

105TH ANNUAL REPORT OF THE STATE GEOLOGIST

of

INDIANA GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES

for

July 1, 1980 - June 30, 1981

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

PERSONNEL

Permanent Personnel

Administration

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

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Donald D. Carr.Geologist and Head
Curtis H. Ault.Geologist and Associate Head
Pei-Yuan ChenGeologist (To January 2, 1981)
Donald L. Eggert.Geologist
Gordon S. Fraser.Geologist
Denver HarperGeologist
Nancy R. HasenmuellerGeologist (From February 2, 1981)
Walter A. Hasenmueller.Geologist
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Janet Roller.Secretary
Kathryn ShafferSecretary

Drafting and Photography Section

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Richard T. HillSenior Geological Draftsman
Roger L. Purcell.Senior Geological Draftsman
George R. Ringer.Photographer
Wilbur E. Stalions.Geological Artist-Draftsman

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 Roger S. McCayElectronic Technician
 (To July 14, 1980)
 Louis V. MillerCoal Chemist
 Kathryn ShafferSecretary

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 Ned K. BleuerGlacial Geologist
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Jenada Freeman. Laboratory Assistant
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COAL AND INDUSTRIAL MINERALS

Introduction

Members of the Section excelled in all three phases of our activities during the year. Our service to the public and to industry increased considerably, we answered nearly 1200 requests for information during the year, and were instrumental in helping several companies develop new mineral resources in the state. Financial arrangements are nearly complete for the operation of a quarry and construction of a multimillion dollar refractory plant using high-purity dolomite in Jay County. We provided geologic data and counsel in the initial stages of the project during the company's search for a suitable deposit in several Midwestern states. We also provided geologic information for the search for and development of high-calcium limestone in northern and south-central Indiana for several other companies, and a number of companies asked us for information on possible metals deposits in the state. We receive a continual flow of requests for detailed information on Indiana coal resources, and our geologists consult regularly with personnel of major coal companies operating in the state.

The research phase of our activities is necessary to support service activities, and this year we completed a large number of projects or major parts of projects, including compilation of directories, construction of several planning and geologic maps, and publication of articles on industrial minerals and coal of the state. We continue to work on 30 research projects that range from deep drilling for coal information to construction of a geologic map of the state. We find that results of our research are put to immediate practical use by industry and those seeking information on the state's natural resources.

Members of the Section were particularly active in professional organizations, meetings, and activities, a phase of our work that is necessary to keep us abreast of advances in the geologic profession and to make our research most effective. We presented nine papers and posters at professional meetings and lectured at various schools, symposiums, and public and other meetings. Members of the Section were officers in national and local geologic organizations and members of professional and other committees. We began planning and organizing for a major professional meeting in 1982 on geology of industrial minerals.

Research Projects in Progress

Deep drilling program for coal

The Section maintains a continuing project to obtain information on Indiana's deep coal beds, those that probably will be mined by underground methods. This drilling program provides information on thickness, quality, reserves, and mineability of coal; on the properties of rocks associated with the coal for underground mining purposes; and on the methane content of the coal. This year we attempted to drill a deep coal test in Gibson County, but the hole had to be abandoned because of our inability to set surface casing. Several holes are scheduled for next year with partial funding by the U.S. Geological Survey.

Preliminary coal maps of Posey, Greene, Owen, and Putnam Counties

Work continues on our county reconnaissance-type mapping of the distribution, structure, and mined areas of coal. The Putnam County map was completed this year, giving us 18 counties for which maps are available. Progress on the preliminary coal map of Owen County included adding drilling data to our file from a number of test drillings donated by the coal industry. The compilation of maps showing mineable coals in Greene County neared completion. Work maps and most of the final maps have now been compiled on the extent and structure of the coals and mining information for this county. Some progress was also made on coal maps for Posey County.

Characterization of potential roof and floor rocks associated with Indiana coals

A project to examine lithologies of coal-bearing formations has been completed. The final report is being prepared.

Coal resources of Gibson County

Little is known of the thickness and distribution of the major coal beds in the deep subsurface of Gibson County. This study was undertaken to correlate and map the thickness of the coal beds using the abundant electric logs from petroleum tests that have been drilled in the county since the early 1900's. During the year, correlation and interpretation of electric and other geophysical logs were completed and data tabulated. Construction of final maps is underway.

Annual mine check

Each year the Section visits coal mines to record activity, location, geology, and other data. This project was well under way by the end of the year. All initial data has been collected and only final checking remains to be done.

Indiana coal data system

This year the Section attempted to compile and publish a statistical summary of Indiana coal quality information for the analytical data of all coal samples that have been analyzed by the Survey.

Slurry ponds

Before this study was begun, the amount, quality, recoverability, and distribution of finely ground coal that has been disposed of in waste slurry ponds in Indiana was essentially unknown. Sampling of the ponds was completed this year and analysis of these samples continues. Work on the final report was begun, and a paper on the energy resources of the tailings at the Airline-Townslar mine in Greene County was completed and presented at a surface-mine symposium.

Subsidence caused by underground mining of coal

As developments occurred in western Indiana, the Section anticipated a need to determine the extent of subsidence in underground mining in Indiana,

methods of recognizing subsidence where it has already occurred, possible areas of future subsidence, and the possible effects of subsidence in given areas. A survey of subsidence detectable on aerial photographs has been completed, and a report on mine subsidence is now in preparation.

Roof stability and geologic discontinuities in coal seams

One of the Section's geologists has been assigned to study and summarize the effects of geologic features on roof stability in underground coal mines. Work was completed on a study of unusual geologic features encountered in an underground mine now operating in Indiana. A final report on the work has been completed and now awaits drafting before publication.

Demethanization of coal

Indiana coals have been found to contain significant amounts of ethane. A study will determine as far as possible the gaseous content of coal seams in Indiana using desorption methods developed by the U.S. Bureau of Mines. This year, degassification of available cores was completed. A preliminary report, showing results to date, was completed.

Coal resources of Vigo County

Several projects deal with the coal resources of particular counties. One of these is a study of the coal geology and history of mining in Vigo County. Work began on a series of structure and thickness maps for major coal seams and rock intervals between the coal seams. Work also started on the parts of the report containing the chemical analyses of the coals, electric-log cross sections, and unusual geologic conditions reported in the underground and surface mines.

Trends in underground coal mining in Indiana

This project, which included a review and analysis of historical production of coal in Indiana, was completed, and a report was published by the Survey.

Coal resources of Vanderburgh County

Another of the county resource studies was started this year to investigate the thickness, quality, and distribution of coals in Vanderburgh County. Preliminary work has begun on the compiling of a stratigraphic cross section of geophysical logs in the northern part of the county.

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

New well data on file in the Petroleum Section were added to structure maps that are being constructed on top of the Muscatatuck Group and on the top of rocks of Silurian age. Revisions are now nearing completion.

Silurian reefs in northern Indiana

An investigation of the distribution of high-calcium limestone in Silurian reefs of northern Indiana was completed this year and approved for

publication in a special volume of the Bulletin of the Geological Society of America. We continue to receive requests for information on locations and reserves of limestone and dolomite reefs as sources of crushed-stone aggregate.

Carbonate rock fillers and whiting

More than 500 samples have been tested to date to determine whiteness and brightness of limestones and several areas of Indiana have been found to contain high-brightness carbonate rocks. Tables of brightness and results of chemical analyses of all samples were compiled and entered onto punch cards for computer use. A report was prepared on the data that has been compiled to date.

Crushed stone resources of the Blue River Group

Survey drill hole 313 was completed near the Hy-Rock Products Co. mine near Marengo, and the core was described and sampled for chemical analysis. This work helps define the locations and variability of high-calcium deposits in the Ste. Genevieve Limestone in south-central Indiana.

Directory of dimension-stone quarries in Indiana

Compilation of data for this directory began in the latter part of the year and was finished in September, 1981.

Tabulation and description of abandoned quarries

The compilation of geologic data on abandoned limestone and other quarries has continued this year in conjunction with other research projects and service duties. A few quarries were located in northern and southeastern Indiana and the information added to our files, which are regularly consulted for reclamation and mineral-resource information.

Underground mining of limestone and dolomite in Indiana

Although not a formal project, our investigation of possibilities for underground mining of limestone and dolomite continued this year because of the continuing interest in underground mining. A report on areas that have the greatest potential for underground mining for limestone and dolomite in Indiana was completed and accepted for publication by the AIME.

Industrial minerals applications of underclays

X-ray analysis of samples gathered in the field continued. A cooperative program to run tests of the ceramic properties of clay samples was undertaken with the U.S. Bureau of Mines.

Directory of clay and shale producers

The directory was revised and published this year.

Shale and clay

Members of the Section described and sampled several cores this year to continue our collection of detailed data on the shales of Indiana. Samples were also collected at active clay and shale pits during the updating of the directory of producers.

Fluorite, barite, and sphalerite

The Section published and distributed a report on this project. Measurements continued on new samples, and requests for information from industry personnel were answered. Analyses of metals in the New Albany Shale included investigation by scanning electron microscopy, microprobe, and reflected light microscopy. A report of the New Albany Shale metals was prepared for presentation at a Geological Society of America meeting this fall.

Mineral resources map of Indiana

A map showing the location of mineral deposits in Indiana was completed and submitted to the Drafting Section during the year.

Surficial geology of southern Vanderburgh County

A manuscript describing the surficial geology of southern Vanderburgh County and emphasizing the Quaternary geology of the Ohio River Valley was prepared to bring this project near completion. The reports includes a description of the sand and gravel resources associated with the Ohio River.

Alluviation of the Middle Wabash River

Terrace deposits lining the walls of the Wabash River Valley from Terre Haute to Lafayette provide material for an interesting project. Samples were collected this year from numerous exposed sections, and all available subsurface information was collected and combined with the surface data to produce maps of the terraces showing thickness of sand and gravel deposits and thickness of overburden. Some of the results were presented in two papers at professional conferences.

Terrace deposits along the Whitewater River

Sand and gravel deposits along the Whitewater River are subject of a study to determine their nature and origin and their relationship to the sand and gravel deposits of the Ohio River. During the year, field and laboratory work on the project were completed, illustrations and maps were prepared, and a manuscript written.

Pleistocene lake deposits of Daviess County

Section geologists investigated the extensive lake deposits of central Daviess County to determine their origin. During the year the project was expanded to include a study of all the surface deposits of the county, and a preliminary map was prepared showing the distribution of the major types of surficial materials.

Directory of sand and gravel producers in Indiana

In February work was begun to update the present directory.

Sedimentology of the Kankakee River

Studies published by the Illinois Geological Survey and Illinois Water Survey were critiqued to determine whether or not bias was present in their interpretation of the processes leading to increased sediment deposition in the Illinois portion of the river. A preliminary study was begun to understand and identify sedimentary processes of the river, and critiques were forwarded to the Department of Natural Resources.

Terrace deposits of the Eel River

Sand and gravel deposits along the Eel River were included in studies of terrace deposits to determine their origin, extent, and suitability as an economic resource. Several field trips were conducted to the area, outcrops were visited, and samples were collected during the year.

Geologic map of Indiana

Geologists in the Section completed construction of structural maps and mapping of bedrock formational contacts for northern Indiana.

Annotated Bibliography of Indiana geology

We continue to review literature and compile bibliography cards for the years 1972-75 for this project.

Faulting in southwestern Indiana (NRC funded)

This 4-year project was nearly completed. During the year the Section scheduled detailed field work to locate and define the Mt. Carmel Fault and associated faults and to investigate subsurface data to determine depth and possible origin of the faults. Locations were determined for the drilling of two test holes by the Survey to help interpret the structure and possible extension of the known northeastern end of the fault. Work on the final report and drafting of illustrations continued.

Faulting in mines of southwestern Indiana (NRC funded)

Funding for this project was approved to begin in July, 1981. The project includes investigation of small-scale faulting and other displacement structures in surface mines of southwestern Indiana to help characterize the seismicity and determine the times of faulting in the area.

New Albany Shale project (DOE funded)

The final report summarizing the Survey's work on the New Albany Shale and equivalent strata in Indiana was completed this year for the 4-year study. A manuscript summarizing results of the study was prepared and numerous inquiries from industry and other interested persons were answered. Delineation and characterization of the shale resources in southwestern Indiana will continue.

Coal planning information project for the Illinois Basin (USGS grant)

This project is nearly complete. All of the illustrations and tabulations of mine production and reserve data to be included in the final report have been assembled. A draft of the final report has been written, and the report is now under review for inclusion with similar reports from the Illinois State Geological Survey and Kentucky Geological Survey in a source book of coal planning information for planners.

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 publications and talks, preparation of displays, mounting and framing of maps and photographs, typesetting, 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 include: Special Report 20, Aggregate Resources of the Big Blue River Valley in East-Central Indiana; Special Report 21, Possibility of Mississippi Valley-Type Mineral Deposits in Indiana; Occasional Paper 31, Post-Knox Unconformity -- Significance at Unionport Gas-Storage Project and Relationship to Petroleum Exploration in Indiana; Occasional Paper 32, The Petroleum Industry -- Its Birth in Pennsylvania and Development in Indiana; Occasional Paper 33, Trends in Underground Mining in Indiana; Occasional Paper 34, Conodonts from the Vienna Limestone Member of the Branchville Formation (Chesterian) in Southern Indiana; Occasional Paper 35, Generation of Synthetic Seismograms for an Acoustic Layer over an Acoustic Half Space; Circular 11, Halite -- Salty Mystery of Life; Mineral Economic Series 26, Oil Development and Production in Indiana During 1979; State Park Guide 9, Geologic Story of Brown County State Park; Directory of Crushed Stone Producers in Indiana; Directory of Clay and Shale Producers in Indiana; Miscellaneous Map 15, Map of Southwestern Indiana Showing Areas Strip Mined for Coal (rev.); Miscellaneous Map 27, Map of Southwestern Indiana Showing Locations of Active Coal Mines (rev.); Miscellaneous Map 29, Map of Southwestern Gibson County, Indiana, Showing Structure on Cypress Formation (Mississippian); Miscellaneous Map 30, Map of Northern Posey County, Indiana, Showing Structure on Cypress Formation (Mississippian); Miscellaneous Map 31, Map of Southern Posey County, Indiana, Showing Structure on Cypress Formation (Mississippian); Miscellaneous Map 32, Map of Southwestern Gibson County, Indiana, Showing Structure on Springfield Coal Member (V) of the Petersburg Formation (Pennsylvanian); Miscellaneous Map 33, Map of Northern Posey County, Indiana, Showing Structure on Springfield Coal Member (V) of the Petersburg Formation (Pennsylvanian); Miscellaneous Map 34, Map of Southern Posey County, Indiana, Showing Structure on Springfield Coal Member (V) of the Petersburg Formation (Pennsylvanian); Petroleum Exploration Map 4C, Map of Sullivan County, Indiana, Showing Control on Base of Beech Creek Limestone (Barlow); Petroleum Exploration Map 13C, Map of Greene County, Indiana, Showing Control on Base of Beech Creek Limestone (Barlow); Petroleum Exploration Map 39C, Map of Spencer County, Indiana, Showing Control on Base of Beech Creek Limestone (Barlow); Petroleum

Exploration Map 82, Well Location Map of Grant County, Indiana; Petroleum Exploration Map 82A, Well Location Map of Grant County, Indiana, Showing Total Depth of Wells; and revision of the petroleum exploration maps of Indiana counties.

Other jobs completed include displays for the 1980 State Fair, Indiana University Museum, meetings of the Geological Society of American and American Association of Petroleum Geologists, Geology Building, and Indiana Historical Society Museum; sketches for 18 newspaper articles; illustrations for 7 outside publications; slide drawings for 16 talks; posters for a television program; revision of a map showing published petroleum exploration maps; base maps of Grant and Wells counties; and a series of 18 base maps of southwestern Indiana counties for a directory of coal producers.

Jobs in progress at the end of the fiscal year include Special Report 22, Some Environmental Factors as Aids to Planning in Cass County, Indiana; Special Report 23, Environmental Geology of Grant County, Indiana, -- An Aid to Planning; Special Report 24, The Salina Group (Middle and Upper Silurian) of Indiana; Special Report 25, Stratigraphy and Conodont Paleontology of the Serton Creek Limestone and the Salamonie Dolomite (Silurian) in Northwestern Indiana; Special Report 26, Bedrock Geology and Mineral Resources in Putnam County, Indiana; a display for the 1981 State Fair, and a set of 6 sketches for newspaper articles.

Photographic items produced consist of 1008 camera copies, 38 field and laboratory photographs, 17 photomicrographs, 12 photomicrographs, 966 black and white prints, 6 color prints, 581 film positives and duplicate negatives, 133 stripping film prints of stickup type and symbols, 12 scribesheets, 30 peelcoal films, 23 color proofs of maps and artwork for covers, 256 color slides, and 117 black and white slides.

Approximately 80,500 square feet of prints were produced on the diazo printer.

EDUCATIONAL SERVICES

The Office of Educational Services was established by the State Geologist of Indiana to aid in the coordination of the Geological Survey's efforts to provide information about Indiana geology and mineral resources to the public. This office assists in the preparation of materials for newspapers, magazines, public schools, youth and adult groups, and all other groups and individuals who are interested in rocks, minerals, fossils, and the earth. On request, he participates in radio and television programs which deal with Indiana's geology, minerals, etc. By means of news releases to Indiana's newspapers and articles sent to appropriate magazines, the Office of Educational Services not only aids in informing the public about the activities of the Indiana Geological Survey but also aids in the distribution of education information to the public.

In addition to giving public lectures and conducting special field trips, when requested, the Educational Services geologist works directly with teachers in public schools, in college classes, with geology clubs, civic groups, rockhound clubs, Scout groups, 4-H clubs and adult leaders,

conservation clubs, and children and adults throughout the state on programs or projects concerning Indiana's geology and mineral resources. On occasion, when requested, he serves as guest lecturer and conducts special field trips for college classes. He identifies many of the rock, mineral, or fossil specimens sent through the mail or brought in to the Geological Survey by Indiana citizens and other visitors. The geologist in charge of Educational Services also aids in the preparation and installation of exhibits and displays for fairs, for professional meetings, for amateur rock shows, and for displays in the Geology Building. He also serves as judge of geology exhibits at fairs, rock shows, etc.

During the 1980-81 fiscal year, the geologist in charge of Educational Services spent 33 days in the field and traveled more than 7,400 miles. In answer to requests received from the public, he gave 9 public lectures and conducted 3 educational field trips and 3 tours of the Geology Building during the 12 month period.

During the past fiscal year, he continued the program for providing illustrated news items for Indiana's newspapers and, with the assistance of Survey personnel and the Survey artist, added 18 additional units to the series and mailed them to all newspapers throughout the state. The series currently has 132 subjects--another 6 units are in process.

Public lectures were made to the following groups: gifted student class (summer school), University Middle School, Bloomington; members of the Volunteer Workers Group, Indiana State Museum, Indianapolis; 4th grade class, University Elementary School, Bloomington (2 talks); 7th grade class, Binford School, Bloomington; 3rd grade class, Grandview School, Bloomington; Vincennes Historical and Antiquarian Society, Vincennes; Brownie Scout troop, Elm Heights School, Bloomington.

Several field trips (educational) and collecting field trips were conducted for the following groups: gifted student class (summer), University Middle School, Bloomington; 4-H geology group, Morgan County; St. Peter's Lutheran School 8th grade class, Columbus; science students, Pike High School, Indianapolis; and members of a geology class, Manchester College, North Manchester.

The Educational Services geologist again served as the Geological Survey's representative of the Department of Natural Resources State Fair Committee for the 1980 Indiana State Fair. During the 1980 Annual Careers Day at I.U.P.U. - Indianapolis, he served as a geology counselor.

He conducted tours of the Geology Building for the following groups: a gifted student class (summer), University Middle School, Bloomington; and members of the 4th grade class, Childs School, Bloomington (2 sections; 2 trips).

Articles submitted and published in OUTDOOR INDIANA during the past fiscal year included: "The Ohio River Story", by Henry H. Gray (July-August 1980); "Indiana's First Gas and Petrol Boom - New Hoosier Oil Fields Ahead?", by R. Dee Rarick (September 1980); and "Gold! Limited Yields for Indiana Prospectors", by R. Dee Rarick (February 1981). Another manuscript has been submitted to the editor, but had not been published by the end of the fiscal year.

Exhibits prepared by the Indiana Geological Survey for public display included an exhibit about the Trenton Gas and Oil Field of Indiana that was taken to the 1980 Indiana State Fair. Later, this exhibit was placed in the Science and Mathematics Building at Ball State University, Muncie. Another petroleum exhibit was prepared and taken to the regional meeting of A.A.P.G. held in Evansville late in 1980. An exhibit about Indiana's building limestone was prepared and placed on display at the Monroe County Historical Society Museum in Bloomington. Later, this exhibit was placed in the I.U. Museum's exhibit space in the Indiana Memorial Union Building.

During the past fiscal year, the Educational Services geologist submitted 5 news releases about Geological Survey activities and the availability of new Survey maps and publications.

During the 1980 4-H Fair season, 4-H geology and weather exhibits were judged for the Jennings County 4-H Fair, the Martin County 4-H Fair, the Jefferson County 4-H Fair, the Jackson County 4-H Fair, and the Morgan County 4-H Fair.

During the fiscal year he compiled three issues of the Survey Newsletter and distributed them to all Survey personnel.

Conferences attended during the past 12 months included the 1980 Careers Day at I.U.P.U. - Indianapolis where he served as a counselor and the 1980 regional meeting of A.A.P.G. held in Evansville.

GEOCHEMISTRY SECTION

Samples of rocks and minerals that are collected by all of the Sections of the Geological Survey are analyzed to determine their chemical composition. Various spectrometric, x-ray, atomic absorption, and wet chemical methods are used in routine analyses to learn what minerals and elements are present in the samples, what uses might be made of these materials, and whether potentially dangerous substances are present in them.

Jointly with staff from the Petroleum, Coal and Industrial Minerals Sections, and with the organic geochemistry group in the Department of Geology, a report on the work done under the U.S. Department of Energy contract for the study of the New Albany Shale was completed and sent to the Morgantown Energy Technical Center. Work continued on geochemical analysis of samples from Survey Drill Hole 290 (IND-2) and the stratigraphic cross sections. Although the contract has ended, the high level of interest in the New Albany Shale has encouraged the Section to continue working on the shale. New samples were selected and prepared from Survey Drill Holes 304 and 305, including a full section of the New Albany plus several feet of material from above and below the formation.

Shale samples also were obtained during the year from several Pennsylvanian cores in the project to eliminate storage of excess core. Selected black shale samples were processed through final grinding. Most of these samples have been analyzed for sulfur and carbon dioxide and some determinations have been made on major and trace elements.

In the coal chemistry laboratory, geochemists received 286 samples, mainly splits of coal and slurry samples. From these they completed 2,141 determinations, including moisture and ash, carbon and hydrogen, nitrogen, sulfur, heat content, and ash fusion. The laboratory also made carbon dioxide determinations on 503 samples. Louis Miller was coauthor of a paper dealing with waste products of the coal mining industry.

In the spectrographic laboratory Mrs. Golde supervised determinations of CHN in 1,214 samples, made 1,334 qualitative spectrographic determinations, and ran 38 samples by x-ray methods for mineralogic determinations. Mrs. Golde also prepared data on calcite/dolomite contents for all available Mississinewa Shale samples for use by the Geology Section in stratigraphic characterization.

Members of the Section also ran major and trace element analyses on coal slurry samples by means of the inductively coupled plasma spectrometer, and analyzed 4 samples of phosphatic material from rocks of Pennsylvanian age. Mr. Hailer continued analysis of 24 Precambrian samples and reference material by ICP methods. He also presented the results of his work on water from wells in Vigo County at the meeting of the Indiana Academy of Science. In the laboratory, he carried this work a step further by analyzing 145 samples of water from Harrison and Monroe Counties.

GEOLOGY SECTION

The Geology Section is charged with a prime responsibility to collect, interpret, store, and disseminate basic information on the nature and distribution of the rock materials in the earth's crust at and below the surface of the State of Indiana. Considering the geology that is peculiar to Indiana, this charge means that the Section is oriented fundamentally in stratigraphy, including Quaternary stratigraphy, and paleontology. Synthesis of collected information in a framework of geologic time, therefore, is the task of the Section that perhaps expresses best the purist form of scientific research that it carries on.

Particularly in its responsibility to disseminate information, however, the Section's activities become very practical. Probably the most basic of the practical tasks carried on is mapping, and one of the Section's longest enduring (20 to 25 years) major efforts has been devoted to statewide mapping of both unconsolidated and consolidated materials. Mapping may be considered as a chronologically ordered statement of the nature and distribution of rock materials at and near the surface in Indiana.

The most applied of the Section's practical activities are those conducted as direct responses to public, industrial, business, educational, governmental, and professional needs. Many of these applied activities are characterized as educational and environmental.

Mapping is noted above as one activity that spans the functions of the Section that range in nature from research to applied. Another such activity is carried on in the sedimentation laboratory, wherein 3,429 separate analyses and tests were performed during 1980-81. These analyses and tests are of about 10 different kinds and the results are applicable equally to practical studies (e.g., environmental geology reports requested by regional planning groups) and to purely research-oriented studies (e.g.,

Quaternary history of the buried Teays Valley in Indiana). Also, some analyses are performed for Survey geologists to answer specific geological questions.

During the year the Section listed nine separately designated formal projects. Among these, four are practically oriented, including two geographically defined environmental geology projects, one mapping project, and one problem-oriented environmental project.

Two other projects that are designed to gather data (Characteristics of Indiana Tillis and Engineering Properties of Unconsolidated Deposits) were not listed in the monthly reports, but they were carried on largely through the work done in the sedimentation laboratory and they were drawn upon by other projects.

Hazardous waste disposal

This project was begun in 1979-80 in recognition of the need to inventory and discuss geologically acceptable locales and natural materials in Indiana that are amenable to hazardous waste disposal; the project has support from the State Board of Health. In 1980-81 systematic evaluation of both bedrock and unconsolidated materials was begun on both a statewide basis (general emphases) and on a pilot-study basis (detailed emphases of specific locales and materials). Perhaps 20 percent of the field work (augering, collecting samples, etc.) and laboratory work (analytical and testing) was completed. The project has two more years to run.

County environmental projects

The project on "Environmental Geology of Vigo County", begun in 1977-78 and described in an earlier annual report was completed with submission of a comprehensive manuscript that, when published, will have a broad range of practical applications ranging from health and hazardous considerations to economics and engineering.

The other county-oriented environmental project, for Monroe County, was begun in 1973 and has suffered in its conduct by having a continuing low priority assigned to it. Relatively minor work was accomplished in 1980-81, mostly in the form of collecting and interpreting well data.

Bedrock geology map of Indiana

This project, begun in 1978-79, is to produce a single-sheet map at a scale of 1:500,000 showing pre-Quaternary deposits. It will use and update the latest published mapping information that appears in the series of eight 1° x 2° Regional Geologic Maps. Also, it will be the first map of this kind at the stated scale. These byproducts are noted as 1980-81 activities:

- (1) Map of Indiana showing topography of the bedrock surface, submitted for publication, and
- (2) A short article explaining the bedrock-topography map, published.

Quaternary stratigraphy

The three projects listed herein have been described in earlier annual reports: (1) Tillis of Northwest Indiana (begun in 1971), (2) Pleistocene

Stratigraphy of West-Central Indiana (begun in 1968), and (3) Teays Valley of Indiana (begun in 1976). They are designed to provide a better understanding of the nature and chronologies of tills in the Valparaiso Moraine and in the area of merger of tills derived from the Lake Michigan and Lake Erie glacial lobes in western Indiana; also, a first understanding of the tills and other materials that fill the major pre-Quaternary valley system that crosses northern Indiana. The Teays project also forms a basis for the project on ground water that is found in the Teays system, a project that is carried on by the Division of Water. Project 1 saw very little progress in the form of manuscript preparation. Projects 2 and 3 were advanced by field and laboratory studies.

COSUNA-LOBAR project

This project (Correlation of Stratigraphic Units of North America, Lowland Basins and Arches Region) is part of a continent-wide effort, managed by the American Association of Petroleum Geologists (AAPG) and supported by several other societies and the U.S. Geological Survey, and is to produce an up-to-date stratigraphic correlation chart for parts of all of eight states, northern Michigan to northern Alabama and Mississippi River to central Ohio. This part of the overall project was placed in the hands of the Indiana Geological Survey during 1977-78. The chart, consisting of about 30 columns covering the entire Precambrian-Holocene section and showing perhaps 2,500 rock-unit names (some repetitiously), was submitted to the AAPG for publication during the year. It is the first of its kind to be produced for this area, as are the companion 20 (estimated) charts that complete the North American coverage. One explanatory report was published.

Middle Paleozoic geology of northern Indiana

This is a long-standing project (since 1966) that embraces basic stratigraphic and paleontologic studies of particular Silurian and Devonian rocks in an area where little subsurface work on these rocks had been done. It originally had support from the National Science Foundation and has resulted in a series of several reports and in some application to the state mapping program and environmental projects.

GEOPHYSICS SECTION

During the 1980-81 fiscal year the Geophysics Section continued to maintain a program of field work, laboratory measurements of physical properties, and development of computer programs to assist in the interpretation of geophysical data. The Geophysics Section also was responsible for the operation of the Survey's drilling program and equipment.

A field party continued to work to establish gravity stations throughout Indiana in order to develop a network of gravity base stations at a high degree of precision. In developing this network, the party tied into other networks that have been established, at varying levels of accuracy, in Indiana and adjacent states by the federal government and university groups. This network is important as a base from which subsidiary surveys can be run, gravity information coordinated, and questions about the absolute value of gravity for a particular point can be answered. Such data are needed for national defense applications and for water and mineral surveys. One such survey consisted of detailed gravity traverses across the course of a buried

bedrock valley near Kokomo that was mapped in a general way by seismic methods. Elevations of gravity stations were leveled in by U.S. Geological Survey crews to provide excellent vertical control that permitted delineation of a subtle bedrock valley.

The seismic refraction party under the direction of Joe Whaley worked throughout most of the summer field season. During that time the crew made 254 seismic shots at locations in St. Joseph, Howard, Jackson, and Gibson Counties. Much of the work was done in connection with the new bedrock geology map of the State, but surveys also were made in connection with a groundwater problem near Kokomo for the U.S. Geological Survey and the Division of Water.

During the year the Geophysics Section worked on numerous computing problems. Chief among these were efforts to coordinate the INDYMAP program with data files and to refine its usefulness to processing various problems being encountered in geologic activities of the Survey. Bob Blakely conducted a series of seminars for the Survey staff on the use of BASIC programming language, on use of computer terminals, and on computer editing. He also converted the locations of 3000 water wells from township, range, and section locations to latitude and longitude for the U.S. Geological Survey.

Bob also cooperated with the Indiana Limestone Institute in several projects. One dealt with mathematical analysis known as statistics of extremes. Another involved testing various types of anchor bolting systems in the Salem Limestone.

MINERAL STATISTICIAN

The number of companies declining to provide mineral production data continued to increase for 1980, and therefore all figures given in this report include a greater number of estimates than has been necessary in the past.

The total value of minerals produced in Indiana during 1980 increased by 22.63 percent, to \$996,591,430. The manufacture of cement and clay products, and the milling of limestone for building purposes, contributed more than \$100,000,000. additional value to the total for Indiana mineral products. The manufacture of lime, the recovery of sulfur from petroleum, and the processing of perlite, all from raw materials imported into the state, further increased by several millions of dollars the value of Indiana's mineral industries.

For many years coal and petroleum have been among the major mineral commodities produced in Indiana, with coal ranking first and petroleum in positions ranging from second to fourth. In the decade of the 1970's, the amount of coal mined has increased more than 34 percent -- from 22,359,943 tons in 1970 to 30,636,079 tons in 1980. During these same years the price per ton has multiplied by nearly five times, resulting in a total value increase of 558 percent (see Figure 1).

Oil production reached a peak of 12,640,000 barrels in 1953 and remained relatively stable until 1966. Production then dropped steadily, to 4,629,737 barrels in 1976. In 1974, the average price for a barrel of oil increased

from \$3.92 to \$8.62, and it became feasible to operate previously uneconomic older fields and to expand drilling programs. Substantially higher prices, which reached \$35.16 per barrel in 1980, have allowed a steady increase in the amount of oil produced for the past three years and make it again Indiana's second most valuable mineral commodity (see Figure 1).

Of the total value of minerals produced in 1980, the fuels accounted for 84.06 percent. Coal alone accounted for 66.44 percent, and petroleum 17.56 percent. Warrick County produced 36.81 percent of the State's total coal production, followed by Pike County with 22.03 percent and Vermillion County with 8.58 percent. The remaining 32.58 percent came from 12 other counties in the southwest quarter of the state.

An increased number of oil wells drilled, and a greater percentage of them completed successfully, resulted in 5.57 percent more oil produced in 1980 than in 1979.

Decreases, ranging from 8.26 to 26.58 percent, in the amounts of crushed limestone, building limestone, sand and gravel, clay and shale, and cement are indication of the depressed construction industry. The only explanation which come to mind for the reported increase in production of gypsum is that the material was being stockpiled for future use.

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 commodities (in alphabetical order)</u>
<u>\$100 million+</u>		
Warrick	\$243,724,888.00	Coal
Pike	145,886,532.00	Coal
<u>\$50 - 100 million</u>		
Vermillion	58,065,277.00	Clay & shale, coal, sand & gravel
<u>\$25 - 50 million</u>		
Sullivan	47,397,972.00	Coal, crushed limestone, sand & gravel
Knox	38,686,748.00	Coal, sand & gravel
Clay	37,749,386.00	Clay & shale, coal
Greene	33,182,356.00	Coal, sand & gravel
<u>\$5 - 25 million</u>		
Spencer	21,930,568.00	Coal
Daviess	20,719,201.00	Coal, sand & gravel
Dubois	10,129,916.00	Clay & shale, coal
Lawrence	9,718,480.00	Crushed limestone, dimension limestone, dimension sandstone
Hamilton	9,645,969.00	Crushed limestone, peat, sand & gravel
Putnam	9,626,022.00	Clay & shale, crushed limestone, dimension limestone, sand & gravel

Marion	9,403,568.00	Crushed limestone, sand & gravel
Martin	-C-	Coal, gypsum
Crawford	-C-	Crushed limestone
Clark	7,174,681.00	Clay & shale, crushed limestone, sand & gravel
Monroe	6,677,615.00	Crushed limestone, dimension limestone

PETROLEUM SECTION

The chief functions of the Petroleum Section consist of services, projects that are performed annually, projects that are related to records, subsurface study projects, and special projects.

Services

The services offered by the Section consist mostly of conferences and correspondence about subsurface records such as well locations, driller's logs, geophysical logs, samples, cores, and interpretations made from these data. The section handled 386 visitors during the fiscal year. In addition to the visitors, requests for subsurface information are received daily by correspondence and telephone.

Annual Projects

Indiana Drilling Statistics -- Drilling statistics were compiled for wells drilled in Indiana during the year. These statistics comprise a part of the nationwide totals compiled by the American Association of Petroleum Geologists and the American Petroleum Institute.

Indiana Exploration Development -- An annual review of exploration activity in the state was compiled for inclusion in the Bulletin of the American Association of Petroleum Geologists.

Indiana Oil Production -- Preparation of the annual oil production statistics by fields in the Survey's Mineral Economic Series was completed.

Indiana Oil Reserves -- Although the American Petroleum Institute Committee on oil reserves (of which Dan Sullivan was a member) has disbanded, Dan is continuing to prepare reserves statistics for Indiana oil fields in order to provide continuity of reserves data for the Geological Survey.

Review of Petroleum Exploration Map Series -- The individual county petroleum map transparencies were updated at year's end. Forty-seven maps were revised, four new maps were published, and 44 were checked with no revisions necessary.

Records Improvement

Trenton Field Well Records -- A project of evaluating miscellaneous well records associated with the Trenton Field and preparing them for inclusion in the master well data file was continued. The project consisted of associating the proper well record with the appropriate well location and determining the ground elevation for that well location. Records were then prepared in a manner consistent with existing file data prior to insertion in the master file. Larry Enochs was employed to undertake the project. Evaluation of records

in Adams County was completed during the year and expansion of the project to include records in Jay County was initiated.

Microfilming of Master File Well Data -- A proposal submitted by Petroleum Information Corp. of Denver, Colorado to microfilm the master file of well data of the Petroleum Section was reviewed and accepted December 15, 1980. A feature of the proposal provides for a complete set of microfiche of the data file and a reader to be supplied to the Geological Survey by PI.

Acquisition of Geophysical Logs -- Approximately 1,500 geophysical logs that were acquired from a private donor were reviewed and those which represented new additions to the master file of well data were processed and made a part of the permanent file of well information. Approximately 300 to 350 logs were retained for filing.

Indexing of Core Data by Stratigraphic Unit -- William Hamm prepared an index of cores filed in the core library based on stratigraphic unit(s) cored and filed. This index facilitates determination of available cores in a stratigraphic unit as well as geographic location.

Subsurface Studies

Structural Control Maps -- Maps for Spencer, Greene, and Sullivan Counties showing structural position of the base of the Beech Creek Limestone were published during the year. With the publication of those maps, maps for all counties in which the Beech Creek Limestone is present now have been completed and published. The maps now form a part of the Petroleum Exploration Map Series.

Natural Gas in Indiana -- Dan Sullivan is conducting a study of the natural gas fields in Indiana. A discussion of the future of natural gas exploration in Indiana and a determination of areas which are currently productive of gas forms an important part of the report.

Geology of Unionport Gas Storage Field -- Stanley Keller and graduate student Talal Abdulkareem prepared a paper entitled "Post-Knox Unconformity--Significance at Unionport Gas-Storage Project and Relationship to Petroleum Exploration in Indiana" which was published as an Occasional Paper (No. 31) in October 1980.

Geology of the Trenton Field in Indiana -- Brian Keith prepared an informal status report on his study of the Trenton Field of east-central Indiana which is intended to help answer questions from industry and the public concerning the Trenton Field. Also, two articles prepared by Brian to report on renewed activity and the status of current investigation of the stratigraphy and reservoir condition of the Trenton oil field were published in successive issues of the Oil and Gas Journal.

Study of Salem Limestone and Associated Rocks -- Occasional Paper No. 30, authored by Stanley Keller and Leroy Becker and entitled "Subsurface Stratigraphy and Oil Fields in the Salem Limestone and Associated Rocks in Indiana", was published in October, 1980.

Special Projects

Sample Consolidation -- A milestone was reached when the project to

consolidate well samples in order to create additional storage space in the existing well sample library was completed during the year. About 10,200 wells were converted to the new system and we estimate that the project will provide sample storage for an additional 26 years.

Geology of the New Madrid Area -- Dan Sullivan is co-principal investigator of a project to study the geology and faulting within a 200-mile radius of the New Madrid, Missouri seismic area which includes part of southwestern Indiana. George Tanner, geologist for the project, continued mapping faults in various stratigraphic units. Maps on the Springfield Coal member and the Cypress Formation for Posey and Gibson Counties were prepared and were published by the Geological Survey as special maps. Also detailed field mapping of the Mt. Carmel Fault in Lawrence and Monroe Counties was completed. The project is under the sponsorship of the Nuclear Regulatory Commission.

U.S. Department of Energy Eastern Gas Shale Project -- Geologist Nancy Hasenmueller continued a study of the stratigraphy of the Devonian New Albany Shale in Indiana under sponsorship of the U.S. Department of Energy. Three maps and two stratigraphic cross sections were completed and submitted to the Department of Energy for publication during the year. They are:

- 808 Map of Indiana showing thickness of the Selmier Member of the New Albany Shale (Devonian and Mississippian).
- 811 Map of Indiana showing structure on top of Silurian Rocks.
- 814 Map of Indiana showing structure on top of the Knox Dolomite (Cambro-Ordovician), Mt. Simon Sandstone (Cambrian), and Precambrian Basement Complex.
- 816 Stratigraphic cross sections showing members of the New Albany Shale (Devonian and Mississippian) in Indiana.
- 817 Stratigraphic cross sections showing the Sunbury, Ellsworth, and Antrim Shales (Devonian and Mississippian) in northern Indiana.

Preparation of New Geologic Map of Indiana -- Stan Keller, acting as a contributor to the preparation of a new geologic map of Indiana, compiled data on the bedrock geology of the northern quarter of Indiana.

Evaluation of Improvement Projects for the Indiana State Highway Commission -- During the year geologists in the Section reviewed four different highway bridge projects.

Paper on Carboniferous Oil in the Illinois Basin -- Gerald Carpenter, Brian Keith, Stan Keller, and Dan Sullivan worked with members of the Illinois and Kentucky Surveys on a paper documenting Pennsylvanian and Mississippian petroleum in the Illinois Basin. When completed, this paper will be included in a volume on the worldwide occurrence of Carboniferous oil to be published by the American Association of Petroleum Geologists.

Assistance to Graduate Student Research -- Members of the Petroleum Section provided technical assistance throughout the year to geology

graduate students from Indiana University and Ball State University who are doing subsurface studies in Indiana.

Evaluation of Waste-Disposal Well at Valparaiso -- Gerald Carpenter and Dan Sullivan met with representatives of Pfizer Chemical Company and Resources Service, Inc. to discuss plans for a second waste disposal well contemplated by Pfizer Chemical Company at their plant at Valparaiso.

PUBLICATIONS SECTION

During the past fiscal year the Publications Section sold 10,821 reports and 19,624 maps. The section sent 1,277 reports and 264 maps on exchange to institutions in the United States and in foreign countries. It also distributed without charge 2,239 reports and 1,658 maps to members of its own organization and to individuals, libraries, and companies in the United States and abroad. The Publications Section served 6,119 office customers, handled 4,640 letters pertaining to geologic reports and maps, and sent out 1,254 announcements of new publications.

Twelve reports, 15 new maps, and 78 revised maps were issued during the fiscal year, and three reports were reprinted. One of the reports reprinted was a popular publication: "Gold and Diamonds in Indiana" (11,000 copies printed since 1963).

Eleven manuscripts of Survey reports, nine abstracts and 29 manuscripts prepared by Survey personnel for outside publication, and 20 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 32 miscellaneous projects was prepared.

New equipment in the Publications Section was a shrinkpak machine, manufactured by the CLAMCO Corporation. This machine, which was received at the end of the fiscal year, will be used for sealing and shrinking packages of publications for storage.

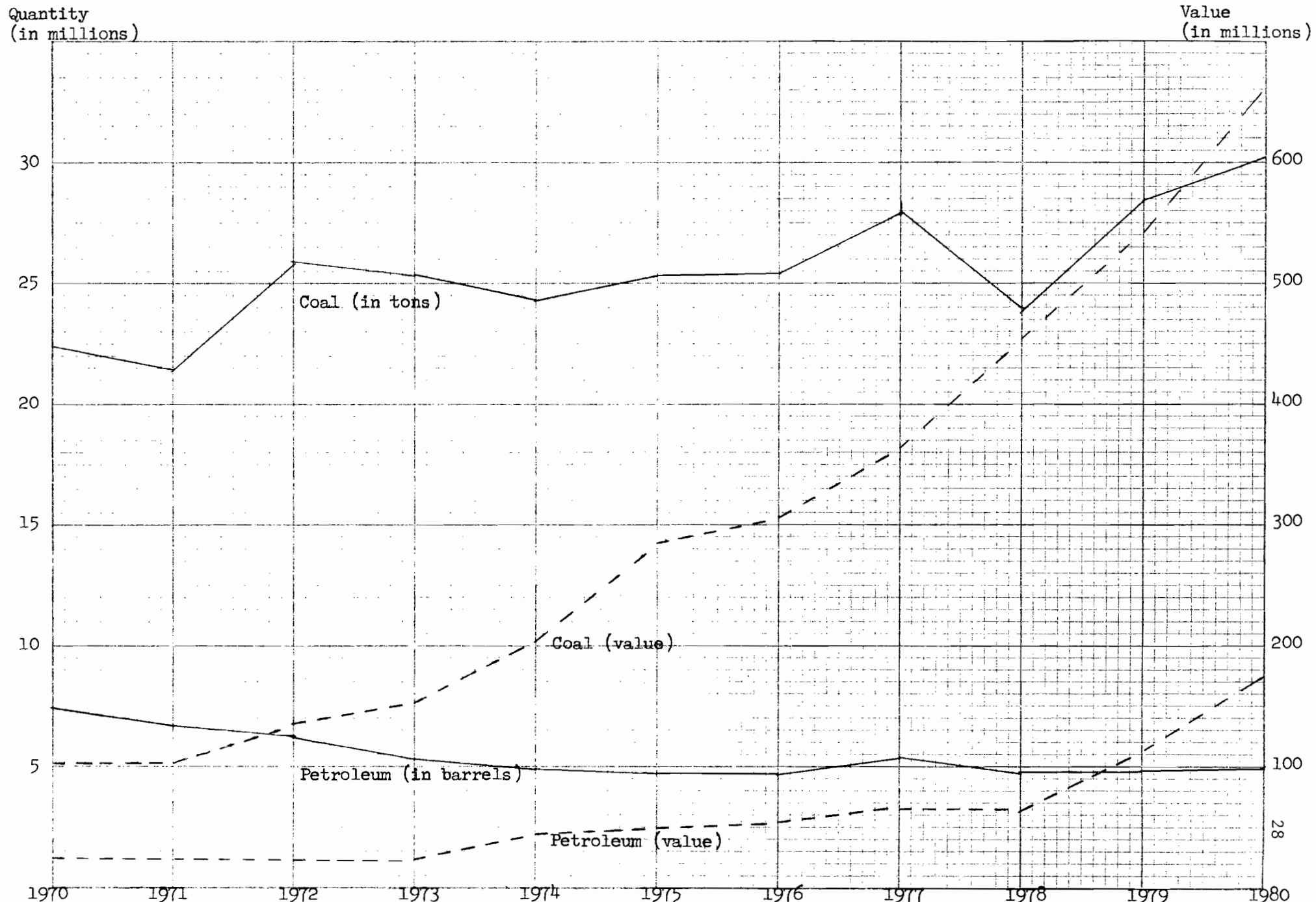


Figure 1.--Volume and value of Indiana coal and petroleum production in 1970-1980.

	1979		1980	
	<u>Quantity</u>	<u>Value</u>	<u>Quantity</u>	<u>Value</u>
Coal	28,496,886 tons	\$541,440,777.00	30,096,022 tons	\$662,112,484.00
Petroleum	4,714,855 bbls	111,081,984.00	4,977,581. bbls	174,993,499.00
Crushed limestone	33,849,583 tons	92,539,526.00	30,914,434 tons	92,104,486.00
Sand and gravel	24,734,292 tons	51,783,610.00	20,036,338 tons	48,724,940.00
Dimension limestone	2,146,468 cu.ft.	6,011,679.00	1,969,141 cu.ft.	6,971,873.00
Clay and shale	1,093,194 tons	1,866,370.00	860,261 tons	1,633,212.00
Peat	76,514 tons	1,242,343.00	76,916 tons	1,390,400.00
Natural gas	350,000,000 cu.ft.	369,000.00	464,000,000 cu.ft.	626,000.00
Undistributed:				
Dimension sandstone, gypsum, marl, whetstones		<u>6,343,513.00</u>		<u>8,034,536.00</u>
TOTAL		\$812,678,802.00		\$996,591,430.00
Value added for additional processing of dimension limestone, and manufacture of clay products, cement.		\$133,404,943.00		\$106,132,421.00

FIGURE 2.--Quantity and Value of Industrial Minerals for 1979 and 1980

COAL AND INDUSTRIAL MINERALS SECTION
 STATISTICAL SUMMARY FOR THE
 FISCAL YEAR 1980-1981

	TOTAL
Projects in Progress	30
Projects Completed	20
Conferences with visitors to the Survey	302
Telephone Conferences	673
Total Service Requests	1196
Man days of fieldwork	134
Incoming Letters	1267
Outgoing Letters	520
Thickness of stratigraphic sections measured	1831
Public Lectures	17
Papers and Posters Presented at professional meetings	9
Field trips (Total)	10
In connection with conferences	9
Educational	1
News releases submitted	14
Attendance at professional meetings	84
Samples received or collected (Total)	706
Clay Sample	8
Rocks, Minerals	243
Sand & gravel	374
Slurry samples	77
Gas samples	4
Brightness tests	561
Mineralogic analyses	64
X-ray mineralogic analysis	223

FIGURE 3.--Statistical Summary for Coal and Industrial Minerals Section

Core described	828
Grain-size analyses	424
Pebble counts	20
Thin sections prepared	10
Area mapped	650 sq.mi.

TABLE 1. Manhours applied to drafting and photography jobs.

Month	Survey Manhours		Department* Manhours		Other** Manhours		Total Manhours
	Draft.	Photog.	Draft.	Photog.	Draft.	Photog.	
J	696.50	121.00	57.00	6.25	5.75	10.75	897.25
A	562.75	136.25	104.50	37.25	----	7.25	848.00
S	583.75	90.00	208.50	63.25	----	7.25	952.75
O	518.50	73.75	276.75	79.25	----	5.75	954.00
N	348.50	56.75	261.75	76.00	29.00	10.25	782.25
D	427.00	37.25	118.50	58.25	73.00	31.00	745.00
J	489.00	107.00	92.50	41.25	141.75	9.25	880.75
F	496.00	75.75	55.50	39.50	194.75	41.25	902.75
M	441.50	44.50	254.75	51.75	52.75	2.00	847.25
A	522.50	57.75	230.25	110.00	34.75	5.50	960.75
M	507.25	23.75	193.50	131.50	22.00	6.50	884.50
J	555.00	87.50	115.00	74.00	----	----	831.50
TOTAL:	6,148.25	911.25	1,968.50	768.25	553.75	136.75	10,486.75

TABLE 2. Total manhours and percentages applied to Geological Survey and Department of Geology jobs.

	Manhours Applied to Jobs Requested			Total Manhours	Percentage of Total Time		
	Survey	Department	Other		Survey	Department	Other
DRAFTING TIME	6148.25	1968.50	553.75	8670.50	70.9	22.7	6.4
PHOTOGRAPHY TIME	911.25	768.25	136.75	1816.25	50.2	42.3	7.5
TOTAL:	7,059.50	2,736.75	690.50	10,486.75	(67.3)	(26.1)	(6.6)

*Includes jobs requested for I.U. Geologic Field Station on account 10-272-10.

**Time applied to jobs billed for payment to the Publications Section rotating fund.

FIGURE 4.--Statistical Summary of Drafting & Photography Section

STATISTICAL SUMMARY OF ACTIVITIES FOR FISCAL 1980-1981

Conferences	76
Man days of field work	33
Incoming letters	269
Outgoing letters	308
Special mailings (series to Indiana's newspapers)	709
Total number of Survey vehicles	1
Total number of miles traveled	7,408
Public lectures -	
Civic - 2	
School - 7	
Other - 0	
Total	9
Field trips (educational)	4
News releases submitted	5
Special rock sets prepared for teachers, et al	7
Identification of specimens (rock, mineral, and fossil)	146
Information packets mailed	97
Rock sets mailed	17
Attendance at professional meetings	2
Exhibits installed for special occasions, etc.	5
Reports completed and sent to editors for outside publication (OUTDOOR INDIANA)	5
Survey publications completed and published	2
Tours of the Geology Building conducted	3

FIGURE 5.--Statistical Summary of Educational Services

Miscellaneous Statistics

*1. Projects in progress	8
*2. Projects completed	1
3. Visitors	386
4. Visitor days	669
5. Outgoing letters	180
6. Incoming letters	308
7. Man days in field	137
8. Talks at technical programs	8
9. Well cutting sets catalogued and filed	262
10. Cores (wells)	35
11. Strip logs made (wells)	177
12. Feet of well cuttings represented on strips	341,102
13. Wells field checked (current drilling only)	894
14. Published petroleum exploration maps:	
New	4
Revised	47
Checked without revision	44
15. Number of vehicles	2
16. Total miles traveled (total of all vehicles)	24,786
17. Reproduction-Royfax	\$11,243.15
18. Reproduction-Xerox	\$2,773.55

*Does not include projects under the captions "Annual Projects" or "Special Projects". Two projects were transferred to Coal and Industrial Minerals Section.

FIGURE 6.--Statistical Summary of Petroleum Section

STATISTICAL SUMMARY

Letters

Incoming - - - - -	4,640
Outgoing - - - - -	1,453

Published reports

Circulars - - - - -	1
Directories - - - - -	3
Mineral Economics Series - - - - -	1
Occasional Papers - - - - -	3
Special Reports - - - - -	3
State Park Guides - - - - -	1

Published maps

Miscellaneous Maps (new) - - - - -	6
Miscellaneous Maps (revised) - - - - -	2
Petroleum Exploration Maps (new) - - - - -	8
Petroleum Exploration Maps (revised) - - - - -	75
Petroleum Exploration Maps (checked without revision) - - - - -	46
Preliminary Coal Maps - - - - -	1
State Base Maps (revised) - - - - -	1
Published reports sold - - - - -	10,821
Published maps sold - - - - -	19,624
Publications office customers - - - - -	6,119
Publications announcements mailed - - - - -	1,254

FIGURE 7.--Statistical Summary of Publications Section

REPORTS AND MAPS PUBLISHED BY THE GEOLOGICAL SURVEY

Circulars

Rarick, R. D., 1981, Halite -- Salty mystery of life: Circular 11, 24 p., 12 figs.

Directories

Ault, C. H., and Carr, D. D., 1980, Directory of crushed stone, ground limestone, cement, and lime producers in Indiana: Indiana Geological Survey Directory, 34 p., 1 fig.

Hasenmueller, W. A., 1980, Directory of coal producers in Indiana: Indiana Geological Survey Directory, 36 p., 1 fig.

Shaffer, N. R., 1981, Directory of clay and shale producers and ceramic plants in Indiana: Indiana Geological Survey Directory, 12 p., 1 fig.

Mineral Economic Series

Carpenter, G. L., Keith, B. D., and Keller, S. J., 1980, Oil development and production in Indiana during 1979: Mineral Economic Series 26, 36 p., 3 figs., 5 tables.

Miscellaneous Maps

Hughes-Owens, Kim, 1980, Map of southwestern Indiana showing areas strip mined for coal: Miscellaneous Map 15 (revised).

Hasenmueller, W. A., and Wiggins, John, 1980, Map of southwestern Indiana showing locations of active coal mines: Miscellaneous Map 27 (revised).

Tanner, G. F., Stellavato, J. N., and Mackey, J. C., 1980, Map of southwestern Gibson County, Indiana, showing structure on Cypress Formation (Mississippian): Miscellaneous Map 29.

Tanner, G. F., Stellavato, J. N., and Mackey, J. C., 1980, Map of northern Posey County, Indiana, showing structure on Cypress Formation (Mississippian): Miscellaneous Map 30.

Tanner, G. F., Stellavato, J. N., and Mackey, J. C., 1980, Map of southern Posey County, Indiana, showing structure on Cypress Formation (Mississippian): Miscellaneous Map 31.

Tanner, G. F., Stellevato, J. N., and Mackey, J. C., 1981, Map of southwestern Gibson County, Indiana, showing structure in Springfield Coal Member (V) of the Petersburg Formation (Pennsylvanian): Indiana Geological Survey Miscellaneous Map 32.

Tanner, G. F., Stellavato, J. N., and Mackey, J. C., 1981, Map of northern Posey County, Indiana, showing structure in Springfield Coal Member (V) of the Petersburg Formation (Pennsylvanian): Indiana Geological Survey Miscellaneous Map 33.

Tanner, G. F., Stellevato, J. N., and Mackey, J. C., 1981, Map of southern Posey County, Indiana, showing structure in Springfield Coal Member (V) of the Petersburg Formation (Pennsylvanian): Indiana Geological Survey Miscellaneous Map 34.

Occasional Papers

Keller, S. J., and Becker, L. E., 1980, Subsurface stratigraphy and oil fields in the Salem Limestone and associated rocks in Indiana: Occasional Paper 30, 63 p., 15 figs., 3 tables.

Keller, S. J., and Abdulkareem, T. F., 1980, Post-Knox unconformity -- Significance at Unionport gas-storage project and relationship to petroleum exploration in Indiana: Occasional Paper 31, 19 p., 10 figs.

Rarick, R. D., 1980, The petroleum industry -- Its birth in Pennsylvania and development in Indiana: Occasional Paper 32, 36 p., 29 figs.

Petroleum Exploration Maps

Carpenter, G. L., Cazee, J. T., and Keith, B. D., 1980, Map of Sullivan County, Indiana, showing control on base of Beech Creek Limestone (Barlow): Petroleum Exploration Map 4C.

Carpenter, G. L., and Cazee, J. T., 1980, Map of Martin County, Indiana, showing control on base of Beech Creek Limestone (Barlow): Petroleum Exploration Map 12C.

Carpenter, G. L., Cazee, J. T., and Keith, B. D., 1980, Map of Greene County, Indiana, showing control on base of Beech Creek Limestone (Barlow): Petroleum Exploration Map 13C.

Carpenter, G. L., and Cazee, J. T., 1980, Map of Crawford County, Indiana, showing control on base of Beech Creek Limestone (Barlow): Petroleum Exploration Map 28C.

Carpenter, G. L., Cazee, J. T., and Keith, B. D., 1980, Map of Spencer County, Indiana, showing control on base of Beech Creek Limestone (Barlow): Petroleum Exploration Map 39C.

Carpenter, G. L., and Cazee, J. T., 1980, Map of Perry County, Indiana, showing control on base of Beech Creek Limestone (Barlow): Petroleum Exploration Map 40C.

Sullivan, D. M., Enochs, L. G., and Cazee, J. T., 1980, Well location map of Grant County, Indiana: Petroleum Exploration Map 82.

Sullivan, D. M., Enochs, L. G., and Cazee, J. T., 1980, well location map of Grant County, Indiana, showing total depth of wells: Petroleum Exploration Map 82A.

Revised Petroleum Exploration Maps (as of December 31, 1980): 3A, 3B, and 3C (Warrick County); 4A, 4B, and 4C (Sullivan County); 5A and 5B (Vigo County); 12, 12A, and 12C (Martin County); 13A and 13B (Greene County); 14A and 14B (Clay County); 15A (Parke County); 18A (Owen County); 20A (Montgomery County); 21A, 21B, and 21C (Dubois County); 22A (Jackson County); 23, 23A, and 23C (Knox County); 24A (Monroe County); 26, 26A, and 26C (Daviness County); 27A (Orange County); 30 and 30A (Harrison County); 32A (Bartholomew County); 33A (Hendricks County); 39, 39A, and 39C (Spencer County); 40, 40A, and 40C (Perry County); 42A (White County); 46A (Jennings County); 48A (Scott County); 50A (Floyd 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); 60A (Whitley County); 62A (Elkhart County); 65A (Fulton County); 66A (Cass County); 67A (Pulaski County); 73A (Lake County); 74A (Miami County); 75A (Wabash County); 76 (Huntington County); 79 (Jay County); 81 (Delaware County); 87A (Ripley County); 92A (Randolph County); 93A (Henry 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, 1980): 13C (Greene County); 16A (Vermillion County); 17A (Fountain County); 19A (Putnam County); 25A (Lawrence County); 28A and 28C (Crawford County); 29A (Washington County); 31A (Brown 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); 47A (Jefferson County); 49A (Clark County); 55A (Steuben County); 56A (Lagrange County); 57A (Noble County); 58A (DeKalb County); 59A (Allen County); 61A (Kosciusko County); 63A (St. Joseph County); 64A (Marshall County); 68A (Starke County); 69A (LaPorte County); 70A (Porter County); 71A (Jasper County); 72A (Newton County); 77 (Wells County); 78 (Adams County); 80 (Blackford County); 83A (Howard County); 84A (Switzerland County); 85A (Ohio County); 86A (Dearborn County); 88A (Franklin County); 89A (Union County); 90A (Fayette County); 91A (Wayne County); 98A (Hamilton County); and 100A (Tipton County).

Special Reports

Hartke, E. J., and others (including N. K. Bleuer), 1980, Geology for environmental planning in Marion County, Indiana: Indiana Geological Survey Special Report 19, 53 p., 19 figs., 7 tables, 1 pl.

Ault, C. H., and Moore, M. C., 1980, Aggregate resources of the Big Blue River Valley in east-central Indiana: Indiana Geological Survey Special Report 20, 40 p., 1 pl., 3 figs., 1 table.

Shaffer, N. R., 1981, Possibility of Mississippi-Valley type mineral deposits in Indiana: Indiana Geological Survey Special Report 21, 49 p., 18 figs., 7 tables.

Preliminary Coal Maps

Hill, J. R., 1980, Outcrop and mined areas of coals in Putnam County, Indiana: Preliminary Coal Map 16.

State Base Maps

Moran, W. H., and Peace, J. E., 1981, Base map of west-central and southwestern Indiana (T. 25 N. to Indiana-Kentucky boundary, R. 1 W. to Indiana-Illinois boundary): Base Map 104 (revised).

State Park Guides

Hill, J. R., 1981, Geologic story of Brown County State Park: Indiana Geological Survey State Park Guide 9, 4 p., and 6 figs.

MISCELLANEOUS PUBLICATIONS

Ault, C. H., Sullivan, D. M., and Tanner, G. F., 1980, Faulting in Posey and Gibson Counties, Indiana: Proceedings of the Indiana Academy of Science, v. 89, p. 275-289.

Basu, A., Shaffer, N. R., and Hunt, G., 1980, Petrography of the Louisville Meteorite: Meteoritics, v. 15, p. 262.

Bleuer, N. K., 1980, Recurrent surging (?) of the Wisconsinan Huron-Erie Lobe in Indiana (abs.): American Quaternary Association Abstract and Program, v. 6, p. 28.

Carr, D. D., and Ault, C. H., 1980, Potential for deep underground limestone mining in Indiana: American Institute of Mining, Metallurgical Petroleum Engineers Preprint 80-334, 11 p.

Droste, J. B., and Shaver, R. H., 1980, Structural interpretation of buried Silurian reefs in southwestern Indiana (abs.): American Association of Petroleum Geologists Bulletin, v. 64, p. 1283-1284.

Droste, J. B., and Shaver, R. H., 1980, Recognition of buried Silurian reefs in southwestern Indiana: Application to the Terre Haute Bank: Journal of Geology, v. 88, p. 567-587.

Eggert, D. L., Miller, L. V., and Irwin, P. N., 1980, Energy resources of the west tailings pond, Airline-Sponsler mine, Greene County, Indiana: Proceedings of Symposium on Surface Mining Hydrology, Sedimentology and Reclamation, p. 255-260.

Fraser, G. S., Bleuer, N. K., and Fishbaugh, D. A., 1981, Sedimentology of terrace deposits at Bend Areas of Wabash River (abs.): American Association of Petroleum Geologists Bulletin, v. 65, no. 5, p. 927.

Fraser, G. S., and Fishbaugh, D. A., 1980, Sedimentary structures of the Late Wisconsinan terraces along the Wabash River in Fraser, G. S., ed., Field Trip Guidebook, 10th Annual Fall Field Conference, Great Lakes Section: Society of Economic Paleontologists and Mineralogists, p. 59-78.

Gray, H. H., and Davis, P. G., 1980, Bedrock topographic map of Indiana: Indiana Academy of Science Proceedings, v. 89, p. 272-273.

Harper, Denver, 1980, Coal resources of Indiana and potential geologic problems in their exploration (abs.): American Association of Petroleum Geologists, V. 64, no. 8, p. 1284.

Horowitz, A. S., and Rexroad, C. B., 1980, A summary of Chesterian (Carboniferous) conodonts from the Illinois Basin, U.S.A. (abs.): Geological Bundesanstalt (Austria) Abh., v. 35, p. 197-199.

Horowitz, A. S., and Rexroad, C. B., 1981, Statistical evaluation of middle Chesterian (Carboniferous) conodonts from southern Indiana (abs.): Geological Society of America Abstract with Programs, v. 13, p. 28.

Johnson, W. H., and Bleuer, N. K., 1980, Quaternary geology of east-central Illinois and west-central Indiana: Great Lakes Section, Society of Economic Paleontologists and Mineralogists Field-Trip Guidebook, p. 45-48, 5 figures.

Merrill, G., and Rexroad, C. B., 1981, Conodonts from the Middle Carboniferous of southern Illinois and the base of the Pennsylvanian System (abs.): Geological Society of America Abstract with Programs, v. 13, p. 309.

Shaver, R. H., 1981, COSUNA charts used to determine stratigraphy (an editorially abused title): Northwest Oil Reporter, v. 1, no. 4, p. 67-70, 2 figures.

REPORTS PUBLISHED IN OUTDOOR INDIANA

Gray, Henry H., 1980, The Ohio River story: Outdoor Indiana, v. 45, n. 6, p. 14-15.

Rarick, R. Dee, 1980, Indiana's first gas and petrol boom - New Hoosier oil fields ahead?: Outdoor Indiana, v. 45, n. 7, p. 4-10.

Rarick, R. Dee., 1981, Gold! Limited yields for Indiana prospectors: Outdoor Indiana, v. 46, n. 1, p. 4-8.

REPORTS AND MAPS SUBMITTED FOR PUBLICATION

Eggert, D. L., A fluvial channel contemporaneous with deposition of the Springfield Coal Member (V), Petersburg Formation, northern Warrick County, Indiana.

Gray, H. H., Map of Indiana showing topography of the bedrock surface: Miscellaneous Map (scale 1:500,000).

Harper, D., Mine subsidence in Indiana.

Harper, D., Trends in underground coal mining in Indiana.

Hartke, E. J., and others, Environmental geology of Vigo County, Indiana -- An aid to planning: Special Report, 65 p., 2 pls., 31 figs., 5 tables.

Hasenmueller, W. A., Directory of coal producers in Indiana.

Hasenmueller, W. A., and Wiegand, J., Map of southwestern Indiana showing locations of active coal mines.

Palmer, A. R., Fossils of Dresbachian and Franconian age from the subsurface of west-central Indiana: Special Report, 51 p., 2 pls., 2 figs.

Rexroad, C. B., Conodonts from the Vienna Limestone Member of the Branchville Formation (Chesterian) in southern Indiana: Occasional Paper, 37 p., 2 pls., 1 fig., 1 table.

Shaffer, N. R., Ault, C. H., Carr, D. D., and Hasenmueller, W. A., Map of Indiana showing mineral resources.

REPORTS SUBMITTED FOR OUTSIDE PUBLICATION

Don Carr continued to serve as Subject Editor for Industrial Minerals for Pergamon Press Encyclopedia of Materials Science and Engineering. Curt Ault and Gordon Fraser completed articles on construction materials for the new encyclopedia.

Don Carr acted as editor for Geological Society of America's special volume on "Industrial Minerals of the Upper Midwest", which was a symposium at an industrial minerals symposium of the GSA at Bloomington in 1980. Don Carr wrote an introduction for the volume and Curt Ault and Don contributed an article on high-calcium limestone in reefs.

Ned Bleuer and Gordon Fraser submitted an article entitled "Late Wisconsinan history of the middle Wabash River valley (abs.)", to the Geological Society of America Abstract with Programs.

Henry Gray submitted "Origin of overbank silt deposits on the flood plain of the Ohio River near Louisville, Kentucky" to the Journal of Sedimentary Petrology.

Alan Horowitz and Carl Rexroad co-authored a paper, "An evaluation of statistical reconstructions of multielement conodont taxa from middle Chesterian rocks (Carboniferous) in southern Indiana" for the Journal of Paleontology.

Robert Shaver (with others) prepared a chart showing correlation of stratigraphic units in the lowland basins and arches region for the American Association of Petroleum Geologists correlation of stratigraphic units of North America chart series.

MEMORANDUM REPORTS

Ault, C. H., Memorandum reports on quarries in northern and southeastern Indiana.

Carr, D. D., Computer program to print coal production data.

Clement, L., Strauser, R., and Hasenmueller, W. A., Map showing abandoned underground coal mines in the Lewis Quadrangle, Indiana.

Fraser, G. S., Review of Hydraulics of Flow and Sediment Transport in the Kankakee River in Illinois: Illinois Water Survey Report of Investigation 98.

Gray, H. H., Geology of Anderson Falls, Bartholomew County, Indiana: 4 pages (September 2, 1980), for Nature Conservancy, Nashville, Indiana.

Harper, D., Ownership of surface lands by coal companies in Indiana.

Hartke, E. J., A general geologic survey of Winamac, Pulaski County, and its six-mile fringe, with emphasis on environmental considerations: 5 pages, 5 figures (December 15, 1980), for Kankakee-Iroquois Regional Planning Commission.

Hartke, E. J., A general geologic survey of Medaryville, Pulaski County, and its six-mile fringe, with emphasis on environmental considerations: 5 pages, 5 figures (December 15, 1980), for Kankakee-Iroquois Regional Planning Commission.

Hartke, E. J., A general geologic survey of Koontz Lake and its six-mile fringe, Starke and adjoining counties, with emphasis on environmental considerations: 5 pages, 5 figures (January 7, 1981), for Kankakee-Iroquois Planning Commission.

Hasenmueller, W. A., Field trip to type localities of the Survant Coal Member (IV) and Houchin Creek Coal member (IVa), eastern Pike County, Indiana.

Kolata, D. R., and Dean, L. L., A report on the Thornton quarry for an AIME field trip, February 26, 1981.

Shaffer, N. R., Memoranda on mineralogy of insoluble residues in a Posey County sample and greensand.

Shaver, R. H., Geology pertinent to septic system proposed for the Indiana Alumni Association campsite on Lake Monroe: 3 pages (July 22, 1980), for Frank B. Jones, secretary, Indiana University Alumni Association.

Shaver, R. H., Geology of a tunnel site, Inland Steel Company plant, Lake County, Indiana: 14 pages, 3 figures (May 4, 1981), for Inland Steel Company, East Chicago.

PAPERS AND POSTERS PRESENTED AT PROFESSIONAL MEETINGS

Ault, C. H., Sullivan, D. M., and Tanner, G. F., Faulting in Perry and Spencer Counties, Indiana; Indiana Academy of Science, November 7, 1980, Rensselaer.

Ault, C. H., and Tanner, G. F., Report on the faulting project in southwestern Indiana; the New Madrid Study Group, April 15, 1981, Silver Springs, Maryland.

Basu, A., Shaffer, N. R., and Hunt, G., Petrography of the Louisville meteorite; Meteoritical Society of America, September, 1980.

Carr, D. D., and Ault, C. H., Potential for deep underground limestone mining in Indiana; Society of Mining Engineering fall meeting, October 23, 1980, Minneapolis, Minnesota.

Chen, P.-Y., Poster on kaolins formed from alteration of igneous rocks in southeastern China, Clay Minerals Conference, October, 1980, Waco, Texas.

Eggert, D. L., Miller, L. V., and Irwin, P. N., Energy resources of west tailings pond, Airline-Sponsler Mine, Greene County, Indiana; Symposium on Surface Mining, Hydrology, Sedimentology and Reclamation, December 4, 1980, Lexington, Kentucky.

Fraser, G. S., Poster display on the origin of the Wabash River terraces; annual American Association of Petroleum Geologists meeting, June, 1981, San Francisco.

Fraser, G. S., Paper on braided stream terrace deposits; 10th Annual Great Lakes Section--Society of Economic Paleontologists and Mineralogists Fall Field Conference, September, 1980.

Harper, D., Trends in underground mining in Indiana; Eastern Section American Association of Petroleum Geologists meeting, October 3, 1980, Evansville.

Keller, S. J., St. Louis and Salem stratigraphy and oil production in Owensville North and Mt. Carmel Consolidated Fields, Gibson County, Indiana, at the annual spring meeting of the Independent Oil Producers Association Tri-State, Inc., in Evansville on April 3, 1981.

Keith, B. D., Talk at the March meeting of the Indiana Geologists in Indianapolis on the recent developments in the Trenton oil field.

Keith, B. D., Application of geology to solve an engineering problem, to geology students at Ball State University in Muncie.

Keith, B. D., Historical development and future potential of the Trenton Field in Indiana, to general public in Muncie.

Rexroad, C. B., Statistical evaluation of Middle Chesterian (Carboniferous) conodonts from southern Indiana; North-Central Section of the Geological Society of America, Ames, Iowa, April 30, 1981.

Shaver, R. H., (with J. B. Droste), Structural interpretation of buried Silurian reefs in southwest Indiana; Eastern Section of the American Association of Petroleum Geologists in Evansville, Indiana on October 2, 1980, and at a later date to the Indiana University Geobiology Seminar on the same topic.

PUBLIC LECTURES

Gordon Fraser gave three lectures on shelf and shoreline sedimentation to Indiana University Department of Geology 501 seminar.

On October 1, Curt Ault gave lectures on geology careers to a careers class and a geology class of Bedford-North Lawrence high school.

On October 30, Don Carr gave a talk on the coal resources of Indiana at Wabash College.

Nelson Shaffer gave lectures on industrial minerals to the Indiana University Department of Geology 416 class, November 18 and 20.

Nelson Shaffer spoke to Noel Krothe's hydrology course about hydro-geochemical prospecting.

Don Eggert presented a paper on the energy resources of west tailings pond, Airline-Sponsler Mine, Greene County, Indiana, by Don, Lou Miller, and Paul Irwin at the Symposium on Surface Mining, Hydrology, Sedimentology, and Reclamation at Lexington, Kentucky, December 4.

Curt Ault and George Tanner gave an oral report on the faulting project in southwestern Indiana before a group of Nuclear Regulatory Commission staff and the New Madrid Study Group, April 15, at Silver Spring, Maryland.

On April 6 at a meeting of landowners from southern Indiana, sponsored by the Cooperative Extension Service and the Scott County Soil and Water Conservation Service, Don Carr gave a talk on the history of oil shale investigations in Indiana. Nancy Hasenmueller spoke at the same meeting on distribution, thickness, lithology, and geochemistry of the New Albany Shale in southeastern Indiana.

On May 5, Nancy Hasenmueller gave a talk on the New Albany Shale in southeastern Indiana to local residents at Crothersville, Indiana.

Nelson Shaffer was interviewed for ten minutes on WTTS TV "Indiana Outdoors" June 28 about Indiana meteorites. He gave a talk on minerals on June 26 to some Girl Scout day campers.

Dee Rarick gave a lecture to a summer class of gifted students from University Middle School, Bloomington.

Dee Rarick gave a lecture to members of the Volunteer Workers Group from the Indiana State Museum in Indianapolis.

Dee Rarick presented lectures to a 4th grade class at University Middle School, 7th grade class at Binford School, and a 3rd grade class at Grandview School, all in Bloomington.

Dee Rarick gave a lecture to the Vincennes Historical and Antiquarian Society.

Dee Rarick lectured to a Brownie Scout troop from Elm Heights School in Bloomington.

John Hill presented a talk on the Pleistocene geology of Indiana to a group of Indiana State Museum curators in Indianapolis on October 13, 1980.

John Hill talked to the Indiana Gems and Geology Society of Indianapolis about the Pleistocene geology of Indiana on November 14, 1980.

John Hill presented a talk and demonstration on the operation of the Mobile B-34 auger rig to the U.S. Geological Survey staff in Indianapolis on January 30, 1981.

On June 12, 1981, Don Carr was interviewed by the IU New Bureau about Indiana coal. Radio broadcasts were carried by Indiana radio stations on June 13 and 14.

John Hill was a guest on WTTS TV's "Indiana Outdoors" program on April 18, 1981 to discuss the geology of Brown County.

Carl Rexroad lectured to the Indiana University Geobiology Seminar on December 10, 1980 concerning conodonts from the Vienna Limestone.

Carl Rexroad presented a lecture entitled "Chesterian conodonts, or games people play" to the University of Kentucky Department of Geology colloquium on April 9, 1981.

Robert Shaver presented a lecture in Harvey, Illinois on September 12, 1980 to the Amoco Production Company geologists on the geometry of Silurian reefs.

Robert Shaver traveled to Terre Haute, Indiana on January 22, 1981 to talk at the Indiana State University Department of Geology Colloquium on the geometry of Silurian reefs of the Great Lakes area--including their fourth dimension.

Robert Shaver presented a lecture on the Silurian paleogeography of the Great Lakes area--in fact and fancy, to the Michigan Basin Geological Society in East Lansing on March 19, 1981.

Robert Shaver was a guest of the Wright State (Ohio) University Department of Geology on April 16, 1981 to lecture on the Silurian paleogeography of the Great Lakes Region.

Robert Shaver presented a lecture on April 22, 1981 to the Upper Mississippi Valley Cluster Meeting (State Geological Survey and U.S. Geological Survey) on the COSUNA project in the upper Mississippi Valley, and at a later date, the same presentation was made to the Indiana University Geobiology Seminar.

Brian Keith prepared material for a teaching project for a course on clastic sedimentology taught by Lee Sutner in the Indiana University Department of Geology. The project served as a final term project for the class, and Brian presented two lectures to the class during November 1980.

John Patton spoke to the Bloomington Kiwanis senior citizen group on the subject of Indiana mineral resources on July 24.

John Patton gave a talk entitled "Outlook for shale-oil recovery from New Albany Shale in Indiana" at the annual meeting of the Indiana Academy of Science at St. Joseph College on November 6-8.

John Patton presented a talk, "Origin of Natural Gas - Organic or Inorganic?" to ScienTech Club in Indianapolis on March 2.

John Patton gave a talk, "Geologic origins of Indiana mineral resources and landscape" at Sertoma Club meeting in Bloomington on March 18, and repeated this talk, with particular emphasis on Monroe County, at a meeting of the Unionville Senior Citizens on March 21.

John Patton lectured on geology to the High School Science Institute, an activity of the National Science Foundation on June 22.

FIELD TRIPS

Curt Ault, Walt Hasenmueller, Henry Gray, and Don Carr attended a field trip for the Tri-State Committee on Correlations in the Pennsylvanian System of the Illinois Basin on July 7 and 8. Walt prepared an informal guidebook and led the group to type localities of the Servant Coal Member (IV) and Houchin Creek Coal Member (IVa).

Don Eggert led a trip for preschoolers to the Hawthorn mine on July 13.

Don Eggert led a field trip with Tom Phillips for students from the University of Illinois to the Roaring area of Parke County to examine rocks of Pennsylvanian age.

Nelson Shaffer attended the Indiana Geologists field trip to the Kentland quarry May 10.

Curt Ault attended three field trips at the Forum on Geology of Industrial Minerals to view mining operations for potash, perlite, pumice, gypsum, and pegmatite in New Mexico.

Dee Rarick conducted a field trip for the gifted student class (summer) at University Middle School, Bloomington.

Dee Rarick conducted a field trip for a 4-H geology group from Monroe County.

Dee Rarick conducted a field trip for an 8th grade class from St. Peter's Lutheran School from Columbus, Indiana.

Dee Rarick conducted a field trip for a group of science teachers from Pike High School, Indianapolis.

Dee Rarick conducted a field trip for members of a geology class from Manchester College, North Manchester, Indiana.

Dee Rarick conducted a tour of the Geology Building for a summer class of gifted students from University Middle School, Bloomington.

Dee Rarick conducted a tour of the Geology Building for 2 classes of fourth grade students from Childs Elementary School, Bloomington.

Carl Rexroad conducted a field trip on the Mississippian-Pennsylvanian boundary in southern Illinois for Illinois Geological Survey and Southern Illinois University personnel on November 24, 1980.

Ned Bleuer conducted a field trip on the Quaternary geology of west-central Indiana for a geology class from Clemson University on October 18, 1980.

Robert Shaver led a field trip on an examination of Silurian rocks, including reefs, in the Great Lakes area for personnel of Amoco Production Company, Houston, on September 12, 1980.

Robert Shaver led a group of personnel from Shell Oil Company, based in Houston, on an examination of Silurian rocks on September 19, 1980.

John Patton conducted a field trip to a building limestone quarry and mill, then gave an illustrated talk on the use of stone to a class in historic preservation from Ball State University on April 15.

PROFESSIONAL COMMITTEES AND SOCIETIES

Don Carr, Curt Ault, and Walt Hasenmueller served on the Tri-State Committee on Correlations in the Pennsylvanian System of the Illinois Basin and participated in cross-section studies, report writing, and field trips. The objective of this committee is to confirm and establish correlations of coals and related rocks in the Illinois Basin and promote a uniform nomenclature.

Don Carr finished his 3-year term on the Board of Directors of the Society of Mining Engineers of AIME and began a 1-year term as Chairman of the Nominations Committee. He also served on the IndMD Scholarship and Development Committee and on the Hardings Award Committee.

Don Carr was elected President of the Illinois-Indiana Section of the American Institute of Professional Geologists and served as representative to the AIPG National Advisory Board.

Nelson Shaffer served as Vice Chairman for the Staff Council at Indiana University, Bloomington during the year.

The annual meeting of the Forum on Geology of Industrial Minerals will be held on the Indiana University campus. Members of the Geological Survey involved in its organization for the April, 1982, meeting are Don Carr, Vice Chairman; Curt Ault, Technical Program Chairman; Nelson Shaffer, Field Trip Chairman; and Gordon Fraser, Finance Chairman.

Gordon Fraser served as Treasurer and field trip leader for the Great Lakes Section--Society of Economic Paleontologists and Mineralogists and was nominated at the end of the year for President. He is also on the Membership Committee of the SEPM.

Don Carr served on the Research Committee of the Interstate Mining Compact Commission.

Don Carr served on the Energy Resources Committee of the Interstate Oil Compact Commission.

Don Carr was a member of the Governor's Water Resource Study Commission, which completed its work on January 3, 1981.

Ned Bleuer served as a critical reviewer of Pleistocene-oriented proposals for research grants from the National Science Foundation.

Ned Bleuer served as a long-continuing consultant to the U.S. Geological Survey concerning the Chicago sheet of the new map on Quaternary geology of the United States.

Henry Gray participated in the U.S. Department of Agriculture Soil Conservation Service's annual review meeting on soils in Indianapolis and in given field reviews.

Henry Gray served and attended four meetings as a member of the Tri-State Committee on Pennsylvanian Correlations in the Illinois Basin.

Henry Gray attended cluster meetings of personnel of the U.S. Geological Survey and of Midwestern state geological surveys.

Henry Gray served as long-continuing consultant to the U.S. Geological Survey concerning the Louisville sheet of the new map on Quaternary geology of the United States.

Henry Gray served as chairman of the Geography and Geology Section, Indiana Academy of Science.

Henry Gray served as consultant to the City of Bloomington Utilities Board, re disposal of sewage sludge.

Henry Gray served as reviewer of parts of the new stratigraphic code, auspices of American Commission on Stratigraphic Nomenclature.

Edwin Hartke served as a member of the Technical Coordinating Team for the State Board of Health's study of ground-water quality management.

John Hill served as geologic consultant to the U.S. Department of Agriculture Soil Conservation Service in Indianapolis and participated in given field reviews.

John Hill served as a member of the Technical Advisory Committee of the City of Bloomington's Planning Commission.

John Hill served as a consultant to the Indiana Heritage Program, under the auspices of the Division of Outdoor Recreation.

John Hill served as consultant on public lectures and displays to Brown County State Park.

Carl Rexroad served as a member of Working Group on Lower Carboniferous Series Boundaries and Stratigraphy, Society of Economic Paleontologists and Mineralogists.

Carl Rexroad co-chaired a session on "Conodont Biostratigraphy and Paleontology" at the North-Central Section of the Geological Society of America in Ames, Iowa.

Carl Rexroad served as critical reviewer of proposals for research grants from the National Science Foundation and the Petroleum Research Fund of the American Chemical Society.

Robert Shaver served on and ended a term as president of the Foundation for the Advancement of Paleontology and Sedimentology, in Tulsa, Oklahoma.

Robert Shaver served on the Presidential Advisory Committee, Society of Economic Paleontologists and Mineralogists.

Robert Shaver served as a member of the 1983 Convention Committee for the Geological Society of America.

Robert Shaver chaired the 1983 Geological Society of America Field Trip Committee.

Robert Shaver attended the meeting of the Operating Committee of the American Association of Petroleum Geologists project on the Correlation of Stratigraphic Units of North America, in San Francisco, California.

Robert Shaver served as a critical reviewer of paleontological proposals for research grants from the National Science Foundation.

Robert Shaver served as critical reviewer for the Journal of Paleontology.

Gerald Carpenter chaired the Levorsen Awards committee which judged the papers presented at the meeting of the Eastern Section of the American Association of Petroleum Geologists which was held in Evansville.

Gerald Carpenter developed oil and gas statistics for Indiana for the American Association of Petroleum Geologists' Committee on Statistics of Drilling. He attended the Committee's meeting at San Francisco June 5 and 6, 1981.

Stanley Keller is a member of the Potential Gas Committee and develops potential gas reserve figures for Indiana for publication by the Committee.

NEWS RELEASES

Nelson Shaffer prepared a news item on mass spectrometers and worked on three others in October, 1980.

Nelson Shaffer wrote drafts for three illustrated news items on white limestone, underclay, and radiometric dating of geologic materials in November, 1980.

Don Carr, Curt Ault, Nelson Shaffer, and Gordon Fraser completed text for six illustrated news articles on the Salem Limestone and turned them in to Dee Rarick in January, 1981.

Curt Ault submitted a news release in February on the publication of the maps of Posey and Gibson Counties showing faulting on the Cypress Formation.

Nelson Shaffer prepared or worked on news items on Tioga bentonite, the Salem Limestone, and heavy minerals in April.

Nelson Shaffer helped prepare an illustrated news item on heavy minerals in June.

A news release in June was prepared by Nelson Shaffer for Special Report 21 on the possibility of Mississippi Valley-Type mineral deposits in Indiana. Several professional journals were notified of the publication.

REVIEWS

On July 22, Don Carr completed a review of Sam Friedman's manuscript on "Geology and coal deposits of the Clinton area, west-central Indiana", and returned it to Maurice Biggs for further processing.

On July 3, Don Eggert reviewed a manuscript on "Depositional environments of strata of Late Desmoinesian age overlying the Herrin (No. 6) Coal in southwestern Illinois and the occurrence of low-sulfur coal", by James E. Palmer, C. Brian Trask, and Russell J. Jacobson, for possible inclusion in the proceedings of the Ninth International Congress of Carboniferous Stratigraphy and Geology.

Nelson Shaffer reviewed an abstract by Pei-Yuan Chen concerning kaolin formed by alteration of igneous rocks in China.

Don Carr reviewed 5 manuscripts (2 for outside publications and 3 for Survey publication), and started work as subject editor on industrial minerals for the Encyclopedia of Materials Science and Engineering.

Curt Ault, as part of a local committee, reviewed three textbooks on General Science submitted for use in Indiana high schools.

Gordon Fraser reviewed a thesis on the Glen Eyrie Formation of Colorado and a paper by Haydn Murray on magnetic beneficiation of industrial minerals.

Nelson Shaffer reviewed Haydn's paper and a doctoral thesis by Phil Amadi.

Curt Ault reviewed the manuscript, "What is COSUNA? Time and humility is of the essence", by Robert Shaver for geologic names.

Don Carr reviewed five manuscripts for articles for inclusion in Pergamon's new encyclopedia.

Gordon Fraser reviewed a paper for the Geological Society of America Bulletin on Mississippian evaporites in Iowa, and M.S. thesis on Cretaceous sediments in Colorado, a publication for the Department of Natural Resources on hydrology of the Kankakee River, and a manuscript on outwash sedimentation in Illinois accepted for publication by the Journal of Sedimentary Petrology.

SYMPOSIA

Brian Keith assembled core and well data material to be used in a carbonate symposium studying the subsurface Valmeyeran Series in the Illinois Basin. The symposium, attended by Brian, was held on April 23 and 24, 1981 at Mt. Vernon, Illinois and was sponsored by the Illinois State Geological Survey and the Illinois Geological Society.

ATTENDANCE AT PROFESSIONAL MEETINGS

Walt Hasenmueller and Don Carr attended meetings of the Energy Task Force meeting in Indianapolis, July 30 and 31, 1980.

Gordon Fraser was one of the prime movers for the 1980 Society of Economic Paleontologists and Mineralogists field conference, which was also attended by Don Eggert, a field trip leader, and Nelson Shaffer, Joe Hailer, and Pei-Yuan Chen.

Walt Hasenmueller attended the September 18, 1980 meeting of the Indiana Mining and Technical Society meeting in Vincennes.

Curt Ault, Pei-Yuan Chen, Gordon Fraser, Joe Hailer, Nelson Shaffer, and Lou Miller attended the Indiana Geologists meeting, September 10, 1980.

On September 9, 1980, Curt Ault, Henry Gray, and Don Carr attended a meeting of the Tri-State Committee on Correlations of Pennsylvanian Rocks in the Illinois Basin at Urbana.

Curt Ault, Dan Sullivan, and George Tanner attended an American Geophysical Union meeting in DeKalb, Illinois, September 18 and 19, 1980.

On September 26, 1980, Don Carr attended a meeting of the Indiana-Kentucky Geological Society in Evansville.

Nelson Shaffer attended an earth science mineral show at Greenfield, Indiana on September 13.

Curt Ault, Denver Harper, and Don Carr attended the American Association of Petroleum Geologists Eastern Section Conference in Evansville, October 2 and 3.

Don Carr attended the Illinois Geological Survey Symposium at Urbana, October 9-10; a meeting of the Society of Mining Engineers of AIME at Minneapolis, Minnesota, October 22-24; and the annual meeting of the Indiana Limestone Institute of America, October 28.

Nelson Shaffer attended the open house at the Illinois State Geological Survey October 9-10 and attended a mineral show for the Indiana Gem and Minerals Club, October 11.

Pei-Yuan Chen attended the 29th Annual Clay Minerals Conference in Waco, Texas, October 5-9.

Walt Hasenmueller attended the Illinois Mining Institute meeting in Springfield, Illinois, with Lou Miller on October 15-17.

On October 8, Nelson Shaffer and Gordon Fraser attended a meeting of Indiana Geologists.

Gordon Fraser and Nelson Shaffer attended Indiana Geologists on November 12, 1980.

Curt Ault and Walt Hasenmueller attended the annual meeting of the Indiana Academy of Science, November 7 and 8, at Rensselaer.

Don Carr, Curt Ault, Henry Gray, and Walt Hasenmueller attended a meeting on correlation of the Pennsylvanian System in the Illinois Basin on January 19, in Henderson, Kentucky.

Don Carr, Gordon Fraser, Nelson Shaffer, and Walt Hasenmueller attended an Indiana Geologists meeting in Indianapolis on January 14.

Don Carr attended the final meeting of the Governor's Water Resource Study Commission on January 6, 1981.

Walt Hasenmueller and Don Carr attended the Indiana Mining and Technical Society meeting at Vincennes, January 15.

On February 23-25, Don Carr and Denver Harper attended the American Institute of Mining Engineers Annual Meeting in Chicago. Don conducted business with the Society of Mining Engineers Board of Directors. This was his last meeting of the Board, having completed a 3-year term.

Walt Hasenmueller attended the Indiana Mining and Technical Society meeting at Vincennes, February 19, 1981.

Gordon Fraser and Nelson Shaffer attended a meeting of the Indiana Geologists, February 18.

On February 17, at the request of the Monroe County Plan Commission, Don Carr presented geological background material in regard to a petition for rezoning near Stinesville by the American Aggregates Corporation.

On February 10, John Patton, Dick Leininger, and Don Carr attended a meeting of the Indiana Energy Development Board in Indianapolis.

Gordon Fraser, Don Carr, and Curt Ault attended the annual meeting of the Indiana Mineral Aggregates Association, March 12-14, at Vincennes.

Nancy Hasenmueller, Curt Ault, Nelson Shaffer, and Gordon Fraser attended a meeting of Indiana Geologists, March 10 at Indianapolis.

Walt Hasenmueller attended the Indiana Mining and Technical Society meeting in Vincennes March 19.

Walt Hasenmueller attended the Indiana Coal Mining Institute Annual Convention in Evansville on March 27-28.

Don Carr, Walt Hasenmueller, and Henry Gray met on April 7 with the Tri-State Committee on Correlation of Pennsylvanian rocks.

On April 13, Don Carr attended the annual meeting of the Indiana Limestone Institute of America.

On April 15, Curt Ault and George Tanner attended a report meeting of the New Madrid Study Group in Silver Spring, Maryland.

On April 22 and 23, various members of the Survey attended the U.S. Geological Survey Cluster Meeting, held in Bloomington.

On April 23 through 25, Curt Ault and Dan Sullivan attended an earthquake seminar, field trip, and planning meeting of the New Madrid Study Group and others at Martin, Tennessee.

On April 21, Don Carr attended the Illinois-Indiana Section of the American Institute of Professional Geologists spring meeting in Merrillville.

Nelson Shaffer and Walt Hasenmueller attended a meeting of Indiana Geologists April 8.

Nelson Shaffer attended mineral shows at Cincinnati on April 15; at Columbus, Ohio on April 25 and 26, and Richmond, Indiana on April 12.

Walt Hasenmueller attended a meeting of the Indiana Mining and Technical Society at Vincennes, April 16.

Curt Ault attended the Forum on Geology of Industrial Minerals, May 12-15, at Albuquerque, New Mexico.

Nancy Hasenmueller, Dick Leininger, and Gerald Carpenter attended a meeting on the Chattanooga oil shale sponsored by the Tennessee Energy Authority, May 21, at Nashville, Tennessee.

Nancy Hasenmueller, Don Carr, John Patton, and Gerald Carpenter attended a meeting of Southern Indiana Oil Shale in Henryville May 12.

On May 14, Don Carr, Walt Hasenmueller, and John Patton attended the Indiana-Kentucky Geological Society meeting in Evansville.

Walt Hasenmueller attended the Indiana Mining and Technical Society meeting in Vincennes, May 21, 1981.

Gordon Fraser attended the annual meeting of the American Association of Petroleum Geologists at San Francisco, May 30 through June 3.

Nelson Shaffer attended the annual meeting of the Indiana Water Resources Association of June 25.

During the 1980 4-H Fair season, Dee Rarick judged 4-H geology and weather exhibits for the Jennings County 4-H Fair, the Martin County 4-H Fair, the Jefferson County 4-H Fair, the Jackson County 4-H Fair, and the Morgan County 4-H Fair.

Henry Gray attended the Indiana Academy of Science meeting in Rensselaer on November 7 and 8, 1980 and at Turkey Run State Park on April 17 and 19, 1981.

Edwin Hartke attended the Midwest Groundwater Conference in Indianapolis on October 23-24, 1980.

Robert Shaver attended the Geological Society of America and Paleontological Society annual meeting in Atlanta, Georgia on November 16-19, 1980.

Gerald Carpenter accompanied John Patton, Nancy Hasenmueller, Dick Leininger, and Don Carr to Henryville for a meeting of landowners called by Southern Indiana Shale Development Corporation on May 12, 1981.

Stan Keller, Brian Keith, and Gerald Carpenter attended the annual meeting of the Independent Oil Producers Association at Mt. Vernon, Indiana.

Dan Sullivan and Gerald Carpenter attended the annual Illinois Oil and Gas Association meeting held at Rend Lake (Benton) Illinois.

Dick Leininger and Gerald Carpenter attended an Eastern Oil Shales seminar held in Lexington, Kentucky on July 23 and 24, 1980. At this meeting the Petroleum Section was the recipient of a gift of approximately 1,500 electric logs from Ed Wilson.

Gerald Carpenter attended the annual convention of the American Association of Petroleum Geologists held in San Francisco July 1-4, 1981. During the meeting he acted as one of the judges to help determine the recipient of the Matson award for the best paper presented at the convention. Following the close of the convention he attended the annual workshop meeting of the American Association of Petroleum Geologists drilling statistics committee also held in San Francisco.

Dan Sullivan attended the annual outing of the Illinois Oil and Gas Association held in Robinson, Illinois on June 18, 1981.

Gerald Carpenter, Andrew Hreha, and Dan Sullivan attended the 30th Annual Meeting of the Illinois Basin Chapter of the American Petroleum Institute held in Evansville on April 30, 1981.

The cluster meeting hosted by the Indiana Geological Survey was attended by Gerald Carpenter. Don Haney, State Geologist of Kentucky, was a pre-meeting visitor to the Petroleum Section facilities to observe the manner of processing and filing Indiana well data.

George Tanner, Dan Sullivan, and Curtis Ault attended the annual fall meeting of the Nuclear Regulatory Commission-New Madrid Study Group held in conjunction with the American Geophysical Union sixth annual meeting at Northern Illinois University, DeKalb, Illinois. George presented a project status report at the New Madrid Group session. In addition, he presented a paper entitled "Movement, Drag Features, and Complexity of the Mt. Carmel Fault, South-Central Indiana" in the regular session of the AGU meeting.

George Tanner, Dan Sullivan, and Curtis Ault attended the annual meeting of the Indiana Academy of Science at Rensselaer. George presented a paper "Faulting in Perry and Spencer Counties, Indiana" which was authored by George, Dan and Curtis.

George Tanner and Curtis Ault presented a summary of the total mapping project of the Nuclear Regulatory Commission study at a joint meeting of the New Madrid Study Group and various NRC agency personnel held in Washington, D.C.

Dan Sullivan and Curtis Ault attended a symposium and field trip on earthquakes and related features of the Mississippi River Valley in Northwest Tennessee at the University of Tennessee at Martin.

John Patton attended the meeting of the Interstate Coal Task Force in Indianapolis on July 30.

John Patton attended the Advisory Council Meeting at Jasper, Indiana on August 19-20.

John Patton participated in the Indiana University Conference on Historic Preservation, gave a brief talk, and conducted a walking tour of the old crescent part of campus on September 26-27.

John Patton attended the fall meeting of the Indiana Limestone Institute of America in Bloomington on October 28.

John Patton met with Dr. Carol Garcia Gutierrez, from the University of Chihuahua, Mexico, who visited the Indiana Geological Survey to examine facilities and to discuss programs, organization, and equipment to assist in his efforts to establish a geological survey in Chihuahua on October 30.

John Patton attended a workshop on preservation and restoration of building stone at Mt. Carroll, Illinois on November 19-21.

John Patton participated in a meeting at Scottsburg on January 21 that was held to inform the public about oil shale development.

John Patton was in Denver on January 29 and 30 to attend a meeting of the committee on revision of North American Stratigraphic Code.

John Patton participated in a meeting on February 13, 1981 of the planning committee for the 1983 Geological Society of American annual meeting to be held in Indianapolis.

John Patton attended the annual meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers in Chicago on February 23-25 and gave a talk, "Breadth and Fundamentals -- The Prime Requisites for Training Geologists to Work in Industrial Minerals".

John Patton attended the spring meeting of the Indiana Academy of Science at Turkey Run State Park on April 17-18.

John Patton participated in a cluster meeting in Bloomington on April 21-23 with representatives of the U.S. Geological Survey and other midwestern state geological surveys.

John Patton participated in a meeting of Committee C-18 Natural Building Stones, American Society for Testing and Materials, in Washington, D.C., on April 26-28.

John Patton attended the annual meeting of the American Association of Petroleum Geologists in San Francisco on May 31 - June 3. During this same period, he participated in meetings of the committee to review the Stratigraphic Code of North America.

John Patton participated in the annual meeting of the Association of American State Geologists in Baltimore on June 7-11.

John Patton attended a meeting of the Indiana Energy and Development Board on June 17.

EXHIBITS

An exhibit about the Trenton Gas and Oil Field of Indiana was prepared and displayed at the 1980 Indiana State Fair. This exhibit also was placed in the Science and Mathematics Building at Ball State University in Muncie after the state fair.

A petroleum exhibit was prepared and taken to the regional meeting of the American Association of Petroleum Geologists held in Evansville late in 1980.

An exhibit about Indiana's building limestone was prepared and placed on display at the Monroe County Historical Society Museum in Bloomington. This exhibit was later placed in the Indiana University Museum's exhibit space in the Indiana Memorial Union Building.