THE DIVISION OF GEOLOGY

(Sixty-sixth Annual Report of the State Geologist)

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Faculty members of the Department of Geology at Indiana University are members of the staff, but act only in an advisory capacity to the Division of Geology. They are: E. R. Cumings, Stratigraphic Geology; C. A. Malott, Physiography and Stratigraphy; J. J. Galloway, Paleontology; W. D. Thornbury, Glaciology; and Ralph Esarey, Economic Geology. They receive no compensation from the Department of Conservation.

OIL AND GAS SUPERVISION

The Supervisor of Natural Gas, with the field force of nine deputy natural gas inspectors, carries out the enforcement of laws and regulations governing the development and production of petroleum and natural gas, supervises the plugging of dry and abandoned wells, and aids in the prevention of pollution of water courses by oil and brines. A very important part of the work of the staff consists of the collection and compilation of geological and production data. This material is made available to the public through various publications. All such data is on file in the Division offices at Indianapolis, for use by the public.

During 1941 the Deputy Gas Inspectors were: Marion Brown, Loogootee; Harold L. Caldwell, Ligonier; Herman D. Chanley, Fredonia; William F. Conners, Vincennes; L. W. Edmundson, Pennville; Fred E. Harrer, Tell City; Howard W. Legge, Bloomington; Don B. Riggs, Montpelier; and James Wyman, Sullivan. These deputy inspectors receive no salary from the Department, but receive a part of the fee collected for plugging the wells.

The Division of Geology, in addition to other duties, gathers information on the drilling wells in the State. This information is available to all interested persons. Each month the Oil and Gas News, containing the latest available information on drilling wells, is mimeographed and mailed to a large number of interested persons in Indiana and other states. There is no charge for this publication. Through this bulletin, persons interested in the petroleum industry are kept informed regarding developments in Indiana.

Collection of samples from drilling wells continued during 1941. At the end of the year there were approximately 750 sets of cuttings on file at the laboratory of the Division at Indiana University at Bloom-

ington. These samples may be studied by any person interested. The study of such cuttings furnishes information regarding sub-surface conditions in Indiana, and are of the greatest aid to geologists.

OIL AND GAS OPERATIONS

During the year 1941 there was a slight increase over the previous year in drilling for oil and gas. 552 wells were drilled in Indiana, of which 411 were pool wells, and 141 wildcat wells. Of the pool wells drilled, 260 were oil wells, 57 gas wells, and 94 dry holes. 16 of the wildcat wells produced oil, 3 produced gas, and 122 were dry and abandoned. At the end of the year there were 53 pool wells and 34 wildcat wells drilling in various parts of the State.

In addition to other tests in the State there have been a number of core tests drilled in northern Indiana. These tests were drilled to horizons below the glacial drift, and have resulted in the drilling of several oil and gas test wells, some of which were small producers. Drilling during the past year, as in most recent years, was mainly in southwestern Indiana. There were 154 wells drilled in Gibson County, of which 125 were productive. 155 wells were drilled in Posey County, 98 of which were oil wells. The Griffin Pool, located in Gibson and Posey Counties, was the most active in Indiana, with 177 wells drilled and only 20 dry holes.

The following pools were discovered during 1941: Hatfield, in Spencer County; Hazelton and Patoka, in Gibson County; and Mt. Vernon, in Posey County. In addition there have been a number of one-well discoveries, which to date have not been extended into pools by continued drilling.

Oil production in Indiana during the year was 7,295,515 barrels, an increase over the 5,290,000 barrels produced during 1940. Gas production also climbed from 1,244,090,000 cubic feet in 1940 to 1,355,440,000 cubic feet in 1941.

Toward the end of the year there was a noticeable decrease in pool drilling due to the Federal regulations governing the spacing of wells. Due to these regulations, however, there have been more edge wells drilled and perhaps more wildcat wells than would have been drilled under normal circumstances. There is considerable interest in northern Indiana where several tests to pre-Trenton formations are planned.

OFFICE WORK

Routine office work has consisted mainly of answering correspondence, identifying rocks and minerals brought or sent in by owners or finders, supplying information to many hundreds of geologists, oil and gas operators, and others interested in oil and gas production and prospecting. In addition there have been compiled and published several reports and maps dealing with various phases of the geology of the State.

These reports and maps, when published, usually are compilations of material gathered over a period of years. They require much research, as records and reports of former years must be carefully checked.

Many hundreds of mineral specimens and rocks are identified each year by members of the Division. Such specimens, many of which the owners believe to contain valuable minerals, are usually rather common materials. They include calcite, quartz, iron ores, pyrite, mica, etc. The Division welcomes these requests and members of the staff are always glad to be of service.

Many requests are received each year from individuals and companies interested in developing or in the possibilities of development of the various mineral resources of Indiana. These include stone, sand and gravel, coal, oil and natural gas, iron ore, marl, peat, ground water, mineral wool, moulding sands, clay, kaolin, dolomite, etc. In many instances the Division is called upon for information concerning the status of mineral industries already established in Indiana.

Other requests for information upon all branches of geology include caves, fossils, physiography, topography, rock garden material, geology of the State parks, State forests, etc.

FIELD INVESTIGATIONS

Field investigations required a considerable amount of time during 1941 and included work with other divisions, enforcement of laws and regulations, and work upon geologic problems dealing with mineral resources. Summer field parties continued their work on the geology of the topographic quadrangles in southwestern Indiana. The ultimate goal is a complete inventory of Indiana's coal seams, estimates of the amount of coal still available, character and availability of the coal, and the finding of these areas favorable for testing for oil or gas. The last coal survey made in the State was conducted more than 30 years ago, so that this work has been needed for several years. Only one party, consisting of two men (Willis L. Smith and Victor Means) was actively engaged in this work during the summer. As a result the Pimento and Lewis Quadrangles have been completed in the field and the manuscripts are in the process of completion. Other work was in Mt. Carmel Fault Region in Washington County, of which the Director of the Division had charge.

DEPARTMENTAL WORK

Cooperative work with the various Federal Officials and Agencies carrying out the war program has been placed ahead of every other activity of the Division. The following is a summary of the projects upon which the Division has been consulted directly or indirectly:

Charlestown Ordnance Plant.
Burns City Ordnance Plant.
Camp Atterbury.
Clinton Ordnance Plant.
Terre Haute Ordnance Plant.

Seymour Training School.

The possible use of dolomite deposits for the manufacture of magnesium.

The possible use of kaolin deposits for the manufacture of aluminum.

The possible use of iron deposits in Martin County for making ferro-silicon.

Since war was declared by the United States no work upon geologic problems has been done that did not directly contribute to the war effort. The geologic mapping upon the new topographic sheets has been discontinued until after the war.

A cooperative research agreement with the Ground Water Division of the United States Geological Survey, instituted in 1935, was continued during the year. Observation water wells are located throughout the entire State and water levels are checked every two weeks. These wells represent all variations of topography, altitude and water-bearing strata, and continuation of the measurement program will give valuable information concerning the fluctuations in level of the subsurface water supplies. Data are assembled and studied in the offices of the U. S. Geological Survey in Washington. Several new wells were added to the list being measured in Indianapolis during the early months of the year, and two automatic, continuous water-level recorders are now in operation. During the summer field season Charles L. McGuinness, of the Ground Water Division of the United States Geological Survey, has been continuing his ground water research in the State. This work is carried on in cooperation with other members of the Division. During the latter part of the year an expansion of the ground water program was made possible by the contribution of $1,500.00 by Governor Schricker for this work so that Mr. McGuinness could spend his full time in Indiana. This will result in greater service to the industries and citizens of the State and the compilation of much valuable information upon the amount of ground water available, the effects of land drainage projects on the water table, whether and where a progressive and permanent decline of the water table is taking place, and the effects of soil erosion control methods on the water levels.

As in previous years, the Department of Conservation cooperated with the United States Geological Survey in a topographic mapping program, wherein each sponsor furnished $25,000.00 per year. Mapping of the quadrangles is done by engineers from the Federal Survey and assistants who are residents of Indiana. The finished maps are compiled and published in Washington. The Division of Geology and Engineering have charge of the selection of areas to be mapped, and also select part of the non-technical personnel. Mapping under the new program is done on the scale of 2 inches per mile, approximately, and each quadrangle or map is 7½ minutes of arc square. The new, larger scale of these maps and the accuracy of the work done by the Geological Survey makes these maps very valuable. They are the most accurate maps of their kind in the world and their utility in highway construction, flood control, State and city planning, exploration for oil and coal, and many other types of endeavor, cannot be overestimated. Mapping has progressed along the Ohio River until only three quadrangles remain to be mapped

to complete the entire southern border of the State. Field parties are working to complete the coal field area in the southwestern part of the State and mapping is also in progress in northeastern Indiana. Completions for the year of 1941 are listed below. Those with all field work done and the maps either published or in the process of publication are the following quadrangles: Bright, East Enterprise, Sullivan, Merom, Oaktown, Carlisle, Oaktown Southwest, Bicknell, Newberry, Marco, Plainville and Elnora. Maps upon which the horizontal and vertical control has been completed are as follows: Wheatland, Frichton, Verne, Monroe City, Montgomery, Washington, Sandy Hook, Glendale, DuBois, Jasper, Huntingburg and Kyana. Indiana is far behind most other States in the amount of area mapped. Many States east of the Mississippi are completely mapped, as Indiana should be.

PUBLICATIONS

The annual report upon the oil and gas industry was submitted to the American Institute of Mining and Metallurgical Engineers for publication in their proceedings. Reprints are available in this office. Likewise a report upon natural gas in Indiana was prepared for the Minerals Yearbook published by the U. S. Department of Mines, at Washington, D. C. In September, Part I of the Devonian Formations of Indiana, by T. A. Dawson, was published by the Division. This report covers the outcrop area of the Devonian formations in southern Indiana and is the second of a series of two publications upon the Devonian System in Indiana.

STATE MUSEUM

The Division of Geology supervises the State Museum located in the basement of the State House. The exhibits continue to attract large numbers of visitors and have great variety and appeal to persons in all walks of life.

DIVISION OF ENGINEERING

*RALPH B. WILEY, Engineer Consultant.
DENZIL DOGGETT, State Engineer.
CHARLES H. BECHERT, Sanitary Engineer.
RICHARD E. BISHOP, Architect.
EDSON L. NOTT, Landscape Architect.
CHARLES B. PRESTON, Office Engineer.
ERNEST M. JACKSON, Architectural Draftsman.
CLAUDE H. COYNE, Architectural Draftsman.
L. E. RATCLIFF, Civil Engineer.
HAROLD L. BALLARD, Engineering Draftsman.
FRANCIS DAILY, Secretary.

* Professor Ralph B. Wiley is head of the School of Civil Engineering of Purdue University and Consultant to the Department of Conservation, ex officio.

The Division of Engineering of the Department of Conservation was created by an act of the Seventy-second General Assembly and was organized in May, 1921.

The work of the Division of Engineering falls under two classifications, namely, drainage and land reclamation and engineering service. The work under drainage and land reclamation is specifically set forth in the act creating the division, and considerable detail is given regarding the duties pertaining to these types of engineering work. The Division's work under "Engineering Service" is allocated to the various divisions of the Department of Conservation and consists of planning and executing engineering works, making surveys, maps, investigations, reports, graphs and similar work. These two general classifications are grouped in more detail as follows:

I. Drainage and Land Reclamation.
   1. Collection and dissemination of data and statistics.
   2. Legislative recommendations.
   3. Special investigations and reports on drainage and levee projects.
   4. Advisory consultation.

II. Engineering Service.
   1. State parks, memorials, forests, game preserves and fish hatcheries.
      a. Surveys, design, construction.
      b. Supervision of construction.
   2. Lakes.
      a. Lake levels, surveys, and reports.
   3. Special surveys, investigations, and miscellaneous works.

I. Drainage and Land Reclamation.

The Division of Engineering is empowered by statute to make investigations of drainage and flood control projects, to compile and disseminate information which may be used in planning such works, to recommend and secure enforcement of laws pertaining to such works, to assist in design of such works by measuring or computing flows in natural or artificial channels, to collect such data or information as it may regard necessary to any particular project, to assist drainage or levee commissioners, as they may desire, in the inspection of lands under consideration, to assist courts in an advisory capacity and to cooperate with superintendents of construction in matters on which advise is sought.

Collection and Dissemination of Data and Statistics

In its conduct of investigations and other works, the Division is constantly on the lookout for general information of both technical and non-technical nature that relates to drainage and flood protection work, as well as other phases of reclamation work. In addition to the above, the Division is directing its efforts toward the collection of specific information under three distinct headings, namely, a stream gauging program, a drainage survey of the State, and investigation of the effects of drainage in definite areas of the state.

STREAM GAUGING

In the development of the agricultural and commercial resources of the State, it is important that accurate information be available concerning the flow in the various streams of the State. Such data is used in the planning of reclamation works, in the design of water power, water supply and sewage disposal works, and in the study and correction of stream pollution.

During the past eleven years the stream gauging program was furthered through the operation of forty-two gauging stations by the United States Geological Survey. Twenty-seven of these stations are equipped with automatic water stage recorders. These stations were operated through a cooperative agreement whereby half the expense was borne by the Department of Conservation and the State Highway Commission of Indiana, and the other half by the above Federal Agency. The United States Geological Survey maintains a district office at Room 300 Reserve Loan Life Insurance Bldg., Indianapolis, where flow data on Indiana streams may be secured.

DRAINAGE SURVEY

There is still an active demand for the blueprint copies of the various county drainage maps that have been compiled, which has justified the belief of the originators of the survey that there was a real need for reliable drainage maps.

Investigations and Reports on Drainage and Levee Projects

The statute provides that the Department of Conservation, upon the written request of the court having jurisdiction, the drainage commis-

sioner, the superintendent of construction, or any petitioner or landowner who may be affected by the proposed work, or upon its own initiative may direct the State Engineer or his authorized agent to investigate any proposed drainage or levee project and make known his findings. Usually the assistance of the Division has not been sought until all surveys and plans for the project have been completed and the reports filed. The Division can render a more valuable service if consulted at the time the petition is filed, thereby giving it an opportunity to advise with the engineer, drainage commissioner and attorney during the progress of the survey, location and preparation of the specifications. In many cases it has been found that approval could have been given a project provided certain changes in the plans or specifications had been made. After the final report has been filed, changes are difficult to make, and in such cases the Division has been forced to withhold its approval.

ADVISORY CONSULTATION

The assistance of the Division of Engineering in an advisory capacity on drainage projects is provided by law. In connection with the proper location, design and establishment of drainage or levee systems, the Division will endeavor to render every possible service when its aid is requested. This does not mean that the Division will make the necessary surveys and prepare the plans and specifications required, but that it will advise the landowners, engineers, or attorneys as to the location and design of ditches and levees, methods of construction and other points of a like nature upon which the advice and assistance of the Division may be desired.

II. Engineering Service.

MAINTENANCE

Maintenance, one of the principal functions of the Division of Engineering, was prescribed and supervised on the various facilities constructed in past years on the land holdings of the Conservation Department. Water supply and sanitary facilities affecting the health of the many visitors at these holdings were carefully checked at stated intervals and frequent personal inspections made of these facilities by members of the Division's staff. Roads, bridges, hotels and other structures affecting the safety and enjoyment of the public were inspected and their maintenance prescribed.

FEDERAL WORKS AGENCIES

The work of the Civilian Conservation Corps and the Works Projects Administration ended with this fiscal year as far as the Department of Conservation was concerned. The Division of Engineering prepared but few plans and specifications for work to be done by these agencies since they spent most of their limited labor supply in the completion of works already started. The work of these organizations had done much toward