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# **ANNUAL REPORT 1979-1980**

**KENTUCKY GEOLOGICAL SURVEY  
Donald C. Haney, Director and State Geologist  
UNIVERSITY OF KENTUCKY, LEXINGTON**

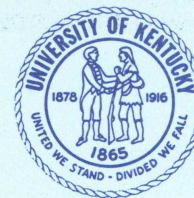
**1979-1980  
ANNUAL REPORT**

**KENTUCKY GEOLOGICAL SURVEY**

**UNIVERSITY OF KENTUCKY  
LEXINGTON, KENTUCKY**

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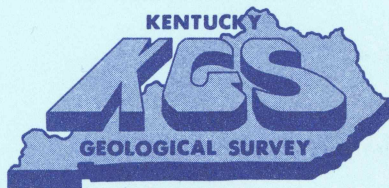
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## CONTENTS

	Page
Foreword . . . . .	1
Research . . . . .	2
Coal . . . . .	2
Industrial and metallic minerals . . . . .	10
Oil and gas . . . . .	14
Water . . . . .	18
Other research . . . . .	22
Cooperative programs . . . . .	22
Geologic mapping . . . . .	22
Topographic mapping . . . . .	23
National Cartographic Information Center . . . . .	24
Water Resources . . . . .	25
Publications . . . . .	27
Information circulars . . . . .	28
Thesis series . . . . .	29
Special publications . . . . .	29
Reprints . . . . .	29
Guidebooks . . . . .	31
Map . . . . .	31
In press or editing completed . . . . .	31
Open-file material . . . . .	32
Papers by staff members in outside publications . . . . .	32
Services . . . . .	33
Well record library . . . . .	33
Sample library . . . . .	34
Public information services . . . . .	34
Personnel . . . . .	35
Professional staff . . . . .	35
Clerical and technical staff . . . . .	39



## FOREWORD

The Kentucky Geological Survey was established in 1854 as the official geologic research organization in the Commonwealth. Since that time the Survey, which is part of the University of Kentucky, has continued to perform basic research in a number of geologic areas such as energy (coal, petroleum, and natural gas), applied geology, mineral resources, geologic mapping, topographic mapping, and hydrology.

Some of the Survey's ongoing and future research objectives include: studies of coal bed continuity, quality, and characteristics in the Eastern and Western Kentucky coal fields; a coal hydrology study in eastern Kentucky for environmental control measures; various mineral resources investigations; stratigraphic and structural subsurface investigations related to the occurrence of oil and gas; initiation of geologic hazards research throughout the Commonwealth; and a study to characterize specific aquifers in Kentucky that have the potential to supply potable water.

As an ex-officio member of the Kentucky Department of Energy, the Survey serves in an advisory capacity to various State and Federal agencies. Additionally, the Survey places great emphasis on maintaining a dialogue with the general public through multifaceted public service activities. Public awareness and participation are essential to the Kentucky Geological Survey in attaining its goal of defining, understanding, and utilizing the natural resources of the Commonwealth of Kentucky.



## RESEARCH

Basic research in geology and hydrology has formed the cornerstone of the Kentucky Geological Survey since its inception. This dedication to the identification and characterization of the Commonwealth's vast natural resources has continued throughout the Survey's 125 years of service to the people of Kentucky.

The Kentucky Geological Survey maintains a diversified and comprehensive research program which includes the fields of coal geology, industrial and metallic minerals, oil and gas, and hydrology. In addition, there are a number of energy-related special projects which are funded by grants or contracts. Projects in all of these areas of research are described in greater detail in the following sections.

Although research at the Kentucky Geological Survey covers a wide variety of subjects, it has a unified goal: a better understanding of the geology of the Commonwealth and utilization of the State's resources for the greatest benefit to the citizens of Kentucky and the Nation.

## Coal

Coal continues to occupy a place of importance for power and steel production and as the source for synfuels. Kentucky coal mines produced nearly 150 million tons of coal in 1979, reflecting strong base level demands in the face of a depressed general economy.

Coal has been produced in Kentucky since 1790 and totals approximately 5 billion tons. The remaining resources of coal total approximately 67 billion tons, based on new data for western Kentucky and data currently under revision for eastern Kentucky.

The Kentucky Geological Survey is currently involved in several coal-related projects including estimation of coal resources, determination of chemical characteristics and mineability of coal, and determination of geologic hazards.

### COAL RESOURCES OF KENTUCKY BRANT, Russell A.

Research continues to define Kentucky's coal resources under grants from the Kentucky Institute for Mining and Minerals Re-

search and the U.S. Geological Survey. The first definitive work for the Western Kentucky coal field, which was released to open file in 1978, was published jointly in September 1980 by the Kentucky Geological Survey and the Institute for Mining and Minerals Research. That report estimates more than 38 million short tons of remaining resource and classifies the resource by thickness, reliability, overburden, and county.

Field work in the Eastern Kentucky coal field, which began in 1976, is over 85 percent complete. Field work involves examining thickness of coal beds and describing enclosing rocks. Coal resources maps showing mineable thickness variation and reliability classification are now complete for the Princess reserve district and nearly complete for the Southwest reserve district. Estimation of the resources and classification by bed, thickness, reliability, and county has also been completed for the Princess reserve district. The Southwest reserve district is now mapped and ready for estimation. Current efforts in the field are in the Hazard reserve district. Field work in the Upper Cumberland and Licking reserve districts is complete and awaiting preparation of resources maps. The Big Sandy reserve district awaits completion of field work, primarily in the Pike County area.

The data thus far developed and released are proving to be valuable to public, state, and federal agencies as well as private enterprise and individual citizens.

"The Guide and Finding Key to Eastern Kentucky Coal Literature and Information" was released on an open-file basis in November for those who are investigating coal resources or geology in the region.

As energy problems increase and debates over coal resources become sharper, sound data will become more and more important.

### ACQUISITION, STORAGE, AND CLASSIFICATION OF ENGINEERING AND GEOLOGICAL DATA FOR SURFACE-MINE DESIGN AND RECLAMATION COBB, James C., and HESTER, N. C.

This project gathers information pertaining to geologic characteristics and engineering properties of overburden rocks and surface mine spoil of the Eastern Kentucky coal field. A computerized data management system will be established which will allow rapid



and easy access to rock property information for surface mine design and reclamation. Methods will be developed for field recognition of rock groupings which will serve as an aid for determining slope stability of surface mine spoil. This information will facilitate more effective and efficient enforcement and compliance with portions of section 515 (3) of Public Law 95-87 (Surface Mining and Reclamation Act of 1977). A user manual will be developed and seminars will be presented on surface coal mine design, including presentations on effective use of the data retrieval system. The methods and procedures developed will apply to surface mining throughout the Appalachian Basin.

## **STUDY OF LIGNITE IN KENTUCKY**

**COBB, James C., and WILLIAMS, David A.**

A dual-purpose project to study Kentucky lignite will characterize the lignite resources of Kentucky, and utilize lignite deposits to assess faults in the New Madrid seismic area of Kentucky. A one-day meeting was held in which U.S. Geological Survey and Kentucky Geological Survey personnel discussed the geologic setting of Kentucky lignite and coordinated plans to share data and expertise in future work. A one-year grant was received by the Kentucky Geological Survey from the Nuclear Regulatory Commission to study faulting in lignite deposits of western Kentucky.

Sites for drilling by the Kentucky Geological Survey within the next year have been identified. The drilling will help define the presence, extent, and ages of displacement of faults critical to the seismotectonic study of the New Madrid seismic area.

Field work was carried out to collect and describe lignite deposits in outcrop and to locate potential drilling sites in order to sample deeper lignite deposits. Kentucky has lignite deposits in six western Kentucky counties, and preliminary chemical results indicate this lignite has 7,110 BTU per pound, 1.0 percent sulfur, 15.0 percent ash, 26.5 percent moisture, 37.8 percent volatiles, and 21 percent carbon.

The data derived from this project will be placed on open file and the information on faulting will be included in reports to the Nuclear Regulatory Commission.

## **SAMPLING AND ANALYSIS OF EASTERN KENTUCKY COALS**

**CURRENS, James C.**

An extensive coal sampling and analysis program for the Eastern Kentucky coal field was funded in May 1979 by the U.S. Geological Survey. This three-year project has a two-fold purpose. First, the Kentucky Geological Survey will describe the coal and enclosing rocks and sample the coal, and the U.S. Geological Survey will analyze the samples for basic coal-quality parameters and trace element content. Trace element data will be used to delineate coal resources that can be used for liquefaction, gasification, and as non-polluting sources of steam coal. Second, the Kentucky Geological Survey has a long-standing need for basic coal-quality data. The coal sampling program will provide essential data which will be used to evaluate the state's coal resources and provide regional data to potential resource developers.

The coal sampling follows procedures established by the U.S. Geological Survey. The objective is to collect as many samples as possible from given beds with as wide a geographic distribution as possible. Each sample is intended to represent the quality of the entire thickness of the coal bed at the site. A detailed set of records is kept to accurately delineate the pattern of sample sites and the geologic conditions at each site.

During the first year of the project 209 full-thickness channel samples were collected. During fiscal year 1979-1980, 298 benched channel, parting, roof rock, and seat rock samples were collected. Of these 298 samples, 243 were full-thickness coal channel samples. This was accomplished despite changes in sampling procedure, which halved the number of samples anticipated at a given site, and despite the loss of an assistant. Presently, the program is approximately on schedule for a 10-month field season.

Regional coal quality maps for individual coal beds and coal zones are now being prepared, using new data in conjunction with available information. The field notes and analysis results will be made available to the public when completed. Draft copies of the regional coal quality maps will be open filed when a satisfactory data point density has been attained. A final report will be open filed in July 1982.

## **GEOLOGY OF THE PRINCESS COAL DISTRICT, EASTERN KENTUCKY**

**SERGEANT, Richard E.**

A report on the Princess reserve district will be the first in a series



of reserve district reports for the Eastern Kentucky coal field. Work on the Princess district was initiated as a four-phase project in December 1978.

Phase I examines the Pennsylvanian upper Breathitt Formation, which includes the Princess No. 5-Richardson through Princess No. 9 coal beds.

Phase II deals with the Pennsylvanian Conemaugh Formation, and, more specifically, with the Ames and Bush Creek Limestones.

Phase III examines the Pennsylvanian Breathitt Formation from the Mississippian boundary to the Princess No. 5-Richardson coal bed.

Phase IV coordinates data from the first three phases in a comprehensive report for the entire reserve district. The report will include information on coal correlations and continuity, coal quality, district-wide structural implications, stratigraphy, and flint and plastic clays.

Phase I was completed in August 1979, and Phases II, III, and IV will be completed in early 1981.

## **FACTORS AFFECTING COAL DEVELOPMENT IN THE ILLINOIS BASIN**

**SERGEANT, Richard E., and BINGEMER, Roxanne**

During the decade of the 70's the world energy picture was changed drastically by the Organization of Petroleum Exporting Countries (OPEC). This resulted in the United States establishing the goal of energy independence by the year 2000. To accomplish this independence it is necessary to accelerate the development of coal resources such as are found in eastern and western Kentucky. Increased coal production and development of synfuel alternatives require heavy concentrations of people from the mining and construction industries and capital investment for equipment and construction.

Development of this nature will have a severe impact on rural settings such as western Kentucky, where there is only one large urban center (Owensboro). It is essential that this impact be mitigated wherever possible by comprehensive regional and local planning. To this end, the U.S. Geological Survey has funded the Geological Surveys of Kentucky, Illinois, and Indiana to compile coal and coal-mining-related data for their respective portions of the Illinois Basin. These data, which include information concerning reserves and resources, coal quality, mined-out areas,

hydrology, reclamation, hydrocarbon exploration and production, limestone, and other related information, will be organized and explained in manuals targeted for the non-scientist. The manuals will direct the user to sources of additional, more specific information. Data compilation was initiated in January 1980; project denouement is scheduled for June 1981.

## **COAL SAMPLE INDEX AND MAP WILLIAMS, David A.**

Numerous coal channel samples for chemical and petrographic analysis have already been taken in Kentucky. In order to avoid duplicate sampling in future programs and to control the density of sample sites, a program was initiated to delineate previous sampling. A map at a scale of 1:250,000 showing sample sites and coal bed designation is on open file at the Survey. Included with the map is an index of sample sites by Carter coordinate location, coal bed name, and sampling agency.

The study was initiated May 1, 1980, and was completed June 13, 1980.

## **STRATIGRAPHIC INVESTIGATION OF THE AMOS AND FOSTER COALS OF BUTLER COUNTY, KENTUCKY WILLIAMS, David A.**

The purpose of this project is to determine the relative stratigraphic position and areal extent of the Amos and Foster coal beds in western Kentucky. The project is particularly aimed at determining possible areas of fluvial interruption. The coals are studied in mines, in outcrop, and by drill hole.

To date, a map showing the extent and position of possible channels has been developed. An isopachous map of the Foster coal and a mine map of the study area have also been generated. Fourteen channel samples have been taken and are currently undergoing chemical analysis. Petrographic investigations of these and future samples will be made at a later date.

Duration of the project is three years.

## **MINING POTENTIAL OF ORPHAN LANDS WILLIAMS, David A., and HESTER, Norman C.**

This project was funded by the Kentucky Department for Na-



tural Resources and Environmental Protection for the purpose of assessing the potential for renewed coal mining on abandoned mine lands in Kentucky.

A methodology was developed to enable Kentucky Division of Orphan Land personnel to quickly categorize orphan land areas according to economic potential. The methodology was then evaluated in the London, Hazard South, and Argillite quadrangles in the Eastern Kentucky coal field, and the Providence, Drakesboro, Dawson Springs Southeast, and St. Charles quadrangles in the Western Kentucky coal field.

The project was completed in April 1980.

### **RECLASSIFICATION OF THE PENNSYLVANIAN STRATIGRAPHIC SECTION IN WESTERN KENTUCKY**

**WILLIAMSON, Allen D.**

The purpose of this project is to develop a comprehensive rock stratigraphic classification for the coal-bearing Pennsylvanian System of western Kentucky. The lack of such a classification has caused invalid regional correlations and confused estimates of coal-bed thickness, continuity, quality, and stratigraphic position. A comprehensive rock stratigraphic classification will effect intra- and interregional stratigraphic correlation, and will consolidate and condense coal bed names.

Pertinent literature has been reviewed and available paleontological data have been evaluated. A tentative biostratigraphic framework has been constructed, and basic intra- and interregional correlations have been established.

This five-year project has a completion date of January 1, 1985.

### **STUDY OF THE PENNSYLVANIAN-AGE CASEYVILLE FORMATION**

**WILLIAMSON, Allen D., BEARD, John G., and HESTER, Norman C.**

Most of the high-BTU, low-sulfur coal in western Kentucky is in the Pennsylvanian Caseyville Formation. In order to aid exploration for this coal, which complies with Environmental Protection Agency standards, a study of the Caseyville Formation was initiated in 1979. The project will define the boundaries of the Caseyville, describe the internal sedimentary features of the forma-

tion, and interpret the depositional history and sedimentary environments of the Caseyville.

In fiscal year 1979-1980, pertinent coal beds and other units were identified, and preparation of lithologic and thickness maps was initiated. Work halted temporarily in favor of higher priority programs, and is expected to renew in June 1981. The study will be completed by January 1, 1982.

### **WESTERN KENTUCKY COAL BED INDEX**

**WILLIAMSON, Allen D., BINGEMER, Roxanne, and BRANT, Russell A.**

This project was intended to enumerate the more important coal beds in western Kentucky and summarize their distribution, thickness, stratigraphic relationships, quality, and structure.

The most extensive and economically important coal beds in the Western Kentucky coal field are the Mulford (Western Kentucky No. 9) and the Herrin (Western Kentucky No. 11) of the Carbon-dale Formation. These beds are restricted to the central part of the coal field, where they have been mined extensively. Of secondary importance are the Paradise (Western Kentucky No. 12), Wheatcroft (Western Kentucky No. 13), and Coiltown (Western Kentucky No. 14) coal beds, which are mined near the center of the Western Kentucky coal field, and the Davis (Western Kentucky No. 6) and Mannington (Western Kentucky No. 4) coal beds, which have been mined near the southern rim of the coal field; all of these coal beds have been mined extensively in western Kentucky. Other less extensive coal beds are found throughout the Western Kentucky coal field.

The first draft of this report was submitted on February 1, 1980, and was returned for revision in September 1980. The suggested revisions will be made and the revised text is expected to be submitted by December 1, 1980.

### **KENTUCKY-ILLINOIS-INDIANA CORRELATION COMMITTEE**

**WILLIAMSON, Allen D., and WILLIAMS, David A.**

The Illinois Basin is composed of parts of Kentucky, Illinois, and Indiana. There are discrepancies in correlation of coals and other geologic features from state to state within the Illinois Basin. In order to resolve these discrepancies and develop a basin-wide



nomenclature, a committee was formed comprised of personnel from the Kentucky, Illinois, and Indiana Geological Surveys.

The Committee will publish its results through the respective surveys.

## **INDUSTRIAL AND METALLIC MINERALS**

Industrial minerals continue to play an important role in the economic growth and well-being of Kentucky. The value of Kentucky's non-fuel minerals produced in 1979 has been estimated to exceed \$200 million. Cement, clay, dolomite, gravel, lime, limestone, sand, and sandstone were the principal commodities produced.

Investigations are being focused on the identification and characterization of the industrial and metallic minerals, not only for their direct resource potential but also for their application in the development and utilization of the State's present and future energy supplies. The latter application includes evaluation of carbonate-rock resources for use in environmental control measures employed by coal-producing and coal-consuming industries, and inventories of barite deposits for use in heavy muds for oil-field drilling.

### **ZINC DEPOSITS OF SOUTH-CENTRAL KENTUCKY ANDERSON, Warren H.**

Searching for Mississippi Valley-type ore deposits in the midcontinent region requires a thorough knowledge of the interrelationships between stratigraphy, lithology, and ore mineralization. The object of this investigation is to provide a preliminary data base of geologic information for the Cambro-Ordovician Knox Dolomite in south-central Kentucky.

Information generated from detailed lithostratigraphic descriptions of selected south-central Kentucky cores is used to characterize the carbonate-rock sequence in the Knox Dolomite. The identification and correlation of marker beds provide stratigraphic control which assist in a better understanding of the lithologic assemblages associated with zinc mineralization.

The current phase of the investigation is focused on northwest Cumberland County; subsequent core studies will be directed toward Adair, Russell, and Casey Counties. A detailed description of

Kentucky Geological Survey core C-285, Cumberland County, is nearly completed and will be placed on open file during the 1980-1981 fiscal year.

### **BARITE DEPOSITS OF KENTUCKY ANDERSON, Warren H., TRACE, Robert D., and McGRAIN, Preston**

Barite, an important industrial mineral, has special significance during the current energy shortage because of its use in heavy muds for oil-field drilling. This investigation is an inventory of known and reported deposits of barite in Kentucky. Barite is found in the state primarily in the Central Kentucky mineral district and the Western Kentucky fluorspar district.

Geologically, most of the Kentucky barite deposits are classified as vein or residual deposits. The vein deposits are cavity and breccia fills along faults and joints, commonly in limestone. Residual deposits occur in an unconsolidated clayey residuum formed by weathering of preexisting vein or breccia deposits. Most deposits are mixed ores that contain calcite, fluorite, galena, or sphalerite. Host rocks are almost exclusively formations of Ordovician and Mississippian ages.

Identification and description of more than 150 outcrops, prospects, and abandoned mines, located by field work and literature search, will be presented in a report which should be completed for editorial review before the end of the 1980 calendar year.

### **CHEMICAL CHARACTERISTICS OF CARBONATE ROCKS IN THE HIGH BRIDGE GROUP (MIDDLE ORDOVICIAN) OF CENTRAL AND NORTH-CENTRAL KENTUCKY DEVER, Garland R., Jr.**

The objective of this project is to determine the availability of high-carbonate and high-calcium stone in the High Bridge Group (Middle Ordovician) for industrial uses requiring carbonate rocks of high chemical purity. The High Bridge is a thick (430 to 570 feet), widespread body of limestone and dolomite which is at a mineable depth in central and north-central Kentucky. It is mined in central Kentucky for construction and agricultural stone, and in north-central Kentucky for the production of lime for flux, flue-gas desulfurization, and chemical industries. Chemical characteristics of the carbonate rocks are being determined by the analysis of foot-by-



foot samples from cores donated to the Survey by private companies.

The High Bridge in both central and north-central Kentucky contains thick deposits of chemically pure carbonate rock. Analysis of samples from a Fayette County core show the presence of three zones of high-carbonate stone (16, 28, and 55 1/2 feet thick). The Fayette County deposits closely correlate with the stratigraphic position of three high-carbonate zones (19, 32, and 67 feet thick) in a Boone County core that is 70 miles to the north, suggesting that the deposits may be widespread. A report on the Fayette County core is being prepared; analyses of the Boone County core have been published by the Survey (1974, Inf. Circ. 22). Chemical analyses are being completed on a Grant County core. Project duration is dependent upon the availability of cores to define the regional chemical characteristics of the High Bridge.

### **LIMESTONE RESOURCES IN EASTERN KENTUCKY FOR ENVIRONMENTAL-CONTROL MEASURES USED BY COAL-PRODUCING AND COAL-CONSUMING INDUSTRIES**

**DEVER, Garland R., Jr., and MOODY, Jack R.**

The objective of this project is to determine the availability of limestone and dolomite resources in eastern Kentucky which have chemical characteristics suitable for use in environmental-control measures employed by coal-producing and coal-consuming industries to meet federal and state standards for mine safety and reclamation, water quality, and air quality. During the first four years of the project, 2,087 foot-by-foot samples were taken for chemical analysis from deposits exposed in quarries, mines, and roadcuts along the western border of the Eastern Kentucky coal field and along Pine Mountain in the southeastern part of the coal field. Samples are being analyzed at the Kentucky Center for Energy Research Laboratory (KCERL). A site was selected for coring the shallow subsurface limestone deposit on the Paint Creek uplift in the northern part of the coal field.

Potential sources of stone for fluidized-bed combustion plants are being evaluated at KCERL by conducting sulfur-sorption tests on the principal carbonate lithotypes of each sampled section in eastern Kentucky. Carbonate lithotypes in western Kentucky also are being sampled for testing. Experimental work is being conducted to increase the accuracy of porosity determinations used in

evaluating carbonate rocks for environmental-control measures involving reactive processes. Data entry and storage programs were prepared for storing geologic and geographic data for sampled sections in the KCERL computer. The project is funded by the Institute for Mining and Minerals Research. Its proposed duration is 1976-1982.

### **NON-FUEL MINERAL STATISTICS**

**McGRAIN, Preston**

The Industrial and Metallic Minerals Section of the Kentucky Geological Survey has continued to cooperate with the U.S. Bureau of Mines in the collection and compilation of non-fuel mineral statistics and activities.

A new state mineral information program was inaugurated by the U.S. Bureau of Mines to replace the former state liaison program. The Bureau's liaison office in Frankfort, Kentucky, was closed, and a single individual was assigned to the Bureau's Pittsburgh, Pennsylvania, office to collect data on Kentucky, West Virginia, Tennessee, and Ohio.

The Kentucky chapter of the 1976 Minerals Yearbook was published at the end of the 1979-1980 fiscal year.

### **GEOLOGY AND ORE DEPOSITS OF PART OF THE TABB FAULT SYSTEM, CRITTENDEN COUNTY, KENTUCKY**

**TRACE, Robert D.**

The project is part of a continuing investigation of the geology and ore deposits of the Western Kentucky fluorspar district. The 4-mile-long segment of the Tabb fault system being investigated has been the most productive area in the district, but little has been published on this area for more than 50 years. The study includes the formerly active Lafayette, Blue, Haffaw, Eva Tanguay, and Pigmy mines. Plans call for the results of the study to be published, along with detailed surface and underground maps derived from data from private and public sources. This investigation should contribute to a better understanding of the origin and geologic controls of the mineral deposits of the district. The first draft of a manuscript should be completed by the end of the 1980-1981 fiscal year.



## OIL AND GAS

One of the basic responsibilities of the Kentucky Geological Survey is to provide industry, government agencies, academic institutions, and the general public with information pertinent to the exploration for and development of oil and gas in Kentucky.

The Survey is the official repository for oil and gas well records; a well record library is maintained for public use. Presently, there are approximately 150,000 well records on file. In addition to providing public service, the Survey's Oil and Gas Section is also involved in basic geologic research which includes both regional and local subsurface studies of structure and stratigraphy.

### THE NEW ALBANY-SUNBURY-OHIO BLACK SHALE OF KENTUCKY

**BEARD, John G.**

The New Albany black shale of Devonian age has recently been investigated as a source of crude oil. Analyses indicate that 5 to 25 gallons of crude oil per ton of New Albany black shale can be obtained; the remaining ash contains 10 to 50 parts per million of uranium. In 1977 the Kentucky Geological Survey obtained a contract with the U.S. Department of Energy, Morgantown Energy Technology Center, contract number EW-78-S-21-8215, to characterize the New Albany black shale of western Kentucky. In February 1980 the final report "The New Albany Black Shale of Western Kentucky" was submitted to the Morgantown Energy Technology Center; in July 1980 DOE published it as "Studies of the New Albany Shale in Western Kentucky—Final Report."

The Kentucky Geological Survey and the Kentucky Institute for Mining and Minerals Research initiated a resource study of the Sunbury and Ohio Shales in Lewis and Fleming Counties in April 1980. The project is supported by the Buffalo Trace Area Development Council through the Department of Energy. At present, eight drill sites have been located, permitted, cored, and described in detail. The cores were systematically sampled for complete chemical analysis and partial retort analysis. These data were combined with the abundant material generated by the U.S. Geological Survey-Kentucky Geological Survey geologic mapping program. Resource estimates of the oil and gas potential of the Sunbury and Ohio Shales in Fleming and Lewis Counties are being made. The project has been extended to include Bath, Montgomery, Powell, and

Estill Counties by the Kentucky Department of Energy and the U.S. Department of Energy; to date, 10 drill sites have been located, permitted, and cored, and the required data are being collected.

### NATURAL GAS FIELDS OF WESTERN KENTUCKY DUFFY, Julian E.

The purpose of this project is to review and summarize the development of natural gas in western Kentucky. A map of western Kentucky at a scale of 1:250,000 outlining all known gas fields and individual wells that are currently producing or are abandoned has been completed and submitted for final drafting. An index of fields and wells showing location, productive horizon, depth of pay, date of discovery, and status will accompany the map.

An additional benefit of this project is the incorporation of the individual field summaries into the oil and gas pool open file. The summary will be composed of a base map at a scale of 1:24,000 locating all wells, an index identifying the wells, and a review of the history and production of each field.

### STRUCTURE OF THE KNOX DOLOMITE GOODING, Patrick J.

A state-wide structural map on top of the Knox Dolomite is being prepared to aid in the exploration and development of oil and gas and other mineral resources such as lead and zinc. This map will compliment a similar map published by the State of Tennessee. It will be compiled from subsurface information derived from the examination of well samples, cores, and geophysical logs, and drillers' logs in locations where other information is lacking. The scale will be 1:250,000 with a contour interval of 100 feet. Completion date is July 1, 1981. Over 450 cores, samples, and drillers' logs have been examined, and a literature search has been completed.

### SUBSURFACE STUDY OF THE MISSISSIPPIAN SYSTEM OF EASTERN KENTUCKY NOGER, Martin C.

The purpose of this project is to investigate the roles played by stratigraphy and structure in the entrapment of hydrocarbons in rocks of Mississippian age in eastern Kentucky. The rocks are



divided into three study units, the Pennington Formation, the Newman Limestone, and the Borden Formation. Present research is concentrated on the Pennington Formation.

Cross sections, and structural, isopachous, lithofacies, and production maps at a scale of 1:250,000 are being compiled. Results will be published or open filed.

Studies on the Newman Limestone and the Borden Formation are being conducted by graduate students at some state and adjacent state universities. When these studies are completed they will be incorporated into a comprehensive report on the Mississippian System of eastern Kentucky.

## **CORRELATION OF STRATIGRAPHIC UNITS OF NORTH AMERICA (COSUNA)**

**NOGER, Martin C., DEVER, Garland R., Jr.,  
SMITH, J. Hiram, SCHWALB, Howard R.,  
and WILLIAMSON, Allen D.**

This project is addressed to the long-term need to update the series of North American correlation charts of geologic units published by the Geological Society of America. The new charts will be enhanced by the large amount of subsurface data that has accumulated in recent decades. An adjunct effort is the creation of a central stratigraphic data bank.

Working areas designated for the United States are based on the provinces set up by the Committee on Statistics on Drilling (CSD). Kentucky encompasses parts of the following CSD provinces: 250 (Mississippi Embayment), 300 (Cincinnati Arch), 315 (Illinois Basin), and 160 (Appalachian Basin).

The Kentucky Geological Survey COSUNA Committee has compiled 10 charts for the Kentucky portion of provinces 160, 300, and 315. A preliminary review of these charts is being conducted, and stratigraphic sheets for each unit shown on the charts are being compiled. The charts and stratigraphic sheets are scheduled to be completed for final review by July 1981.

## **COMPUTERIZATION OF OIL AND GAS RECORDS** **NUTTALL, Brandon C.**

The purpose of this project is to provide a unified storage and retrieval system for oil and gas records on file at the Kentucky Geological Survey. The computerization of the well record library is ex-

pected to considerably enhance the speed and efficiency of data retrieval.

In conjunction with the county oil and gas base map project, well record data sets have been computerized and are now available for Bell, Caldwell, Harlan, Letcher, Lewis, and Montgomery Counties. An index of deep test wells has also been computerized as part of a subsurface study of the Cambrian of Kentucky.

## **OIL AND GAS BIBLIOGRAPHY** **PONSETTO, Louis R.**

The new oil and gas information file is organized by county and includes such information as cumulative oil production figures, oil and gas pool maps at a scale of 1:250,000, pool indexes, geologic quadrangle indexes, and county bibliographies.

The new filing system created the need for an oil and gas bibliography. This bibliography is composed of all known publications, including unpublished theses and open-file reports, relative to oil and gas in Kentucky.

The bibliography has been compiled regionally and by individual counties. The regional bibliography is further divided into eastern Kentucky, central Kentucky, western Kentucky, and the Jackson Purchase area. These divisions correspond to the Committee on Statistics on Drilling provinces as designated by the American Association of Petroleum Geologists. The county bibliographies include only those publications that pertain exclusively to the county or areas involving no more than three or four adjoining counties.

This information will be invaluable to the public and will also enhance the efficiency of dealing with general information inquiries.

## **OIL AND GAS COUNTY BASE MAPS** **PONSETTO, Louis R.**

The purpose of this project is to build a file of current oil and gas base maps that give location, identification, and well status for each county in Kentucky. Individual county maps are being compiled on a planimetric base at a scale of 1:48,000 and will be accompanied by an index of wells and a generalized columnar section. These maps and columnar sections are prepared on mylar to facilitate updating and reproduction. As the individual counties are completed, the data will be placed on open file and maintained for the use of industry, government, educational institutions, and the general public.



To date, Barren, Grayson, Greenup, Letcher, Lewis, Rowan, and Todd Counties have been completed and placed on open file; Bell, Caldwell, Carter, Grant, Harlan, and Montgomery Counties lack only generalized stratigraphic columns or final drafting to be complete. Counties in progress are Adair, Clinton, Cumberland, Lawrence, Logan, Martin, Perry, Pike, Pulaski, Anderson, Boyle, Clark, Fayette, Garrard, Jessamine, Madison, Mercer, Washington, and Woodford.

## **CAMBRIAN OF KENTUCKY, OIL AND GAS STUDY WALKER, Frank H.**

This is a subsurface study of a little-understood section of the rock column. Few wells have topped this unit and even fewer have penetrated the entire section. Each year a few additional wells are drilled that penetrate all or part of this unit, adding further to our knowledge. To date, all of the wells on which the Kentucky Geological Survey has any record have been identified and entered into our developing computer system. There is now available an open-file map on the scale of 1:500,000 showing the location and total depth formation of each well. A computer print-out accompanying the map gives details concerning the wells.

## **WATER**

Since its establishment in 1854, the Kentucky Geological Survey has played a vital role in the development and management of water resources in Kentucky, and 1980 was no exception. The current role of the Water Resources Section at the Survey is to collect data and to conduct research in hydrology in order to provide for the optimum development, utilization, and management of the state's water resources. As in the past, many of our programs are carried out in cooperation with the U. S. Geological Survey.

Since the U. S. Geological Survey has been traditionally strong in the area of surface water, it is felt that our greatest contribution can be in the realm of ground water; most of our programs reflect that emphasis.

With the advent of the Environmental Protection Agency, a new awareness has been generated of the tremendous potential of, the difficult problems with, and the overall critical importance of the nation's ground-water resource. If one considers the basic needs of modern civilization—food, clothing, shelter, and energy—there is

virtually nothing that can be produced without large quantities of water. There is also a need to dispose of the vast quantities of waste our system generates. At present, more than 80 percent of our total water use comes from surface-water sources. Yet our lakes and rivers make up less than 1 percent of the total world reserves of fresh water. More than 75 percent is bound up in glacial ice and the remainder, more than 20 percent, is stored in underground aquifers. According to the U. S. Geological Survey, one million cubic miles of the world's ground-water reserves are estimated to be stored within one-half mile of the land surface. Surely the efficient development, utilization, and protection of ground water is a major challenge of the 80's. It is our goal to meet that challenge.

## **HYDROGEOLOGY OF THE EASTERN KENTUCKY COAL FIELD REGION**

**CORDIVIOLO, Steven, and KIEFER, John D.**

The objectives of this program are to provide baseline geologic and hydrogeologic information about ground water in the Eastern Kentucky coal field region and to assess the effects of surface mining on ground-water quality and quantity. Information gained from this project will add to the understanding of the ground-water system throughout the Eastern Kentucky coal field and aid regulatory agencies and the mining industry in developing reliable ground-water monitoring programs to insure adequate aquifer protection. The study is funded by the Water Resources Division of the U.S. Geological Survey. The project began in January 1980 and is scheduled for completion in September 1984.

A network of 10 permanent ground-water observation wells will be installed in the 1,100-square-mile drainage basin of the North Fork of the Kentucky River, upstream of Jackson. These observation wells will provide long-term information on precipitation and recharge to the regional aquifer, if an aquifer exists. Within the larger watershed, three or four first- or second-order watersheds will be selected for detailed study. The smaller drainages will include a pristine watershed in which no mining will occur during the term of the project, a watershed in which some portion will be mined and reclaimed during the project, a watershed on which mining and reclamation has occurred, and a watershed on which mining has occurred but on which there has been no reclamation. Approximately 40 borings will be drilled for the detailed studies.



Hydrogeologic, stratigraphic, and water-quality information will be collected and compiled.

A conceptual model of the hydrogeology of the coal field will be developed. Products of this project will include reports and maps which will be useful in preparing pre-mining, mining, and post-mining plans and will be helpful in assessing environmental impacts to both surface and deep mining of coal.

Most of the work to date has involved setting up the project; hiring two additional hydrologists, a driller, and a driller's helper; and ordering the many pieces of equipment necessary to do the drilling. The 10 observation wells should be installed by the end of June 1981, and drilling will commence on the smaller watersheds immediately thereafter.

## **AQUIFER CHARACTERIZATION, KENTUCKY**

**CORDIVIOLO, Steven, and TOWNSEND, Margaret A.**

The purpose of this study is to identify and delineate ground-water aquifers in Kentucky presently supplying or having the potential to supply potable water. The Federal or State Underground Injection Control Program will protect these aquifers from possible contamination by injection of liquid wastes underground. The study is funded by the Kentucky Department for Natural Resources and Environmental Protection, Division of Water.

Guidelines set forth by the U.S. Environmental Protection Agency set a minimum of 10,000 parts per million total dissolved solids concentration in ground water as the criteria for protecting aquifers. In Kentucky, very little is known about ground water having total dissolved solids concentrations within the indicated range, as most of the potable water presently being used is below this figure.

Drillers' logs, brine analyses, and various indirect techniques, which include the use of geophysical logs, are being utilized to delineate salt-water zones on a county-by-county basis. To date, the preliminary evaluation for the occurrence of salt-water zones has been completed in the Jackson Purchase region; the Bluegrass region; Breckinridge, Meade, Hardin, and Grayson Counties in the Mississippian Plateau; Lewis, Boyd, Rowan, Carter, and Greenup Counties in eastern Kentucky; and Trigg, Christian, Todd, Logan, Simpson, Allen, Monroe, Cumberland, and Clinton Counties along the Tennessee border. The county and multicounty maps, cross

sections, and reports are in various stages of completion. The entire state is projected to be completed by September 1981.

Final products of the study will include maps, charts, and tables which will enable the Federal or State agency in charge of the program to make sound judgments on any requests for permits to inject liquid wastes underground.

## **GEOHYDROLOGY OF THE OIL SHALE AREAS OF KENTUCKY**

**KIEFER, John D.**

The purpose of this Kentucky Geological Survey-U. S. Geological Survey cooperative study is to describe the general hydrology of the oil shale areas of Kentucky, including an inventory of ground-water yields from the shale and adjacent units, methods and directions of ground-water flow through the shale, and ground-water quality studies. The study is to include the entire area along and adjacent to the outcrops of the shale, but will focus on areas in which initial development of the oil shale is most likely to occur. These studies will add to the hydrologic knowledge of a region of Kentucky that has been generally ignored in previous studies, and it will assist regulatory agencies and industry in the proper development of the oil shale resource.

A preliminary study is currently underway and is expected to generate an initial open-file report to be used in planning the remainder of the project. The overall length of the project is to be approximately three years, and a summary report will be published at the completion of the project.

## **MISSISSIPPIAN PLATEAU WATER RESOURCES**

**KIEFER, John D.**

The purpose of this Kentucky Geological Survey-U. S. Geological Survey cooperative investigation is to provide information on water levels, directions of ground-water movement, and ground-water quality to aid in locating additional ground-water supplies and to guide planning agencies in making decisions regarding the conflicting uses of karst regions.

Major objectives are: (1) to construct maps of the potentiometric surface to show the general direction of ground-water movement, (2) to provide drillers, planners, and users with information on the Mississippian aquifers, (3) to gain a better understanding of the areas of recharge and discharge, and (4) to provide a data base for future studies.



The project area coincides with the area of outcrop of Mississippian-age rocks in central and western Kentucky. The first report resulting from this project, Water Resources Investigation 78-25, "Potentiometric Surface of the Mississippian Aquifer in Parts of Trigg, Lyon, Caldwell, and Christian Counties, Mississippian Plateau Region, Kentucky," by R. O. Plebuch, has been published and a second report which includes Meade County and parts of Breckinridge, Hardin, and Larue Counties should be published soon.

## Other Research

### ECONOMIC GEOLOGY OF ROWAN COUNTY, KENTUCKY

**McGRAIN, Preston, and NOGER, Martin C.**

This will be another in the series of reports describing the economic geology of selected Kentucky counties. Geologic formations of Rowan County contain a number of mineral-resources commodities which have been or are potentially important to the economy of the county and adjacent area. This report will focus attention on these commodities and record data which may be useful in their exploration and development. It will summarize and synthesize information relative to the several geologic resources.

The report will contain a well-illustrated text with accompanying geologic and mineral-resource maps. In addition to being useful to those interested in exploration for and development of mineral resources, this geologic overview should be helpful to those concerned with engineering and environmental projects, industrial development, land utilization, and water-resource development. A manuscript should be ready for editorial review before the end of the 1980-1981 fiscal year.

## COOPERATIVE PROGRAMS

### Geologic Mapping

In 1960, the Commonwealth of Kentucky, University of Kentucky, and the Kentucky Geological Survey in cooperation with the U. S. Geological Survey began a project to map the Commonwealth geologically at a scale of 1:24,000 (1 inch on the map equals

2,000 feet on the ground); the maps were to be published as U. S. Geological Survey geologic quadrangle maps. The last of 707 geologic maps was printed on October 30, 1978.

Benefits of the mapping project appear to be exceeding the most optimistic expectations. Reports of discoveries of coal, fluorspar, petroleum, stone, and other minerals resulting directly or indirectly from the project indicate a benefit-cost ratio in excess of 50:1. Savings from proper design and location of highways, factories, waste-disposal sites, and other facilities could enhance this figure. Total cost of the program was \$20,927,500; this cost was shared equally by State and Federal governments.

Users of the new geologic maps represent a broad spectrum of Kentucky activities—agriculture, business, education, government, and industry. More than 100,000 copies have already been sold by the Kentucky Geological Survey to geologists, engineers, landowners, planners, realtors, researchers, soil scientists, students, teachers, and many others. Approximately 150 scientific articles resulting from the project have been published or are currently in progress.

### NEW GEOLOGIC MAP OF KENTUCKY

A major bonus of the geologic mapping program will be a new Geologic Map of Kentucky at a scale of 1:250,000 (1 inch on the map equals 4 miles on the ground). The new map has been compiled on three sheets by synthesizing and generalizing the 707 geologic quadrangle maps resulting from the Kentucky Geological Survey—U.S. Geological Survey cooperative mapping project. This synthesis will make it possible to delineate large-scale trends and distribution of geologic units and structures that are difficult to comprehend on the larger-scale individual quadrangle maps. In addition to depicting geologic relationships for the entire State, the new geologic map will also be useful in preparation of illustrations for reports dealing with major geologic provinces within Kentucky.

The map is in the final stages of cartographic preparation with a color proof scheduled to be printed in December 1980. Estimated publication date is March 1981.

### Topographic Mapping

The Kentucky Geological Survey has an ongoing cooperative program with the U.S. Geological Survey for topographic map revision in Kentucky. This program, which is designed to maintain re-



vised and up-to-date maps for all areas of the Commonwealth, has been active since Kentucky became the first major state to be entirely mapped topographically at a scale of 1:24,000, more than 20 years ago.

During fiscal year 1979-80, 74 quadrangles were revised; each quadrangle encompasses 7.5 minutes of latitude and 7.5 minutes of longitude and covers an area of approximately 59 square miles. Of this total, 21 maps were standard revisions which involve recontouring in areas where there have been changes in the topography; changes of these maps are field checked. The remaining maps were photorevisions on which changes are compiled from aerial photographs but are not field checked. Orthophotoquads, which are corrected aerial photographs overprinted with minimum geographic information in standard 7.5-minute quadrangle format, are available for portions of eastern and south-central Kentucky.

Work has been progressing on the preparation of intermediate-scale (1:100,000) maps in a 1-degree by 30-minute format for western and southeastern portions of the State. Planimetric maps at this scale are now published for the Paducah, Hazard, Middlesboro, and Pikeville areas. Intermediate-scale planimetric maps are also available in a county format for a number of Kentucky counties. Work is continuing on county topographic maps at a scale of 1:50,000 for Boone, Campbell, Kenton, Jefferson, and McCracken Counties. Slope maps will be prepared for these counties after the topographic mapping is finished.

A map showing status of the topographic mapping revision program is available free upon request to the Kentucky Geological Survey.

## National Cartographic Information Center

In March 1980 the Kentucky Geological Survey became the state affiliate of the National Cartographic Information Center (NCIC). NCIC was established by the U.S. Geological Survey in 1974 as the national repository for information regarding maps, charts, aerial photography, space imagery, digital map data, and geodetic control. Its mission is to organize cartographic data of national significance into a usable information system while the data itself remains with the original holder.

Since joining as a state affiliate, KGS-NCIC has seen the number of monthly users increase geometrically. Through affiliation with Publication Sales, KGS-NCIC provides better, more comprehensive service to Kentucky map users. A vigorous data acquisition program has recently begun. Through this KGS-NCIC will attempt to inventory and make available to the general public all cartographic products dealing with the state of Kentucky. As an affiliate member of NCIC, the Survey will become the state center for cartographic information.

## Water Resources

The Kentucky Geological Survey has maintained an excellent working relationship with the U. S. Geological Survey throughout the years. Water-related cooperative programs with the U. S. Geological Survey date back to as early as 1920. The cooperative programs have covered a wide range of water-information needs on both Federal and State levels and have provided data for more than 200 maps, publications, and open-file reports, many of which are currently available from the Kentucky Geological Survey. These data provide the basis for answering several hundred requests annually from individuals, industry, and State and Federal agencies. Most of the information is summarized in an annual report entitled "Water Resources Data for Kentucky," published by the U. S. Geological Survey. This report combines streamflow data, water-quality data for surface and ground water, and ground-water level data from the basic network of observation wells. Additional information on ground water can be found in the Hydrologic Atlases which are available for all areas of Kentucky. Both the "Water Resources Data for Kentucky" and the Hydrologic Atlases are available from the Kentucky Geological Survey.

The present cooperative program for water resources calls for a total funding of over \$1,000,000. Following are brief descriptions of the projects.

*1. Surface-Water Stations*—A Statewide network to collect surface-water data for a variety of uses such as research and special studies, assessment of water resources, waste disposal, pollution control, planning and design of facilities, and forecasting of water levels has been in continuous operation since 1938. Prior to 1960, information from this program was published annually in the U. S. Geological Survey Water Supply Paper series, "Surface



Water Supply of the United States." From 1961 to 1970, 5-year compilations were published. Daily streamflow records for Kentucky from 1961 to 1974 were also published in annual U. S. Geological Survey open-file reports. Records since 1975 are found in the annual publication, "Water Resources Data for Kentucky."

2. *Water-Quality Stations*—This Statewide network of approximately 60 sites where water quality is monitored on a regular basis provides data for broad Federal and State planning and for the management of waterways. This program has been continuous since 1949. Prior to 1971, these data were published annually in the Water Supply Paper series, "Quality of Surface Waters of the United States." For the years 1964 to 1974, these data for Kentucky were also released annually in open-file U. S. Geological Survey reports. Records since 1975 are found in the annual report, "Water Resources Data for Kentucky."

3. *Ground-Water Stations*—The purpose of this Statewide network is to collect water-level data for a long-term base which will allow data collected during hydrologic investigations to be compared against the base-line data. This information can also be used to predict future conditions, to detect and define pollution and supply problems, and to manage ground-water resources. The program has been continuous since 1943. Prior to 1975, ground-water levels and artesian pressures in observation wells in Kentucky were reported in the 5-year U. S. Geological Survey Water Supply Paper series, "Ground-Water Levels in the United States, Southeastern States." Records since 1975 are found in the annual publication, "Water Resources Data for Kentucky."

4. *Sediment Stations*—A network of stations for sampling stream sediment provides data for State and Federal planning and for management of interstate waters. Six stations are sampled on a daily basis, and 43 stations are sampled once a week or more frequently during periods of abnormally high or low streamflow. Information can be found in "Water Resources Data for Kentucky."

5. *Mississippian Plateau Potentiometric Map*—This project is designed to provide detailed information on water levels, directions of ground-water movement, and ground-water quality in order to aid in locating additional ground-water supplies and to guide planning decisions regarding the conflicting uses of karst regions. The project area coincides with the area of outcrop of Mississippian-age rocks in central and western Kentucky. The first report resulting from this project, Water Resources Investigation 78-25, by R. O. Plebuch, was published this summer and encompasses most of

Trigg County and portions of Lyon, Caldwell, and Christian Counties.

6. *Water from Coal Mines in Johnson and Martin Counties*—The purpose of this project is to provide geologic and hydrogeologic information on quantity and quality of potential water supplies available from abandoned coal mines. This information can then be used by communities and industries in planning for future water supplies. A summary report of this project is currently in review and is due for publication in 1981.

7. *Sediment Characteristics of Kentucky Streams*—The objective of this project is to define sediment yields and particle-size distribution of suspended and bed material transported by streams draining the major physiographic and land-use areas of the State. Sediment stations are also installed for selected problem drainage areas.

8. *Water Resources of Levisa Fork and the Big Sandy River Basin*—This project is planned as a reconnaissance of the Levisa Fork of the Big Sandy River and the Big Sandy River basin from the confluence of the Levisa and Tug Forks to the mouth. Major objectives are to study the water quantity, runoff characteristics, magnitude and frequency of flooding, and quality of surface water throughout the basin. The general features of occurrence of ground water in the basin, yields, water-level fluctuations, water-bearing characteristics of rocks, gains or losses to streams, and ground-water quality will be determined.

9. *Hydraulics of Bridge Sites*—This project, continuous since 1939, provides hydraulic factors at proposed bridge sites to assure that adequate information is available for proper design.

10. *Geohydrology of the Oil Shale Areas of Kentucky*—This project to describe the general hydrology of Kentucky's oil shale areas includes an inventory of ground-water yields from the shale and adjacent units, methods and directions of ground-water flow through the shale, and ground-water quality studies. The study will concentrate on areas in which initial development of the oil shale is most likely to occur.

## PUBLICATIONS

Publications are the means by which the results of research projects and field investigations of the Kentucky Geological Survey are



made available to the public. Making this information readily available is one of the major functions of the Survey as a public geologic research organization. These publications serve as a vehicle for the dissemination of geologic data generated by Survey staff members, by members of cooperating agencies, and by other earth scientists doing research on Kentucky's geology and mineral resources. The Survey also publishes the proceedings of technical sessions and symposia, and guidebooks for geologic field conferences.

Publications of the Kentucky Geological Survey are made available at a nominal cost and have received widespread distribution. Distribution of maps and publications is handled through the sales office which is located in the Small Animal Building on the University of Kentucky campus. Total sales for fiscal year 1979-80 amounted to about \$86,000.

During the past fiscal year, the Kentucky Geological Survey issued the following publications:

## Information Circulars

**Information Circular 2. Bibliography of the Kentucky Geological Survey, 1839 through 1978, by Howard R. Schwalb and others, 171 p.**

It is the hope of the authors that all the various publications and maps of the Kentucky Geological Survey are included in the bibliography. The publications are listed chronologically and by author. Maps are listed in chronological order, as nearly as possible. This publication should be useful to those doing research on the geology of Kentucky.

**Information Circular 3. Catalog of Well Samples, Cores, and Auger Samples on File at Kentucky Geological Survey, by Patrick J. Gooding, 408 p.**

More than 13,000 sets of well cuttings, 400 sets of cores, and 1,000 sets of auger-hole samples are listed in this catalog. Samples processed after May 31, 1979, are not included. This catalog will be invaluable to the members of industry, government, academic institutions, and the general professional community who examine the cores and samples on a daily basis.

## Thesis Series

**Thesis Series 1. Stratigraphic Relationships in the Lower and Middle Newman Limestone (Mississippian), East-Central and Northeastern Kentucky, by Garland R. Dever, Jr., 49 p., 30 figs.**

A complex series of depositional, tectonic, diagenetic, and erosional events are recorded in six lithologic units in the lower and middle Newman Limestone of east-central and northeastern Kentucky. The Newman was deposited during renewed transgression across the area in Late Mississippian time, following regressive deposition of detrital sediments during the Early Mississippian. The Late Mississippian marine advance was interrupted by two periods of renewed uplift along the early Paleozoic Waverly arch, which exposed carbonate sediments to subaerial diagenesis and erosion. Recurrent movement along a Precambrian basement fault system, in association with the second period of movement along the arch, caused differential uplift of the northern part of the area. The tectonic activity was followed by erosional thinning, or, in parts of the area, complete removal of rock units. The effects of uplift and erosion limited or modified the areal extent of deposition during subsequent transgression.

The Newman consists of subtidal, tidal-flat, and supratidal limestones, with lesser amounts of dolomite and detrital clay, silt, and sand. Features developed during exposure to subaerial diagenesis, and the varied areal distribution and thickness of lithologic units furnish the principal evidence of tectonic, diagenetic, and erosional events.

## Special Publication

**Special Publication 1. Bibliography of Karst Geology in Kentucky, by James C. Currans and Preston McGrain, 59 p.**

More than 600 articles, maps, and reports dealing with karst features in Kentucky are listed in this bibliography. Geographic and subject indexes are included to aid both the scientific and non-professional investigator.

## Reprints

**Reprint 4. Oil and Gas Developments in East-Central States**



in 1978, by G.L. Carpenter and others. Reprinted from the *American Association of Petroleum Geologists Bulletin*, v. 63, no. 8 (August 1979), p. 1324-1337, 4 figs., 10 tables.

In Kentucky 924 oil and gas tests were drilled in 1978, down 8.1 percent from 1977. The 351 exploratory tests, down from 365 in 1977, resulted in 38 oil wells and 33 gas wells, a success rate of 20.2 percent. Development wells were 63 percent successful, resulting in 256 oil wells and 105 gas wells. Exploratory interest in Valmeyeran production in western Kentucky waned in 1978, despite encouraging discoveries elsewhere in the Illinois Basin. Seismic activity in eastern Kentucky was quite good, but deeper drilling declined despite large blocks of acreage held by the majors. Major discoveries in Cambrian-Ordovician strata in the Rome Trough will be necessary to reverse a declining production trend. Crude oil production in Kentucky in 1978 was 5,712,339 bbl, down 13.19 percent from 1977.

**Reprint 5. The Mississippian and Pennsylvanian (Carboniferous) Systems in Kentucky**, by Charles L. Rice and others. Reprinted from *U.S. Geological Survey Professional Paper 1110-F*, 32 p., 18 figs.

Kentucky is unique among the states of the eastern United States in that it contains parts of two major sedimentary basins that have nearly complete successions of Carboniferous rocks. These basins, The Appalachian and Eastern Interior, each contain more than 2,100 meters of Mississippian and Pennsylvanian strata.

**Reprint 6. The Mineral Industry of Kentucky, 1976**, by William T. Boyd and Preston McGrain. Reprinted from *U.S. Bureau of Mines Minerals Yearbook, 1976*, 15 p., 2 figs., 10 tables.

The value of mineral production in Kentucky increased 14 percent in 1976 to a total of \$3.11 billion. This increase largely reflects the State's continuing first place in coal production, the fluctuating spot market coal prices, and some increases in unit value of petroleum produced from stripper wells. Fuel resources—coal, natural gas, and petroleum—accounted for approximately 96 percent of the total value of all minerals produced in the State in 1976. Non-fuel minerals produced included cement, clays, fluorspar, lime, sand and gravel, stone, and zinc.

## Guidebooks for Geology Field Trips

**Depositional Environments of Pennsylvanian Rocks in Western Kentucky**, by Peter W. Whaley and others (*Annual Field Conference of the Geological Society of Kentucky, 1979*), 48 p., 47 figs., 1 plate, 1 table.

Environments of deposition of Pennsylvanian rocks in western Kentucky are examined. The stratigraphy and depositional environments of coal and related rocks are particularly emphasized. Samples of several important coals of the Western Kentucky coal field can be collected.

## Map

**Structure and Isopach Map of the New Albany-Chattanooga-Ohio Shale: Eastern Sheet**, by Linda Provo Fulton. Scale 1:250,000.

## In Press or Editing Completed

The following publications are either at the printer or have undergone final editing and are being processed for printing:

**Special Publication 2. *Proceedings of Technical Sessions of the Kentucky Oil and Gas Association, 1972-1973.***

**Special Publication 3. *Proceedings of Technical Sessions of the Kentucky Oil and Gas Association, 1974.***

**Special Publication 4. *Proceedings of Technical Sessions of the Kentucky Oil and Gas Association, 1975-1976.***

**Special Publication 5. *Proceedings of Technical Sessions of the Kentucky Oil and Gas Association, 1977.***

**Special Publication 6. *Proceedings of Technical Sessions of the Kentucky Oil and Gas Association, 1978-1979.***



**Thesis Series 2.** *Kimberlite of Elliott County, Kentucky*, by Stephen L. Bolivar.

**Map.** *Residual Total Intensity Aeromagnetic Map of Kentucky: Central Sheet*, by R.W. Johnson, Jr., and others. Scale 1:250,000.

**Map.** *Residual Total Intensity Aeromagnetic Map of Kentucky: Eastern Sheet*, by R.W. Johnson, Jr., and others. Scale 1:250,000.

## Open-File Material

The Kentucky Geological Survey maintains an open file of reports, maps, manuscripts, theses, and other material including logs of core holes, sample descriptions, and gravity base station networks. Some of this material will eventually be published but has been placed on open file in order to make the data available prior to publication.

During the past year, the Survey began preparation of a series of open-file oil and gas county base maps. These maps show the locations of all known wells drilled for oil or gas in a county. They are prepared at a scale of 1:48,000 and indicate whether the wells produced oil or gas, have been abandoned, or were completed as dry holes. A well index and columnar stratigraphic section accompany the maps. Base maps for seven counties are presently available, and work is in progress for 25 counties.

Open-file reports are available for inspection at Survey offices in Breckinridge Hall on the University of Kentucky campus during regular office hours. Copies of reports which consist of page-size material or for which the Survey has reproducible copy are available for purchase. The Kentucky Geological Survey also maintains copies of most open-file reports dealing with Kentucky geology which are prepared by the U.S. Geological Survey.

## PAPERS BY STAFF MEMBERS IN OUTSIDE PUBLICATIONS

**Cordiviola, Steven, 1980**, Hillslope processes in southwestern Arizona, *in* Studies in western Arizona: Arizona Geological Society Digest, v. 12, p. 53-62.

**Cordiviola, Steven, Townsend, M.A., Gilmore, M.K., and Dugan, T.E., 1980**, Indirect methods for delineating fresh-water aquifers in areas with limited water-quality information: Geological Society of America Abstracts with Programs, v. 12, no. 7, p. 406.

**Dever, G.R., Jr., McGrain, Preston, and Moody, J.R., 1980**, Stratigraphic and economic significance of the *Lithostrotion (Siphonodendron) genevievensis* zone in the Ste. Genevieve Limestone (Mississippian) of western Kentucky: Geological Society of America Abstracts with Programs, v. 12, no. 5, p. 223.

**Dugan, T.E., Cordiviola, Steven, Townsend, M.A., and Gilmore, M.K., 1980**, *See* Cordiviola, Steven, Townsend, M.A., Gilmore, M.K., and Dugan, T.E., 1980.

**Gilmore, M.K., Cordiviola, Steven, Townsend, M.A., and Dugan, T.E., 1980**, *See* Cordiviola, Steven, Townsend, M.A., Gilmore, M.K., and Dugan, T.E., 1980.

**McGrain, Preston (with Boyd, W.T.), 1979**, The mineral industry of Kentucky, 1976: U.S. Bureau of Mines Minerals Yearbook 1976, v. 2, p. 297-311.

**McGrain, Preston, Dever, G.R., Jr., and Moody, J.R., 1980**, *See* Dever, G.R., Jr., McGrain, Preston, and Moody, J.R., 1980.

**Moody, J.R., Dever, G.R., Jr., and McGrain, Preston, 1980**, *See* Dever, G.R., Jr., McGrain, Preston, and Moody, J.R., 1980.

**Townsend, M.A., Cordiviola, Steven, Gilmore, M.K., and Dugan, T.E., 1980**, *See* Cordiviola, Steven, Townsend, M.A., Gilmore, M.K., and Dugan, T.E., 1980.

**Townsend, M.A. (with Turk, L.J., and Sorber, C.A.), 1980**, Hydrogeology and health effects of a sewage irrigation site, Kerrville, Texas: Geological Society of America Abstracts with Programs, v. 12, no. 7, p. 537.

**Trace, R.D., 1979**, Exploration for fluorspar vein deposits in western Kentucky: Economic Geology, v. 74, no. 7, p. 1684-1687.

## SERVICES Well Record Library

The Oil and Gas Section of the Kentucky Geological Survey is the official repository for records of all wells drilled in the State. A



variety of records such as drillers' logs, wireline logs, well-location survey plats, plugging affidavits, and completion reports are on file for an estimated 150,000 wells. Records for approximately 2,500 wells are processed and recorded annually by the Survey.

The Survey is obligated to make all such data and records available and open to the public. Facilities in the Well Record Library for examination of records are used daily by representative of industry, government, academic institutions, and the general public. An estimated 45,000 records are duplicated annually in reply to mail orders, telephone requests, and walk-in requests.

## Sample Library

The Kentucky Geological Survey Well Sample and Core Library is the official repository for well cuttings and core samples of wells drilled in Kentucky. Approximately 400,000 feet of well cuttings are processed, catalogued, and filed annually. At the present time there are cuttings from over 14,000 wells and approximately 400 cores on file in the library.

The objective of the Survey is to selectively provide, wherever possible, a representative set of well cuttings or core samples for every Carter coordinate section (approximately 1 square mile) in the State. Also, the Survey strives to make these samples available to industry, government, academic institutions, and the general professional community by providing adequate space and facilities in the library for sample examination.

## Public Information Services

Questions concerning various aspects of Kentucky geology come in to the Survey almost daily. These questions come from landowners, teachers, businessmen, farmers, schoolchildren, spelunkers, rock and mineral collectors, persons planning vacations in Kentucky, and many others, residing within the Commonwealth and outside the State. Most inquiries are answered by providing leaflets, maps, and pamphlets designed for this purpose, or by recommending available publications and maps that deal with the topic of interest.

Services include identification of rock, mineral, and fossil specimens and the distribution of rock and mineral sample sets to schoolchildren. Displays are prepared for conferences, fairs, rock

and mineral shows, and other public functions. These exhibits are designed to inform people about the many interrelationships of geology to everyday life and educate them in the use of maps and other geologic publications.

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