

108TH ANNUAL REPORT OF THE STATE GEOLOGIST

of

INDIANA GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES

for

July 1, 1983 - June 30, 1984

GEOLOGICAL SURVEY
ONE HUNDRED AND EIGHTH ANNUAL REPORT OF THE STATE GEOLOGIST

PERSONNEL

Permanent Personnel

Administration

John B. Patton	State Geologist
Maurice E. Biggs	Assistant State Geologist
Mary E. Fox.	Mineral Statistician
E. Coleen George	Principal Secretary

Coal and Industrial Minerals Section

Donald D. Carr	Geologist and Head
Curtis H. Ault	Geologist and Associate Head
Donald L. Eggert	Geologist
Gordon S. Fraser	Geologist (To March 15, 1984)
Denver Harper.	Geologist
Nancy R. Hasenmueller.	Geologist
Walter A. Hasenmueller	Geologist
Paul N. Irwin (OSM).	Geologist
Nelson R. Shaffer.	Geologist
Christopher R. Smith (NRC)	Geologist (To May 4, 1984)
	Geologist (From June 13, 1984)
Belita J. Gerth.	Secretary (From January 9, 1984)
Donna Isard.	Secretary (From November 14, 1983 to December 23, 1983)
Susan E. Rumple.	Secretary (To November 15, 1983)
Kathryn R. Shaffer	Secretary

Drafting and Photography Section

William H. Moran Chief Draftsman and Head
Barbara T. Hill. Photographer
Richard T. Hill. Senior Geological Draftsman
Roger L. Purcell Senior Geological Draftsman
George R. Ringer Photographer
(To January 31, 1984)
Kimberly H. Sowder Draftsperson/Photographer
(From March 5, 1984)
Wilbur E. Stalions Artist/Draftsman
James R. Tolen Senior Geological Draftsman

Educational Services Section

John R. Hill Geologist
(From April 1, 1984)
Reevan D. Rarick Geologist
(To March 31, 1984)

Geochemistry Section

Richard K. Leininger Geochemist and Head
Margaret V. Ennis. Instrument Analyst
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Louis V. Miller. Coal Chemist
Jimmy J. Johnson Electronic Technician
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(To December 30, 1983)
Belita Gerth Secretary
(From January 9, 1984)

Geology Section

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Ned K. Bleuer Glacial Geologist
Gordon S. Fraser Geologist
(From March 1, 1984)
Henry H. Gray Head Stratigrapher
Edwin J. Hartke Environmental Geologist
John R. Hill. Glacial Geologist
(To March 1, 1984)
Carl B. Rexroad Paleontologist
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Geophysics Section

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Joseph F. Whaley Geophysicist
Thomas W. Chitwood Geophysical Assistant
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Petroleum Section

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Brian D. Keith Geologist
Stanley J. Keller Geologist
John A. Rupp Geologist
Dan M. Sullivan Geologist
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Patsy Starks Secretary and Curator of Records

Publications Section

Gerald S. Woodard Editor and Head
Shelley S. Fox Senior Records Clerk
Pat Gerth Principal Records Clerk

Other Personnel

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(May 20, 1984 to June 30, 1984)

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(August 28, 1983 to December 17, 1983)

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 (May 23, 1984 to June 30, 1984)
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 Julie Gordon Laboratory Assistant
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 David Hall Laboratory Assistant
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 Paul Hickner Laboratory Assistant
 (July 1, 1983 to August 26, 1983)
 Michael Hudelson Laboratory Assistant
 (September 6, 1983 to December 8, 1983)
 Mark Hudson. Laboratory Assistant
 (January 16, 1984 to April 20, 1984)
 Robert Kirk. Laboratory Assistant
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 William Nellist Laboratory Assistant
 (May 2, 1984 to June 30, 1984)
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 Derek Perrigo. Laboratory Assistant
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 Julie Warren Laboratory Assistant
 (September 13, 1983 to May 2, 1984)
 Bruce Wilcer Field Assistant
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Lisa Mattingly Laboratory Assistant
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COAL AND INDUSTRIAL MINERALS SECTION

INTRODUCTION

During the year, geologists of the Coal and Industrial Minerals Section answered more than 800 requests for information from mineral producers, private citizens, and other geologists. The Section's geologists conducted geological research on 37 projects to find and evaluate mineral resources in the state. Included in the studies were the investigation of the potential for petroleum from black shale in several parts of the state and of sources of high-purity limestone for whiting and fillers, the mapping of coal resources in several counties in southwestern Indiana, the mapping of sand and gravel resources in several of the major river valleys of Indiana, and the collection and compilation of industry and Survey file maps of surface and underground coal mines in Indiana.

Present or past discoveries and characterizations of mineral resources in Indiana by Section geologists were responsible in part for location of a limestone fine-grind plant that was under construction at the end of the year and the planning for a second plant in northern Indiana, the continued exploration for low-sulfur and other coal resources by industry in southwestern Indiana, the site evaluation for a gypsum plant in northern Indiana, and the continued industry interest in oil-shale prospects in southeastern Indiana.

To support the above service and activities, members of the Section continued research and mapping of coals in seven counties, of oil-shale resources in several areas in the state, and limestone resources in parts of northern Indiana. Archiving of geological data, an essential basis for our service, included a mine-mapping project and computer filing of voluminous point-source coal data. Isotope analysis and a detailed investigation to determine the environment of deposition of black shales led to a much better understanding of their petroleum potential than was known before.

The quantity and quality of our research was reflected in the publication of 29 professional abstracts and papers by members of the Section. Section geologists were active as officers or participants for both national and local professional organizations and had a major role in conducting a national meeting of about 4,000 professional geologists and students in Indianapolis last fall.

COMPLETED PROJECTS OR MAJOR PARTS OF PROJECTS

Compendium of rock-unit stratigraphy for Pennsylvanian rocks
Coal map for Greene County
Faulting and other structures in mines in southwestern Indiana
Annotated bibliography of Indiana geology for period from 1956 to 1975
Oil-shale prospects of the New Albany Shale in southeastern Indiana
Origin and economic geology of the Springfield Coal Member in Gibson County
Correlating several coal members and standardizing names in the Illinois Basin

RESEARCH PROJECTS

CLAY AND SHALE

General

Numerous samples from cores and outcrops of clay and shale were sampled and sent to the U.S. Bureau of Mines for ceramic analysis. Mineralogic analyses of samples and limited chemical analyses were made, and efforts to develop an X-ray diffraction method to determine total mineralogy of these rocks were continued. Several professional papers were prepared, and research continues, particularly on stable-isotope studies.

Pennsylvanian black shales

Many samples of Pennsylvanian black shales were collected and analyzed this year to determine mineralogy, chemistry, and oil yield. Results from 126 samples were obtained. A report was made to the Department of Energy, and several professional papers were prepared detailing the results, including the results of numerous sulfur-isotope analyses.

New Albany Shale

During the past year two cores of the New Albany Shale were drilled to obtain additional information on the stratigraphic and geochemical nature of the shale in central and west-central Indiana. Data from the cores and past investigations were published in reports on stratigraphy, mineralogy, oil-shale developments in Indiana, and variability of the shale. Research continued on the geology, mineralogy, and chemistry of the New Albany Shale.

COAL

Deep drilling program for coal

This project was initiated to gather information on deep coal resources in Indiana. Through the drilling of 15 holes in six counties we have obtained information on thickness, depth, quality, reserves, and for several holes, the methane content of coal. The information obtained is released to the public after each hole is drilled, and it has proved useful in assessing resources and mining conditions for possible underground mines.

Preliminary coal maps of Posey, Greene, and Owen Counties

These projects continue our county reconnaissance mapping of the

distribution, structure, and mined areas of coal. Collection of drilling data and construction of the map continues in Owen County. The map for Greene County was completed and is being drafted for publication. Some detailed correlations of rock units were made in the northern part of Posey County.

Coal resources of Gibson County

Maps showing the distribution, structure, and thickness of several coalbeds and their associated strata in Gibson County were completed, advancing our understanding of the origin of the thick low-sulfur Springfield Coal Member (Petersburg Formation) in the county. A report on the thickness and quality of the Springfield Coal Member as a function of differential compaction of precursor sediments was presented at a professional meeting.

Coal resources of Vanderburgh County

Driller's logs and geophysical logs from northern Vanderburgh and western-most Warrick County were reviewed to determine the thickness and distribution of coals and other significant stratigraphic units in the area. Several stratigraphic cross sections were compiled.

Subsidence caused by underground mining of coal

Fieldwork was conducted to establish the relationship between hydrologic changes and mine subsidence. Existing boreholes into abandoned mines were located to be used in dye-tracer experiments, and a dye-tracer experiment was conducted at a subsidence event near Linton, Indiana.

Roof stability and geologic discontinuities in coalbeds

Visits were made to surface mines that have recently encountered geologic discontinuities, and sketches and descriptions of the features were recorded. Fieldtrip reviews were made of a variety of geologic discontinuities that have been studied and recorded in past years.

Coal resources of Sullivan County

Work continued on a report discussing the coal geology and mining history of the county. Many maps showing the structure, thickness, and geologic irregularities of major coals in the important mining districts were included in the report.

Demethanization of coal

This continuing study will determine the methane content of coalbeds in Indiana using desorption methods developed by the U.S. Bureau of Mines. As cores of coal are drilled with the Survey's drilling rig, degassification of the coal is conducted.

Indiana coal data system

Much progress was made again this year on the computerization and recording of mine data in this overall project, which includes two separate projects, discussed below, the point-source data project for the USGS and the project on abandoned mines supported by the Indiana Division of Reclamation and the U.S. Office of Surface Mining. In addition to the data being added by these two projects, coal analyses were reviewed and recomputed in part for the file and entered into the data system.

Point-source data for the National Coal Resources Data System (USGS funded)

Point-source coal data and coal-extent information, including information from drilling records, coal samples, outcrop descriptions, mine maps, published maps, and miscellaneous coal maps, were collected for entry into the U.S. Geological Survey's computer files in preparation for calculations of Indiana's coal resources. Maps and data collection for entry into the system were completed for Vigo, Clay, Putnam, Owen, Sullivan, Greene, Knox, Daviess, and Martin Counties.

Mine-map project (Division of Reclamation-OSM funded)

This project to map location and extent of mines in southwestern Indiana made much progress during the year. The mapping of surface coal mines in 23 7 1/2-minute quadrangles was completed, including all of Clay, Vermillion, and Vigo Counties. Most of the data was entered into a computer data base, and the task of updating, revising, and correcting the data was continued.

Coals of the Mansfield and Brazil Formations

The objective of this project is to map and evaluate the coal resources in the Mansfield and Brazil Formations. Preliminary work has focused on identifying and mapping the distribution and structure of marker beds such as the Lead Creek Limestone Member of the Mansfield Formation to establish the stratigraphic framework needed for regional correlation of the coals.

Reference section of the Survant and Houchin Creek Coal Members (Linton and Petersburg Formations)

Correlation of the Survant and Houchin Creek Coal Members continues along with an investigation of stratigraphic relationships of these coals with the Springfield and Colchester Coal Members.

GEOLOGY AND STRUCTURE OF INDIANA

Geologic map of Indiana

The map for this project, the joint effort of three geologists from three Sections of the Survey, is awaiting drafting before being published.

Maps of Indiana showing structure on top of the Muscatatuck Group and rocks of Silurian age

Both of these maps are nearing completion.

Faulting in mines of southwestern Indiana (NRC funded)

This study to determine the nature and location of faults and other structures in southwestern Indiana was completed at the end of the year. During the year, bedrock joints were measured at 240 locations, and small faulting and other structures were measured in most of the more than 100 mines in southwestern Indiana to help evaluate tectonic forces operating within the study area. Based on the jointing and small-scale faulting, a major stress field is suggested in the southern part of the area.

Annotated bibliography of Indiana geology

The annotating and indexing of publications pertaining to Indiana geology for the period from 1956 to 1975 were completed and are now being reviewed and edited prior to publishing as a supplement to Bulletin 24 of the Survey. Compilation of references on Indiana geology for the period from 1976 to the present is underway.

Compendium of rock-unit stratigraphy in Indiana

The part of this report on rock units of Pennsylvanian age was reviewed and revised for republication.

LIMESTONE AND DOLOMITE

Silurian reefs in northern Indiana

We continued to gather information on reefs in northern Indiana by mapping outcrops and studying deepened sections in quarries. Continued interest by industry for high-calcium limestone has been increased through use of the large amount of data gathered by the Survey over the past years.

Carbonate rock fillers and whiting

Brightness data, results of chemical analyses, and geologic information were collected into tables and placed in computer files. Several samples were collected and analyzed including several dolomites, which had not been included in the original sampling. Several methods of improving whiteness of limestones were investigated.

Stylolite minerals

Collection of outcrop samples continued. A literature search was made, and a technique for removing minerals using ultrasonic washing was developed. First results of the study showed that some euhedral neofomed minerals, especially dolomite and quartz, are present in some stylolites.

Tabulation of abandoned quarries

We continue to compile data on abandoned quarries in conjunction with other research and service duties. Location and field examination of abandoned quarries in several counties were conducted this year. Our files on abandoned quarries are regularly consulted for reclamation and mineral-resource information.

METAL DEPOSITS

Three hundred fifty samples were collected in a hydrogeochemical reconnaissance of Washington and Lawrence Counties. Rock samples were collected and analyzed, and two reports were prepared on the study. A study of isotopes in sulfur-rich groundwater was completed.

MINERAL RESOURCES OF INDIANA

Indiana Survey Miscellaneous Map 41, "Map of Indiana showing locations of coal and industrial minerals operations," was sent to the printers and is due to be published in early fall.

SAND AND GRAVEL

Lake Michigan sedimentation

Grain-size analyses of samples collected by both U.S. Geological Survey and Indiana Geological Survey personnel have been analyzed. Fifty-one holes were drilled in the study area and results of preliminary investigations were reported. A bedrock topographic map, a surficial geology map, and cross-sections were constructed showing the stratigraphy of unconsolidated deposits along the National Lakeshore.

Alluviation of the Middle Wabash River

Maps showing the distribution, thickness, and amount of overburden covering the sand and gravel deposits in the terraces between Logansport and Delphi were prepared, completing the mapping project along the river between Terre Haute and Logansport. Fieldwork also was done near West Lafayette, an area of late Pleistocene catastrophic floods, and fieldwork was completed on the Deer Creek drainage system near Delphi.

Terrace deposits along the Whitewater River

Subsurface information concerning the thickness, extent, and amount of overburden covering the sand and gravel in the terraces was collected. Eleven townships have been surveyed to date.

Kankakee dune sands

Dunes along the south margin of the Kankakee Valley were test drilled, and an interpretation of the stratigraphy of the valley was reported in a technical paper. A subsurface topographic map and cross section showing the stratigraphy of late Wisconsinan deposits were constructed, and a computer program for analysis of grain size was written.

Surficial geology of Vanderburgh County

Samples collected from test holes were analyzed for grain size and moment statistics were derived from the data. Interpretation of these data was begun. A computer program allowing simultaneous analysis of pipette and sieve data for moment statistics was written.

DRAFTING AND PHOTOGRAPHY SECTION

The primary function of the Drafting and Photography Section is to provide service to the commodity and research sections of the Geological Survey. The services consist mainly of the final preparation of maps and illustrations for publishing, preparation of displays, mounting and framing of maps and photographs, phototypesetting, diazo printing, photocopying, film processing

and printing, photomacrography, field photography, color proofing of maps and artwork, and preparation of projection slides.

Jobs completed for publication by the Geological Survey are: Special Report 31, Environmental Geology of Vigo County, Indiana--an Aid to Planning; Occasional Paper 42, Geology for Environmental Planning in Starke County, Indiana; Occasional Paper 43, Spickert Knob Formation, Borden Group, in Indiana; Occasional Paper 44, Time Required for the Erosion of Clifty and Butler Ravines; Mineral Economics Series 29, Oil Development and Production in Indiana During 1982; Directory of Coal Producers in Indiana; Misc. Map 41, Map of Indiana showing Locations of Coal and Industrial Minerals Operations; Petroleum Exploration Map 80, Well Location Map of Blackford County, Indiana; Petroleum Exploration Map 80A, Map of Blackford County, Indiana, Showing Total Depth of Wells; Petroleum Exploration Map 81, Well Location Map of Delaware County, Indiana; Petroleum Exploration Map 81A, Map of Delaware County, Indiana, Showing Total Depth of Wells; revision of Misc. Map 27, Map of Southwestern Indiana Showing Locations of Active Coal Mines; and revision of the series of petroleum exploration maps of Indiana counties.

Included in other jobs completed are a base map of Delaware (scale 1:63,360), guidebooks for 4 field conferences, a map showing published petroleum exploration maps, a display for the 1983 Indiana State Fair, 5 poster displays for the national meeting of the Geological Society of America, remodeling of 2 displays for a meeting of the Indiana Coal Mining Institute, sketches for 4 sets of 6 articles for the newspaper series, slide drawings for 10 talks, and illustrations for 6 papers for publishing in journals and the proceedings of meetings of geologic organizations.

Other jobs in progress include Special Report __, Geology and Coal Deposits of the Clinton Area, West-Central Indiana; Special Report 33, Trepostome Bryozoa from the Dillsboro Formation, Southeastern Indiana; Special Report 34, Coal Mining in Vigo County, Indiana; Occasional Paper 45, Indiana Gravity Base Network; Misc. Maps (3) showing the bedrock topography of the Teays Valley in Indiana; a display for the 1984 Indiana State Fair; and a set of 6 sketches for the newspaper series.

Photographic items produced consist of 1323 camera copies, 88 field photographs, 39 photomacrographs, 1198 black and white prints, 409 film positives and duplicate negatives, 36 stripping film prints of stick-up type and symbols, 22 scribesheets, 89 peelcoat films, 19 color proofs of maps and artwork for covers, 323 color slides, and 47 black and white slides.

Approximately 52,500 square ft. of prints were produced on the diazo printer.

A digital typesetter was installed in May. Three people in the Drafting and Photography Section were trained to operate the typesetter and process the type. The typesetter produces many type styles, an infinite number of type sizes, and produces lettering much faster than the mechanical process of Leroy Lettering.

EDUCATIONAL SERVICES SECTION

General Functions

The Educational Services Section functions primarily as a liaison between the Indiana Geological Survey and the private and business sectors. This service includes the dissemination of information about industrial minerals, Survey research programs, and the general geologic makeup of Indiana. Recipients of this information include the public schools (middle school through high school), universities and colleges, the media, other divisions within the Department of Natural Resources, and the general public on a request basis. Special-interest organizations, such as rock clubs, 4-H groups, and speleological societies, also seek information from this office. Included in the section duties is the conception of displays that are used at fairs, rock shows, and geologic meetings.

Preparation of news releases, magazine articles, Geological Survey publications, field-trip guidebooks, and general-information memorandum reports is also a function of the Educational Services geologist. This material varies in content from nontechnical/popular publications to the results of geologic research.

Direction of the Educational Services Section changed in April 1984 with the retirement of R. Dee Rarick. Mr. Rarick was head of this office for 29 years. His successor, John R. Hill, served as Glacial Geologist in the Geology Section for the past 13.5 years.

From April 1 through June 30, 1984, the Educational Services geologist recorded 59 conferences, five field trips, and 62 items of correspondence with private individuals, the media, businesses, and educational institutions. Most of these items were answers to requests for information, including the identification of rock, mineral, and fossil specimens.

The Educational Services geologist is continuing research in the field of Quaternary geology and geomorphology that was begun earlier in the Geology Section. A long-standing project that treats the glacial geology of northwestern Indiana remains to be completed. New work that will include some research is underway. The origins and geomorphic history of the Norman Upland is part of a study being done for a publication on the scenic uplands of Indiana.

Status of Projects

Slide file

This is an ongoing project designed to provide detailed 35-mm color-slide coverage of a variety of geologic subjects. Specific subjects for which complete, or nearly complete, slide files already exist include: caves of Indiana, the coal industry, the gypsum industry, the petroleum industry, geophysical research, Quaternary geology, the lime industry, the dimension-stone industry, and the physiography of the Norman Upland. Completed since April of this year are the seismic-refraction field program and the Norman Upland.

Subject matter within each of the separate files is constantly updated as new information, techniques, and equipment make such photography necessary.

Our Hoosier State Beneath Us

The first newspaper briefs under the general title "Our Hoosier State Beneath Us" were released in February 1974. Since that time, the Educational Services Section has generated, with help from other Survey staff, 213 separate releases covering nearly every topic of geologic interest in Indiana. Although the series has not been abandoned, the rate at which new releases are being prepared has been slowed because most of the reasonable subject matter has already been adequately covered.

Scenic uplands of Indiana

This project is intended to be published in three parts, one each is to discuss the landforms typical of the Norman, Crawford, and Dearborn Uplands. Work is currently underway on the Norman Upland.

The general theme of these reports, which are to be published in the Circular series, will be the excellent beauty of these rolling regions of Indiana. Photographic work that will be used in the report on the Norman Upland has begun. More than 36 black and white photographs and 60 color slides are now in hand.

Special Field Trips

The following field trips were wholly or partly prepared and conducted by the Educational Services geologist: (1) A series of six 45-minute lectures were given on the local geology of Fern Cliff in Putnam County. The lectures and group discussions were a part of an outing for the Greencastle Middle School. (2) A guidebook was prepared and a field trip was run for the spring meeting of the Indiana Academy of Sciences. The geologic field trip, "Scenes of Geologic Interest in the Brookville Region," included stops at the Derbyshire quarry, the Holzhaus Stone Service Co., and the Brookville Reservoir spillway. (3) Another trip to the Brookville Reservoir was run for a group from Pike High School of Indianapolis. (4) A special tour of the Patoka Lake area was given at the request of the IU News Bureau for an article that they wanted to do on geologically interesting parts of Indiana.

Lectures

The following lectures were given: four lectures on the caves of Indiana to students at Edgewood Jr. High School, Ellettsville; a day-long series of lectures on the general topic of "Careers in Geology" to the Girl Scouts of America; a lecture to a group of campers at Hardin Ridge (Monroe Reservoir) on the geology of Monroe County; a talk to the Girl Scouts about geodes (Lake Lemon, Monroe County); a lecture to 50 students from the High School Science Institute on the subject of hazardous-waste disposal in Indiana.

Miscellaneous

The Educational Services Section geologist, with help from Drafting and Photography Section staff, served as the Survey's representative on the DNR State Fair Committee for the 1984 Indiana State Fair.

One edition of the Survey Newsletter was written and distributed to Survey staff and friends.

Information was prepared for use in the distribution of public information packets. This effort included the revision, printing, and duplication of maps, printed stratigraphic columns, and reprints. Other items prepared for public distribution included photographs and rock specimens.

At the request of Carol Groves, naturalist at the Patoka Reservoir, a short geologic summary of the Patoka Reservoir and environs was written and sent to the Patoka office. The report was used to help train guides.

A list of earth-science movies was prepared, and some of the films on the list were reviewed. The resulting annotated film file will be used in answering requests about the availability of such films.

GEOCHEMISTRY SECTION

In line with continuing efforts to upgrade the analytical capabilities of the geochemistry laboratories, a new Leco sulfur determinator and a Hardgrove grindability testing machine were obtained during the year. The new sulfur apparatus has more than doubled the output of sulfur determinations. In addition, the Section obtained a new hammermill that has facilitated preparation of coal samples.

In the coal laboratory, Louis Miller supervised the running of 4,741 determinations. Of these, 2,820 were total sulfur, 527 were calorimetric, and 976 were carbon dioxide determinations. The remaining determinations were of sulfur forms, low temperature ash, and proximate and ultimate analyses. The determinations obtained for total sulfur and carbon dioxide were obtained from the backlog of core material that gradually is being reduced.

An investigation of the New Albany Shale as well as potential oil shales in the Pennsylvanian rocks of the state provided many of the samples for calorimetric, sulfur, and carbon dioxide determinations. Nelson Shaffer submitted most of the Pennsylvanian shale samples to further his research on those rocks.

Mrs. Ennis continued supervision of several part-time employees operating the Carbon-Hydrogen-Nitrogen (CHN) analyzer. The equipment was used to make 11,485 determinations from 3,104 samples. She also learned sample dissolution techniques and ran the Induction Coupled Plasma (ICP) spectrometer. Including samples prepared by other workers, she ran 429 samples to obtain 5,335 determinations. Mr. Ennis and Dick Leininger made 425 quantitative spectrographic determinations from 30 samples. They also documented identification of 32 unknowns by x-ray diffraction, and used x-ray diffraction for numerous routine mineral identifications. Mark Gilstrap supervised

students who prepared shale samples for analysis by ICP. This work resulted in 47 determinations of loss on ignition and 940 determinations of major and trace components for 47 samples of New Albany Shale.

In a project with Brian Keith for the Petroleum Section, Joe Hailer sampled Trenton and Maquoketa formations. He ran 10 samples of oil and 51 samples of rock by organic extraction, separation of paraffin fraction, and gas chromatography. An additional 26 samples each of rock and oil were collected, but have not been run. In another activity to attempt to develop age determination procedures for Pleistocene formations, Joe analyzed total amino acid content of 27 samples in Dr. Hare's laboratory in Washington, D.C.

Joe worked with an official of Ellettsville to assist in the choice of a site for a landfill. On the project, he ran cation exchange capacity on 14 samples. He also made 56 determinations of carbon isotope ratios. Of these, 42 were of samples of New Albany Shale, 6 of glacial carbonates, and 8 of carbonates from water. Results of analyses of the New Albany Shale were reported in a paper at the Third Eastern Oil Shale Symposium in November.

Dick Leininger attended the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy and the Third Eastern Oil Shale Symposium. At the latter, he served as a session chairman. Jim Johnson completed the data base entry routine for creation of a computer file of analytical data and started on a program for retrieval of data. Jay Arnold has continued operation of the preparation laboratory and has reduced the backlog of core samples considerably despite receipt of approximately 1,000 new samples of core.

GEOLOGY SECTION

Basic Orientation

As its name suggests, the Geology Section is organized as the traditional research section of the Indiana Geological Survey. As befits a state such as Indiana that everywhere has a few to several thousands of feet of sedimentary rock cover, the Section's principal research areas are in stratigraphy, glacial geology and sedimentology (which qualify as subdisciplines of stratigraphy), and paleontology. In each of these areas, therefore, the Section is charged with collecting, storing, interpreting, applying, and disseminating information. Users of this information regularly include private citizens, professional geologists and their organizations, educational organizations, commercial and industrial groups, and governmental agencies of local to federal scope.

Particularly in recent decades as public awareness of environmental problems has ballooned, much of the Section's work has been done in an applied sense, and much of this application has been done in direct response to requests from the user areas noted above.

During the 1983-84 year, for example, the Section recorded 590 conferences and special field trips and 1796 items of correspondence with persons (and their organizations) not in the Survey's employ. Also, 258 environmental questionnaires were completed in relation to projects using local governmental and federal funds and dealing with (in general order of decreasing frequencies) bridge construction and repair, road and street

improvement and construction, water-supply development, industrial and business development, railroad overpass construction, airport construction, sewer and other-ditch excavation, urban development, and waste treatment works.

Mapping is one activity that spans the functions of the Section that range in nature from pure to applied research. During the year the new bedrock geology map of Indiana was completed and remained in drafting at the end of the year.

Some of the items noted above as conferences, special field trips, and correspondence are classified as educational. To these may be added for 1983-84 eight lectures and professional papers presented orally and the preparation and conduct of eight field trips. The latter represent a major effort as part of the Survey's hosting responsibilities for the October-November 1983 meeting of the Geological Society of America and affiliated societies in Indianapolis.

During the year the Section actively furthered 15 separately listed formal projects, (1 of which has 7 formal subprojects), 2 being new, and 3 being completed. Among these, 6 are more or less applied and service projects and pertain to mapping, environmental concerns, and service to professional organizations. The remainder are basic research projects, although each has practical applications, for example, to mapping, mineral resources, water supplies, and environmental concerns. Two other projects that are data-gathering projects (Character of Indiana Tills; Engineering Properties of Unconsolidated Deposits) are not included in the numerical tallies above, but they were carried on through an extensive augering program, sampling, logging of well bores, and testing in the Sedimentation Laboratory. For example, 842 rock samples were collected, 2783 sedimentological tests were made, 98 holes and 4984 feet of section were augered, and 43 holes and 3995 feet of section were gamma-ray logged. A modest part of this effort was made cooperatively with or for other organizations, the U.S. Geological Survey (Indianapolis), for example. These statistically stated results were heavily drawn upon for several of the projects described further on in this report.

Status of Projects

Bedrock geology map of Indiana

This project, begun in 1977-78, was completed during the year with submission to drafting all the necessary materials. This map will be the first single-sheet bedrock map of the state published at a scale of 1:500,000. It joins the already published Regional Geologic Map series (8 sheets; scale 1:250,000) and the 1:500,000-scale single sheet maps showing topography of the bedrock surface and thickness of unconsolidated deposits in Indiana. The 1:500,000-scale map of Quaternary (unconsolidated) deposits is the only one yet to be finished in the planned modern series for the state, which series, even before completion, represents one of the very few finest sets of geologic maps for any state. (For formal evidence of results, see "Miscellaneous Publications," one item identified to Gray; also, "Reports and Maps Submitted for Publication," three items identified to "author undecided," Gray, Ault, and Keller, and Gray; and, also, "Papers and Posters . . .," one item identified to Gray. Also, see status of the Quaternary map under the title below.

Quaternary map of Indiana

This project was begun in 1982-83 but saw little progress in that year and in 1983-84 but is expected to be advanced rapidly in the succeeding year. Much of the augering, sampling, logging, and testing of unconsolidated materials that are reported as statistics has a bearing on this mapping.

Geological Society of America 1983 field trips

This project was begun in 1980-81 with assignment to Section personnel the major part of the task both to organize and to conduct 17 field trips, 1 to 4 days each, in conjunction with the 1983 national meeting of the Geological Society of America and affiliated societies in Indianapolis. During 1983-84, this project was completed with conduct of the trips and with publication of two volumes of field-trip guides totalling about 500 pages. All Section personnel were involved directly in the conduct of eight of these trips and in preparation of the guides, and one of them was in overall charge (See "Miscellaneous Publications, eight wholly or partly Geology Section items identified to Eggert and others (including Rexroad); Fraser, Bleuer, and Smith; Gray and others; Kempton, Bleuer, and Johnson; Mirsky, Hartke, and others; Rexroad, Gray, and Noland; Shaver, Sunderman, and others; and Shaver and Sunderman.)

GSA-DNAG-CFG

The coded title above stands for part of a continent-wide celebration of the 100th anniversary of the Geological Society of America. The celebration project entitled "Decade of North American Geology" is to result in publication of a few dozen volumes on North American geology, one of them being a midwestern Centennial Field Guide. The Geology Section was assigned the prime responsibility for Indiana, and five of its personnel directly participated in preparing seven of 13 Indiana articles. Also, one of our personnel had overall responsibility for organizing and editing the whole. This project was both begun and concluded during the year. (See "Reports and Maps Submitted for Publication," seven items identified to Bleuer and Shaver, Gray, Hasenmueller and Bleuer, Hill, Shaver, Shaver, and Rexroad and Powell.)

Middle and Upper Silurian conodonts of northern Indiana

This title represents a 1982-83 reorganization of the tasks remaining to a more embracing project on northern Indiana middle Paleozoic geology that was begun in 1966-67 and that has seen several published reports. A principal report on Middle and Upper Silurian conodont biostratigraphy is yet to be completed, and to this end conodont-processing work was continued in 1983-84. Also, during 1983-84 two substantial publications appeared that have much of their foundation in the predecessor project: a middle Paleozoic paleogeographic atlas of maps for the Great Lakes area and a Silurian field-trip guide for the 1983 Geological Society of America meetings. (For these and other formal evidences resulting from this project and the earlier, parent project see "Reports and Maps Published by the Geological Survey," one item identified to Droste and Shaver; also, "Miscellaneous Publications," one item identified to Droste and Shaver; and, also, "Papers and Posters . . .," one item identified to Droste and Shaver.

Beaver Bend-Reelsville biostratigraphy and Middle Ordovician conodonts

These two conodont-based projects were begun in 1981-82 and were described in the reports for that year and 1982-83. They reached about 60- and 35-percent completion respectively during 1983-84. Information coming from these projects has already been applied in Special Report 32 (see "Reports and Maps Published ...," Droste and Shaver item) and in the project to revise the Compendium of Rock-Unit Stratigraphy in Indiana (see below).

Environmental geology activities

Only one formal project was listed during 1983-84 in this category, "Environmental geology of Monroe County," which was begun in 1972-73, was later revised, and saw good progress last year to about 90 percent of completion. A great deal of other effort, however, was expended on environmental activities in other ways as discussed in part above under the heading "Basic Orientation," and including effort put into environmental questionnaires and conferences. Also, two environmentally oriented reports, submitted in earlier years, were published. (See "Reports and Maps Published . . .," two items identified to Hartke.) Still another, earlier submitted report, on the Koontz Lake area of Starke County, remained in editorial hands during 1983-84. The two published county reports noted above bring the number of published modern geographically defined environmental reports to 17.

Quaternary stratigraphic, sedimentologic, and geomorphic investigations

Four formal projects are grouped under the heading above: (1) Pleistocene stratigraphy west-central Indiana, (2) Teays Valley of Indiana, (3) Tills of northwest Indiana, and (4) Sedimentologic projects in Quaternary geology. They have been described in earlier annual projects, the several subprojects under item 4 having last been noted under "Sand and Gravel" in the Coal and Industrial Minerals Section's report for 1983-84. These subprojects are: (a) Lake Michigan sedimentation, (b) Surficial geology Vanderburgh County (especially of the Ohio Valley), (c) Alluviation of the middle Wabash River, (d) Terrace deposits along the Whitewater River, (e) Kankakee dune sands, (f) Daviess County lake deposits, and (g) White River sedimentation. These subprojects were transferred to the aegis of the Geology Section with transfer to that section of the principal investigator, which was complemented by one transfer out of the section, the principal investigator of Quaternary project 3 noted above.

These projects accounted for most of the augering and logging of holes that penetrate unconsolidated materials and that are reported as statistics, as well as most of the tests made in the Sedimentation Laboratory. They had many direct applications to environmental and economic geology (including water supplies) of Indiana, to the State mapping program described above, and as input to many conferences (see "Basic Orientation") in which Section personnel were asked for geologic information.

Eight formal results of all these projects for 1983-84 are identified to Bleuer, Fraser, Nelson and Fraser, and Thompson and Fraser under "Miscellaneous Publications" and to Bleuer, Fraser and Nelson, Fraser and Thompson, and Fraser under "Papers and Posters . . ."

Mississippian rocks northwest Indiana

Although some work was done on this project in the preceding year, it acquired formal status during 1983-84. For some time we have known from subsurface records of western northern Indiana that the lower Middle Mississippian Borden Group in that area had a much greater content of carbonate rocks than does the Borden Group in south-central and southwestern Indiana. The project plans call for three new 700-foot (and less) core holes in the Warren and Fountain county area, for study of outcrops and of cuttings and logs of wells already drilled in that area, for conodont age determinations, and for lithologic characterization. The results should include a partial reclassification of rocks of the Borden Group and better understanding of the stratigraphic relations within a great mass of Indiana rocks that collectively comprise a deltaic facies and a carbonate-shelf facies. During 1983-84 one core hole was completed, and the overall project reached about 10-percent completion.

Revision of Compendium of rock-unit stratigraphy of Indiana (Bull. 43)

This project was begun during the year and reached about 85-percent completion. Its purpose is to bring up to date the Survey's classification of bedrock units in Indiana. In this way needed stability in nomenclature is brought to bear and nomenclature is developed that is cognizant of the great amount of subsurface data accumulated especially since the time of compilation of the first compendium. Such an up-to-date statement of the basic disposition of bedrock in Indiana facilitates continuing stratigraphic studies and utilization of this part of Indiana's natural resources.

A complete first draft of the manuscript was produced during the past year, so that the remaining tasks include revision (after reviewing and editing), drafting of charts, and publication. Three formal results during the year, short of the final, principal manuscript and directly or indirectly related to this project, are recorded under "Miscellaneous Publications," one item identified to Gray; under "Reports and Maps Submitted . . .," one item identified to Rexroad and Lane; and under "Papers and Posters . . .," one item identified to Gray.

Miscellaneous Activities

Five manuscripts were produced during the year that emanated belatedly from projects finished in earlier years or requested from efforts not having the status of formal projects. They are:

(1) A new manuscript for our reprint series of now-classic articles on Indiana geology ("Reports and Maps Submitted . . .," item identified to Culbertson . . . and Gray).

(2) A contribution for northern Indiana to the Michigan Basin chapter in a volume to be published by the Geological Society of America, Decade of North American Geology program ("Reports and Maps Submitted . . .," item identified to Fisher . . . and Shaver).

(3) A guidebook prepared for a joint meeting of the North-Central and Southeastern Sections, Geological Society America ("Miscellaneous Publications," item identified to Rexroad and Kleffner).

(4) An Outdoor Indiana article on mastodons and mammoths in Indiana ("Reports and Maps Submitted . . .," item identified to Hill).

(5) A manuscript on archaeological sedimentology for a portion of the Ohio River floodplain near Evansville, Journal Archaeological Science ("Reports and Maps Submitted . . .," item identified to Gray).

A further tabulation (in part repletitive of some statements above) of the Section's miscellaneous activities is: 1 course taught in the Indiana University Living-Learning Center ("Geology and Theology"); 1 course team taught in the IU Department of Geology ("Sedimentary Processes and Environments"); 8 professional papers, poster sessions, and public lectures given; service (including chairing) on 6 extra-Survey professional committees; 2 principal editorships (illustrations and geologic names) for all Survey maps and reports; 9 field trips conducted; 10 attendances at professional meetings; and 25 critical reviews of manuscripts. Some other miscellaneous activities are recorded in the introduction and are not reported here.

GEOPHYSICS SECTION

Between August and November 1983, Joe Whaley conducted a gravity survey in east-central Indiana. Approximately 1,150 stations in a relatively closely spaced pattern of a one-mile grid were occupied in Henry, Randolph, Delaware, Jay, and Madison Counties. All stations were tied to bases that form the Indiana Gravity Base Network 1981. Following the field work, Joe encoded the field recordings and location information, and reduced the data to the standard reference system of the gravity base network. These gravity measurements became part of the state's gravity data bank that until now has been limited mainly to data compiled for the half of Indiana south of the 40th parallel by other surveys. The new work is intended to cover the northern half of Indiana with the same degree of control that is available in the southern half. When the survey is completed, Indiana will have gravity control that is equivalent to the aeromagnetic coverage of the state.

During the first few months of 1984, a geophysics party participated in a seismic project to study decay of seismic waves in overburden materials. Since 1950, the Geophysics Section has made more than 12,000 seismic refraction shots to determine the thickness of unconsolidated sediments throughout Indiana. These shots also have produced a vast amount of velocity information that may be useful in interpreting the geology of those deposits. This new study of the rate of decay of seismic waves may enable us to correlate wave amplitude attenuation with type and thickness of unconsolidated materials.

Bob Blakely was active during the year in presenting information about earthquakes and other geophysical phenomena to civic groups, and newspapers, and on television. In addition to giving talks to the Bloomington Lions and Rotary Clubs, Bob was interviewed by Indianapolis' Channel 6 and Channel 8 television stations, and talked with reporters from newspapers throughout the state. In line with this activity, Bob attended a conference at Cape

Girardeau, Missouri on earthquakes in the New Madrid region, and was appointed to the earthquake advisory panel of the Indiana Office of Civil Defense.

In his role as the Geological Survey's expert on computing, Bob continued development during the year of an information retrieval system for the Petroleum Section's oil well files. He also modified INDYMAP, a computerized mapping system, to run on a new compiler, FORTRAN5, and continued development of accounts receivable and inventory control for the Publications Section. At the physical constants laboratory, Bob worked on an investigation of the physical properties of earth materials, with special attention during the year to tests of resistance to abrasion, particularly as it relates to foot traffic.

MINERAL STATISTICS

As production figures for minerals are reported largely on a calendar year basis by producers, and are so tallied by the Indiana Geological Survey, the U.S. Bureau of Mines, and other agencies that collect and compile such data, this report covers calendar year 1983.

Continued general economic recovery was reflected in the mineral industries, as almost all commodities showed increases (some substantial) in both quantity and value. The total value (at first stage of salability) was \$1,092,001,477. -- an increase of 4.03 percent over 1982. The manufacture of cement and clay products, and the processing of limestone for dimension purposes, contributed an additional \$100,000,000.-plus. The manufacture of lime, recovery of sulfur, and processing of perlite, all from materials imported from out-of-state, further enhanced the value of the mineral industries of the state by several millions of dollars.

Coal remained the major commodity, comprising 72.89 percent of the total value of all minerals produced during 1983. Of all the coal reported from 14 counties, production in Pike and Warrick Counties amounted to more than 51 percent.

Although the number of holes drilled in 1983 remained essentially the same as in 1982, the amount of oil produced declined 4.37 percent.

Clay and shale, crushed limestone, dimension limestone, dimension sandstone, gypsum, and sand and gravel accounted for 12.53 percent of the total value of minerals produced in 1983. Their processing into materials for use, mainly in the construction industry, resulted in greatly increased ultimate value.

Production of clay and shale, used in the manufacture of brick, cement, drain tile, and lightweight aggregate, increased 11.39 percent in volume and 1.36 percent in total value.

Crushed limestone, for agricultural lime, building and road construction, cement manufacture, and numerous other uses, showed an increase of 8.08 percent in volume and 11.99 percent in total value over 1982.

Sand and gravel, used for building and road construction, cement manufacture, fill, ice control, molding sand, blast furnace sand, and many

other uses, showed an increase of 4.33 percent in volume and 11.51 percent in total value.

The building limestone industry benefitted from several large contracts, and 55.25 percent more stone was quarried in 1983 than in the previous year, with a total increase in value of 46.21 percent.

Although figures for gypsum, used in the manufacture of wallboard, insulation, etc., are not available (for publication?), indications are that production increased approximately 20 percent in quantity and 15 percent in total value.

As data on cement production are not available to us from the U.S. Bureau of Mines, it was necessary to make estimates based on materials reported produced for cement manufacture. Following the trend of all other mineral commodities used in the construction industry, cement production apparently increased approximately 22 percent in quantity and 24 percent in total value.

The following counties led in production of minerals (exclusive of oil and gas):

<u>County</u>	<u>Value at first stage of salability</u>	<u>Mineral commodity (in alphabetical order)</u>
<u>\$100 million+</u>		
Warrick	\$240,626,772.00	Coal
Pike	167,022,736.00	Coal
<u>\$50-100 million</u>		
Daviess	87,943,981.00	Coal
Vigo	66,774,793.00	Coal, sand and gravel
<u>\$25-50 million</u>		
Clay	48,673,708.00	Clay and shale, Coal
Sullivan	45,181,504.00	Coal, crushed limestone
Knox	44,484,185.00	Coal, sand and gravel
Greene	37,237,779.00	Coal, sand and gravel
Spencer	30,001,514.00	Coal
<u>\$5-25 million</u>		
Dubois	21,411,981.00	Clay and shale, coal
Martin	12,292,182.00	Coal, gypsum

Lawrence	10,893,806.00	Crushed limestone, dimension limestone, dimension sandstone
Crawford	- C -	Crushed limestone
Marion	8,268,450.00	Crushed limestone, sand and gravel
Clark	7,765,516.00	Clay and shale, crushed limestone, sand and gravel
Hamilton	7,305,351.00	Crushed limestone, peat, sand and gravel
Lake	- C -	Sand and gravel, sulfur
Monroe	6,257,120.00	Crushed limestone, dimension limestone
Allen	5,971,383.00	Crushed limestone, peat, sand and gravel
Owen	5,456,670.00	Coal, crushed limestone, sand and gravel
Putnam	5,379,725.00	Clay and shale, crushed limestone, dimension limestone, sand and gravel

PETROLEUM SECTION

Many conferences with petroleum industry representatives and with the general public are held annually by geologists and other staff members of the Petroleum Section. Visitors to the section numbered 563 during the year. Additionally, many requests for information or assistance are routinely processed by the staff. Incoming letters to the section numbered 718 and telephone requests were routinely received and handled.

Compilation of drilling statistics is annually performed and assimilated into a nation-wide total prepared jointly by the American Petroleum Institute and the American Association of Petroleum Geologists. These statistics are published annually by the AAPG and made available on a world-wide distribution basis.

A review of petroleum exploration activity in Indiana was prepared for inclusion in the Bulletin of the American Association of Petroleum Geologists.

A summary of petroleum development and production statistics by fields in the Survey's Mineral Economics Series was completed during the year.

Preparation of statistics of reserves of Indiana's oil fields is maintained as an annual revision as part of the information available on Indiana's oil industry.

Continued compilation of estimates of statistics for the undiscovered potential gas reserves in Indiana was effected as an annual revision during the year. The findings were submitted to the Potential Gas Committee as part of national figures on potential gas supplies compiled and published by that committee.

Maps in the Survey's Petroleum Exploration Map Series were updated and revised during the year. Two new maps were compiled and published, 59 were revised, and 46 were reviewed with no revision necessary.

Evaluation of well data and preparation of information in a format consistent with existing file information was effected for Blackford, Delaware, and Jay Counties. New Petroleum Exploration maps for Blackford and Delaware Counties were completed and published as a result of the data-file improvement for those counties. Progress was made on preparation of a new map for Jay County.

All data for well completions received during the year were micro-filmed and placed in a microfiche file maintained as a separate file of well information as a safeguard against loss of data from an unforeseen catastrophic event.

Following suspension of work on preparation of a manuscript concerning occurrences and production of natural gas in Indiana, Dan Sullivan resumed progress on the project during the year. An occasional paper should result from this progress during the next year.

Preparation of a map of the Mississippian - Pennsylvanian unconformity in Indiana was virtually completed by Stanley Keller. The map is to be published as one in the Miscellaneous Map Series.

John Rupp continued progress on preparation of an atlas of maps showing thickness and structural position of stratigraphic units in Indiana. Forty-two maps depicting structure and thickness of selected units have been compiled and are ready for reduction to a uniform size and format. Preparation of selected references to accompany the maps is next to be done.

Study of the Trenton Oil Field of Indiana continued by Brian Keith. In association with the study, samples of oil from wells producing from Trenton Limestone were obtained and analyzed for comparison with analyses of shale from the Maquoketa Group to determine a potential source of the Trenton oil. Additionally, cores from wells in Michigan were obtained on loan from Shell Oil Co. for examination and sampling of the Trenton rocks. Maps of the structural position of the Black River Limestone and an isopach map of the Trenton and Lexington Limestones were prepared by Brian in conjunction with the Trenton study. The maps are to be issued for publication in the Miscellaneous Map Series. A further consequence of the investigation was the preparation by Brian of a manuscript titled "Litho-stratigraphy of the Lexington Limestone in Indiana" for publication as an Occasional paper in order that a section concerning the Lexington could be included in the compendium of Rock Unit Stratigraphy in Indiana.

Gerald Carpenter and other members of the Geological Survey met with Gary Fricke, Director of the Division of Oil and Gas, to discuss formulation of rules and regulations for protection of coal seams encountered in drilling for oil and gas within Indiana.

Gerald Carpenter and John Rupp met with representatives of Region V of the Federal Environmental Protection Agency and the director of the Division of Oil and Gas to discuss implementation of the federal underground injection control program in Indiana. Another meeting, attended by Gerald and John was held at the offices of the Indiana Board of Health, concerned the underground injection of industrial waste in Indiana and assumption of control of regulations by the EPA.

Gerald Carpenter and John Rupp consulted with representatives of Hoskins Mfg. Co. who were planning development of an industrial waste disposal well at their plant in New Paris, Elkhart County.

PUBLICATIONS SECTION

During the past fiscal year the Publications Section sold 9,698 reports and 23,800 maps. The section sent 892 reports and 55 maps on exchange to institutions in the United States and in foreign countries. It also distributed without charge 1,494 reports and 1,177 maps to members of its own organization and to individuals, libraries, and companies in the United States and abroad. The Publications Section served 4,700 office customers, handled 3,509 incoming and 1,071 outgoing letters pertaining to geologic reports and maps, and sent out 1,427 announcements of new publications.

Six reports, four new maps, and 81 revised maps were issued during the fiscal year, and four reports were reprinted.

Nine manuscripts of Survey reports, 14 abstracts and 27 manuscripts prepared by Survey personnel for outside publication, and 15 news releases, newsletters, exhibits, and similar material were edited during the fiscal year. Twenty-four news releases, "Our Hoosier State Beneath Us," were also edited, and camera copy for them and for 31 miscellaneous projects was prepared.

The upswing in the economy of Indiana and of the nation had an effect on the sale of publications during 1983-84. In 1983-84, compared with 1982-83, the sale of reports was up 24 percent, the sale of maps was up 38 percent, and the number of letters received was up 8 percent. The number of office customers, however, was down 8 percent. Fewer student customers, perhaps because of the increased prices of U.S. Geological Survey topographic maps, may account for the decline.

An IBM personal computer and a Diablo 630 communications terminal were installed in the Publications Section in December 1982. During the fiscal year a program for invoicing by computer was completed, and programs for maintaining the general announcement files and the gratis and exchange files by computer were prepared. Preparation of programs for maintaining accounts receivable and inventory records by computer was also begun.

REPORTS AND MAPS PUBLISHED BY THE GEOLOGICAL SURVEY

Directories

Hasenmueller, W. A., 1983, Directory of coal producers in Indiana: Unnumbered Directory, 62 pages, 17 figures.

Mineral Economics Series

Carpenter, G. L., and Keller, S. J., 1983, Oil development and production in Indiana during 1982: Mineral Economics Series 29, 47 pages, 3 figures, 5 tables.

Miscellaneous Maps

Hasenmueller, W. A., 1983, Map of southwestern Indiana showing locations of active coal mines: Miscellaneous Map 27 (revised). Scale, 1 inch equals approximately 6 miles.

Occasional Papers

Hartke, E. J., 1984, Geology for environmental planning in Starke County, Indiana: Occasional Paper 42 (Environmental Study 19), 13 pages, 8 figures.

Rudman, A. J., and Blakely, R. F., 1983, Computer calculation of two-dimensional gravity fields: Occasional Paper 40, 22 pages, 3 figures.

Petroleum Exploration Maps

Sullivan, D. M., Enochs, L. G., and Cazez, J. T., 1983, Well location map of Blackford County, Indiana: Petroleum Exploration Map 80. Scale, 1 inch equals approximately 1 mile.

Sullivan, D. M., Enochs, L. G., and Cazez, J. T., 1983, Well location map of Blackford County, Indiana, showing total depth of wells: Petroleum Exploration Map 80A. Scale, 1 inch equals approximately 1 mile.

Sullivan, D. M., Enochs, L. G., and Cazez, J. T., 1983, Well location map of Delaware County, Indiana: Petroleum Exploration Map 81. Scale, 1 inch equals approximately 1 mile.

Sullivan, D. M., Enochs, L. G., and Cazez, J. T., 1983, Well location map of Delaware County, Indiana, showing total depth of wells: Petroleum Exploration Map 81A. Scale, 1 inch equals approximately 1 mile.

Revised Petroleum Exploration Maps (as of December 31, 1983): 3A, 3B, and 3C (Warrick County); 4A, 4B, and 4C (Sullivan County); 5A and 5B (Vigo County); 12, 12A, and 12C (Martin County); 13A, 13B, and 13C (Greene County);

14A and 14B (Clay County); 15A (Parke County); 18A (Owen County); 19A (Putnam County); 21A, 21B, and 21C (Dubois County); 23, 23A, and 23C (Knox County); 24A (Monroe County); 25A (Lawrence County); 26, 26A, and 26C (Davies County); 27A (Orange County); 32A (Bartholomew County); 39, 39A, and 39C (Spencer County); 40, 40A, and 40C (Perry County); 42A (White County); 46A (Jennings County); 47A (Jefferson County); 51, 51A, and 51C (Pike County); 52, 52A, and 52C (Vanderburgh County); 53, 53A, and 53C (Gibson County); 54, 54A, and 54C (Posey County); 57A (Noble County); 59A (Allen County); 65A (Fulton County); 69A (LaPorte County); 70A (Porter County); 71A (Jasper County); 74A (Miami County); 75A (Wabash County); 76 and 76A (Huntington County); 77 and 77A (Wells County); 78 and 78A (Adams County); 79 (Jay County); 80 and 80A (Blackford County); 81 and 81A (Delaware County); 82 and 82A (Grant County); 92A (Randolph County); 94A (Hancock County); 95A (Decatur County); 96A (Shelby County); 97A (Rush County); and 99A (Madison County).

Checked Without Revision Petroleum Exploration Maps (as of December 31, 1983): 16A (Vermillion County); 17A (Fountain County); 20A (Montgomery County); 22A (Jackson County); 28A and 28C (Crawford County); 29A (Washington County); 30 and 30A (Harrison County); 31A (Brown County); 33A (Hendricks County); 34A (Marion County); 35A (Morgan County); 36A (Johnson County); 37A (Tippecanoe County); 38A (Warren County); 41A (Benton County); 43A (Carroll County); 44A (Clinton County); 45A (Boone County); 48A (Scott County); 49A (Clark County); 50A (Floyd County); 55A (Steuben County); 56A (Lagrange County); 58A (DeKalb County); 60A (Whitley County); 61A (Kosciusko County); 62A (Elkhart County); 63A (St. Joseph County); 64A (Marshall County); 66A (Cass County); 67A (Pulaski County); 68A (Starke County); 72A (Newton County); 73A (Lake County); 83A (Howard County); 84A (Switzerland County); 85A (Ohio County); 86A (Dearborn County); 87A (Ripley County); 88A (Franklin County); 89A (Union County); 90A (Fayette County); 91A (Wayne County); 93A (Henry County); 98A (Hamilton County); and 100A (Tipton County).

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PROFESSIONAL ACTIVITIES AND COMMITTEES

In August 1983, Nelson Shaffer judged 4-H exhibits at the Marion County Fair and the Indiana State Fair.

Don Carr was chairman of programming for the Coal Geology Division of the Geological Society of America meeting at Indianapolis October 31-November 3 and arranged for a field trip, symposium, technical session, and luncheon speaker. Don also presided with Charlie Wier at the technical session of the Division on October 31. At the Division luncheon on November 2, Don Carr became chairman.

Nelson Shaffer organized the session on stable isotope studies of clastic rocks at the Geological Society of America meeting on October 30.

In February 1984, Gordon Fraser made final preparations on a Great Lakes Section-Society of Economic Paleontologists and Mineralogists sponsored short course on organic geochemistry.

Nelson Shaffer judged a middle-school science fair at Owen Valley Schools on March 21.

On May 18, Don Carr served as chairman of a technical session at the Forum on Geology of Industrial Minerals in Baltimore, MD.

Don Carr served as chairman of the Governmental Affairs Committee of the American Institute of Professional Geologists.

Don Carr served as vice-chairman of the Education Board of the Society of Mining Engineers.

Don Carr served as vice-chairman of the membership Committee on the Long-Range Planning Commission of the Society of Mining Engineers.

Ned Bleuer attended a U.S. Geological Survey-sponsored joint agency water resources conference at McCormick's Creek State Park, April 18, and has joined Hilton Johnson, Univ. Illinois, Champaign, and Stanley Totten, Hanover College, Indiana, in a so-called JPL Shuttle Radar project (NASA flights) to study certain aspects of midwestern continental glaciation.

Gordon Fraser served as chairman of the Membership Committee of the Great Lakes Section, Society of Economic Paleontologists and Mineralogists; acted as organizer of a short course on "Organic Geochemistry of Contemporaneous and Ancient Sediments," auspices of the Great Lakes Section, Society of Economic Paleontologists and Mineralogists, for the October 1983 Geological Society of America meeting in Indianapolis and served as business manager for the published syllabus in the SEPM Short Course Notes series; and has been named to

an associate editorship for the Journal of Sedimentary Petrology (Soc. Econ. Paleontologists and Mineralogists).

Henry Gray attended the meeting of the Tristate Committee on Pennsylvanian Correlations in the Illinois Basin, Bloomington, Ind., Nov. 14, 1983; and attended a reception at Shawnee Bluffs in honor of William Andrews, Deputy Director, Indiana Department of Natural Resources, June 20, 1984.

Edwin Hartke served as illustrations editor for all maps and reports of the Geological Survey; and attended a Status of Projects meeting, U.S. Dept. Agriculture Soil Conservation Service, Indianapolis, May 25.

Robert Shaver chaired the Geologic Names Committee for the Geological Survey; served as a member of the 1983 Indianapolis Convention Committee, Geological Society of America; chaired the 1983 Geological Society of America Field Trip Committee for the Indianapolis Convention; attended two committee meetings in conjunction with the Geological Society of America annual meeting in Indianapolis: (a) Geological Society of America Local Committee, Nov. 2, 1983, and (b) Geological Society of America Field Trip Chairmen, Indianapolis, Nov. 3, 1983; attended a coordinating conference for the Geological Society of America-Decade of North American Geology volume on the sedimentary cover of the craton, United States, Norman, Okla., March 3-4, 1984; and served as a member of the Presidential Advisory Committee of the Society of Economic Paleontologists and Mineralogists.

Gerald Carpenter and Brian Keith attended the annual meeting of the American Association of Petroleum Geologists in San Antonio, Texas. While there, Brian attended a short course titled "Geological Applications of Reservoir Engineering Tools". Gerald attended a pre-convention workshop meeting of the AAPG-API Committee on Statistics of Drilling. Also he attended the meeting of the House of Delegates of the AAPG as a representative of the Indiana-Kentucky Geological Society. On Monday, May 21, Gerald served as a Matson Award judge to assist in selecting the best paper presented at the convention.

Stan Keller reported to the Potential Gas Committee on new drilling activity in Indiana during 1983 and first quarter of 1984.

PUBLIC LECTURES

Curt Ault gave a lecture on mineral resources of Indiana to a physical science class at Manchester College, North Manchester, December 5, 1983.

Nelson Shaffer gave a lecture on hydrogeochemical exploration to an IU hydrogeology class, December 8, 1983.

Chris Smith lectured on hydrodynamics to the Indiana University hydrogeology class on December 6, and he made a presentation on isotopes to U.S. Geological Survey personnel in Indianapolis, December 19, 1983.

In February 1984, Nelson Shaffer and Don Carr made presentations on coal and Pennsylvanian black shales to the Department of Commerce.

Nelson Shaffer gave a talk at the Illinois Geological Survey on "Metal enrichment and sulfur isotope fractionation in the New Albany Shale," March 2.

Nelson Shaffer lectured to an economic geology class, March 26 and 28.

Nelson Shaffer gave a talk on Pennsylvanian black shales to a paleontology-stratigraphy seminar of the Geology Department, April 11, 1984.

Gordon Fraser, Alluviation of the Wabash Valley: Department of Geology, Univ. Iowa, April 19, 1984.

John Rupp presented an invited talk to the Geosciences Survey class at Purdue University. John spoke on careers in geology.

Brian Keith gave a lecture to an Indiana University North American Stratigraphy class on Cambrian and Ordovician rocks of New York and Vermont.

Brian Keith lectured to an Indiana University petroleum geology class on use and interpretation of geophysical logs.

Gerald Carpenter attended a meeting of the Indiana Oil and Gas Association and gave a brief summary of oil and gas developments during 1983 and some comments on the activities of the Geological Survey.

Brian Keith prepared some material and presented a brief talk on geophysical logging of coals at a Coal Section workshop held on February 28.

Dan Sullivan and John Rupp presented talks to the Minerals Land Management class at the University of Evansville on May 8. Topics of their presentations were oil and gas developments in Indiana and a review of the activities of the Petroleum Section.

ATTENDANCE AT PROFESSIONAL MEETINGS

On July 8, Don Carr met with Geological Society of America's joint technical program committee in Denver and helped with the preparation of programs for the Indianapolis meeting.

Denver Harper attended the "First conference on the use of computers in the coal industry" at Morgantown, West Virginia, August 1-3.

Nelson Shaffer attended a rock exhibition August 5 and 6 in Lawrence County.

On September 14, Don Carr and Nelson Shaffer attended a meeting of Indiana Geologists in Indianapolis.

Dee Rarick, Stan Keller, Dan Sullivan and Gerald Carpenter attended the annual Independent Oil Producers Assoc. outing held at Mt. Vernon, Indiana on September 15th.

Nelson Shaffer attended the 500 Earth Science mineral and gem show, September 17.

Stan Keller and Dan Sullivan attended the opening meeting of the Indiana Kentucky Geological Society held in Evansville on September 20.

Nelson Shaffer and Don Eggert attended the American Association of Petroleum Geologists Eastern Section meeting, October 3-4, 1983, at Carbondale, Illinois.

On October 19-21, Don Carr attended the Society of Mining Engineers meeting in Salt Lake City, Utah.

John Rupp and Gerald Carpenter attended a public hearing conducted by Region V of the Environmental Protection Agency held in Indianapolis, October 25. The meeting was held to present proposals of the agency for control of underground injection of fluids in Indiana. Since no Indiana agency submitted proposals for assuming powers of control commensurate with federal standards, regulation of underground injection of fluids in Indiana will be done by the Environmental Protection Agency.

Gerald Carpenter attended the October meeting of the Indiana-Kentucky Geological Society in Evansville on October 27. George Shurr, St. Cloud, Minnesota spoke on Lineaments in the Eastern Interior Basin.

Curt Ault and Chris Smith attended a meeting of the Indiana-Kentucky Geological Society in Evansville, October 27.

Ned Bleuer, Henry Gray, Edwin Hartke, John Hill, and Robert Shaver attended the Geological Society of America annual meeting in Indianapolis, October 27-November 3, 1983.

The annual meeting of the Geological Society of America and affiliated societies was held in Indianapolis October 31-November 3 with pre- and post-meeting field trips. Many members of the Survey were involved in various capacities with field trips, papers, posters, symposia, and business meetings.

John Rupp and Brian Keith attended the national Geological Society of America annual meeting in Indianapolis.

Chris Smith, Curt Ault, and Denver Harper attended a report meeting of the New Madrid Study Group, November 3, at Indianapolis.

Don Carr, Nelson Shaffer, and Chris Smith attended Indiana Geologists, November 9.

Nancy Hasenmueller and Nelson Shaffer attended the 1983 Eastern Oil Shale Symposium from November 13-16 at Lexington, Kentucky.

Walt Hasenmueller, Curt Ault, Don Carr, and Hank Gray attended a meeting of the Tri-state Committee on Correlations in the Pennsylvanian System of the Illinois Basin, November 14, at the Survey.

Chris Smith attended a meeting of the Indiana Water Resources Association, November 15.

Don Eggert attended a meeting of the North American Coal Petrologists, November 17-18, at Merrillville, Indiana. About 50 petrologists from the United States and Canada attended.

Dan Sullivan and Gerald Carpenter attended the November meeting of the Indiana-Kentucky Geological Society in Evansville. Frank Walker of the Kentucky Geological Survey spoke on the efforts of the state of Kentucky to assume jurisdiction over the underground injection of fluids in Kentucky and the ramifications of some of the proposed regulations of the U. S. Environmental Protection Agency on the oil industry in Kentucky.

Chris Smith and Nelson Shaffer attended a workshop on use of lineaments, December 1, at Morgantown, West Virginia.

On December 5-7, Don Carr and Chris Schubert attended a review of projects being conducted in the Coal Branch, U.S. Geological Survey, and talked with U.S. Geological Survey personnel about the National Coal Resources Data System project.

Walt Hasenmueller, Licia Weber, and Paul Irwin attended a retreat of the Division of Reclamation at McCormicks Creek State Park, December 13.

Curt Ault and Chris Smith attended a report meeting to the Nuclear Regulatory Commission, December 15, at Washington, D.C.

Dan Sullivan and Gerald Carpenter attended the December meeting of the Indiana-Kentucky Geological Society in Evansville. John Patton was the after-dinner speaker.

John Hill attended the first meeting of the new Indiana Environment Policy Commission, in which the Survey has observer status, Indianapolis, January 12, 1984.

Nelson Shaffer attended a meeting of Indiana Geologists, January 18, at Indianapolis.

On January 19, Don Carr attended a meeting of the Task Force for Industrial By-Products, Corporation for Science and Technology, in Indianapolis.

On January 19, Don Carr, Dick Leininger, and John Patton attended a meeting of the Energy Development Board and a ground-breaking ceremony for a facility to test the Ebarra Process, a method to remove sulfur and nitrogen oxides from coal combustion gases.

On January 24, members of the Coal and Industrial Minerals Section met for the annual review of projects of the Section. At the meeting Mr. Nelson Severinghaus, Jr., president of the Society of Mining Engineers, spoke on commercial aspects of industrial minerals.

Dan Sullivan attended the January meeting of the Indiana-Kentucky Geological Society in Evansville, L. Braille spoke on Tectonics of the New Madrid area.

On February 2, Don Carr and Nelson Shaffer accompanied Dick Leininger and John Patton to a meeting in Indianapolis with personnel from the Indiana Department of Commerce and the Western Research Laboratory of the University of Wyoming.

Nelson Shaffer and Gordon Fraser attended a meeting of Indiana Geologists, February 8, at Indianapolis.

Members of the Coal and Industrial Minerals Section and others from the Survey met for a geophysical log seminar, February 28. Curt Ault and Brian Keith made presentations on log interpretations in Pennsylvanian rocks.

Dean Alger, Indiana University graduate student, presented a talk at the February meeting of the Indiana-Kentucky Geological Society. Title of the talk was "Depositional Environments of sandstone bodies in the Renault and A Vases Formations". Gerald Carpenter, Stan Keller, John Rupp, and Brian Keith attended the meeting held in Evansville.

Chris Smith attended a meeting of Indiana Geologists March 14.

Walt Hasenmueller and Chris Schubert attended the Indiana Coal Mining Institute at Owensboro, Kentucky, March 28-31.

Stan Keller and John Rupp attended the March meeting of the Indiana-Kentucky Geological Society in Evansville. Speaker for the evening was American Association of Petroleum Geologists Distinguished Lecturer John Balsley who spoke on Cretaceous tidal-dominated clastic systems.

Don Carr, Curt Ault, and Chris Smith attended the coal-field trip associated with the meeting April 2-4.

Don Carr, Curt Ault, Chris Smith, Gordon Fraser, and Nelson Shaffer attended the regional Geological Society of America meeting in Lexington, Kentucky, April 4-6.

Gordon Fraser and Carl Rexroad attended the annual meeting of the North-Central and Southeastern Sections of the Geological Society of America, Lexington, Ky., April 5-6, 1984.

On April 10, Don Carr attended a meeting of the Coal Advisory Committee of the Energy Development Board at Indianapolis.

On April 11, Don Carr attended a meeting of Indiana Geologists in Indianapolis.

On April 23, Don Carr attended the spring meeting of the Indiana Limestone Institute of America.

On April 26, Nancy Hasenmueller, Curt Ault, Don Carr, and Nelson Shaffer attended the session on black shale at the Indiana University Expo 84 at Bloomington.

On April 27-28, Don Carr and Curt Ault attended the spring meeting of the Indiana Academy of Science at Brookville.

Nelson Shaffer attended mineral shows at Cincinnati on April 8, Richmond, on April 28, and Columbus, Ohio, on April 29.

On May 15-18, Don Carr and Curt Ault attended the Forum on Geology of Industrial Minerals at Baltimore, Maryland.

Gerald Carpenter and Brian Keith attended the annual meeting of the American Association of Petroleum Geologists in San Antonio, Texas in May.

John Rupp and Gerald Carpenter attended the Indiana-Kentucky Geological Society meeting in Evansville on June 7. Howard Schwalb of the Illinois Geological Survey presented a talk on "Tectonics of the Illinois Basin". Background data for the topic was gathered as part of the New Madrid Study Group with which the Indiana Survey has been involved for a number of years.

Dan Sullivan attended the Kentucky Oil and Gas Association in Owensboro, Kentucky on the 13th-15th of June.

Nelson Shaffer attended a mineral show at Lawrence County, June 16.

Edwin Hartke attended the Indiana Water Resources Association meetings at Shawnee Bluffs, June 20-22, 1984.

Chris Smith attended the technical session of the Indiana Water Resources Association, June 21. On June 20, Don Carr attended the reception the Association held for Bill Andrews.

John Rupp and Gerald Carpenter attended a hearing held in Evansville by the Division of Oil and Gas on proposed rules changes and changes already in effect as a result of action taken by the 1983 legislature. The meeting was well attended by representatives of both the oil and coal industries.

FIELDTRIPS

Don Eggert conducted a fieldtrip to the Lynnville Mine, Eby Pit, for several geologists from the Illinois Geological Survey, the University of Washington, and the Kentucky Institute of Minerals and Mining, July 1983.

In August 1983, Don Eggert conducted a field trip to examine the Springfield Coal Member with two Kentucky geologists.

Carl Rexroad conducted a field trip for his class on "Geology and Theology," September 17.

On September 21, Don Carr guided a group from Marathon Oil Co. on a field excursion to look at Middle Mississippian rocks in western Monroe and eastern Owen Counties.

On October 2, Nelson Shaffer and Don Eggert attended a field trip to visit several Consolidation Coal Company mines at the American Association of Petroleum Geologists meeting in Carbondale.

The following field trips were conducted by the leaders listed below in conjunction with the Geological Society of America meeting in Indianapolis October 30-November 5.

Urban and engineering geology of the Indianapolis area, October 30. Mirsky, A., and Hartke, E. J. with contributions from Ault, C. H., Fraser, G. S., Bailey, Bruce, Banaszak, K. J., Bruns, T. J., Strange, J. T., Haumesser, Andrew, and Schmidt, K. K.

Origin and economic geology of the Springfield Coal Member in the Eastern Interior Basin, October 28-30. Eggert, D. L., and Harper, Denver.

Silurian reef and interreef strata and responses to a cyclical succession of environments, November 3-6. Shaver, R. H., Sunderman, J., and others.

History of Pleistocene alluviation of the middle and upper Wabash Valley, November 4-5. Fraser, G. S., and Bleuer, N. K.

Lithostratigraphy, mineralogy, and geochemistry of the New Albany Shale (Devonian and Mississippian) in southeastern Indiana, November 4. Hasenmueller, N. R., Leininger, R. K., and Shaffer, N. R.

The Salem Limestone in the Indiana building-stone district, November 4. Patton, J. B., and Carr, D. D.

John Hill and John Rupp conducted a fossil and otherwise oriented field trip for Indianapolis minority school children to the Brookville Reservoir, November 1.

Ned Bleuer and Gordon Fraser, with Norman Smith, conducted Geological Society of America field trip 13 on "History of Pleistocene alluviation of the middle and upper Wabash Valley," November 4-5.

Henry Gray helped to conduct a one-day version of the Geological Society of America field trip 14 on "Archaeological geology of the Wyandotte Cave region, south-central Indiana," November 5.

Carl Rexroad, with Mark Kleffner, conducted a field trip on "The Silurian stratigraphy of east-central Kentucky and adjacent Ohio," for the Pander Society meeting at the North-Central and Southeastern Sections, Geological Society of America, meeting at Lexington, Ky., April 7.

Ned Bleuer and Gordon Fraser attended two field conferences on Pleistocene geology, one a private trip with Michigan State University geologists in southern Michigan, April 14, and the other from Albion College, sponsored by Eastern Section, National Association Geology Teachers, April 15.

Gordon Fraser participated in an informal Pleistocene field conference led by Iowa Geological Survey personnel in Iowa, April 19-20.

On April 28, Curt Ault and John Hill conducted a geology field trip to a quarry and other locations near Brookville for the Indiana Academy of Science

On May 10 and 11, Curt Ault, Don Carr, and Walt Hasenmueller attended a field trip of the Tri-State Committee on Correlations in the Pennsylvanian System in the Illinois Basin.

On May 15 and 17, Curt Ault and Don Carr attended field trips near Baltimore, Maryland, at the Forum on Geology of Industrial Minerals.

On May 19, Nelson Shaffer attended the Indiana Geologists field trip.

Ned Bleuer attended the meeting of the Midwest Friends of the Pleistocene, River Falls, Wisc., June 1-3, 1984.

On June 27, Curt Ault conducted a field trip to dimension-stone quarries and a mill for a local church group.

John Rupp was a co-leader with Al Horowitz and John Hill of a field trip conducting 135 high school students from Indianapolis to Brookville, Indiana to observe upper Ordovician outcrops as part of the national Geological Society of American meeting in Indianapolis.

REVIEWS

In July 1983, Gordon Fraser reviewed a National Science Foundation proposal on biofacies study of Middle Ordovician rocks of the upper Mississippi Valley.

In December, Nelson Shaffer reviewed a paper on metals in black shales of Montana for a geologist at the Montana Geological Survey.

In January, Nelson Shaffer reviewed an article, "Our crumbling rock," and reviewed a report on classic papers in geology.

In March, Don Carr reviewed Carl Rexroad's Compendium articles.

In March, Curt Ault reviewed several abstracts for geologic names and reviewed Compendium articles for rock units of Pennsylvanian age.

On May 4, Don Carr reviewed a technical paper for the Society of Mining Engineers on "Waste-clay disposal and land reclamation techniques in the Florida phosphate industry."

On May 7, Don Carr reviewed a paper on "University-based cooperative research for the mining industry."

In May, Curt Ault reviewed abstracts for the Geologic Names Committee.

In June, Don Carr reviewed a manuscript for publication by the Society of Mining Engineers. He also reviewed a proposal on coal for the National Science Foundation.

Ned Bleuer critically read the following: a manuscript on "Sedimentology of a Drumlin Substage Moraine, County Down, Ireland," for Jour. Sedimentary Petrology; a research proposal to the National Science Foundation on "Climatic implications of Ohio and Indiana molluscan assemblages during the

last glacial maximum"; and an article on Fort Wayne-area geology for the Geological Society of America Centennial Field Guide.

Gordon Fraser reviewed a paper on trace elements in till for the Jour. Sedimentary Petrology.

Henry Gray reviewed the following: part of a manuscript for a member of U.S. Dept. Agriculture Soil Conservation Service, Greene Co., on soils of Greene County; a manuscript on "History of alluviation of the Ohio River Valley near Evansville, Indiana"; a manuscript on Foerstia in Devonian black shales; five articles for the Geological Society of America Centennial Field Guide on the Wabash reef, Falls of the Ohio, Lost River features, Cataract Lake spillway section, and Lovers Leap section; and copy for the Blue River, Borden, and Sanders articles for the revised "Compendium of rock-unit stratigraphy in Indiana."

Edwin Hartke critically reviewed a manuscript on "Water quality in Lake Lemon, Indiana" for a student in the School of Public and Environmental Affairs, Indiana University.

John Hill reviewed a manuscript by a member of the Environmental Protection Agency, Washington, D.C., on low permeability soils for hazardous waste disposal and also a manuscript on "Aquifer performance characteristics of the Sand Hill Aquifer near New Washington."

Carl Rexroad reviewed the following: an article on Early to Middle Pennsylvanian conodonts from the Klawak Formation and Ladrows Limestone, southeastern Alaska, for the Jour. of Paleontology editors; all copy for post-Paoli Chesterian units for the revised "Compendium of rock-unit . . . Indiana"; a review of his own Vienna conodont paper, the review having been written for the Soviet Academy of Sciences; a manuscript for publication in Lethaia; and a manuscript by R. S. Nicoll, Australian Bureau of Mineral Resources.

Robert Shaver critically reviewed the following: an article on New Harmony, prepared for a British geographical magazine; a Geological Society of America poster session on relation of underground coal mines in western Indiana to buried Silurian reefs; a proposal to make Hanging Rock a National Natural Landmark for the National Park Service office in Omaha; a manuscript on Carboniferous rocks in the Michigan Basin, requested by an employee of the Michigan Geological Survey; an Occasional Paper manuscript on the Sauk sequence in Indiana and a manuscript on ostracods for Jour. of Paleontology; articles for the Geological Society of America Centennial Field Guide on Ardmore Avenue Quarry site and vicinity, Fort Wayne, Pyramid Site near Oolitic, Quaternary and Ordovician geology at Madison, and Orangeville Rise and Lost River; U.S. Geological Survey Prof. Paper 1300 on resources in U.S. Wilderness Areas and "Draft environmental impact statement, Hoosier National Forest" and related management plan and maps; and an article on "Diagenetic history of a Middle Silurian pinnacle reef from northwestern Michigan Basin," to be published in Jour. of Sedimentary Petrology.

Stan Keller acted as map editor for a manuscript prepared by Ed Hartke titled "Geology for Environmental Planning in Starke County, Indiana".

Stan Keller acted as critical reader for a manuscript authored by John Droste and John Patton titled "Lithostratigraphy of the Sauk Sequence". The paper is to be published as an occasional paper by the Geological Survey.

Brian Keith critically read a manuscript authored by Carl Rexroad which describes the geology of the falls of the Ohio.

John Rupp critically read a manuscript for a portion of a field trip guidebook to the Indiana Dunes authored by John Hill.

Gerald Carpenter and John Rupp reviewed plans for two liquid waste disposal wells submitted to the State Board of Health at the request of that office. A request by U. S. Steel was made for a permit to install a back-up facility to the existing disposal well they presently utilize at their plant site. Hoskins Manufacturing Co. applied for a permit to dispose of waste pickle liquor at their plant site at New Paris, Elkhart County. Both firms are requesting permission to utilize the Mount Simon Sandstone as their disposal reservoir.

NEWS RELEASES

In October, Nelson Shaffer was interviewed about unusual rocks in Indiana for the Indiana Outdoors program on Channel 4, WTTV, Bloomington.

Dan Sullivan prepared some comments on the activities of the oil industry in Indiana for inclusion in an annual oil-progress issue of the Evansville Courier and Press newspaper.

Brian Keith was interviewed by a reporter from the Indiana Daily Student newspaper for an article on the consequences of the oil crises in the years since 1973.

REPORTS AND MAPS SUBMITTED FOR PUBLICATION

(author undecided), Correlation chart showing Paleozoic stratigraphic units of Indiana: Indiana Geol. Survey Supplement to Misc. Map ____.

Bassett, P. A. and Keith, B. D., Data base for deep wells in Indiana; Indiana Geological Survey Occasional Paper.

Bleuer, N. K., and Shaver, R. H., The Lovers Leap section and related observations of multiple and cross-cutting glacial drifts in the Great Bend area, Indiana: Geol. Soc. America, Decade of North American Geology (GSA-DNAG), Centennial Field Guide, 15 p., 6 figs.

Culbertson, Glenn, and Culbertson, J. A., with introduction and commentary by H. H. Gray, Time required for the erosion of Clifty and Butler Ravines: Occasional Paper, 7 p., 4 figs.

Fisher, J. H., Barratt, Michael, Droste, J. B., and Shaver, R. H., The Michigan Basin and area, in The North American Craton in the United States: Boulder, Colorado, Geol. Soc. America, Decade of North American Geology Ser., 17 p., 15 figs.

Gray, H. H., Ault, C. H., and Keller, S. J., Bedrock geologic map of Indiana (scale 1:500,000).

Gray, H. H., Archaeological sedimentology of overbank silt deposits on the floodplain of the Ohio River near Louisville, Kentucky: Jour. Archaeol. Sci., 31 p., 5 figs.

Gray, H. H., Origin and history of the Teays drainage system--the view from midstream: Geol. Soc. America symposium, 15 p., 5 figs.

Gray, H. H., Sub-Pennsylvanian disconformity near Shoals, Indiana: Geological Society of America Centennial Field Guide, 10 p., 3 figs.

Hasenmueller, W. A., and Bleuer, N. K., Cataract Lake emergency spillway, Indiana: ibid, 15 p., 5 figs.

Hill, J. R., Indiana Dunes area: ibid, 9 p., 7 figs.

Hill, J. R., Icebound giants: Outdoor Indiana, 2 p., 2 figs.

Keith, B. D., Map of Indiana showing thickness and oil and gas fields in the Trenton and Lexington Limestones; Misc. Map.

Keith, B. D., Map of Indiana showing structure on top of and oil productive areas of Black River Group (Ordovician); Misc. Map.

Rexroad, C. B., and Lane, N. G., The Spickert Knob Formation (new), Borden Group, in Indiana: Occasional Paper, 7 p., 1 fig.

Rexroad, C. B., and Powell, R. L., The Falls of the Ohio River, Indiana and Kentucky: Geological Society of America Centennial Field Guide, 14 p., 5 figs.

Shaver, R. H., Wabash, Indiana: ibid, 8 p., 4 figs.

Shaver, R. H. The Borden Group: Ancient and modern perspectives from the Knobs Overlook, Indiana: ibid, 11 p., 6 figs.

MISCELLANEOUS ACTIVITY

Robert Shaver collaborated with the U.S. Army Corps of Engineers, Louisville, in their acquisition and interpretation of data for their report (October 1983) on the streambank erosion problem along the Wabash River at New Harmony, a problem with which the Section first became centrally involved in 1978. Publicity on this problem and on our involvement got into regional and national press, television, magazine services and networks, not all of it without stirring some controversy and doubt about the efficacy of the Section's own, earlier reports on the erosion problem at New Harmony. In view of such sensitivity, this conclusion from the Corps of Engineer's report is provided here: "... it is apparent that a severe erosion problem exists . . which will likely, within the next 15 years, threaten the community of New Harmony."

Brian Keith prepared an evaluation of the potential of some Pennsylvanian sandstone beds in the vicinity of Vincennes for use as storage of compressed air for later recovery and use. The evaluation was in response to a request for help from Rex Alton, operator of a sand and gravel pit. Mr. Alton hopes to store air and recover it to operate an air-lift dredge.

Stan Keller and Brian Keith constructed east-west cross sections of portions of the Mississippian rocks in southwestern Indiana. Stan depicted the Buffalo Wallow Group from Posey County eastward to the outcrop area in Perry County. Brian constructed a log cross section in northern Gibson County of the Chesterian and Valmeyerian rocks. Two more sections in Gibson County, the central area and the southern area, are planned. The sections were made as an aid in understanding stratigraphic relationships and correlations in southern Indiana.

Stanley Keller and Gerald Carpenter met with representatives of Indiana Gas Co. and of the Division of Oil and Gas of the Department of Natural Resources at the village of Circleville to investigate numerous reported gas leaks.

Brian Keith prepared three sections for inclusion in the proposed Indiana Geological Survey Bulletin "Compendium of Paleozoic Rock Unit Stratigraphy in Indiana--A Revision" authored by R. H. Shaver and others. Brian's contributions were: "Trenton Limestone, Champlainian and Cincinnati Series, Ordovician System"; "Lexington Limestone, Champlainian and Cincinnati Series, Ordovician System"; and "Curdsville Limestone Member, Lexington Limestone, Ordovician System".

Gerald Carpenter prepared some information for the Northeast Oil Reporter magazine in order that they could prepare an article on the exploratory efforts in Indiana during 1983.

Gerald Carpenter prepared a report on oil development and drilling in Indiana as a contribution to a world-wide report on oil and gas development published in the Bulletin of the American Association of Petroleum Geologists.

	Total
Projects in progress	51
Projects completed	13
Visitors . . . . .	.563
Visitor days . . . . .	.1,444
Conferences with visitors to the Survey. . . . .	.793
Telephone conferences. . . . .	.459
Total service requests . . . . .	.845
Man days of fieldwork. . . . .	.584
Incoming letters . . . . .	.5,910
Outgoing letters . . . . .	.3,035
Public lectures.	22
Papers and posters presented at professional meetings.	26
Attendance at professional meetings.	53
Talks at technical programs. . . . .	.6
Field trips (Total).	77
In connection with conferences.	62
Educational	9
News releases.	1
Mineralogic analyses	14
X-ray mineralogic analysis . . . . .	.574
Physical tests	68
Core described (ft.) . . . . .	.1,804
Auger footage. . . . .	.231
Grain-size analyses. . . . .	.168
Area mapped (sq. mi.). . . . .	.108
Joint orientation measurements . . . . .	.950

Special Mailings (series of Indiana's newspapers) . . . . .	.136
Special rock sets prepared for teachers, et al	4
Identification of specimens (rock, mineral, and fossil).	20
Information packets mailed	13
Total number of Survey vehicles.	23
Total number of miles traveled . . . . .	.180,867
Exhibits installed for special occasions, etc.	1
Environmental impact statements completed. . . . .	.263
Identifications (rocks, minerals, fossils)	42
Rock analyses (magnetic, mineralogical, textural, physical). . . . .	.2,783
Thickness of stratigraphic sections measured (ft.) . . . . .	.7,510
No. of stratigraphic sections measured	98
Samples received or collected (total). . . . .	.1,789
Clay and shale samples. . . . .	.432
Rocks, minerals . . . . .	.893
Sand & gravel	21
Coal samples.	20
Water samples . . . . .	.182
Fossils . . . . .	.438
No. of holes gamma-ray logged.	43
Feet of cores gamma-ray logged . . . . .	.3,995
No. of holes augered	98
Feet of holes augered. . . . .	.4,984
No. of rotary water wells sampled.	15
Feet of rotary water wells sampled . . . . .	.1,763
Well cutting sets catalogued and filed . . . . .	.212
Cores (wells). , . . . . .	.8

Strip logs made (wells). . . . .	.195
Feet of well cuttings represented on strips. . . . .	.346,913
Wells field checked (current drilling only). . . . .	.1,153
Published reports	
Bulletins (reprinting). . . . .	.1
Directories . . . . .	.1
"Gold and Diamonds in Indiana" (reprinting) . . . . .	.1
Mineral Economics Series. . . . .	.1
Occasional Papers (new) . . . . .	.2
Occasional Papers (reprinting). . . . .	.1
Special Reports . . . . .	.2
State Park Guides (reprinting). . . . .	.1
Published maps	
Miscellaneous Maps (revised). . . . .	.1
Petroleum Exploration Maps (new). . . . .	.4
Petroleum Exploration Maps (revised).	80
Petroleum Exploration Maps (checked without revision)	48
Reproduction-Logs.	\$31,765.00
Reproduction-Xerox . . . . .	.\$4,456.30
Published reports sold . . . . .	.9,698
Published maps sold.	23,800
Publications office customers. . . . .	.4,700
Publications announcements mailed. . . . .	.1,427
Survey reports edited. . . . .	.9
Papers reviewed.	10
Outside publications edited.	41
Reports completed and sent to editors for outside publication.	1
News releases, newsletters, exhibits, etc., edited	39

Camera copy projects prepared.	55
Survey reports now in editorial process (total). . . . .	.4
State geologic map series . . . . .	.1
Miscellaneous map (supplement). . . . .	.1
Occasional Papers . . . . .	.2
Outside publications in editorial process (total).	10
Complete reports. . . . .	.3
Field-trip guides . . . . .	.7
Published outside publications (total)	14
Abstracts . . . . .	.6
Field-trip guides . . . . .	.8

	1982		1983	
	<u>Quantity</u>	<u>Value</u>	<u>Quantity</u>	<u>Value</u>
Coal	30,387,315 tons	\$750,262,807.00	32,407,957 tons	\$795,939,424.00
Petroleum	5,562,696 bbls	176,082,400.00	5,319,578 bbls	157,565,900.00
Limestone, crushed	22,229,216 tons	71,406,993.00	24,026,270 tons	79,970,743.00
Sand and Gravel	13,713,948 tons	36,468,606.00	14,308,099 tons	40,665,039.00
Limestone, Dimension	1,349,640 cu.ft.	4,971,627.00	2,095,384 cu.ft.	7,269,066.00
Clay and Shale	500,923 tons	1,220,519.00	557,998 tons	1,237,149.00
Natural Gas	226,000,000 cu.ft.	360,000.00	135,318,000 cu.ft.	282,815.00
Undistributed (includes dimension sandstone, gypsum, marl, peat, whetstones)		<u>8,956,123.00</u>		<u>9,071,341.00</u>
TOTAL		\$1,049,729,075.00		\$1,092,001,477.00
Value added for additional processing of dimension limestone, and manufacture of clay products and cement		\$ 93,761,831.00		\$ 104,484,639.00