultural areas underlain by carbonate rock were found to be most susceptible to contamination. Pesticides were most prevalent and nitrate concentrations typically exceeded drinking water standards for these areas. ACD: Sept. 1992.

RICHARD LOWRIGHT and PATRICIA SCHNEIDER, Susquehanna Univ. **A Survey of Water Quality in the Tonoloway and Keyser Formations in Snyder County**. Water samples collected from 35 wells receiving water from only these aquifers were analyzed for naturally occurring chemicals. Preliminary interpretations are that both local and intermediate flow systems were encountered and that this is the primary cause of variation in water quality. ACD: Aug. 31, 1989.

C. R. MOORE, U.S. Geol. Survey. **Effects of Land Use and Organochlorine Insecticide Concentrations on Benthic-Invertebrate Diversity Indices of Selected Streams in Chester County**. The objectives are to relate land use practices and changes to the occurrence and concentrations of organochlorine insecticides in stream-bottom sediments and to diversity-index trends of stream benthic invertebrates. A sediment core was taken from the former Icedale Lake for radionuclide dating and determination of organochlorine insecticide inputs into the lake. ACD: Sept. 30, 1990.

DENNIS RISSER, U.S. Geol. Survey. **Evaluation of Methods to Delineate the Area of Groundwater Contribution to Wells in Various Hydrogeologic Settings in Pennsylvania**. ACD: 1993.

J. B. RITTER and T. W. GARDNER, Pa. State Univ. **Runoff Curve Numbers for Disturbed Surface Mine Watersheds, Central Pennsylvania** [Centre and Clearfield Cos.]. ACD: Sept. 1989.

CHRIS SARSONY and RICHARD LOWRIGHT, Susquehanna Univ. **Comparison of Methods of Peak Streamflow Estimation for Penns Creek, Central Pennsylvania**. The tabular, graphical, and multiple-regression peak streamflow estimation methods were applied to a portion of Penns Creek, central Pennsylvania. The multiple-regression method was the easiest to perform and the most accurate of the methods when compared to actual gaging values. ACD: May 12, 1989.

L. A. SENIOR and K. L. VOGEL, U.S. Geol. Survey. **Radium and Radon Occurrence in Groundwater of the Chickies Formation, Southeastern Pennsylvania**. ACD: Sept. 30, 1989.

R. A. SLOTO, U.S. Geol. Survey. **Groundwater Resources of Chester County.** The objective is to produce a comprehensive report describing the groundwater resources of Chester County. ACD: Sept. 1990.

M. J. VALENTINE, W. Va. Univ. **Investigation of Lineaments and Groundwater Chemistry as Exploration Tools of Natural Gas and Groundwater in Indiana County.** Lineament mapping (on 7.5-minute quadrangles) has been completed. In progress is statistical-trend delineation between lineaments and water and gas yields and between water well geochemistry and gas production. ACD: Sept. 1989.

K. L. VOGEL, U.S. Geol. Survey. **Geohydrology and Simulation of Groundwater Flow in the Red Clay Creek Basin, Chester County, Pennsylvania, and New Castle County, Delaware.** A digital groundwater-flow model will be used to predict the effects of increasing groundwater development on base flow and groundwater levels. A data-collection network (9 rain gages, 16 observation wells, and 3 stream gages) is in place. A water-table map is being constructed. ACD: Sept. 30, 1991.

K. E. WHITE, U.S. Geol. Survey. **Base Flow of Selected Pennsylvania Streams.** Base-flow separations are done for all continuous-record stations in Pennsylvania that have at least 10 years of record. This report will include three methods of hydrograph separation: local minimum, fixed interval, and sliding interval. ACD: June 30, 1989.

D. R. WILLIAMS, U.S. Geol. Survey, and T. A. McELROY, Pa. Geol. Survey. **Geology and Water Resources of Indiana County.** Field work has been completed. Two-, 4-, 24-, and 72-hour pump tests were conducted at the Plumville well nest. All field data have been entered into computer data bases. Compilation of the geologic map is 30 percent complete. ACD: 1990.

DAWNA YANNACCI, Pa. Geol. Survey, and DANIEL HIPPE and DENNIS LOW, U.S. Geol. Survey. **Aquifer Characteristics of the Rocks of Pennsylvania.** A comprehensive summary of the hydrogeologic characteristics of individual formations and regional flow systems will be developed using available data. The study will be published in three parts, the first covering southeastern Pennsylvania. ACD: Sept. 1989.

IGNEOUS AND METAMORPHIC PETROLOGY

P. C. CARNES and G. H. MYER, Temple Univ. **Petrology of the Castle Rock Ultramafic Enclave** [Newtown Square, Delaware Co.]. ACD: Jan. 1990.

J. M. HUSCH, Rider Coll. **Geochemistry and Petrogenesis of Early Jurassic Diabases, Central Newark Basin** [eastern Pa. and west-central N. J.]. The lateral and upward migration of residual liquids after pyroxene-dominated fractionation appears to be a common process in the dia-

bases. The classic view of these sheets being differentiated by vertically directed, olivine-dominated fractionation is not supported. ACD: June 1991.

D. W. VALENTINO and R. T. FAILL, Pa. Geol. Survey. **Metamorphic Isograd Map of the Southeastern Pennsylvania Piedmont**. A preliminary isograd map has been compiled using new and published data. Complex isograd patterns suggest that the regional metamorphic gradients have been modified by post-metamorphic tectonism. ACD: March 1991.

MINERALOGY

C. G. WISWALL, West Chester Univ., and LISA SENIOR, U.S. Geol. Survey. **Solid Phase Source of U and Th in the Chickies Quartzite [southeastern Pa.]**. ACD: Sept. 1989.

PALEONTOLOGY

N. C. ARENS, Harvard Univ., and R. J. CUFFEY, Pa. State Univ. **Bryozoan Fauna, *Prasopora* Taphonomy, and Tempestite Storm Deposits in the Coburn and Salona Limestones (Ordovician) of Central Pennsylvania**. ACD: May 1989.

R. M. FELDMANN, J. T. HANNIBAL, D. J. MULLETT, B. A. SCHWIMMER, D. TSHUDY, A. B. TUCKER, and R. W. WEIDER, Kent State Univ. **The Paleoeecology of *Echinocaris randallii* Beecher from the Vicinity of Drake's Well, Titusville, Pennsylvania**. *Echinocaris randallii* Beecher is reported from the Corry Sandstone for the first time. Evidence based upon brachiopods suggests a Late Devonian, rather than Mississippian, age for the Corry at this locality. ACD: April 1989.

A. G. HARRIS, U.S. Geol. Survey, and CARMEN MOY, Pa. State Univ. [No title provided.] The purpose is to date and paleoecologically characterize the upper part of the Bellefonte Dolomite in the vicinity of State College. For the first time, identifiable palynomorphs have been recovered from the Bellefonte Dolomite; these represent a very shallow water carbonate palynofacies. Conodonts from the same horizons as the palynomorphs precisely place the palynomorph assemblages within middle Whiterockian conodont zones of the North American Midcontinent Province zonation.

ALBERT KOLLAR, Carnegie Mus. of Natural History and Univ. of Pittsburgh. **The Redescription and Reillustration of the Brachiopods from the Cuyahoga and Logan Formations (Lower Mississippian), Upper Waver-**

ly Group of Central and Southern Ohio [includes Cuyahoga Fm. of western Pa.]. ACD: Oct.-Nov. 1989.

R. LITWIN, Project Chief, U.S. Geol. Survey. **Mesozoic Palynology of the Atlantic Continental Margin.** Field work is ongoing in the Gettysburg basin in an attempt to improve the current palynological age determinations in the New Oxford Formation and Gettysburg Shale. A study is also underway to examine the possibility that the Jacksonwald syncline contains a nearly continuous sedimentary sequence through the Triassic-Jurassic boundary interval; the fossil assemblages examined so far do not conclusively confirm the boundary, and additional samples are being sought from both lower and higher in the section.

W. A. OLIVER, JR., U.S. Geol. Survey. **Corals and Biostratigraphy of the Keyser and Helderberg Limestones in the Appalachian Basin** [N. Y., N. J., Pa., Md., W. Va., and Va.]. Rugose corals are being described and their stratigraphic and areal distribution analyzed from the fine-grained, stromatoporoid facies of Pridolian and Lochkovian age. ACD: Ongoing.

W. A. OLIVER, JR., U.S. Geol. Survey. **The Principal Pridolian and Lochkovian Coral Assemblages or Communities in Eastern North America.** Review of subject for ecostratigraphy final report. ACD: Completed.

C. WNUK, Project Chief, U.S. Geol. Survey. **Paleoecology of Coal and Coal-Bearing Rocks.** The objective is to develop an improved understanding of the environmental, edaphic, ecological, and climatological factors that influence the development of peat-forming plant communities and, consequently, affect coal quality, thickness, and distribution. Investigations are concentrating on *in situ* floras that are found in underclays beneath coal beds. Intensive study of a fossil assemblage that occurs in the underclay of the Mammoth #8 coal bed in the Shamokin quadrangle has led to the reconstruction of the growth form and ontogeny of the lycopod *Bothrodendron punctatum*.

SEDIMENTOLOGY

EDWARD COTTER and JOHN LINK, Bucknell Univ. **Clinton Group Sedimentary Ironstones, Central Pennsylvania.** Field examination is nearly complete; petrography has begun; chemical analyses are expected this summer. All aspects of description and interpretation are more complex than expected, and origin is related to conditions at the site of initial accumulation, to several mechanisms and locations of resedimentation, and to several phases of diagenesis. ACD: Summer 1990.

RUDY SLINGERLAND and DAVID SWETLAND, Pa. State Univ. **Circulation and Sediment Transport Modelling in the Late Devonian Catskill Epeiric Sea** [central and western Pa.]. Since last year we have completed 40 numerical experiments using a three-dimensional hydrodynamic model of circulation in the Late Devonian Catskill Sea, five of which include density stratification. The results, consistent with outcrop studies, indicate that the producing sandstones of the Council Run gas field are shore-parallel shelf sand ridges. ACD: 1990.

TAMMY SUTER, W. Va. Univ. **Origin and Significance of Mississippian Polymictic Diamictites in the Central Appalachian Basin** [western Md. and northeastern Pa.]. ACD: May 1990.

STRATIGRAPHY

A. D. GLOVER, C. H. DODGE, L. J. LENTZ, J. R. SHAULIS, and V. W. SKEMA, Pa. Geol. Survey. **TASIC (Temporarily Available Stratigraphic Information Collection)**. A continuing program to collect stratigraphic data and coal samples for analysis from active coal and clay mines and from drill cores in north-central and western Pennsylvania. The project will provide data for future mapping and regional resource evaluation. ACD: Ongoing.

W. M. GOODMAN and CARLTON BRETT, Univ. of Rochester. **Stratigraphic Dynamics of the Medial Silurian (Wenlockian) Northern Appalachian Foreland Basin** [Pa., N. Y., Ontario, Md., W. Va., and Ohio]. Laterally traceable hematitic conglomerate/phosphatic pebble/complex shell beds in upper Clinton strata define several unconformity-bound depositional units. A Vail-type depositional sequence approach is being applied to reconstruct mid-Silurian sea-level and tectonic histories. ACD: May 1990.

J. D. INNERS, Pa. Geol. Survey, W. E. EDMUNDS, Consulting Geologist, and L. J. LENTZ, Pa. Geol. Survey. **Pottsville Stratigraphy and the Mid-Carboniferous Boundary in the North Half of the Anthracite Region** [northeastern Schuylkill Co., northwestern Carbon Co., and Luzerne Co.]. Objective is to determine the nature and areal extent of the basal Pottsville disconformity that is evident in the Northern Anthracite field and the northern part of the Eastern Middle field. ACD: March 1990.

B. N. SHAFFER, W. Va. Univ. **Stratigraphy and Sedimentation of the Acadian Clastic Wedge in Southwestern Pennsylvania**. This study, to start in the summer of 1989, will involve subsurface correlation to determine geometry, trends, depositional environments, and genetic origin of oil- and gas-producing sandstones of Upper Devonian/Lower Mississippian age.

R. C. SMITH, II, and S. W. BERKHEISER, JR., Pa. Geol. Survey, and J. H. WAY, Lock Haven Univ. **Lower Devonian and Other Bentonites and Ash Beds** [Va. to Quebec]. Bald Hill Bentonite Beds A, B, and C have now been correlated from Monterey, Virginia, to Cherry Valley, New York. These as well as the Upper Ordovician bentonites and Tioga ash beds are associated with the drowning of carbonate platforms by major marine transgressions. ACD: Ongoing.

STRUCTURAL GEOLOGY

BARBARA BLOOMFIELD, Temple Univ. **Evidence of Martic Shear Zone Deformation in Rocks of the Honey Brook Upland, Northern Chester County.** ACD: Aug. 1989.

WAYNE BREWER and KEVIN SMART, Allegheny Coll. **Finite Strain Analysis and Deformation Mechanisms in Sandstones of the Homoclinal Portion of the Appalachian Plateau of Pennsylvania.** ACD: 1990.

R. T. FAILL, Pa. Geol. Survey. **Tectonic Map of Pennsylvania.** Map will show locations and names of anticlines, synclines, anticlinoria, structural fronts, thrust, normal, transcurrent, and other faults; basement contours; contours on top of the Onondaga Formation; earthquake epicenters; radiometric dates; nappes and terranes; metamorphic isograds; and other sundry tectonic features. ACD: Dec. 1989.

M. B. GRAY, Univ. of Rochester. **Structural Evolution of the Southern Anthracite Region.** Data on the orientation and relative timing of mesoscopic and microscopic structures will be integrated with the large-scale fault and fold geometry to produce a model for the evolution of the Southern Anthracite region. ACD: 1991.

M. L. HILL, Temple Univ., and D. W. VALENTINO, Pa. Geol. Survey. **Structure of the Martic Zone (Peach Bottom-Trenton Zone), Southeastern Pennsylvania Piedmont.** ACD: 1992.

E. M. HOPKINS, Univ. of Pittsburgh at Bradford. **Effects of Sea-Level Fluctuation and Syndepositional Tectonism on Late Devonian Shoreline Architecture and Depositional Environments in North-Central Pennsylvania and Western New York.** Stratigraphy within the "Bradford" and "Venango" wedges suggests architectural control by features associated with reactivated basement fault zones parallel to and perpendicular to the curving Appalachian basin axis. Sandy sediment dispersal systems repeatedly occupied these features as the Late Devonian sea spasmodically transgressed and regressed across the Catskill coastal plain. ACD: Aug. 1989.

ASSAD IRANPANAH, Univ. of Pittsburgh at Bradford. **Brittle Fracture Analysis of the Middle-Upper Ordovician Carbonates in the Union Fur-**

nace Section, Southeast Limb of the Nittany Anticlinorium. A master joint set having a mean value of N23°W (parallel to σ_1), and a minor joint set having a mean value of N78°E (parallel to ϵ_x) were identified in the field. The early formed master joint set is believed to be both a major conduit and a sink into which chemically charged fluids migrated and reprecipitated dissolved calcite. The conjugate en-echelon vein arrays and the pressure-solution surfaces suggest a stretching and shortening of $\Delta\bar{v}$ with $2\theta = 110^\circ$. ACD: Dec. 1989.

ROBERT KUHLMAN, Montgomery Co. Community Coll. **Contractional Strain in the Westernmost Newark Basin** [Sassamansville and Perkiomenville quads.]. ACD: Ongoing.

R. P. NICKELSEN, Bucknell Univ. **Structural Evolution of the Northwest Limb of the McConnellsburg Anticlinorium.** ACD: Fall 1989.

R. P. NICKELSEN, Bucknell Univ., JEFF WALKER, Vassar Coll., and KAREN MULLANEY, Smith Coll. **Phyllosilicate Reorientation and Recrystallization During Formation of a Marcellus Formation Cleavage Duplex.** ACD: Fall 1989.

L. B. PLATT, Bryn Mawr Coll., and ANDREW QUARLES and STACEY TYBURSKI, Univ. of Texas at Austin. **Strain Recorded by Fossils in the Valley and Ridge Province.** Following the work of Nickelsen and Faill, we are quantifying strain in fossils and cleavage to determine strain sequence and amounts of pure and simple shear. ACD: May 1989.

C. A. SHUMAN, Penn State Univ. **Remote Sensing and Field Analysis of the Muddy Creek Lineament, York County.** ACD: Early 1990.

C. A. SHUMAN, Penn State Univ. **Use of Multiple-Scale Remote-Sensing Imagery and Ground-Based Studies to Assess Fracture Indicators Across the Appalachian Orogen** [nine study blocks (six quads. each) distributed from Piedmont to Plateau]. In order to more completely characterize fracture indicators (lineament and fracture-trace features) observed on aerial photographs and remote-sensing imagery, multiple scales of imagery (from 1:500,000 to 1:20,000) will be used and typical fracture mapping will be employed to define the relationship between fracture patterns and their geomorphic expression. Scale relationships (fractal?) and the role of *in situ* stress on these features will also be investigated. ACD: 1990.

D. W. WATSON, Slippery Rock Univ. **Structural Study of Slippery Rock Creek Gorge Area, McConnells Mill State Park.** ACD: Ongoing.

C. G. WISWALL, West Chester Univ. **Tectonic Evolution of the Brandywine Terrane, Chester County.** A study of the tectonic history of the Piedmont in the vicinity of the West Chester Prong and Woodville Dome as recorded in deformational events. Preliminary results suggest that the Cream Valley fault extends westward of its presently mapped terminus and may represent a major crustal break. ACD: Ongoing.

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compiled by Caron O'Neil
Pennsylvania Geological Survey

Economic Geology

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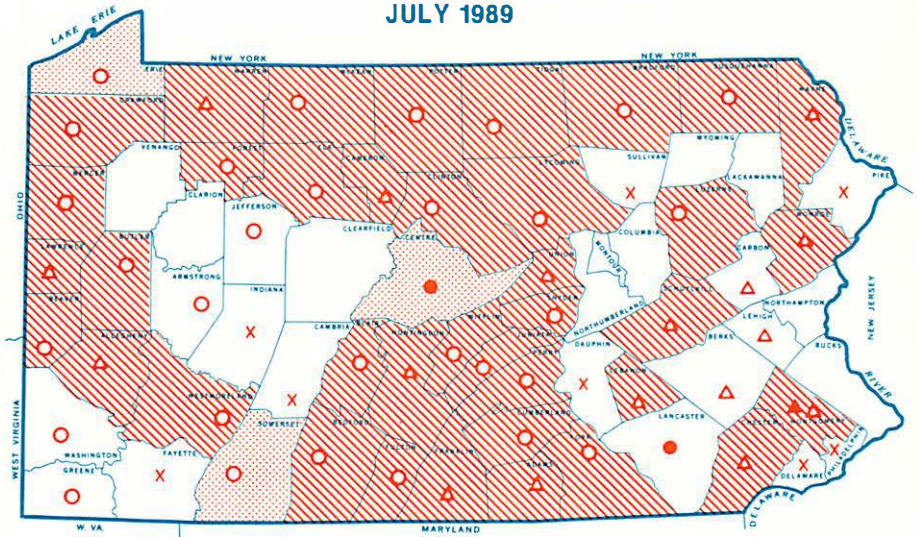
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GROUNDWATER-RESOURCE MAPPING

GROUNDWATER LEVELS FOR JULY 1989



EXPLANATION

○ Above last year
● Below last year
Observation well

△ Above last year
▲ Below last year
Observation well equipped with data-collection platform

X No data

High

Normal range

Low

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