The Kentucky Geological Survey

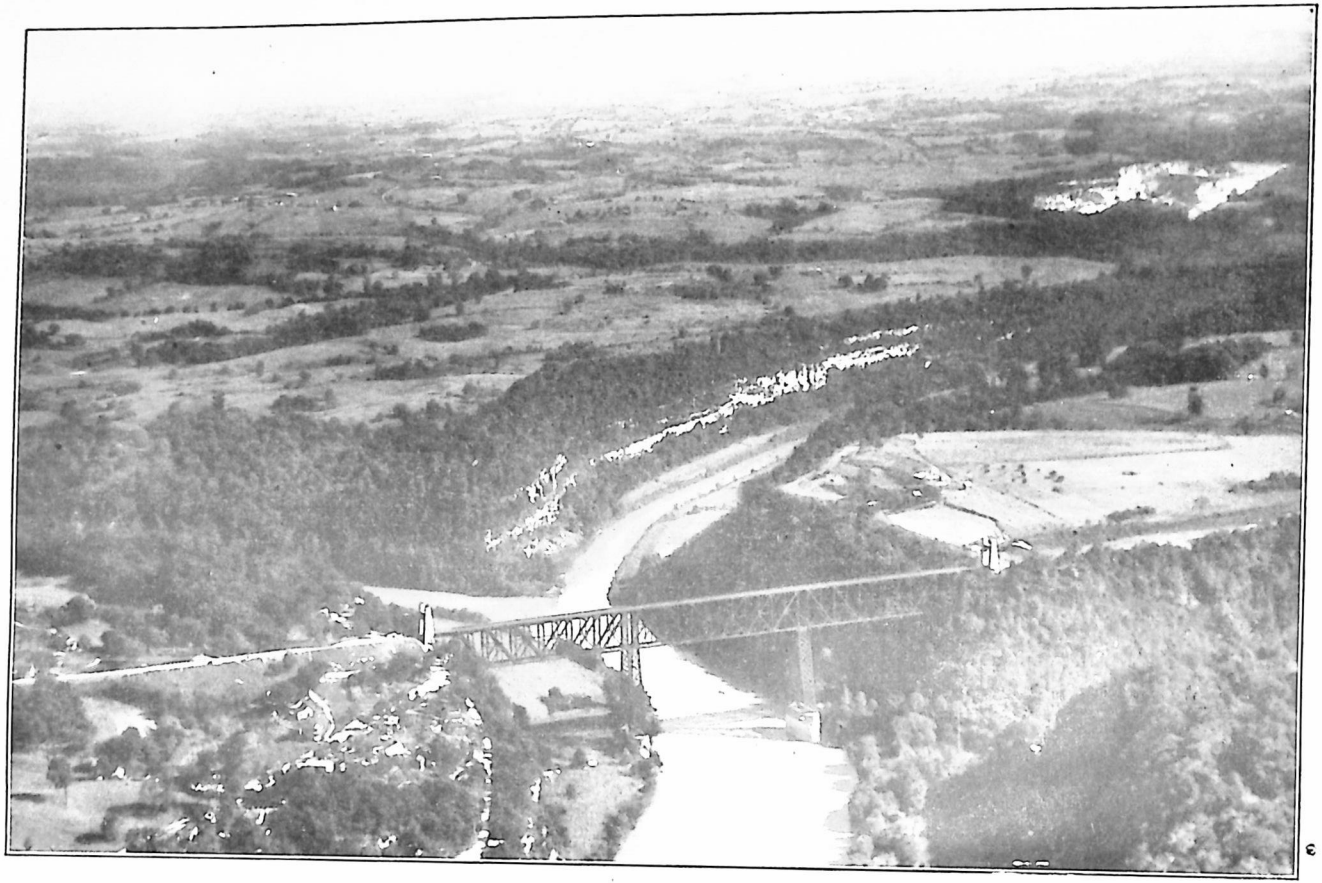
WILLARD ROUSE JILLSON
Director and State Geologist

SERIES VI
VOLUME XLIII

Administrative Report
(1930-1931)

AND OTHER PAPERS

1931



CAUFIELD AND SHOOK—C

THE PICTURESQUE TOPOGRAPHY OF THE KENTUCKY RIVER GORGE

Here in the heart of the Bluegrass country at the juncture of the Dicks and Kentucky Rivers where Garrard in the background, Jessamine on the left and Mercer on the right corner, the traveller by rail, by road, by boat, by air, will find much to arrest and hold his attention. Though he may not realize it, geological factors have been basic in shaping the type of scenic beauty that delights the eye in this region. Note the waters of Herrington Lake in the right background.

AFTER THIRTEEN YEARS

An Administrative Report

FOR THE (SIXTH)

Kentucky Geological Survey

YEARS 1930 AND 1931

By

WILLARD ROUSE JILLSON

Director and State Geologist, Curator, Kentucky State Museum

PREPARED FOR THE GOVERNOR
AND THE LEGISLATURE

Illustrated with Maps, Graphs and Photographs
Index Map of Kentucky

KENTUCKY GEOLOGICAL SURVEY
FRANKFORT, KENTUCKY
1931

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I

AFTER THIRTEEN YEARS

An Administrative Report

1930-1931

With which are presented the following separate papers:

II

STUART WELLER—A TRIBUTE

III

STRUCTURAL GEOLOGY OF NORTHERN CENTRAL KENTUCKY

IV

THE HIMYAR GAS FIELD

AFTER THIRTEEN YEARS

An Administrative Report

For the (Sixth)

KENTUCKY GEOLOGICAL SURVEY

Years 1930 and 1931

By WILLARD ROUSE JILLSON

Director and State Geologist
Curator, Kentucky State Museum

GOVERNING STATUTES

The acts creating and governing the (Sixth) Kentucky Geological Survey and making appropriations for same are three and are entitled as follows:

I. "An act creating the Kentucky Geological Survey, designating its chief executive officer and his duties, and providing funds for its maintenance."[1]

II. "An Act appropriating money for the operation and maintenance of the various departments, boards, commissions, institutions and agencies of the State Government of the Commonwealth of Kentucky, . . . for the fiscal years ending June 30, 1931, and June 30, 1932, designating the funds and sources from which said appropriations are to be paid, and prescribing the manner in which same are to be paid.[2]

These Acts provided a total of $140,000.00 for the fiscal year ending June 30, 1931; and $135,000.00 for the fiscal year ending June 30, 1932, for the maintenance of the various activities of the Kentucky Geological Survey. The appropriations are divided into two funds: (1) Co-operative topographic mapping fund of $200,000.00, and (2) General geological fund of $75,000.00. In accordance with the statute the first fund of

[1] Acts of the General Assembly of the Commonwealth of Kentucky, Chapter 34, p. 141, 1920.
[2] Acts of the General Assembly of the Commonwealth of Kentucky, Chapter 164, Section 28, pp. 559-560, 1930, and Chapter 164, Section 48, paragraphs number two and four, pp. 582 and 583, 1930.

$200,000.00 was appropriated to be used in a "dollar for dollar" co-operation with the U. S. Geological Survey in an extension of the topographic base map of Kentucky. This appropriation of $200,000.00 was made available as two items of

AN AERO VIEW OF TOPOGRAPHY AT HICKMAN, KENTUCKY

The Mississippi River is flowing south and westwardly to the left. Note this photo was taken above the clouds and also shows submerged sandbars in the river.

$100,000.00 each from the revenues of the State Highway Department "upon the advice and recommendation of the Governor." The topographical base mapping outlined in the governing statute was initiated by the Director of the Geological Survey April 1, 1930, but was summarily terminated April 30, 1930, by the written and absolute refusal of the State Highway Commission to meet the maturing payroll for the month of April, 1930, prepared by the U. S. Geological Survey in Washington and advanced to Frankfort for payment. A more detailed statement of this matter is presented subsequently in this report. The second or general fund of $75,000.00 appropriated for the biennium in the budget bill of 1930 has been used for the

maintenance of the Kentucky Geological Survey proper, payment of salaries, field expense, and miscellaneous charges, including all kinds of printing.

III. "An Act to repeal, amend and re-enact section 3 of chapter 34 of the Acts of the General Assembly of Kentucky, 1920 session, touching the Kentucky Geological Survey."[1]

This act amending section 3, chapter 34, of the Acts of 1920, relating to the Kentucky Geological Survey has operated to give the Director of the Survey a broader field of service to the people of Kentucky. By virtue of this act he became the Curator of the mineral and fossil collections of the Kentucky Geological Survey in the custody of the University of Kentucky at Lexington, and is authorized to arrange them for proper public preservation. He is given further authority to lecture on subjects pertaining to the geology, mineral and natural resources of Kentucky. The provisions of this Act have been complied with during the past biennium, as will be outlined later in the report.

PERSONNEL OF THE SURVEY

The personnel of geological assistants and trained office workers employed on the (Sixth) Kentucky Geological Survey during the past biennium is given below. All of these assistants, with the exception of the Director's Secretary and Chief Clerk, are classified as "temporary employees" having been engaged for the summer field season of two or three months to do a special piece of geological or mineral resource investigation:

DIRECTOR AND STATE GEOLOGIST

WILLARD ROUSE JILLSON, B. S., M. S., Sc. D., Frankfort, Kentucky.*

ASSISTANT GEOLOGISTS—TEMPORARY

JOSEPH KENT ROBERTS, A. B., A. M., Ph. D., University of Virginia, Charlottesville, Va.

ARLE HERBERT SUTTON, Ph. D., University of Illinois, Urbana, Ill.

PAUL HEANEY DUNN, A. B., A. M., Miami University, Oxford, Ohio.

WILBUR G. BURROUGHS, M. S., Head of the Department of Geology, Berea College, Berea, Ky.

ARTHUR C. MCFARLAN, Ph. D., Head of the Department of Geology, University of Kentucky, Lexington, Ky.

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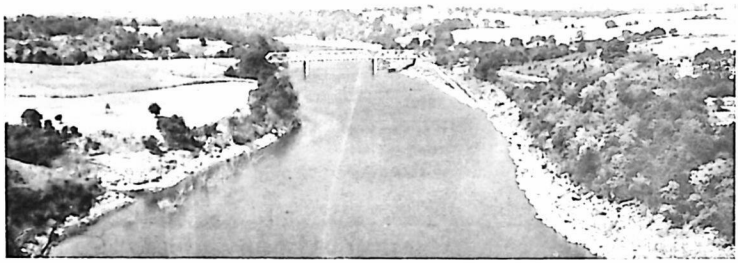
[1] Acts of the General Assembly of the Commonwealth of Kentucky, Chapter 140, pp. 485-86, 1924.

*Permanent employees.



AN AERO VIEW OF GARRARD AND BOYLE COUNTY
Topography at Chenault Bridge, Dicks River.

WILLIAM H. SHIDELER, A. B., Ph. D., Head of the Department of Geology, Miami University, Oxford, Ohio.

L. C. GLENN, A. B., Ph. D., Head of the Department of Geology, Vanderbilt University, Nashville, Tenn.

JOHN J. WOLFORD, A. B., M. A., Xenia, Ohio.

CHARLES V. THEIS, C. E., Ph. D., University of Cincinnati, Cincinnati, Ohio.

LEWIS CASS ROBINSON, S. B., S. M., University of Kentucky, Lexington, Ky.

W. H. TWENHOFEL, A. B., A. M., Ph. D., Madison, Wisconsin.

THOMAS EDMUND SAVAGE, A. B., B. S. ,M. S., Ph. D., Urbana, Illinois.

FRANK LEVERETT, B. S., Ann Arbor, Michigan.

EDWARD M. KINDLE, A. B., M. S., Ph. D., Ottawa, Canada.

F. SPENCER WITHERS, B. S., Lexington, Ky.

RAYMOND MILLER, B. S., Assistant Geologist, Frankfort, Ky.

C. L. COOPER, B. S., M. S., Frankfort, Ky.

JUDSON R. GRIFFIN, A. B., M. A., Ph. D., Urbana, Illinois.

GEORGE R. WESLEY, B. S., Middleburg, Ky.

HENRY G. MARTIN, A. B., Lockland, Ohio.

DAVID B. CHISHOLM, A. B., M. A., Ph. D., Cincinnati, Ohio.

J. A. CULBERTSON, A. B., M. S., Urbana, Illinois.

REID P. MEACHAM, A. B., M. S., Lexington, Ky.

JOHN G. WOODRUFF, B. S., M. S., Cadiz, Ky.

SAMUEL M. MAYFIELD, A. B., Berea, Kentucky.

FIELD ASSISTANTS—TEMPORARY

GUY H. BRIGGS, JR., B. S., Lexington, Kentucky.

DEAN H. CRABB, B. S., Macomb, Illinois.

A. C. MUNYAN, B. S., Lexington, Ky.
M. S. CHAPPARS, A. B., M. A., Oxford, Ohio.
PHIL ASWERUS, B. S., Dry Ridge, Ky.
JAMES K. ROGERS, A. B., Cincinnati, Ohio.
PAUL AVERITT, B. S., Lexington, Ky.
W. E. BACH, B. S., Lexington, Ky.
O. E. WAGNER, A. B., M. A., Chicago, Illinois.
B. R. BEAN, A. B., Sullivan, Illinois.
JAMES S. CULLISON, A. B., Lawrenceville, Illinois.

RODMEN—TEMPORARY

W. L. P. WIARD, Frankfort, Ky.
J. MORGAN SOAPER, Harrodsburg, Ky.

DRAFTSMEN—TEMPORARY

WILLIAM H. GILL, A. B., C. E., Woodmont Ave., Cherrydale, Va.
JOHN B. SHEBLESSY, C. E., Frankfort, Ky.
C. G. MITCHELL, Frankfort, Ky.
MARVIN WHITE, Frankfort, Ky.

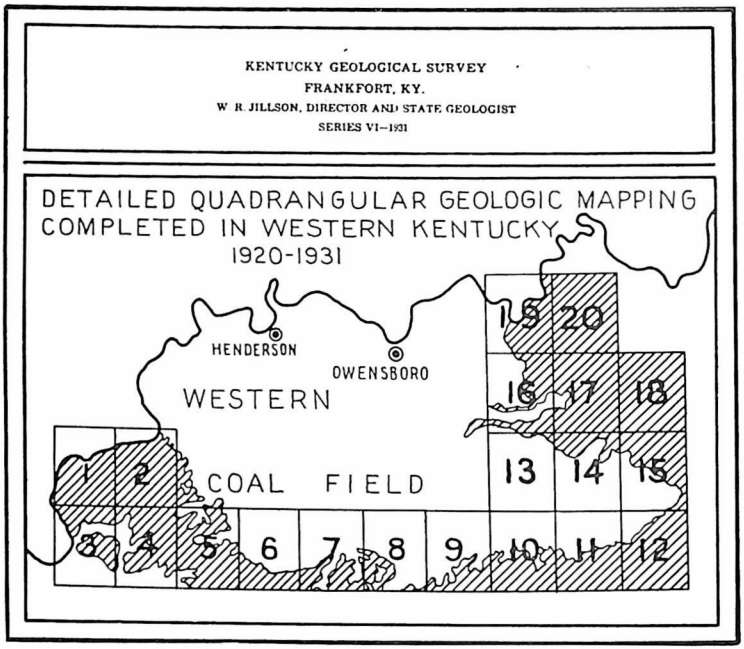
VARIOUS ASSISTANTS—TEMPORARY

GEORGE WILLIS, (Ass't. in Printing) Shelbyville, Ky.
OTTO A. ROTHERT, B. S., (Indexist), Louisville, Ky.
E. A. MARRS, (Accountant), Lawrenceburg, Ky.
JOHN W. TOWNSEND, A. B., (Ass't in Printing), Lexington, Ky.
LUCIEN BECKNER, (Consulting Geologist), Winchester, Ky.
HENRY MACE PAYNE, C. E., Ph. D.,, (Consulting Geologist), Washington, D. C.
LEONARD GIOVANOLI, A. B., M. A., (Biologist), Lexington, Ky.
CATHERINE B. MCNAMARA, Secretary, Frankfort, Ky.
OLIVE DAY, Clerk, Morehead, Ky.*
JERRY L. SAMUELS, Porter and Janitor, Frankfort, Ky.

SUMMARY OF ACTIVITIES

Much might be written concerning the activities of the Kentucky Geological Survey during the past biennium of 1930 and 1931. It has been a time of completion of many projects of various kinds looking toward the improvement of material affairs among the people of Kentucky, particularly in the field of mappng and mineral resource investigation. But in a larger sense it has been the time during which the major policies and proposals of this Survey, outlined by its present Director in 1918 and 1919, have been successfully brought to a finished state. Chief among these several diversified items has been the completion of the long continued, tedious and expensive county mapping program.

After thirteen years of continuous effort it is now possible for the Director of this Survey to say without endangering his reputation for veracity, that a good modern map at the scale of 1 inch to the mile or 1:62,500 is published and available sepa-



INDEX TO DETAILED QUADRANGULAR GEOLOGIC MAPPING BEGUN AND COMPLETED IN WESTERN KENTUCKY, 1920-1931

rately for *every* county in Kentucky. As a matter of fact for many counties there are several different kinds of maps, all produced at the same scale. These are described as geographic, oil and gas, coal, areal geological, structural, soil and topographic. The validity of this statement is seen in the fact that the Survey now has on its shelves 370 separate editions of maps of Kentucky while there are only 120 counties in the entire Commonwealth.

The acquisition of this vast amount of engineering and geological information has not been easily attained, as anyone of the many who have had an important part in the program can readily attest. Starting with the surveying of separate

maps of Allen and Barren counties in the Summer of 1919, this single project completing the remapping of Kentucky at a modern scale, unparalleled for areal scope in the history of any Southern State geological survey, has been steadily advanced year after year. Oftimes during periods of official and financial impoverishment it has been slowed down but never abandoned. Now that it has actually been completed and a modern map scaled 1 inch to the mile has been published and made ready for the people of every county in Kentucky, the accomplishment bcomes one in which all may find genuine satisfaction. Evidence of a conclusive character is now readily at hand to indicate further that Kentucky is the first State in the United States to complete so comprehensive and detailed a mapping program. In this connection, though pertaining to only the northern central portion of Kentucky, the following item taken from a recent number of *Science,* is of much interest:

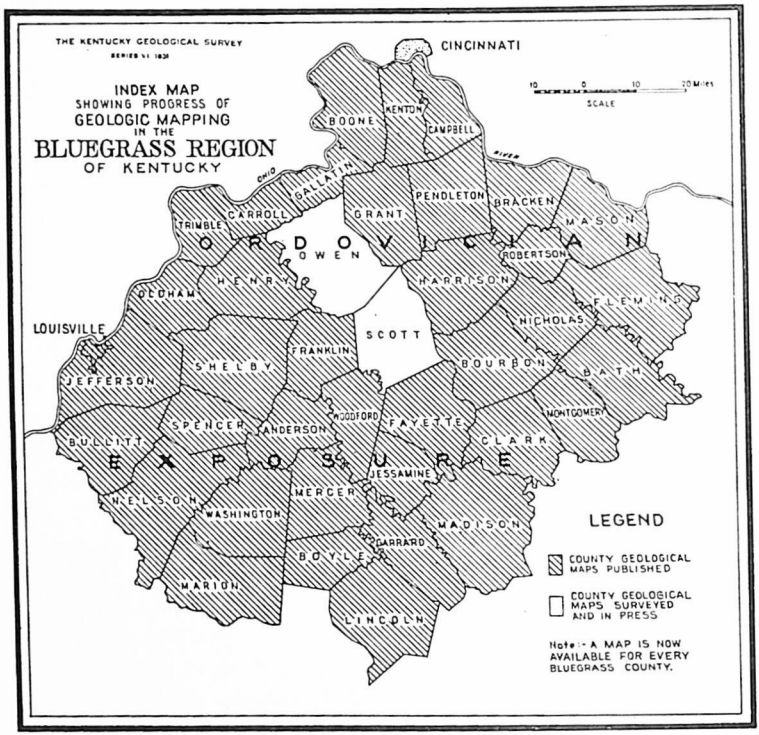
A FIVE YEAR PROGRAM COMPLETED*

"The Kentucky Geological Survey has just brought to completion its five years program of detailed mapping of the areal and structural geology of the Bluegrass Region of Kentucky. This portion of the State which is one of the choice agricultural areas of the entire country is equivalent to the Ordovician exposure of northern-central Kentucky. In this region new base maps have been prepared at the scale of one inch to the mile utilizing topographical surveys wherever possible for each of the counties involved. On these new county maps the areal and structural geology has been executed and with the completion of Scott county which is now shortly to be issued, new inch to the mile areal and structural maps become available for all parts of the Ordovician exposure in the northern-central part of the State. The following county maps have been prepared and have been issued separately:

"Boone, Kenton, Campbell, Gallatin, Grant, Pendleton, Bracken, Mason, Fleming, Nicholas, Bath, Harrison, Owen, Carroll, Trimble, Oldham, Henry, Franklin, Shelby, Jefferson, Spencer, Bullitt, Nelson, Washington, Marion, Boyle, Mercer, Anderson, Woodford, Fayette, Jessamine, Garrard, Lincoln,

* From "Science," Vol. 74, No. 1920, pp. 382-383, October 16, 1931.

Madison, Clark, Montgomery, Bourbon, Robertson and Scott. While it is true that some of these maps overlap the periphery of the Bluegrass and extend into the well known Kentucky



GEOLOGIC MAPPING IN THE BLUEGRASS REGION

Since the preparation of this indexing sketch the geologic map of Owen County has been issued. Like other maps it may now be obtained from the Geological Survey.

Knobs region, it is a fact there are today no areas within the Bluegrass which are not surveyed. These new county maps are available for the general utilization of the public for a nominal sum from the office of the Kentucky Geological Survey at Frankfort, Ky.

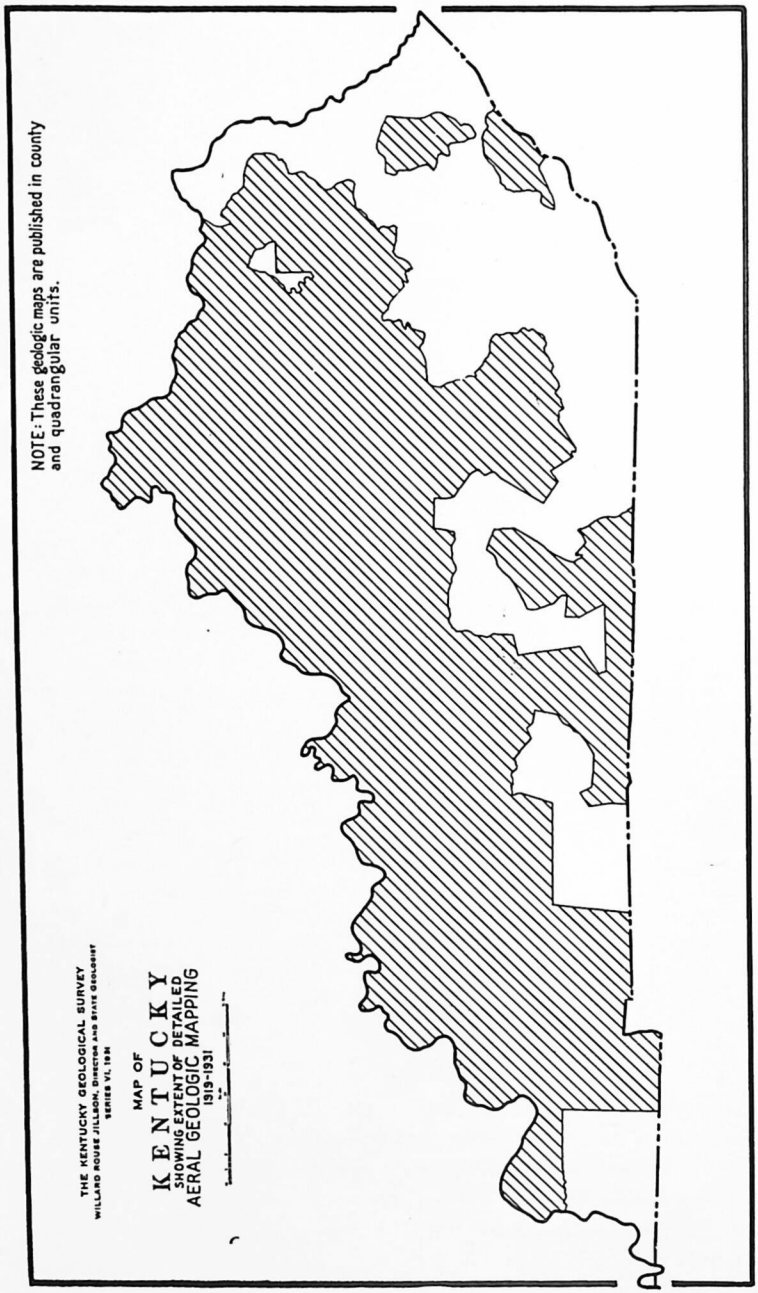
"With the exception of Garrard, Woodford and Fayette, all of these county maps have been published by lithographic processes in standard colors at the scale of one inch to the mile. The usual divisions of the Kentucky Ordovician, ranging from

and including the Richmond of the Upper Cincinnatian through to the High Bridge of the Champlanian, have been shown by outcrop. This area encompasses about 8,000 square miles and constitutes the largest unit outcrop of Ordovician sediments mapped areally and structurally in detail in the world."

NEW MAPS PUBLISHED

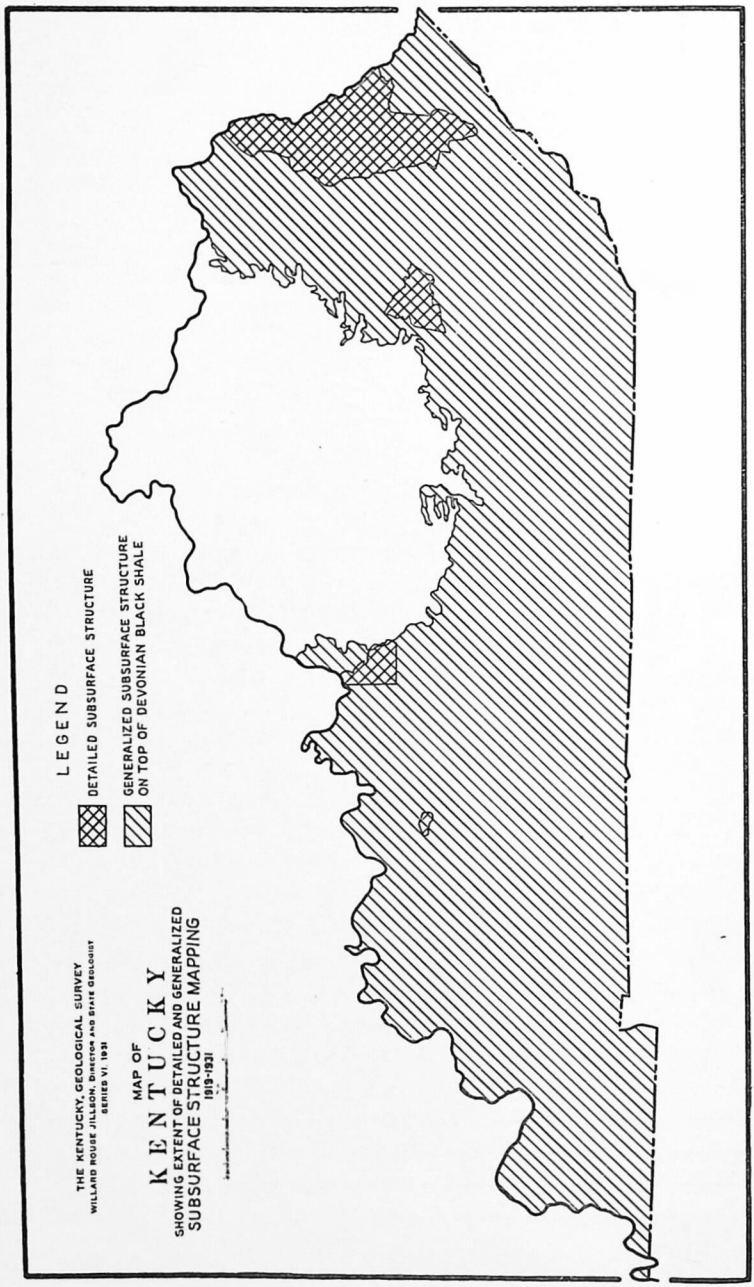
During the past two years, 1930 and 1931, fifty-two new maps of parts of Kentucky have been prepared and published by the Kentucky Gological Survey. Some of these maps delineate simply the geographic base of the area for which they were surveyed. Others show oil, gas and coal and other mineral development, while perhaps the most of them portray the detailed areal and structural geology of certain parts of Kentucky. Most of these maps have been published by lithographic processes in appropriate colors and are the equivalent of the best maps of their kind issued at the scale of an inch to the mile or 1:62,500 anywhere. It is generally acknowledged that no other State survey in the country has within the same period equaled the productivity or quality of work of the Kentucky Geological Survey in this report.

An enumeration of the maps published during 1930 and 1931 follows: (1) Geology of the *Morehead* quadrangle, by Dean Crabb; (2) Geologic map of *Meade* County, Kentucky, by A. H. Sutton and O. E. Wagner; (3) Map of *Washington* County, Kentucky, by W. E. Bach; (4) Map of *Marion* County, Kentucky, by Raymond Miller and Guy H. Briggs, Jr.; (5) Geologic Map of *Marshall* County, Kentucky, by J. K. Roberts and R. P. Meacham; (6) Geologic Map of *Henry* County, Kentucky, by J. J. Wolford; (7) Areal and Structural Map of *Grant* County, Kentucky, by M. S. Chappars and S. Withers; (8) Geologic Map of *Mason* County, Kentucky, by P. H. Dunn and J. J. Wolford; (9) Areal and Structural Geologic Map of *Clark* County, Kentucky, by R. P. Meacham, A. C. Munyan, and G. R. Wesley; (10) Map of the Surface Structural Geology of *Knott* County, Kentucky, by I. B. Browning and Spencer Withers; (11) Geologic Map of *Washington* County, Kentucky, by P. H. Dunn, J. J. Wolford, and S. Withers; (12) Natural Gas Sands of *Eastern Kentucky* (a correlation chart) by W. R. Jillson;



EXTENT OF AREAL GEOLOGIC MAPPING IN KENTUCKY, 1919-1931
Note: Newly mapped areas are shown by hachure.

(13) Reconnaissance Geologic Map of *Hart* County, Kentucky, by S. Withers, A. H. Sutton, G. Wesley and D. Crabb; (14) Oil and Gas Map of *Hart* County, Kentucky, by W. R. Jillson; (15) Oil and Gas Map of *Jefferson* County, Kentucky, by S. Withers and L. Beckner; (16) Geological Map of *Jefferson* County, Kentucky, by Charles Butts (2d edition); (17) Natural Gas Sands of *Western Kentucky* (a correlation chart), by W. R. Jillson; 18 Geographic Map of *Rockcastle* County, Kentucky, by W. C. Eyl; (19) Geological Map of *Franklin* County, Kentucky, by A. M. Miller, J. J. Wolford and S. Withers; (20) Oil and Gas Map of *Owen* County, Kentucky (by J. J. Wolford and others); (21) Geologic Map of *Larue* County, by Judson R. Griffin; (22) Geographic Map of *Kenton* County, Kentucky, by George R. Wesley and others; (23) Map of the Areal and Structural Geology of *Gallatin* County, Kentucky, by W. H. Shideler and F. S. Withers; (24) Geographic Map of *Hancock* County, Kentucky (U. S. Topog. base); (25) Geographic Map of *Scott* County, Kentucky (U. S. G. S. Topog. base); (26) Areal and Structural Geologic Map of *Clinton* County, Kentucky, by R. Miller and D. H. Crabb; (27) Areal and Structural Geologic Map of *Campbell* County, Kentucky, by W. H. Shideler; (28) Geographic Map of *Campbell* County, Kentucky (U. S. G. S. Topog. base); (29) Structural Map of the *Carlisle* Gas Field in Carroll and Gallatin Counties, Kentucky, by F. S. Withers; (30) Map of the Areal and Structural Geology of *Shelby* County, Kentucky, by A. C. McFarlan and F. S. Withers; (31) Geology of the *Fordsville* quadrangle, by Samuel M. Mayfield; (32) Geologic Map of *Boone* County, Kentucky, by W. H. Shideler; (33) Areal and Structural Geologic Map of *Pendleton* County, Kentucky, by P. H. Dunn and S. Withers; (34) Areal and Structural Geologic Map of *Kenton* County, Kentucky, by W. H. Shideler and F. S. Withers; (35) Oil and Gas Structural Geologic Map of *Boone* County, Kentucky, by Spencer Withers; (36) Natural Gas Map of *Shelby* County, Kentucky, by W. R. Jillson; (37) Map of the Areal and Sructural Geology of *Harrison* County, Kentucky, by Paul H. Dunn; (38) Reconnaissance Map of the Areal Geology of *Madison* County, Kentucky, by A. C. McFarlan and S. S. Goodwin; (39) Areal Geological Map of *Breckinridge* County, Kentucky, by J. R. Griffin, J. A.

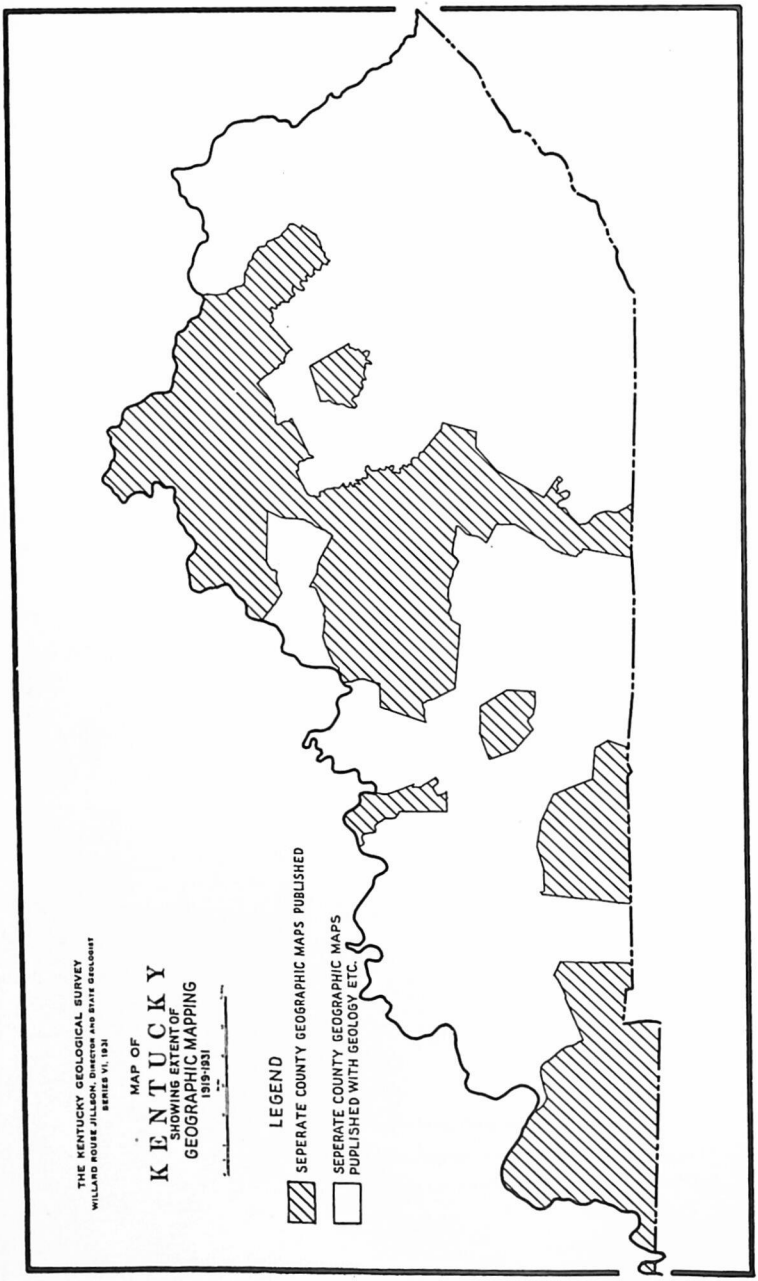


EXTENT OF SUBSURFACE STRUCTURAL MAPPING IN KENTUCKY, 1919-1931

Culbertson and S. M. Mayfield; (40) Geologic Map of *Marion* County, Kentucky, by Raymond Miller and Guy H. Briggs, Jr.; (41) Geologic Map of *Mercer* County, Kentucky, by A. C. McFarlan and Sidney Goodwin; (42) Oil and Gas Map of *Breckinridge County,* Kentucky, by W. R. Jillson; *Fault Pattern,* by A. H. Sutton, J. R. Griffin, J. A. Culbertson and others (43) Areal and Structural Geological Map of *Anderson* County, Kentucky, by A. C. McFarlan and G. R. Wesley; (44) Map of *Boone* County, Kentucky, by G. H. Briggs, Jr., and others; (45) Structural Geologic Map of *Kentucky,* showing All Major Structural Features and their actual Elevations, Oil and Gas Pools and Pipe Lines, by Willard Rouse Jillson (scale 1:500,000); (46) Geographic Map of *Fulton* County, Kentucky, by R. C. Lane and R. Miller, (Rev. Edition); (47) Geologic Map of *Hickman* County, Kentucky, by J. K. Roberts and R. P. Meacham; (48) Geologic Map of *Fulton* County, Kentucky, by J. K. Roberts and R. P. Meacham; (49) Oil and Gas Map of Cumberland County, Kentucky, by George Wesley and J. Morgan Soaper; (50) Geologic Map of *Cumberland* County, Kentucky, by W. H. Shideler, P. H. Dunn, and George R. Wesley; (51) Mineral Resource Map of *Kentucky,* by W. R. Jillson and W. G. Burroughs, (Scale 1:500,000); (52) Areal and Structural Geologic Map of *Owen* County, Kentucky, by J. J. Wolford, M. S. Chappars and S. Withers.

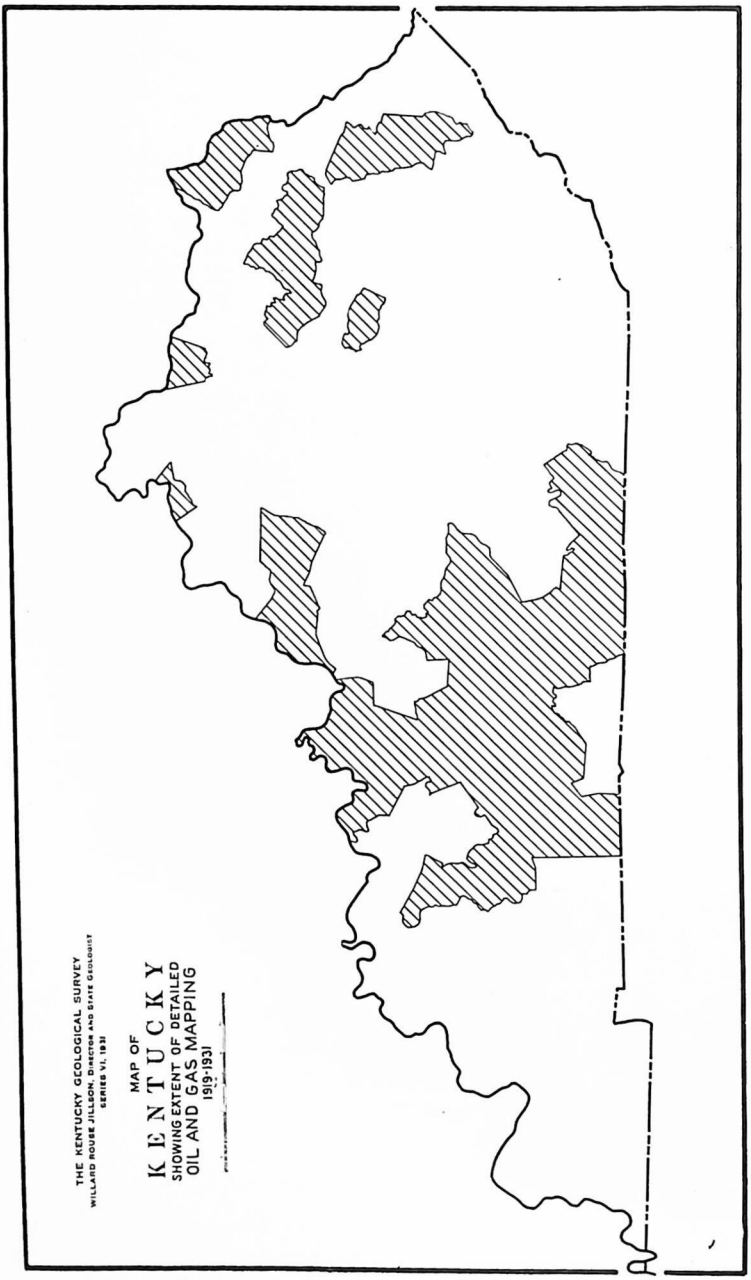
MAP MANUSCRIPTS COMPLETED AND NOW READY FOR PUBLICATION

As is the case with all active governmental Surveys, there are now completed and ready for publication a number of map manuscripts. These are filed for safe keeping in the vault of the Kentucky Geological Survey in the old Capitol Building, "Executive Wing". Their preparation in the field and office has involved a considerable expenditure in the aggregate. Because of this and the further fact that each represents an area of active mineral development and interest during these depressed times, it is felt that funds should immediately be made available for their publication so that the people of the State may receive as soon as possible such broadly spread and continuous benefits as are certain to arise from their public distribution.



EXTENT OF GEOGRAPHIC MAPPING IN KENTUCKY, 1919-1931

The separate map manuscripts now awaiting publication with the name of the counties which they cover in part or in whole follow: (1) Areal and Structural Geologic Map of Scott County, Kentucky, by A. M. Miller, J. J. Wolford and S. Withers (all of *Scott County, Kentucky*); (2) Areal and Structural Geology of the Cannelton quadrangle by Samuel M. Mayfield (parts of *Hancock and Breckinridge Counties, Ky.;* (3) Oil and Gas Map of Allen County, Kentucky, by A. H. Sutton and O. E. Wagner, Jr., (all of *Allen County, Ky.*); (4) Areal and Structural Geologic Map of Allen County, Kentucky, by A. H. Sutton, A. M. Miller and O. E. Wagner, Jr. (all of *Allen County, Ky.*); (5) Areal Geology of the Southern Part of the Nortonville Quadrangle, by A. H. Sutton (part of *Christian and Todd Counties, Ky.*); (6) Areal Geology of the Southern Part of the Drakesboro Quadrangle, by A. H. Sutton (portions of *Todd and Logan Counties, Ky.*); (7) Areal Geology of the Southern Part of the Dunmore Quadrangle, by A. H. Sutton (portion of *Logan County, Ky.*); (8) Areal Geology of the Southern Part of the Little Muddy Quadrangle, by A. H. Sutton (portions of *Logan and Warren Counties, Ky.*); (9) Structural Geology of Boyle County, Kentucky, by F. S. Withers (all of *Boyle County, Ky.*); (10) Areal Geology of the Southern Part of the Brownsville Quadrangle, by J. M. Weller, J. R. Griffin and J. A. Culbertson (Northern portion of *Warren County, Ky.*); (11) Areal Geology of Grayson County, Kentucky, by J. R. Griffin, J. A. Culbertson and A. H. Sutton (all of *Grayson County, Ky.*); (12) Areal Geology of the Smithland Quadrangle, by A. H. Sutton and S. M. Mayfield (parts of *Marshall and Livingston Counties, Ky.*); (13) Areal Geology of the Eddyville Quadrangle, by A. H. Sutton (parts of *Livingston and Lyon Counties, Ky.*); (14) Geology of the Lockport Quadrangle, by J. J. Wolford (Parts of *Henry, Franklin and Owen Counties, Ky.*); (15) Areal and Structural Geology of the Hardinsburg Quadrangle by J. R. Griffin (parts of *Breckinridge and Meade Counties, Ky.*); (16) Structural Geology of Mercer County, Kentucky, by George R. Wesley (all of *Mercer County, Ky.*); (17) Areal and Structural Geology of the Creelsboro Oil Pool, by Dean H. Crabb (parts of *Russell and Cumberland Counties, Ky.*); (18) Oil and Gas Map of the Mammoth Cave



EXTENT OF OIL AND GAS MAPPING IN KENTUCKY, 1919-1931

Region, by W. R. Jillson (parts of *Barren, Hart and Edmonson Counties, Ky.*); (19) Areal and Structural Geology of Hopkins County, Kentucky, by L. C. Robnison (all of *Hopkins County, Ky.*); (20) Areal and Structural Geology of Henderson County, Kentucky, by C. V. Thies (all of *Henderson County, Ky.*); (21) Areal and Structural Geology of Morgan County, Kentucky (Rev. Edition), by James S. Hudnall, L. C. Robinson and Spencer Withers (all of *Morgan County, Ky.*); (22) Areal Geology of the Cub Run Quadrangle, by A. H. Sutton and others (parts of *Edmonson, Hart, Grayson and Hardin Counties, Ky.*).

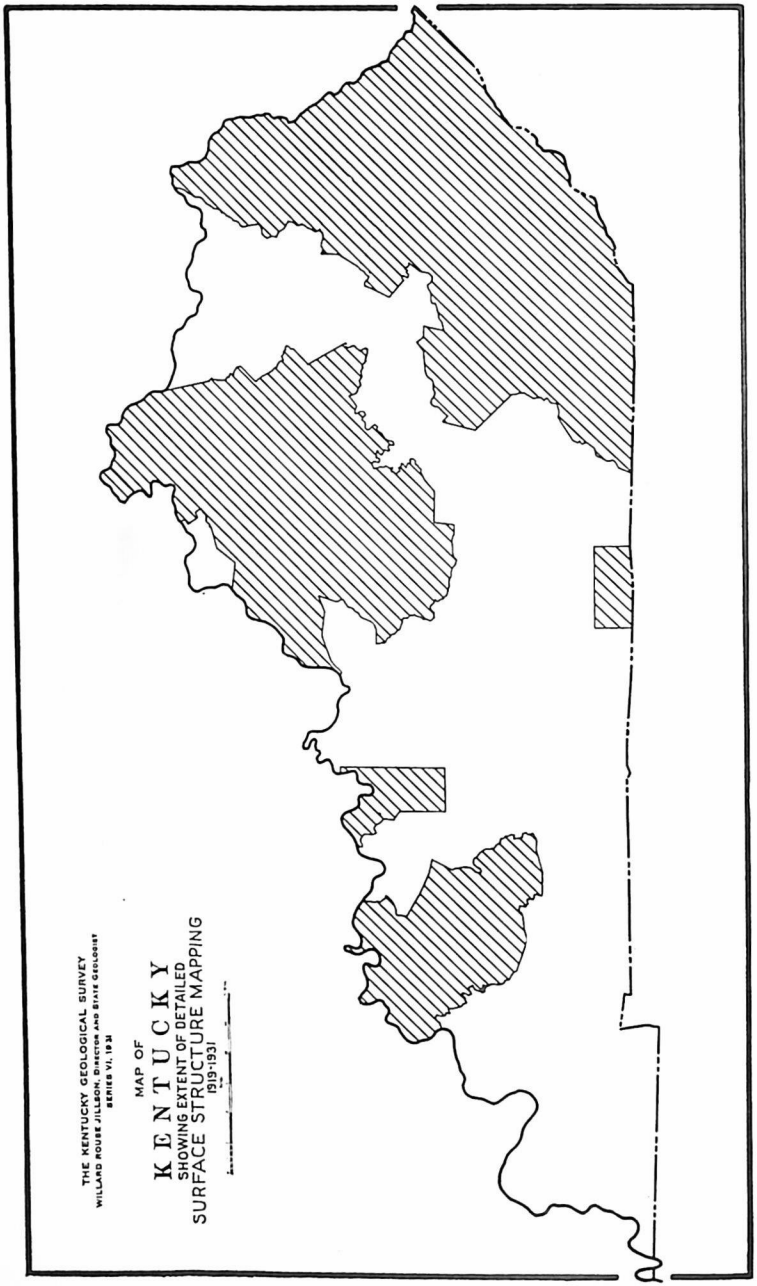
MANUSCRIPT REPORTS COMPLETED

In addition to the more or less routine geological and county base mapping program, the Kentucky Geological Survey has been engaged during the past two years in advancing a number of detailed and general geological and mineral resource investigations broadly distributed throughout the Commonwealth. These projects, some of which have been designed as county reports while others have been shaped as of a regional character, are outlined as follows:

In the field of detailed report writing, Dr. Joseph Kent Roberts of the University of Virginia, Charlottesville, and Professor Reid P. Meacham of the Department of Geology of the University of Kentucky, Lexington, have completed their manuscript report entitled, *"The Geology of the Jackson Purchase Region"*, and forwarded same to this office on May 1, 1931. This manuscript is now ready for publication.

Professor Samuel Newton Dicken of the University of Minnesota, Department of Geography, Minneapolis, who has been engaged for several years in a detailed geographic-geologic study entitled, *"The Big Barrens: A Study of the Kentucky Karst Region"*, completed this manuscript on February 2, 1931. It is now ready for publication. This report is the first of its type to be prepared in the central interior of the United States.

Mr. Vernon Bailey of the Biological Survey of the U. S. Department of Agriculture completed and delivered to this office on May 31, 1930, his manuscript entitled, *"Cave Life in Kentucky"*, a discussion of all forms of life inhabiting the Mammoth



EXTENT OF SURFACE STRUCTURAL MAPPING IN KENTUCKY, 1919-1931

and other large caves in the Eastern, Central and Western parts of the Commonwealth. This interesting manuscript is the result of co-operative endeavors as between the Kentucky Geological Survey and the U. S. Department of Agriculture, Bureau of Biological Survey, and is now ready for publication.

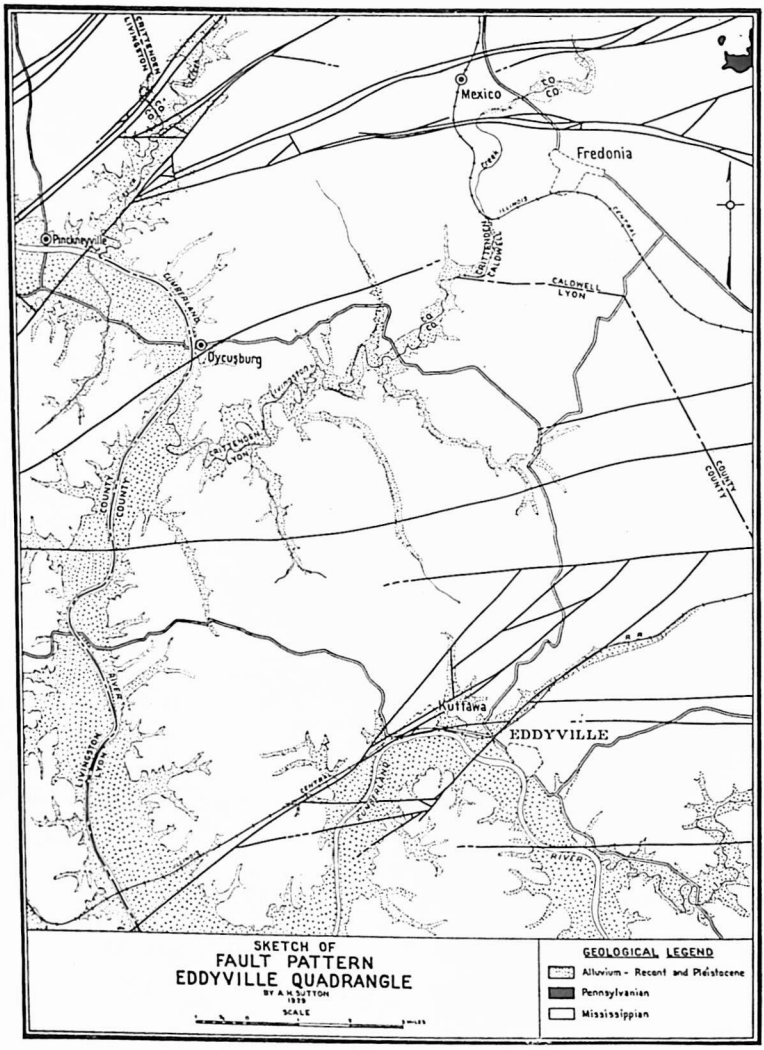
Dr. C. V. Theis of the U. S. Geological Survey, who has been engaged for the last several years in detailing a description of the, *"Geology and Mineral Resources of Henderson County, Kentucky", completed and* delivered this manuscript to the Survey on July 10, 1931. Neither the detailed areal structural map of Henderson County, scale 1:62,500, nor the report have as yet been published; but both are now ready for the printer.

Professor Wilbur Greeley Burroughs, Head of the Department of Geology, Berea College, Berea, Kentucky, completed and delivered to this Survey on June 27, 1930, his manuscript entitled *"Elevations in Kentucky"*. This report, bringing together for the first time all of the U. S. G. S. and other government precise levels throughout the Commonwealth, is an item which is in much demand by mineral operators, engineers and geologists. It is now filed in the Survey's vault ready for publication.

Dr. Arle Herbert Sutton of the Department of Geology, University of Illinois, Urbana, completed and delivered to the Kentucky Geological Survey on April 16, 1930, his manuscript entitled *"Geology of the Smithland and Eddyville Quadrangles"*. This report, together with detailed quadrangular, structural and areal maps of Livingston, Lyon, Crittenden and Caldwell counties, Kentucky, in Western Kentucky, is now ready for publication.

Prof. J. J. Wolford of the Department of Geology, Miami University, Oxford, Ohio, has completed his detailed and illustrated manuscript entitled, *"Geology of Owen County"*. It was forwarded to the Survey on April 28, 1931, and is now ready for publication.

Professor W. H. Shideler, Head of the Department of Geology, Miami University, Oxford, Ohio at this writing is still engaged in his work of preparing a detailed report on *"The Geology of Boone, Campbell and Kenton Counties."* It is hoped



FAULT PATTERN OF THE EDDYVILLE QUADRANGLE

to have this manuscript filed in the Surveys vault prior to December 1, 1931.

Dr. L. C. Glenn of the Department of Geology, Vanderbilt University, Nashville, Tennessee, has been engaged intermittently during the past two years in the preparation of two reports for the Kentucky Geological Survey. These reports are: (1) *"The Geology of the Western Coal Field"* and (2) *"The Geology of the Mineral Resources of Butler County."* Neither of these manuscripts has been completed by Dr. Glenn, but it is anticipated that the report on Butler county will be delivered in manuscript form within a short time.

Professor Reid P. Meacham of the Department of Geology, University of Kentucky, Lexington, who has been engaged during the past two years in studies of the insoluble residiums of Central Kentucky (Ordovician) rocks has now completed the first draft of his manuscript, and it is anticipated that the complete manuscript will be ready for filing with the Survey prior to January 1, 1932.

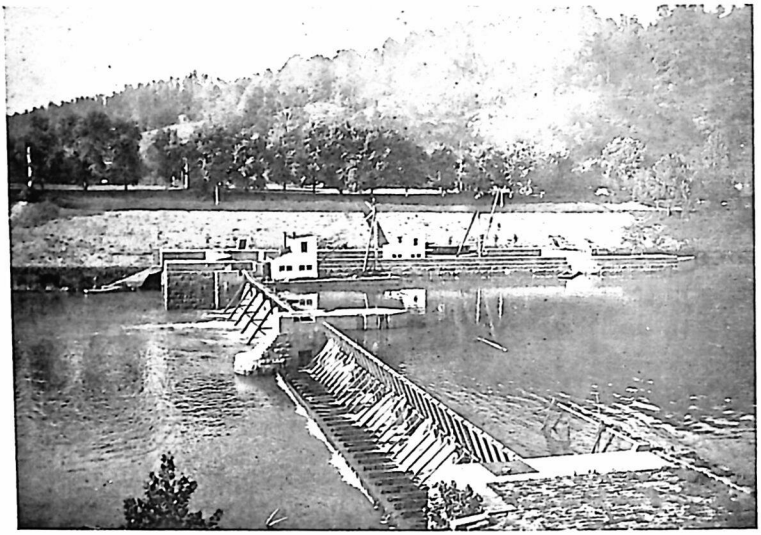
During the past biennium Dr. Edward M. Kindle of the Canadian Geological Survey has prepared a brief manuscript entitled *"The Story of the Discovery of Big Bone Lick."* This manuscript has been filed with the Survey and is now in the hands of the printer. It will shortly appear in Vol. 41.

Mr. Henry G. Martin, Sta. R. R. 5, Box 324, Lockland, Ohio, spent the Summer of 1930 in a preliminary study of, *"The Insoluble Residues from Some Mississippian Limestones."* The rocks investigated were located principally in Western Kentucky. The manuscript resulting from this study has been completed and will appear in the forthcoming bound report of this Survey, Vol. 41.

During the Summer of 1930 Dr. D. B. Chisholm of the Department of Geology, New York University, New York City, N. Y., completed his manuscript on, *"The Geology of Hancock County."* This manuscript has been advanced to the printer with other manuscripts and will also appear shortly in Vol. 41.

During the early Summer of 1931 Mr. John Wilson Townsend of Lexington, Kentucky, made discovery of certain fundamental and hitherto unpublished data relative to the origin and the establishment of the first Kentucky Geological Survey.

This choice historical material was found by Mr. Townsend in perusing, recently, an unearthed copy of, *"The Franklin County Farmer" 1838-1839*—a weekly published in Frankfort nearly a hundred years ago and long since discontinued and forgotten.



U. S. LOCK AND DAM ON THE LOWER BIG SANDY RIVER
This piece of Federal waterway improvement is near Louisa, Ky.

In it was a lively running account in separate news items of the activities of the Franklin County Agricultural Society and other similar organizations looking towards and urging an establishment of the first Kentucky Geological Survey. Mr. Townsend's copy of *"The Franklin County Farmer,"* being the only one known to Kentucky libraries and historians, was purchased by the Survey for its library and he was assigned the project of assembling a readable account of the various efforts and activities which led up to the initial establishment of this Geological Survey during the early part of the last century. This manuscript entitled *"The Story of the Origin of the Kentucky Geological Survey"* has been completed by Mr. Townsend and delivered to the Survey. It will appear as the last chapter in the miscellaneous group of papers in the shortly forthcoming Volume 41 of this Survey.

During the past year Mr. C. L. Cooper, Assistant Geologist

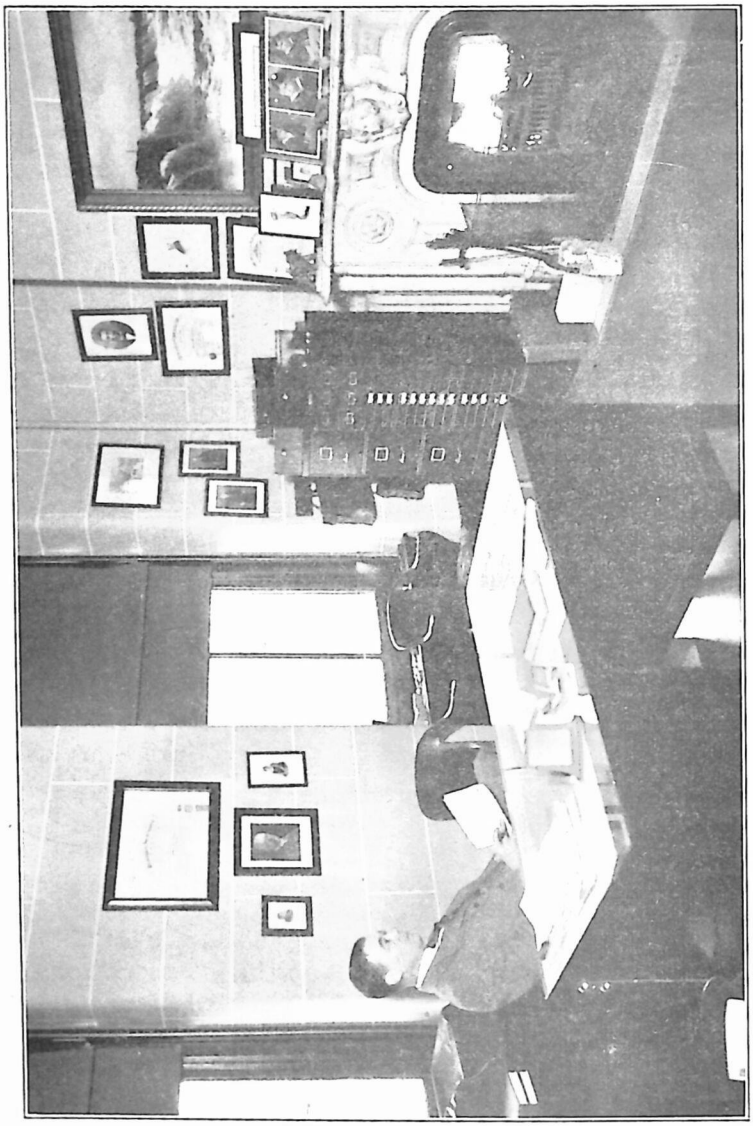
on this Survey, has completed his manuscript entitled, *"The Pleistocene Fauna in Kentucky,"* an item which will appear as the concluding chapter in a shortly forthcoming volume of this Survey—Vol. 36 "Paleontology of Kentucky."

Throughout a greater part of the year 1931 Mr. George L. Willis, Sr., of Shelbyville, has been intermittently engaged in preparing data and in writing a popular account of *"The Activities of the Sixth Kentucky Geological Survey."* This manuscript, though still somewhat incomplete, has been filed with the Survey temporarily for safe keeping.

WORK BY THE DIRECTOR

The Statutes of Kentucky do not provide for an Assistant State Geologist. Consequently during the past two years, as throughout the last decade, the Director has found it necessary to carry all geological research and associated activities as "extra" to the not inconsiderable routine of administrative duties of his office. Without neglecting these fundamental Survey obligations, time has been found to execute the necessary field and library research prerequisites to the writing of a number of geological, mineral resource and historical pamphlets and books. Among these should properly be included some more or less formal public addresses and a set of gratuitous lectures on, "The Geology of Kentucky" given as Course 21 during 1930 and 1931 in the Department of Geology at the University of Kentucky. By way of summary of these activities, a brief bibliographic list of the personal writings and publications of the State Geologist, totaling twenty-two separate titles published during the past biennium is here given. Because of its relevancy there is also added a comparative tabular list of the personal geological publicatons of all the State Geologists of the United States during the decade 1918-1928. A glance at this list will indicate that the State Geologist of Kentucky has contributed during this period *in excess of 20% of all published titles.*

1929	Pages
Administrative Report (1928-1929). Covering the activities of the (Sixth) Kentucky Geological Survey. Prepared for the Governor and the Legislature. 40 illus., 1 topographic index map of Kentucky, 108 pp., Kentucky Geological Survey, Series VI., Pamp. XXII. 1929	108



PRIVATE OFFICE OF THE STATE GEOLOGIST OF KENTUCKY IN THE RECENTLY REBUILT "EXECUTIVE WING" OF THE OLD CAPITOL AT FRANKFORT, KENTUCKY.

1930

Harrod's Old Fort. The Register, Ky. State Hist. Soc., Vol. XXVIII, No. 82, pp. 104-114, Jan., 1930, and also as seperate pamphlet 10

Townsend's Lincoln. The Register, Ky. State Hist. Soc., Vol. XXVIII, No. 82, pp. 127-128, Jan., 1930 2

Tales of the Dark and Bloody Ground. A group of fifteen original papers on the early history of Kentucky, 154 pp., 28 illus. C. T. Dearing Printing Co., Louisville, May, 1930 154

Oil and Gas in Western Kentucky. Ky. Geol. Survey, Ser. VI, Vol. 39, 653 pp., illus., 1930 653

John Filson's Book and Map: Kentucke, 1784. Ky. State Hist. Soc., The Register, Vol. 28, No. 84, 3pp., 2 illus., July, 1930 3

Early Sketches on Kentucky Geology. Ky. State Hist. Soc., The Register, Vol. 28, No. 84, pp. 284-285, July, 1930 2

Kentucky Fluorites. Pan-American Geologist, August, 1930 3

Geological Survey Affairs. Ky. Geol. Survey, Ser. VI, Vol. XXXV, 380 pp., illus., 1930 380

Natural Gas Sands of Eastern Kentucky. A correlation chart Colors. Ky. Geol. Survey, Ser. VI, July 1, 1930 1

Oil and Gas Map of Hart County (Showing the Legrande Oil Pool). Colors. Scale, 1 inch equals 1 mile, 1930 1

The Legrande Oil Pool. Ky. Geol. Survey, Ser. VI, 1930 103

Natural Gas Sands of Western Kentucky. A correlation chart. Colors. Ky. Geol. Survey, Ser. VI, Dec. 15, 1930 1

Oil and Gas Map of Breckinridge County, Kentucky. Scale 1:62,500. Blue drainage. Correct to June 1, 1930. Ky. Geol. Survey, Series VI, 1930 1

1931

The Kentuckie Country. An historical exposition of land interest in Kentucky prior to 1790, coupled with Facsimile Reproductions of the London 1786 Brochure of Alexander Fitzroy and the "Whatman" edition of John Filson's Map. H. L. and J. B. McQueen, Inc., Washington, D. C. 63

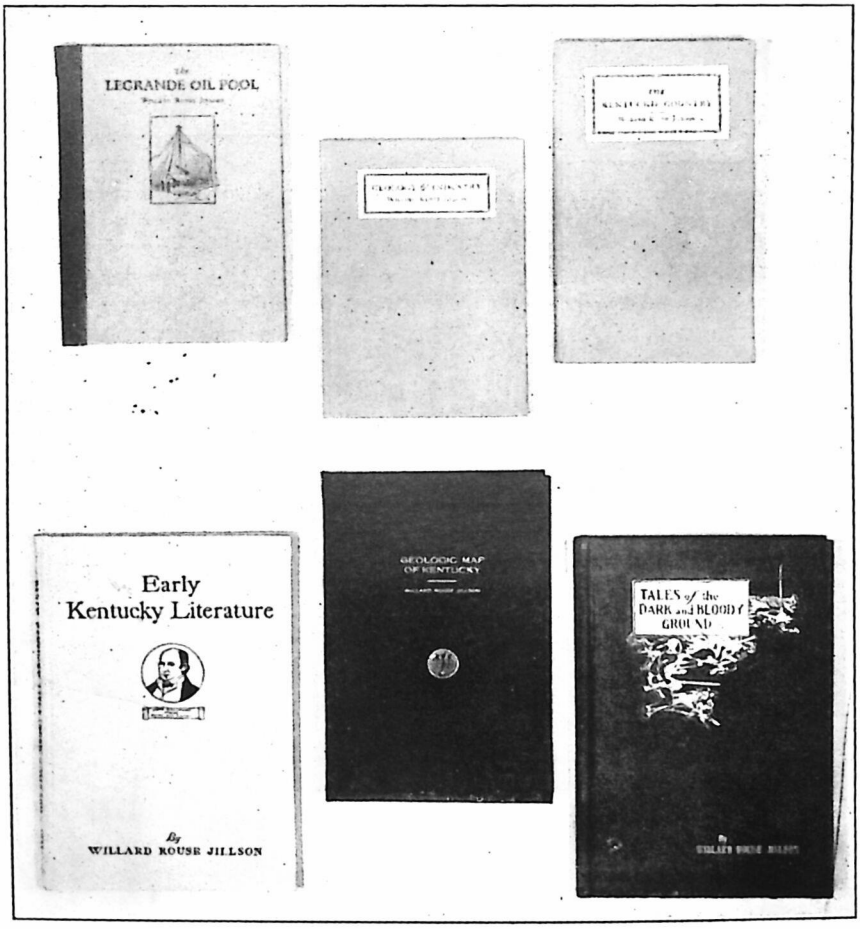
Oil and Gas in the Bluegrass Region. A preliminary report outlining the principal Regional Geological Features and Controls, affecting Exploratory Drilling, its History, Present Status and Prospect within and adjacent to the area of the Ordovician outcrop of this Commonwealth. 45 Illustrations, 123 pp. Ky. Geol. Survey, Series VI, Vol. 40, 1931 123

Structural Geologic Map of Kentucky, showing all major structural features and their actual elevations, oil and gas pools and pipelines, designed as a guide for oil, gas and water explorations, scale 1:500,000. Keybed top of Devonian black shale, contour interval, 100 feet. Ky. Geol. Survey, Series VI, printed in colors, correct to April 1, 1931 1

Early Kentucky Literature: 1750-1840. Fourteen Facsimile Title Page Reproductions. 104 pp. (Annual Dinner Address delivered before the Mississippi Valley Historical Association at the University and Broadcast over WHAS, Louisville, Ky., April 30, 1931.) Kentucky State Historical Society, Frankfort, 1931 104

Structural Geology of Kentucky. Abstract, Toronto, 1930 Meeting of the Geol. Soc. of America, pp. 303-320. Pan-American Geologist, Vol. LV, No. 4, p. 318, May, 1931 1

Geology and Industry. An Exposition of the Economic Relationship Between State Geological and Industrial Surveys. 31 pp., Ky. Geol. Survey, Series VI., 1931 31



SOME OF THE DIRECTOR'S RECENT BOOKS AND MAP

Natural Gas in Western Kentucky. A summary account of the occurrence of Natural Gas in the Western Part of this Commonwealth coupled with Brief Statement as to the Production and Geology of each separate field. Twenty-three sketch maps, 190 pp., Ky. Geol. Survey, Series VI, Vol. 38, 1931 190

Structural Geology of Northern Central Kentucky. Pan-American Geologist, Vol. LV, pp. 337-341, 2 plates, June, 1931 4

George Washington's Western Kentucky Lands. 1 map of a portion of Northwestern Grayson County, Ky., locating the Washington surveys, pp. 379-384. The Register of the Kentucky State Hist. Soc., Vol. 29, No. 89, October, 1931 6

A New Index to Littell. (Review). Ky. State Hist. Soc., The Register, Vol. 29, No. 87, pp. 226-28. April, 1931 3

Geology of the Deep Wells of Kentucky. Kentucky Geological Survey, Series VI, Vol. 42, pp. 647. 1931 647

A Transylvanian Trilogy. Presenting a reprinting of Harry Toulmin's Description of Kentucky and adjacent parts of the United States with critical and explanatory historical comment, and including facsimile of J. Russell's Map of Kentucky of 1794 laid in. The Kentucky State Historical Society, 1932 .....

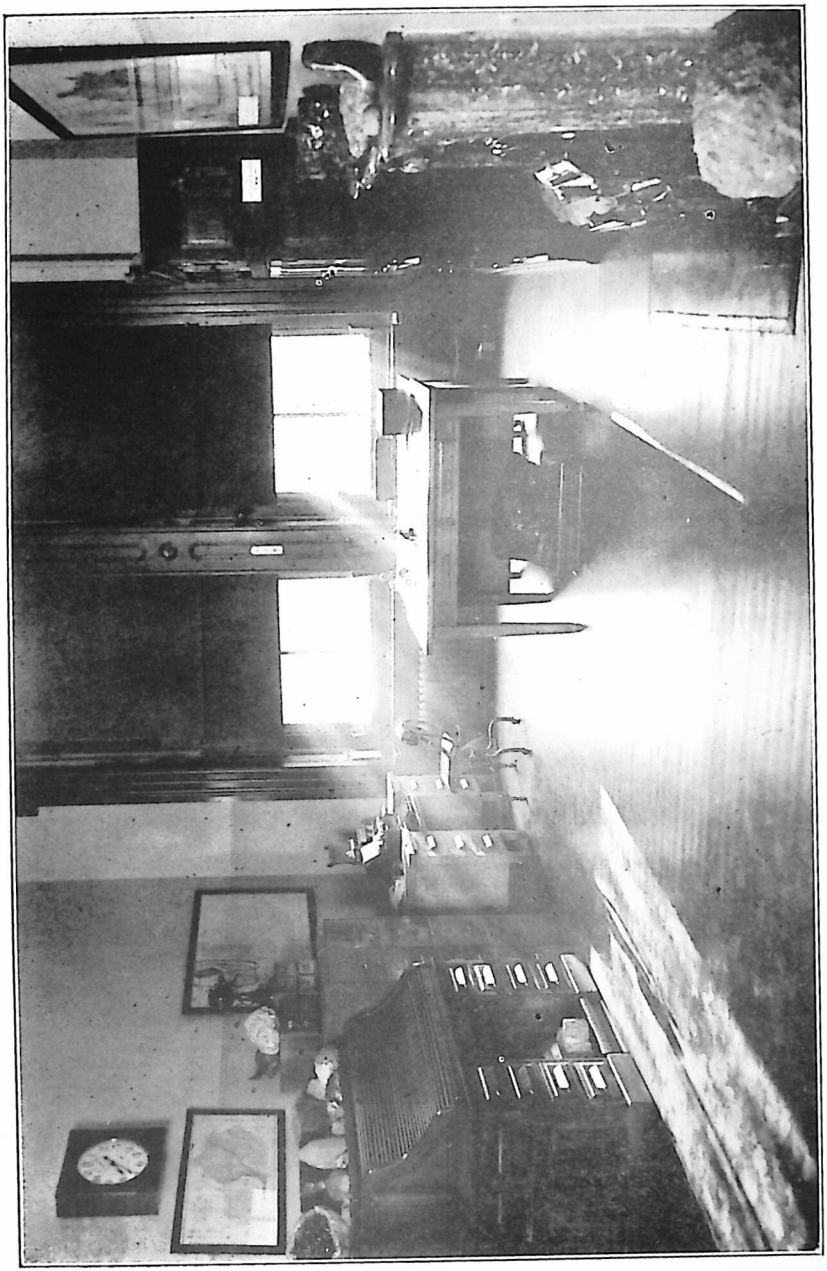
GEOLOGICAL PUBLICATIONS OF THE STATE GEOLOGISTS

OF THE UNITED STATES DURING THE DECADE 1918-1928*

From "Bibliography of North American Geology," Bulletin 823, Department of the Interior, Washington, D. C., 1931.

	No. of Pubs.
Alabama—Dr. Walter B. Jones	13
Arizona—Dr. G. M. Butler	2
Arkansas—Dr. George C. Branner	5
California—Mr. Walter W. Bradley	10
Canada—Dr. W. H. Collins	23
Colorado—Prof. R. D. George	7
Connecticut—Dr. W. E. Britton	1
Delaware—	
Florida—Mr. Herman Gunter	12
Georgia—Prof. S. W. McCallie	8
Hawaii—	
Idaho—	

* Prepared by Olive Day, Clerk Ky. Geol. Survey.



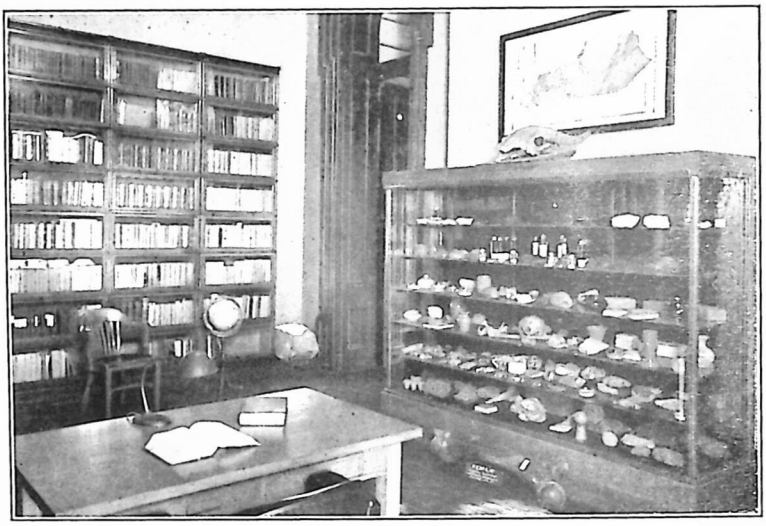
MAIN OFFICE OF THE KENTUCKY GEOLOGICAL SURVEY, IN REBUILT "EXECUTIVE WING," OLD CAPITOL, FRANKFORT, KENTUCKY.

Illinois—Dr. M. M. Leighton	22
Indiana—Prof. W. N. Logan	29
Iowa—Dr. George F. Kay	16
Kansas—Dr. R. C. Moore	41
Kentucky—Dr. W. R. Jillson	113
Louisiana—	
Maine—	
Maryland—Dr. Edward B. Matthews	8
Massachusetts—	
Michigan—Dr. Richard A. Smith	5
Minnesota—Prof. W. H. Emmons	12
Mississippi—Dr. E. N. Lowe	13
Missouri—Dr. H. A. Beuhler	9
Montana—Dr. F. A. Thomson	6
Nebraska—Mr. G. E. Condra	2
Nevada—	
New Hampshire—	
New Jersey—Dr. H. B. Kummel	8
New Mexico—Dr. C. G. Staley	1
New York—Mr. D. H. Newland	9
North Carolina—H. J. Bryson	3
North Dakota—Dr. A. G. Leonard	10
Ohio—Mr. Wilbur Stout	7
Oklahoma—Dr. C. N. Gould	33
Oregon—	
Pennsylvania—Dr. George H. Ashley	26
Rhode Island—	
South Carolina—Prof. Stephen Taber	17
South Dakota—Dr. E. P. Rothrock	6
Tennessee—Mr. Walter F. Pond	0
Texas—Dr. J. A. Udden	27
Utah—Prof. Wm. Peterson	1
Vermont—Dr. George H. Perkins	13
Virginia—Dr. Arthur C. Bevans	9
Washington—Dr. H. E. Culver	13
West Virginia—Mr. James D. Sisler	3
Wisconsin—Dr. E. F. Bean	3
Wyoming—Mr. John G. Marzel	1
Total	547

GUSHER OIL IN CENTRAL WESTERN KENTUCKY

An item of more than ordinary economic importance to Kentucky was the announcement of the discovery of gusher oil in the Louis McKinney No. 1 well drilled by Davis and Norris of Glasgow, near Legrande School in Southeastern Hart county,

on September 18, 1930. Found at a depth of 597 feet in the Corniferous (Devonian) limestone, this well marked the beginning of a widely spread and intensive shallow exploratory drilling campaign for petroleum in Hart, Barren, Metcalfe, Green and some more remote areas in the adjacent counties of Hardin, Grayson, Barren and Edmonson.



LIBRARY AND CABINET, KENTUCKY GEOLOGICAL SURVEY

During the year 1929, the State Geologist had openly predicted before a group meeting of citizens at Hodgensville called by Senator Charles Hubbard, that oil in commercial quantity would be found in this part of Kentucky. Shortly after the "strike," on October 11, 12 and 13, 1930, the Director of the Survey visited the newly opened Hart county field, was impressed with its possibilities, executed the necessary field work and commenced the preparation of a public report on this area. This item, supplemented with geological maps and other illustrations, was rapidly advanced through the State printer. Released as a bound report of 103 pages for public use on November 17, 1930, under the title, "The Legrande Oil Pool," it is unique in that it is the only instance on record, where within 60 days of the discovery of a new oil pool of large importance, a

State Geological Survey had completed new field work thereon, written and published a bound report for general utilization.

The demand for copies of "The Legrande Oil Pool" at once became great as the date of issue coincided with the peak of leasing and drilling development, both actually preceding the pronounced fall in prices of Western Kentucky crude oil. A measure of the success and importance of the Legrande and associated oil pools is seen in the following tabulation and total of oil runs for Hart County, Kentucky, from the date of discovery to the present time. Previously there had been no commercial oil produced in Hart County.

DISCOVERY OF OIL IN LETCHER COUNTY

During the midsummer just passed a well reported to have been drilled in search of natural gas on King's Creek in Letcher County, Kentucky, passed through the Pennsylvanian, Mississippian and Devonian rocks to and into the Corniferous limestone where at about 1850 feet an undetermined quantity of green oil was encountered. A sample of the oil produced in the Kings

REELFOOT LAKE FROM THE AIR IN KENTUCKY

Creek well was collected and has been analyzed by the State Chemist for the Geological Survey. Its interest lies chiefly in the fact that it is the first Corniferous (Devonian) oil known to have been produced in Letcher County, a part of Southeastern Kentucky where the carbon ratio, ranging from 60% to 62.5% has generally been considered too high to admit of the possibility of commercial quantities of petroleum. It will be noted in this connection that the Baume gravity indexed at 42.4 degrees is really high and in keeping with what might have been expected. The analysis follows:

Laboratory No. G-4469. The sample had a greenish yellow color and was labeled from King's Creek, Letcher County, Ky., corniferous limestone, and was collected by L. W. Fields, Lexington, Ky., on July 30, 1931.

ANALYSIS:

Specific Gravity — 0.798 at 35°C = 0.812 at 60°F
== 42.4 Beaume.

Distillation test — 100 cc taken for a sample

First drop at 62°C	143.6°F
Distillate below 150°C	30.0%
Distillate between 150° and 280°C	41.0%
Distillate above 280°C	28.5%
Loss by difference	.5%
Total	100.0%

Above 280°C heavy oil began to distill over.
Analysis by S. D. Averitt.

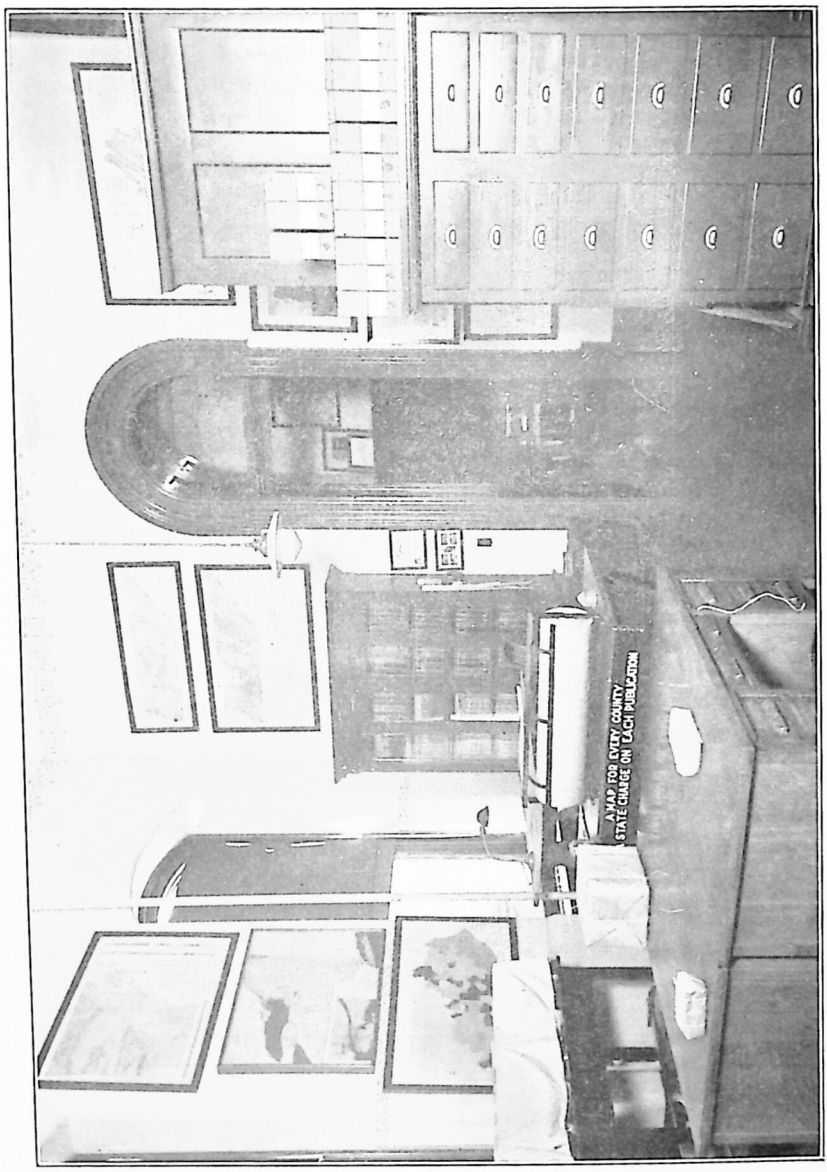
Yours very truly,
J. S. McHARGUE,
Acting Head, Department of Chemistry,
University of Kentucky.

Aug. 4, 1931,
Lexington, Ky.

OIL AND GAS POOLS IN KENTUCKY

	Name of Pool and Producing Sand	County
1.	Highland Oil and Gas Pool—Pottsville	Henderson and Union
2.	Niagara Oil and Gas Pool—Pottsville and Chester	Henderson
3.	Farmersville Gas Field—Bethel	Caldwell
4.	Kirkwood Springs Gas Field—Chester	Hopkins
5.	Southard School Gas Field—Chester	Hopkins
6.	Crofton Gas Field—Chester	Christian
7.	Sebree Gas Field—Pottsville	Webster
8.	Mortons Gap Oil Pool—Pottsville and Missippian	Hopkins

	Name of Pool and Producing Sand	County
9.	Greenville Oil Pool—McCloskey	Muhlenberg
10.	Penrod Oil and Gas Pool—Pottsville	Muhlenberg
11.	Central City Gas Pool—Pottsville	Muhlenberg
12.	Diamond Springs Gas Field—Chester	Logan
13.	Daviess County Oil and Gas Fields—Stray, Jett, Jackson and Barlow	Daviess
14.	McLean County Oil Field—Corniferous	McLean
15.	Pineville Oil Field Jett and Barlow	Hancock
16.	Ohio County Oil and Gas Fields—Stray, Jett, Jackson and Barlow	Ohio
17.	Rochester Oil Pool—Pottsville	Butler
18.	Victorial Oil and Gas Field—Jett and Jackson	Hancock
19.	Cloverport Gas Field (Aband.)—Chester	Breckinridge
20.	Warren County Oil and Gas Fields—Warsaw, Corniferous and Niagaran	Warren
21.	Simpson County Oil Field—Corniferous	Simpson
22.	Allen Co. Oil and Gas Fields—Corniferous and Niagaran	Allen
23.	Glen Dean Oil Pool—Corniferous	Breckinridge
24.	The Sink Oil Pool—Moffett "sand" L. Mississippian	Grayson
25.	Leitchfield Gas Field—Mississippian and Limestone	Grayson
26.	Barren County Oil and Gas Fields—Corniferous and Niagaran	Barren
27.	Legrande Oil Pool—Corniferous	Hart
28.	Logsden Valley Oil and Gas Pool—Corniferous	Hart
29.	Three Springs—Center Gas Field—Corniferous	Metcalfe, Hart, Barren and Green
30.	Meade County Gas Fields—Devonian Shale	Meade
31.	Meadow Gas Field—Devonian Shale	Jefferson
32.	Green-Taylor Counties Gas Fields—Corniferous and Niagaran	Green and Taylor
33.	Cumberland County Oil Fields—Ordovician	Cumberland and Monroe
34.	Wayne County Oil Field—Beaver	Wayne
35.	Lincoln County Oil Pool—Corniferous	Lincoln
36.	Williamsburg Oil and Gas Field—Pottsville (oil), Big Lime and Big Injun	Whitley
37.	Indian Creek Oil and Gas Field—Big Lime	Knox
38.	Knox County Oil and Gas Fields—Pottsville and Big Injun	Knox
39.	Red Bird Gas Pool—Big Lime	Bell
40.	Clay County Gas Fields—Corniferous	Clay
41.	Buffalo Creek Oil Pool—Corniferous	Owsley
42.	Island Creek Oil and Gas Field—Big Injun	Owsley
43.	Turkey Knob Gas Field—Corniferous	Owsley
44.	Ida May Oil Pool—Corniferous	Lee



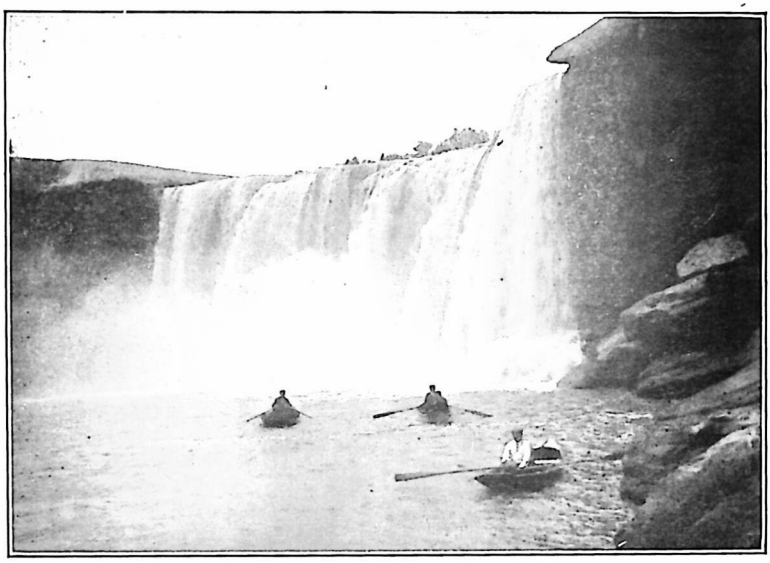
DRAFTING AND SHIPPING ROOM, KENTUCKY GEOLOGICAL SURVEY

	Name of Pool and Producing Sand	County
45.	Station Camp Oil Pool—Corniferous	Estill
46.	Ross Creek Oil Pool—Corniferous	Estill and Lee
47.	Irvine Oil Pool—Corniferous	Estill
48.	Big Sinking Oil Pool—Corniferous	Lee
49.	Menifee County Gas Field—Corniferous	Menifee
50.	Menifee County Oil Pool—Corniferous	Menifee
51.	Ragland Oil Pool—Corniferous	Bath and Menifee
52.	Campton Oil Pool—Corniferous	Wolfe
53.	Stillwater Oil Pool—Corniferous	Wolfe
54.	Grassy Creek Gas Field—Corniferous	Morgan
55.	Cannel City Oil and Gas Pool—Corniferous	Morgan
56.	Breathitt County Gas Fields—Big Six "Sand"	Breathitt
57.	Newcombe Cr. Oil and Gas Field—Corniferous	Elliott
58.	Martha Oil Pool—Wier	Lawrence
59.	Laurel Creek Gas Field—Wier	Johnson
60.	Paint Cr. Oil and Gas Field—Wier	Johnson
61.	Mine Fork Oil Pool—Wier	Johnson
62.	Burning Fork Oil and Gas Field—Wier	Magoffin
63.	Staffordsville Oil Pool—Berea	Johnson
64.	Swamp Branch Gas Field—Devonian Shale	Magoffin
65.	Floyd County Gas Field—Devonian Shale, Big Injun sandstone, "Bradley" sandstone, "Maxon" sandstone, "Big Lime" and Pottsville	Floyd
66.	Knott County Oil Pool—Pottsville	Knott
67.	Martin County Gas Field—"Big Injun, Devonian Shale, "Maxon" and "Big Lime"	Martin
68.	Pike County Gas Fields—Devonian Shale	Pike
69.	Busseyville Oil Pool—Berea	Lawrence
70.	Fallsburg Oil Pool—Berea	Lawrence
71.	Ashland Gas Field—Corniferous, Devonian shale and Salt "sand"	Boyd
72.	Lots Creek Gas Field—Devonian Shale	Knott
73.	Lower Rockcastle—Tug River Gas Field—Devonian shale	Lawrence and Martin
74.	Carlisle Gas Field—Trenton (Jessamine Ls.)	Carroll and Gallatin
75.	Shelbyville Gas Field—Base of Eden Shale	Shelby
76.	Salt Lick Gas Field—Eden Shale	Bath
77.	Himyar Gas Field—Maxon, Big Lime, Big Injun and Corniferous	Knox

NATURAL GAS INCREASE

Within the last two years notable increases in the development of natural gas in Kentucky have taken place. The areas of chief interest today are four: (1) Eastern Kentucky, the largest development and deepest drilling centering in Floyd, Pike and Knott counties; (2) the Western Kentucky field

extending from Green and Metcalfe on the East to Caldwell on the West; (3) Northern Kentucky, particularly in the Ohio River Valley proper, the Carlisle Field, in Carroll and Gallatin Counties, and (4) the Himyar Field in Knox County in Southeastern Kentucky.



CUMBERLAND FALLS, NOW A KENTUCKY STATE PARK

The Eastern Kentucky gas fields now number seventeen separate producing units and from these, in point of fact the Floyd-Pike Gas Field, a new 20-inch pipeline has been laid by the Columbia Gas Construction Company extending eastwardly to Washington, D. C., which city as well as numerous other municipalities enroute are now served with Eastern Kentucky natural gas.

In Western Kentucky, the Kentucky Natural Gas Co. of Owensboro has laid connecting lines to a good many of the twenty commercially productive gas fields in this part of the Commonwealth. At this time West Kentucky is serving an increased number of towns in this region and it is proposed to pipe Kentucky natural gas to large adjacent cities, both in Tennessee on the South, and Indiana on the North. In the Northern Bluegrass plans are afoot to take the newly discovered

Trenton gas from the Carlisle Field to the Cincinnati municipal and industrial district.

In response to a growing demand for geologic data on the rapidly developing natural gas fields of Kentucky, the Survey has issued during 1930 and 1931 from the pen of the State Geologist, two oil and gas reports of comprehensive size on Western Kentucky, and has also recently published separately two reports on the geology of oil and gas in the Bluegrass, and the State as a whole, in the latter report only the deep wells—those below 2,500 feet—being considered. A brief outline of the geology of natural gas in the Himyar Field is appended to this report.

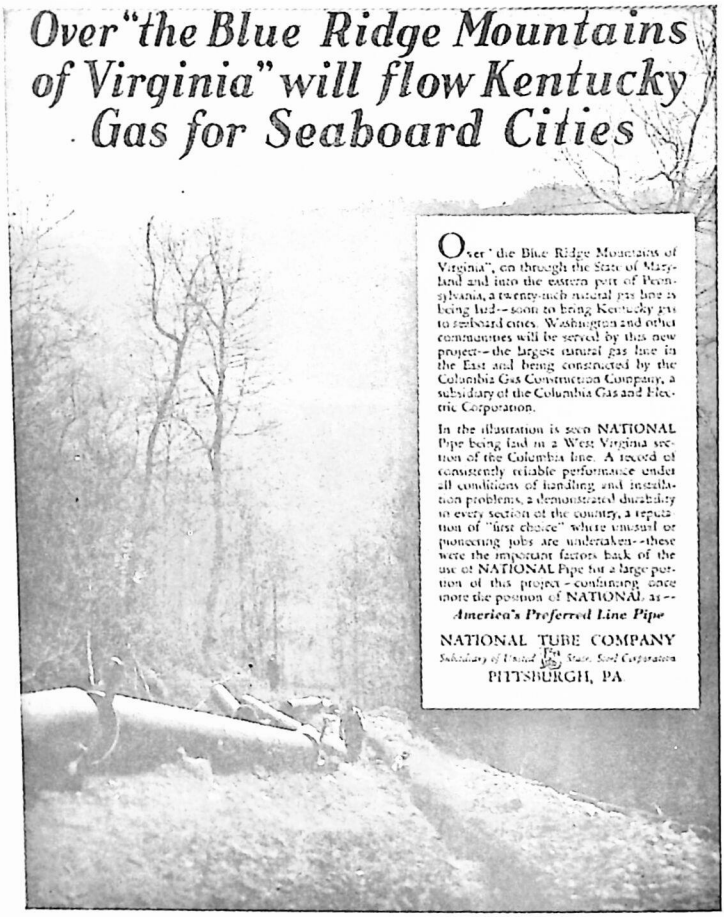
A special report on the Carlisle Field written by the Director and based upon personal field work in Carroll and Gallatin counties is now completed and ready for printing. The present status of the natural gas industry in Kentucky gives promise, with the reawakening of industry of the largest expansion in point of exploration and production in the history of the Commonwealth. Kentucky in this respect, as in many another, is the only great undeveloped natural resource area close to the center of population and the great undersupplied urban markets of the United States.

NATURAL GAS IN NORTHERN CENTRAL KENTUCKY

In common with other oil and gas geologists and engineers, the State Geologist originally held adverse views with respect to the oil and gas possibilities of the Bluegrass region of Kentucky. After a decade of growing intimacy with these rocks, however, he came to feel that the area was not altogether without promise. As a result of the detailing of the geology of this part of Kentucky, a mapping program encompassing an area of about 8,000 square miles which has now been completed as is described elsewhere in this report, he became strongly of the opinion that certain selective areas exhibiting closed structure could produce commercial quantities of natural gas. Finally he openly advocated such procedure where dependable structural data of a positive character was available.

Sustaining and elaborating these more or less independent

views, he prepared a manuscript in 1929 and 1930 which has since been published by the Survey as Vol. 40 under the title, "*Oil and Gas in the Bluegrass Region.*" Then by a rare coinci-



FLOYD AND PIKE COUNTIES GAS GOES EAST
From the Oil and Gas Journal of Oct. 1, 1931.

dence at the time this report was delivered to the Survey by the State Printer and put into circulation, the Kentucky press carried the first news items of the discovery of natural gas in commercial quantity in the F. B. McDonald No. 2 well—the indexing

drilling in the now well developed and widely known Carlisle Gas Field of Carroll and Gallatin Counties, Ky.

Appropos of this newly developed natural gas area in Northern Central Kentucky, now reporting a total open flow in excess of 10 million cubic feet, numerous letters appeared in the correspondence columns of the leading Kentucky dailies. The following communication, printed by the Louisville Courier-Journal May 9, 1931, above the name of Mr. Charles E. Straub, an oil and gas geologist of Northern Kentucky, is indicative of the professional interest aroused by the development of Natural Gas in this part of the Commonwealth:

Central Kentucky as a Potential Gas Region

To the Editor of The Courier-Journal.

Scattered throughout the Central Kentucky region, a number of wells have been drilled that have encountered gas at shallow depths in rocks of Ordovician age, but only in a few cases were the wells capable of producing in commercial quantities.

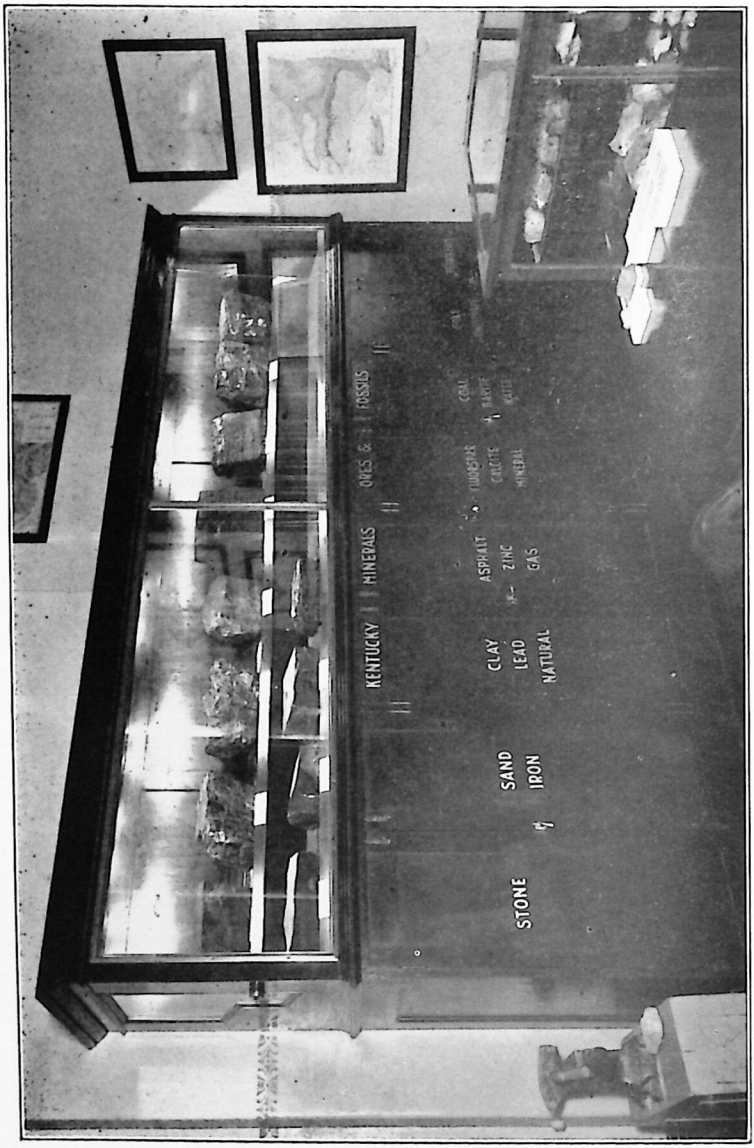
While the State Geologist, Dr. W. R. Jillson, has long recognized and sought to encourage development in this area, operators have been discouraged for the reason that a potential supply which would be adequate to warrant investment in extensive pipe line facilities has not been developed.

Recently McDonald No. 2, near the Carroll-Gallatin County line, was completed by the G. M. C. Oil Company as a commercial gas well at a depth of 321 feet in the Trenton, which is the producing sand in the oil fields on Indiana and Ohio. The well has an open flow of 3,000,000 cubic feet per day, with an exceptional pressure of 160 pounds as measured by the Kentucky Geological Survey.

Failure to develop commercial gas in the North-Central Kentucky Ordovician strata in the past has been due to lack of consideration of proper location of tests with respect to favorable geological structure rather than to the absence of gas in commercial quantities and it is to be expected that many shallow pools will be developed provided proper attention is given to local structural conditions.

The writer, a former consulting geologist of Louisville, who has been active for over ten years in the western fields of the United States is visiting his parents at Bellevue and is much impressed with the progress the State has made, especially in road building, but feels that oil and gas development has not kept pace with development elsewhere and can assign no other cause than previous lack of passable roads to prospective areas.

The Kentucky Geological Survey has as much information available as can be found in any oil and gas producing State and has base



MINERAL RESOURCE ROOM, KENTUCKY GEOLOGICAL SURVEY

maps of every county, which maps are very useful to the pioneers of development, who are the geologists.

The completion of commercial gas wells at Shelbyville and along the Carroll-Gallatin County line demonstrated that gas will be found in commercial quantities in at least two known horizons of the Ordovician strata in North-Central Kentucky and substantiates the heretofore expressed views of Dr. Jillson.

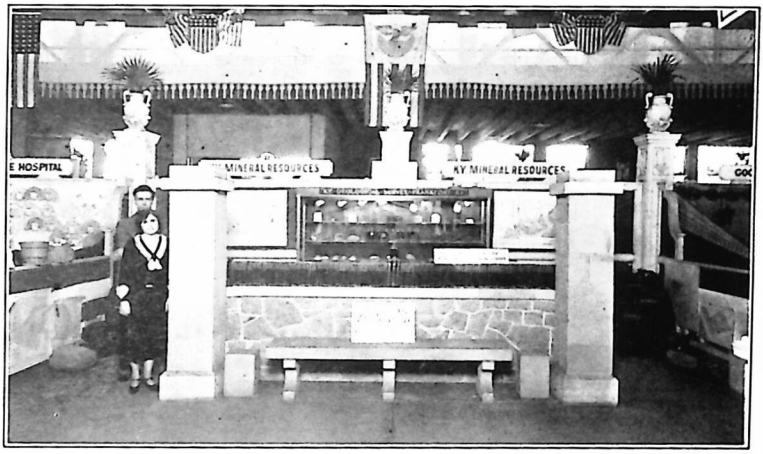
The writer, who was raised in Kentucky and attended the State University, has always been conscious of the presence of an abundance of the most useful natural resources in Kentucky, but inaccessibility for geological and exploration work in 1919 caused him to migrate to the plains of the West, where exploration and development have been of an intensive nature, which if practiced in Kentucky would result in a comparable percentage of productive areas at considerably less expense.

CHARLES E. STRAUB,
Bellevue, Ky.

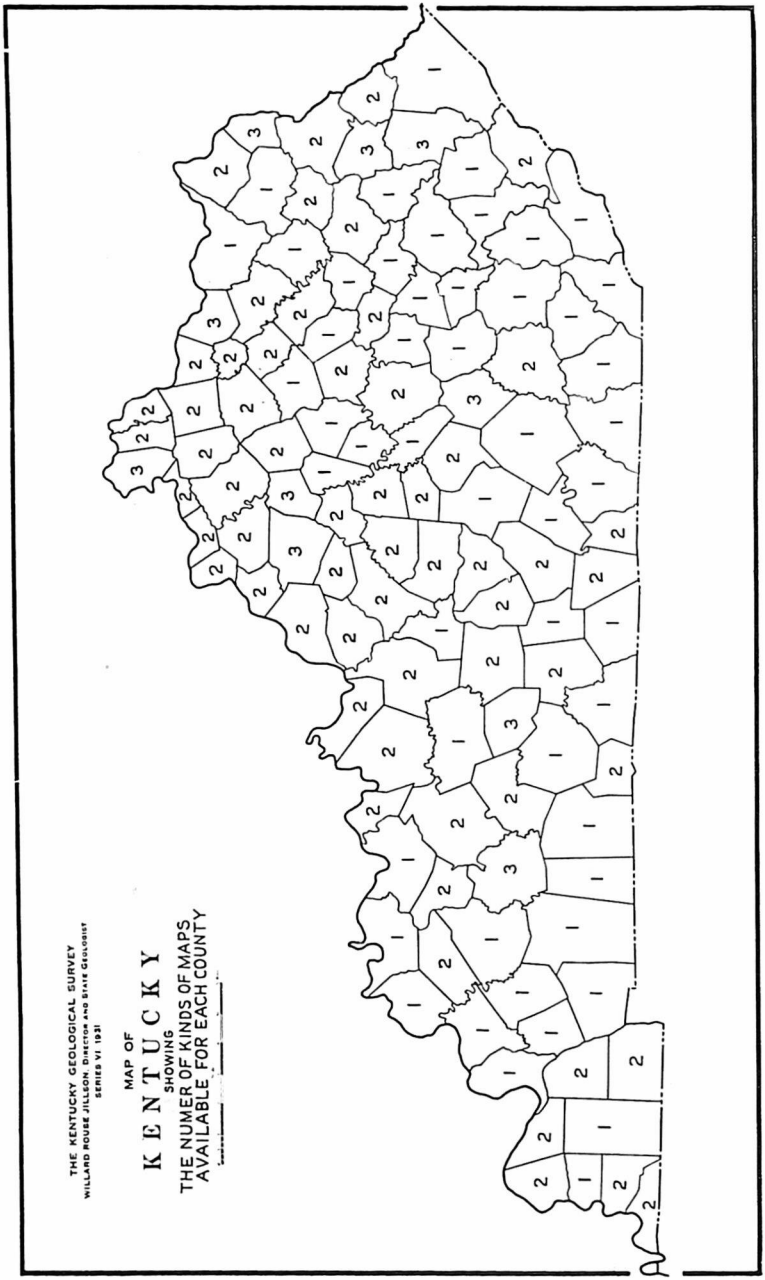
L. C. J. 5/9/31

KENTUCKY STATE FAIR EXHIBIT

In accordance with a policy established in 1928, the Kentucky Geological Survey continued to maintain and enlarge its permanent mineral resource and associated exhibits at the State Fair at Louisville during the past two years. New maps and recent reports as well as a large and attractively arranged layout of the various minerals and mineral products of the State, were



PERMANENT EXHIBIT OF KENTUCKY'S MINERAL RESOURCES MAINTAINED BY THE GEOLOGICAL SURVEY AT THE STATE FAIR, LOUISVILLE, KY.



NUMBER AND DISTRIBUTION OF MAPS PREPARED BY THIS SURVEY, 1919-1931

made a part of the display. During and following the destructive fire of February 23, 1929, in the Old Capitol Building—"Executive Wing"—many maps and reports of the Geological Survey were considerably damaged by water and dampness in the walls. Unable to dispose of these items in the regular manner by sale—many of them, particularly the reports, exhibited a small amount of mildew—a plan was developed whereby they were distributed at the Survey's State Fair booth "without charge" to those who requested them and evidenced genuine interest in the subjects they presented. In this manner several hundrd damaged copies of a number of publications, which were otherwise without value, were put without cost into active circulation in the hands of citizens of Kentucky who were so situated as to derive benefit from them.

REBUILDING OF THE OLD CAPITOL

In compliance with authority vested in the State Sinking Fund Commission and the office of the Attorney General by the General Assembly in its Session of 1930 the Old Capitol Building—"Executive Wing"—which burned in a most destructive fire on February 23, 1929, has been rebuilt. The work was carried forward as expeditiously as possible under a contract made by the State Sinkng Fund Commission with Mr. H. G. Graham, a general building contractor of Frankfort, Kentucky. The work was undertaken on August 5, 1930, and was completed on Jan. 23, 1931. It was supervised for the State by Mr. M. E. Walker of Salvisa, Mercer County, Kentucky.

The work consisted of the removal of the fire debris and the temporary roofs, after which the building was re-topped and re-roofed. Fireproof materials were used. The second floor was finished completely and is now occupied by the *Workmen's Compnesation Bureau* in the South suite, and by the *Kentucky Railroad Commission* in the North suite. Only "roughed in work," consisting of cement floors, brick partitions, and steel framed windows, was done on the third floor, as money was not available according to report for the finishing of this part of the building in accordance with the plans of the architects, Franklin and Curtis of Lexington, Kentucky.

The first floor was given some attention, particularly in the main hallway where re-plastering and re-painting was done to

"EXECUTIVE WING" OF THE OLD CAPITOL REBUILT, FALL OF 1931

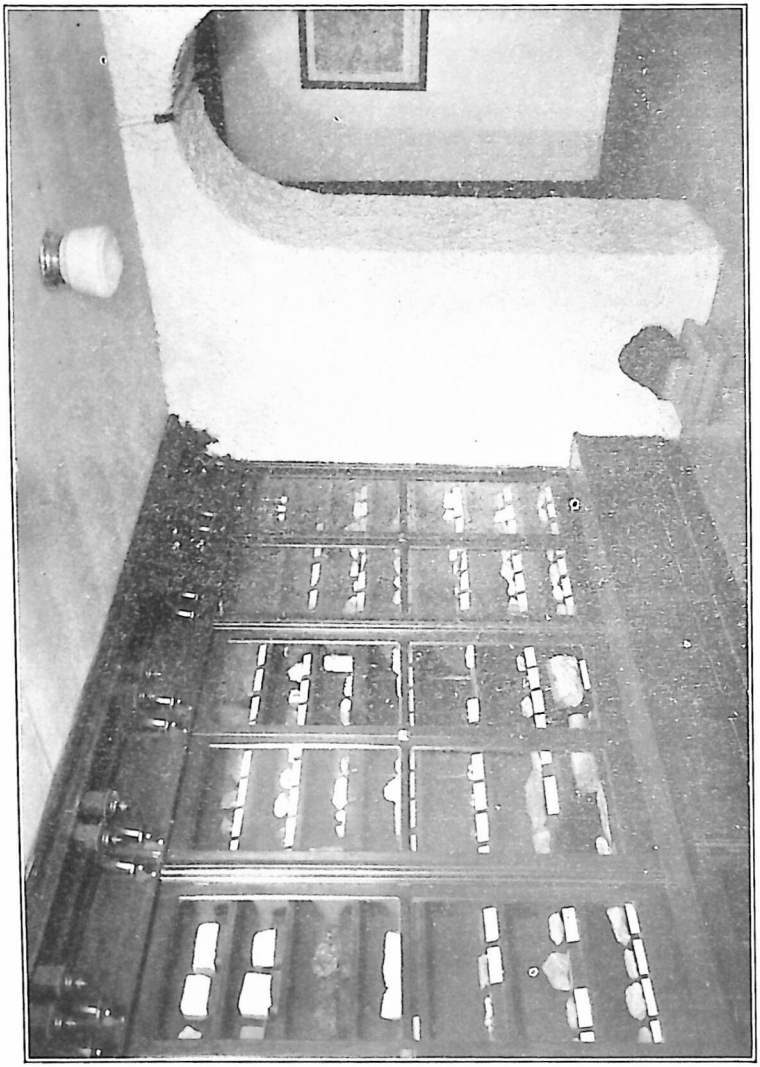
All of the ground floor offices and basement rooms shown in this photograph from Lewis Street, are occupied at the present time by the Kentucky Geological Survey. Colonel Farris, the Custodian, and Willard R. Jillson, III, are in the foreground.

bring those portions of the building back as much as possible to the original condition. In the suite of offices occupied by the Kentucky Geological Survey, with the exception of the State Geologist's office, all of the necessary work of refinishing the floors, walls, ceilings, cabinets and the redecorating has been done by the Kentucky Geological Survey out of its own funds upon instruction and authority of the State Sinking Fund Commission and the office of the Attorney General. Moneys so spent during the years 1929, 1930 and 1931 have totaled $5,091.09 and this authorized and necessary expenditure has been a very considerable and continuing drain upon the small appropriated funds and resources of this Department.

The attention of the Governor and the Legislature of 1932, it is felt, should be directed to this unusual, and ungeologic expenditure which was made imperative by reason of the fire emergency and consequently the undeniable necessity of protecting the extensive property of the Commonwealth in the custody of the Kentucky Geological Survey. Since these necessary repairs were not paid for from funds provided for this purpose by the last Legislature, it is the opinion of the Director and other citizens who are thoroughly conversant with the situation, that these moneys should be returned to the Kentucky Geological Survey immediately as a special appropriation in order that the Survey's obligation and instructions as to public service, as set out in the Statutes, may be fulfilled. The authorized expenditure of this sum by the Geological Survey during the past biennium, has made possible the continued use of the suite of offices assigned to this State Department, but it has seriously crippled its normal function and public service.

NEW KENTUCKY MAPS

There are now available for general use seventy-one new Geological maps of Kentucky. These have been prepared at the scale of one inch equals one mile and on these all major stratigraphic divisions are shown in standard colors. Except as indicated below these detailed maps may be had at $1.00 apiece. In orders totaling thirty or more a discount of ten per cent will be allowed. Purchasers are requested to remit to cover statutory cost with order.



MINERAL CABINET IN BASEMENT OF OLD CAPITOL, KENTUCKY GEOLOGICAL SURVEY

The following areal geological maps are now in course of distribution: Anderson, Bath, Boone, Bourbon, Boyle, Bracken, Breckinridge, Bullitt, Butler, Calloway, Campbell, Carroll, Carter, Christian, Clark, Clinton, Crittenden, Cub Run Quadrangle, Cumberland, Daviess, Edmonson, ($1.50), Elliott, Estill, Fleming, Fordsville Quadrangle, Franklin, Fulton, Gallatin, Golconda, Grant, and Cave-in-rock Quadrangle ($1.50), Hancock, Hardin, Harrison, Hart, Hartford Quadrangle, Henry, Hickman, Jefferson, Jessamine, Jeptha Knob, Kenton, Larue, Lincoln, Madison, Marion, Marshall, Mason, Northern Hardin, McCracken, McLean, Meade, Mercer, Montgomery, Morehead Quadrangle, Muhlenberg, Nelson, Nicholas, Ohio, Oldham, Owen, Pendleton, Powell, Pulaski, Robertson, Rockcastle, Scott, Shelby, Simpson, Spencer, Trimble, and Washington. Address: The Director, Kentucky Geological Survey, Frankfort, Ky.

PERMANENT OFFICE EQUIPMENT

The following items are now in the possession of the Geological Survey, the same having been purchased with the money of the Kentucky Geological Survey. These items are therefore to be recognized as the property of the Kentucky Geological Survey. None of the items listed below have been supplied to the Kentucky Geological Survey by the State Custodian, the Sinking Fund Commission, or any other department or official of the government of the State of Kentucky:

Chairs, 20; racks, 2; desks, 8; step ladders, 4; mineral and map cabinets, 82; clocks, 1; anvils, 1; tables, 15; sectional library cases, 208; permanent mineral cases, 14; Globe, 1; typewriters, 6; optical, surveying instruments, etc., 25; floor specimens and pedestals, 80. Total number of items, 467. This total is exclusive of the books in the library of the Kentucky Geological Survey or the hand specimens in its cabinets which taken together number well into the thousands.

VALUE OF PHYSICAL PROPERTIES

At the request of the State Auditor, the Director of the Kentucky Geological Survey has inventoried the physical properties of this state department and estimated their cost and value. These have been tabulated by groups and total $112,-900.00, the investment period as indicated below extending from

THE

DISCOVERY, PURCHASE, AND SETTLEMENT

OF THE

COUNTRY OF KENTUCKIE,

IN

NORTH AMERICA,

SO FAMOUS FOR ITS

FERTILITY OF SOIL, PRODUCE, CLIMATE

MINERALS, QUADRUPEDES, CURIOSITIES, TRADE,

RAPID POPULATION, RELIGION, &c. &c.

THE WHOLE ILLUSTRATED BY A

NEW AND ACCURATE MAP ANNEXED.

BY ALEXANDER FITZROY.

LONDON:

PRINTED BY H. GOLDNEY, No. 15, PATER-NOSTER ROW.

M. DCC. LXXXVI.

FACSIMILE OF THE TITLE PAGE OF FITZROY'S RARE PAMPHLET ON "KENTUCKIE"

Reprinted during the year by the State Geologist.

(Plate from the Library of Willard Rouse Jillson)

1920 to 1931 inclusive, except in the item of library, a portion of which is probably fifty years old.

ESTIMATES OF VALUES AND EXPENDITURES FOR IMPROVEMENTS AND PRINTING KENTUCKY GEOLOGICAL SURVEY SINCE 1920-1931

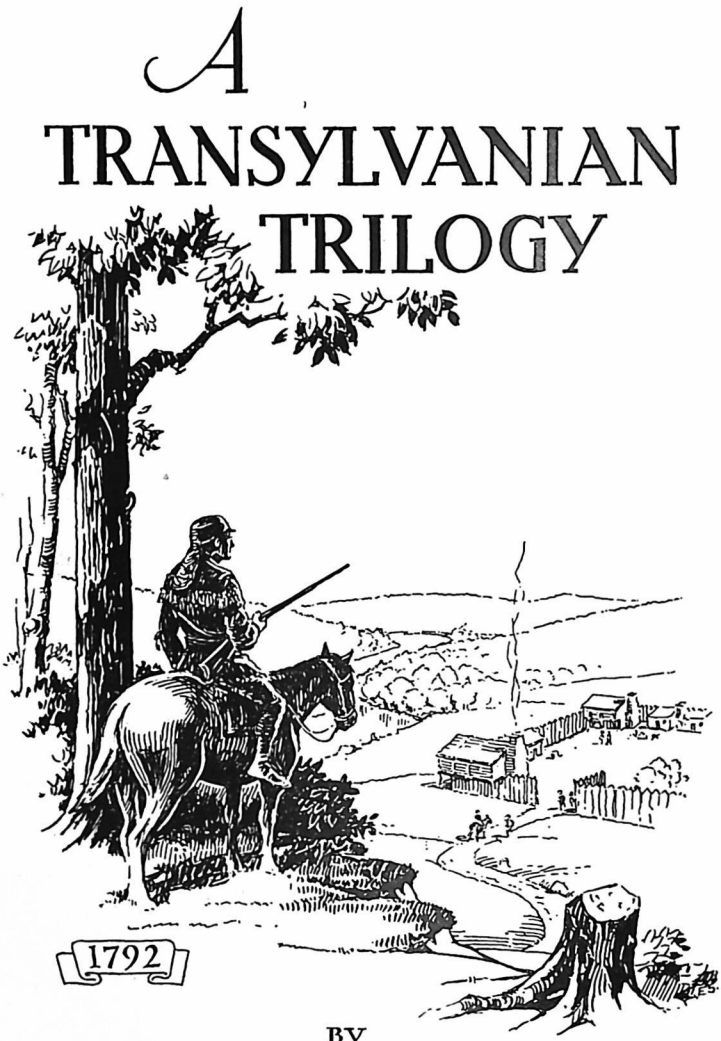
Office furniture, including typewriters, etc.	$2,950.00
Instruments, field and drafting	2,300.00
Permanent improvements including stock filing devices, etc.	7,650.00
Mineral and fossil collections for cabinet	10,000.00
Reports, maps, publications, etc.	73,500.00
Kentucky Geological Survey Library, 14,250 volumes, pamphlets and maps	16,500.00
Total	$112,900.00

LIBRARY AND STOCK DIVISIONS

An exact count has been made of the books in the Survey's library and stock reserve as well as the private library of the Director, and the following totals have been obtained. These two libraries taken together constitute the finest and most extensive geological literature source in the State of Kentucky.

	Books	Pamphlets & Magazines
Kentucky Geological Survey (Library)	6,121	8,129
Kentucky Geological Survey (In Stock)	11,691	4,868
Dr. Jillson's (Private Library)	2,428	973

Due principally to water damage losses brought about by the fire in the Old Capitol building February 23, 1929, there are today only 11,691 bound reports, and 4,868 pamphlets in stock, *a total of 16,559* printed reports of various kinds as compared to 18,351 bound reports and 7,618 pamphlets, *a total of 25,969* reports in stock as cited on page 49 of the last biennial report (1928-1929) of this Survey. This difference of 9,410 items indicates the extent of loss sustained by the Survey as a result of the Old Capitol fire. Numerous reports, particularly "Ancient Life in Kentucky," when but slightly damaged have been sold at appropriately reduced prices. In most cases the water damage was so great as to unfit the publication for sale. In such instances the volumes that were still readable, though usually greatly warped and discolored, have been sent by express as a gift to the libraries of a number of the State's leading Normal, High and Charitable Schools. Several hundred copies of this type have



COVER IMPRINT OF THE DIRECTOR'S LATEST BOOK DESCRIBING KENTUCKY IN 1792.

been donated to the Kentucky State Library Commission which welcoming the opportunity, as the appended letter indicates, has immediately put them into circulation in Kentucky.

KENTUCKY LIBRARY COMMISSION
MISS LENA B. NOFCIER

Secretary and Director of Library Extension
The Capitol, Frankfort

June 3, 1931

Dr. W. R. Jillson,
State Geologist,
Kentucky Geological Survey,
Frankfort, Kentucky

My dear Dr. Jillson:

We very much appreciate the copies of the Geological Survey Reports which you sent to this office for free distribution. I am sure the libraries in Kentucky will be grateful to receive these reports.

Yours very truly,
LENA B. NOFCIER,
Secretary

LBN:EB

PUBLICATIONS IN STOCK

A check prepared especially for presentation in this report indicates that there are now 16,604 bound printed publications on the shelves of the Kentucky Geological Survey and in course of distribution to the public upon order. At the same time a carefully prepared estimate indicates that distributed through 370 separate editions of maps there are now in the Survey's files available to the public a total of 111,000. These reports and maps taken together total 127,604 published items subject to public use. The list of bound publications with the remainder in each edition follows:

SERIES VI.

Vol. 12—New Oil Pools of Kentucky	298
Vol. 14—Surface Waters of Kentucky	308
Vol. 17.—Geology and Mineral Resources	2,233
Vol. 19—Geography of the Ky. Knobs	225
Vol. 20—Coal Industry of Kentucky	491
Vol. 22—Road Materials of Kentucky	14
Vol. 23—Geography of the Bluegrass	590

99193

Vol. 25—Geography of the Pennyroyal	172
Vol. 26—Geology of the Cave-in-Rock Quad.	600
Vol. 27—Mineralogy of Kentucky	516
Vol. 28—Geology of Edmonson County	1,027
Vol. 29—Molding Sands and Cement Materials	146
Vol. 30—Topography of Kentucky	444
Vol. 31—Pleistocene of Northern Ky.	705
Vol. 32—Mineral Operators of Kentucky	180
Vol. 33—Devonian Rocks of Kentucky	624
Vol. 34—Ancient Life in Kentucky	1,060
Vol. 35—Geological Survey Affairs	34
Vol. 37—Building of Kentucky	249
Vol. 38—Natural Gas in Western Kentucky	392
Vol. 39—Oil and Gas in Western Kentucky	1,070
Vol. 40—Oil and Gas in the Bluegrass Region	113
Map Packet—1929 (Three State Maps)	66
Geological Map of Kentucky, mounted	134
Total Bound Volumes	11,691

SERIES VI. PAMPHLETS

No. of Paper Bound Publications on Kentucky Geology in Stock Numbers to 5, inclusive, and 4, 20 and 21 are ..... Exhausted

5.	Administrative Report. 1924-1925. Pam. V.	Exhausted
6.	State Parks in Kentucky. Pam. VI. 1926	220
7.	Resume of Kentucky's Mineral Resources. Pam. VII. 1926	98
8.	Fireclays of Northeastern Kentucky. Pam. VIII. 1926	130
9.	Clays of Kentucky, The. Pam. IX. 1926	65
10.	Oil Shales of Eastern United States. Pam. X. 1926	521
11.	A Bibliography Relating to Geology. Pam. XI. 1926	120
12.	Geology Island Creek Oil Pool. Pam. XII. 1927	39
13.	Kentucky's Mineral Resources. Pam. XIII. 1927	499
14.	Pollution of Stream Waters in Kentucky. Pam. XIV. 1927	Exhausted
15.	Bentonite Deposits of Kentucky. Pam. XV. 1928. (In Press)	
16.	Kentucky Rock Asphalt. Pam. XVI. 1928. (In Press)	
17.	Kentucky State Parks. Special Pub. Illustrated 1927	147
18.	Hypothesis of a Lost Ozarkia. Maps and Illustrations. 1928. (In Press)	
19.	Geology and Geography of Kentucky. A topical outline. 1928. In Press)	
20.	Administrative Report (Year 1926-1927). Pam. 20	Exhausted
21.	Geology and Physiography of the Mammoth Cave National Park. 1928. Pam. 21.	Exhausted
22.	Geology and Physiography of the Midland trail in Kentucky. 1929. Pam. 22	434

27.	The Legrande Oil Pool. W. R. Jillson. 1930	198
28.	Geology and Industry, W. R. Jillson, 1931	5
29.	Examination and Comparative Work of the Kentucky Geological Survey. 1930	65
	Total	2,541

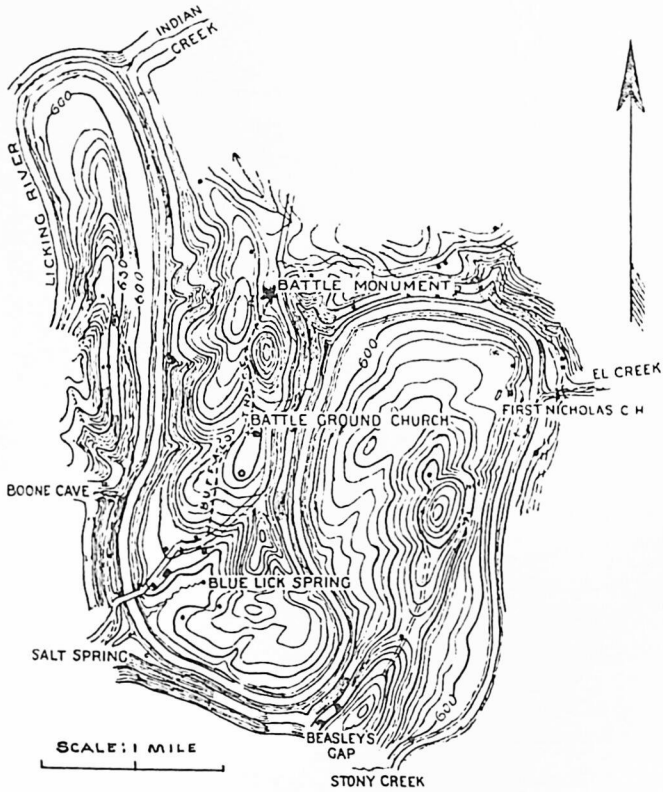
NUMBER OF REPRINTS IN STOCK

1.	Agricultural Perspective of Ky. Geology. Geol. Map. 1925	235
2.	American Karst Country. 1924	95
3.	Bibliography, A, of the John Day Region. Oregon. 1923	Exhausted
4.	Early Glaciation in Kentucky. 1925	135
5.	Fault Pattern of Kenutcky. 1924	Exhausted
6.	Glaciation in Eastern Kentucky. 1924	98
7.	Kentucky Cannel Coals. 1924	79
8.	Kentucky Geological Survey, The. 1927	Exhausted
9.	Major Drainage Modifications of Big Sandy River. 1926	195
10.	Natural Resources of Kentucky. 1926	91
11.	Nest of Sinking Streams. 1927	108
12.	Oil Domes of Ashland. 1926	150
13.	Primeval Tracts of Kentucky. 1924	155
14.	Principal Scientific Achievements of Year 1923. 1923	9
15.	Shaded Topographic Maps. 1927	158
16.	Unique Devonian Sandbar. 1923	16
17.	Unused Wealth—An Opportunity. 1926	95
18.	Trans. Ky. Academy of Science. 1924	Exhausted
19.	Kentucky Fluorites. W. R. Jillson 1930	88
20.	Geology in the Service of A New National Park	240
21.	The Geographical Surveys of Kentucky	105
22.	Structural Geology of North-Central Kentucky	115
23.	Early Carbonic Reformation in Western Kentucky. 1928	35
	Peneplains in Kentucky	125
	Total	2,327

WORK OF THE SURVEY OFFICE

Throughout the past two years, as previously, all of the detailed duties of the Survey's office, including a considerable correspondence, the continuous accession of new specimens and the relabeling of older ones, as well as the personal service to the visiting public desirous of securing various maps and reports, have been fulfilled by a small staff of three full time employees.

These have included Miss Catherine B. McNamara, Secretary to the Director; Miss Olive Day, Chief Clerk; and the State Geologist. During the biennium (1930-1931) the Kentucky Geological Survey received 16,125 letters, an average of 26 per day. At the same time 16,733 letters were written in the Survey office in answer to inquiry and in the course of conducting Survey affairs, an average of 27 per day. During this period 29,444



TOPOGRAPHIC MAP OF THE

BLUE LICKS BATTLEGROUND

BY R.L.HARRISON TOP. ENGR.

This small map was executed at the request of the Blue Licks Memorial Commission, Judge S. M. Wilson of Lexington, Chairman, by the Kentucky and U. S. Geological Surveys in co-operation prior to the closure of topographical work in this State in April, 1930.

publications of various kinds were sent in response to the requests of State Officials and in fulfillment of paid orders, an average of 47+ items per day. In each of these divisions of office routine, the volume fell somewhat below that of the pre-

FIRST OFFICIAL AERO MAPPING FOR OIL AND GAS IN KENTUCKY
This photo was taken just before the flight to map the Carlisle Gas Field, Carroll and Gallatin Counties, May 4, 1931. Taking active part in the work were: W. Sidney Park, G. H. Smith and the State Geologist as seen above.

ceding biennium (1927-1929) due to the general slackening of interest in the mineral industry caused by over production coupled with depressed business conditions throughout the country.

Although the demand for new and detailed publications on the part of mineral operators has thus somewhat and temporarily abated, this reflecting itself in a considerable loss of current revenue from the daily sales, it is pleasing to record that educators and educational institutions of all grades from the graded schools upward through the high schools, Normal Schools, Colleges, University and Municipal Libraries within and outside of Kentucky exhibit a heightening demand for the publications of the Kentucky Geological Survey A parallel and a growing stream of inquiry relative to Kentucky's geology, mineral resources and scenery is now developing from the countless thousands of tourists that annually invade this Bluegrass Commonwealth. Tabular statistics follow:

REDUCED PHOTOGRAPH OF FIRST BOOK ON KENTUCKY
This copy of John Filson's "Kentucke" and map of 1784, at one time the property of the State Geologist, recently sold to a collector for $4,275.

ADMINISTRATIVE REPORT

From July 1, 1929, to June 30, 1930

Month	Letters Received	Letters Sent	Publications Sent
July	728	723	1,164
August	657	573	1,324
September	743	696	983
October	770	631	1,384
November	639	574	793
December	535	936	732
January	611	753	1,123
February	591	624	1,302
March	754	829	1,099
April	722	674	858
May	751	730	1,739
June	639	1,059	957
	8,140	8,812	13,458

ADMINISTRATIVE REPORT

From July 1, 1930, to June 30, 1931

Month	Letters Received	Letters Sent	Publications Sent
July	677	620	744
August	678	831	2,964
September	649	662	1,258
October	733	685	2,615
November	611	563	631
December	570	486	1,129
January	608	462	749
February	737	748	1,187
March	729	625	868
April	682	727	810
May	605	651	1,759
June	706	861	1,272
	7,985	7,921	15,986

Grand total for two fiscal years ending June 30, 1931—16,125 letters received, 16,733 letters sent, 29,444 publications sent.

Daily average (626 working days)—26 letters received, 27 letters sent, 47+ publications sent.

CREDITS AND EXPENDITURES OF THE KENTUCKY GEOLOGICAL SURVEY

	Fiscal Year Ending June 30, 1930			Fiscal Year Ending June 30, 1931		
	Receipts	State Appropriation	Expenditures	Receipts	State Appropriation	Expenditures
Salaries and other expenses	$40,000.00	$40.000.00		$40,000.00	$40,000.00	
Transferred from 1932				7,000.00		
Net receipts	$40,000.00			$47,000.00		
Other receipts						
Sales of publications	$5,150.06			$6,099.95		
Expenditures						
Salaries and wages			$20,265.06			$22,592.97
Traveling expenses			7,643.97			6,049.73
Telephone and telegraph			540.38			614.40
Freight, express, and drayage			252.03			164.07
Postage			145.00			655.00
Stationery and printing			10,239.44			16,853.80
Maps			1,746.89			4,007.72
Office supplies			175.96			357.63
Furniture and Equipment			1,602.65			729.27
Library and auxiliaries			1,349.49			808.63
Fossil collection			170.00			15.00
Renewals and repairs			1,017.69			246.66
Totals	$45,150.06	$40,000.00	$45,148.56	$53,099.95	$40,000.00	$53,094.88

This statement is prepared from vouchers and records on file in the Auditor's Office and is correct to the best of my knowledge and belief.

November 15, 1931.

E. H. MARRS,
Clerk Auditor's Office.

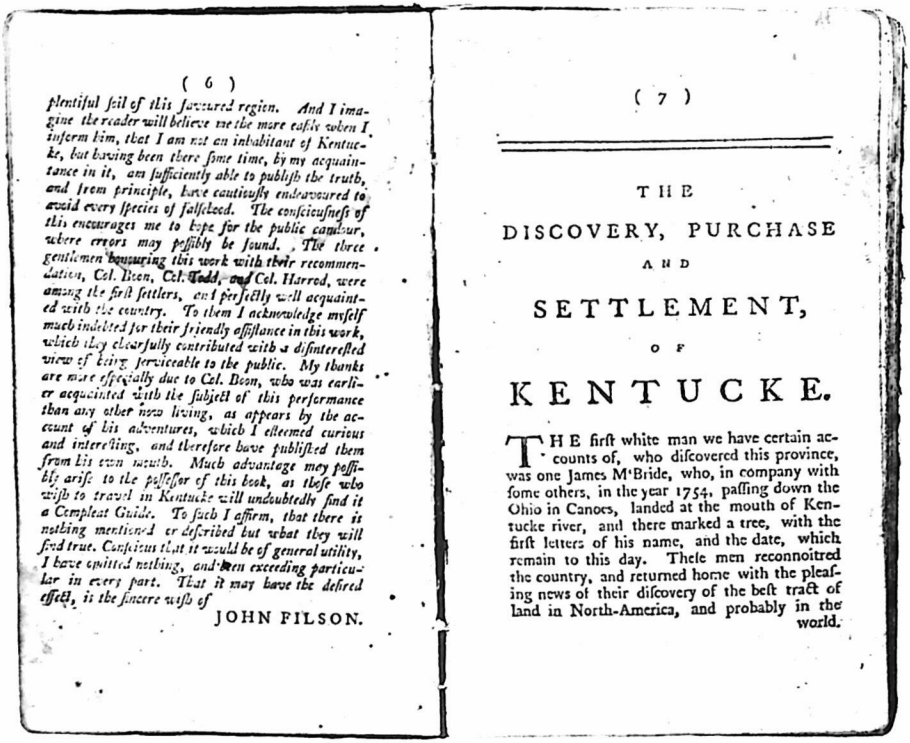
COUNTIES IN THE UNITED STATES

The growing interest in various proposals looking toward the reduction of the cost of government has given rise to the suggestion that Kentucky might well consolidate a number of her smaller counties and thereby lessen the demand for local taxation. Without taking a position either for or against this proposal, since as a question it is somewhat outside of the field of geology, though of interest to the Survey since its maps are issued principally as County units, the following data assembled by the Federal Board of Surveys and Maps, are presented for general informative purposes It will be noted by even the casual observer that only two States—also located in the South but much larger areally than Kentucky with its 40,598 square miles—have more counties than does this Bluegrass Commonwealth.

As a matter of fact, many states in this Union with areas much in excess of Kentucky have only, as for example Pennsylvania, about half as many counties. Since the "good old days" of riding horseback in the Mountains and the "one hoss chaise" in the Bluegrass and Pennyrile on County Court Day have either passed or are rapidly passing, the importance of the small county and its centrally located seat of local government may also be said to be on the wane. In this connection and otherwise these data are of much fundamental interest.

TABULATION OF THE COUNTIES IN THE UNITED STATES—JUNE 1, 1929

State	No	State	No.
Alabama	67	Kansas	105
Arizona	14	Kentucky	120
Arkansas	75	Louisiana	64
California	58	Maine	16
Colorado	63	Maryland	23
Connecticut	S	Massachusetts	14
Delaware	3	Michigan	83
Florida	67	Minnesota	87
Georgia	161	Mississippi	82
Idaho	44	Missouri	114
Illinois	102	Montana	56
Indiana	92	Nebraska	93
Iowa	99	Nevada	17



(6)

plentiful soil of this favoured region. And I imagine the reader will believe me the more easily when I inform him, that I am not an inhabitant of Kentucke, but having been there some time, by my acquaintance in it, am sufficiently able to publish the truth, and from principle, have cautiously endeavoured to avoid every species of falsehood. The consciousness of this encourages me to hope for the public candour, where errors may possibly be found. The three gentlemen honouring this work with their recommendation, Col. Boon, Col. Todd, and Col. Harrod, were among the first settlers, and perfectly well acquainted with the country. To them I acknowledge myself much indebted for their friendly assistance in this work, which they chearfully contributed with a disinterested view of being serviceable to the public. My thanks are more especially due to Col. Boon, who was earlier acquainted with the subject of this performance than any other now living, as appears by the account of his adventures, which I esteemed curious and interesting, and therefore have published them from his own mouth. Much advantage may possibly arise to the possessor of this book, as those who wish to travel in Kentucke will undoubtedly find it a Compleat Guide. To such I affirm, that there is nothing mentioned or described but what they will find true. Conscious that it would be of general utility, I have omitted nothing, and been exceeding particular in every part. That it may have the desired effect, is the sincere wish of

JOHN FILSON.

(7)

THE

DISCOVERY, PURCHASE

AND

SETTLEMENT,

OF

KENTUCKE.

THE first white man we have certain accounts of, who discovered this province, was one James M'Bride, who, in company with some others, in the year 1754, passing down the Ohio in Canoes, landed at the mouth of Kentucke river, and there marked a tree, with the first letters of his name, and the date, which remain to this day. These men reconnoitred the country, and returned home with the pleasing news of their discovery of the best tract of land in North-America, and probably in the world.

REDUCED FACSIMILE OF FRONT PAGES IN FILSON'S "KENTUCKE"

It is not only the first history of Kentucky but it is the first work to discuss the rocks, minerals, soils and terrain of this Commonwealth.

State	No.	State	No.
New Hampshire	10	South Dakota	69
New Jersey	21	Tennessee	95
New Mexico	31	Texas	254
New York	62	Utah	29
North Carolina	100	Vermont	14
North Dakota	53	Virginia	100
Ohio	88	Washington	39
Oklahoma	77	West Virginia	55
Oregon	36	Wisconsin	71
Pennsylvania	67	Wyoming	23
Rhode Island	5		
South Carolina	46	Total	3,072

Armstrong County, South Dakota, with an area of 540 square miles, and 1 person to each 5 square miles, has no post office, while Allegheny County, Pennsylvania, with an area of 725 square miles, has 150 named offices. San Bernardino County, California, is the largest in the United States, having an area of 20,175 square miles. New York County, New York State, is the smallest and has an area of only 22 square miles. Bristol County, Rhode Island, is next, with 24 square miles. Texas, as might be expected, has the largest number of counties, and Delaware the smallest number.

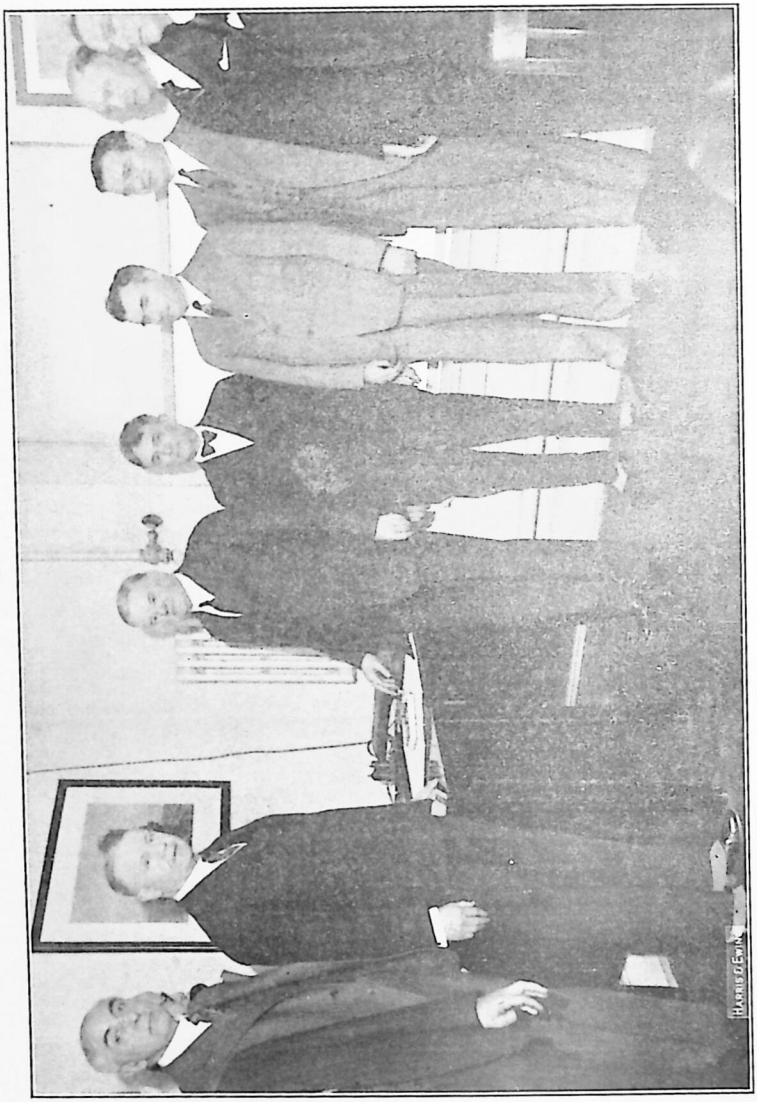
The post office at Leadville, Colorado, is probably the highest in the United States—10,190 feet above sea level. Calipatria, in southern California, is 175 feet below sea level. Frankfort, Kentucky, is 511 feet above the sea. Areas which in other States would be called counties in Louisiana are called parishes.

TOPOGRAPHIC BASE MAPPING

The 1930 General Assembly of Kentucky appropriated in the regular Budget Bill $100,000.00 annually from the general revenues of the State Highway Department for co-operative topographic base mapping in Kentucky for the benefit of the State Highway Department and the people of the State generally. The appropriation was carried in the Highway Department budget and became a law.*

Pursuant to this law the State Geologist in the latter part of March entered into a contract with the United States Geological

* Acts of the General Assembly of the Commonwealth of Kentucky, Chapter 164, Section 48, paragraphs two and four, pp. 582 and 583, in the year 1930.



PRESIDENT HERBERT HOOVER RELEASING KENTUCKY PRODUCED NATURAL GAS INTO WASHINGTON, D. C., CONSUMING LINES. THIS EVENT TRANSPIRED IN THE WHITE HOUSE EARLY IN 1931.

Survey, topographical branch, signed by the Director, Dr. Geo. Otis Smith, whereby the U. S. Geological Survey and the Kentucky Geological Survey would each appropriate during the biennium beginning April 1st, 1930, and extending through to July 1, 1932, Two Hundred Thousand Dollars ($200,000.00), making a total of Four Hundred Thousand Dollars ($400,000.00).

At the same time arrangements were made for the bringing into Kentucky of about eighty (80) topographers and their assistants—the largest group of topographical engineers ever brought together anywhere in the United States for the execution of a cooperative piece of State work. This was carried out by the U. S. Geological Survey and men were sent to Kentucky on April 1, 1930, and worked throughout the month of April at various points in the State on the unmapped areas in western, central and eastern Kentucky. The co-operative agreement providing for this important survey follows.

COOPERATIVE AGREEMENT

AGREEMENT between the Director of the U. S. Geological Survey and the Director of the Kentucky Geological Survey for cooperative topographic surveys in the STATE of Kentucky.

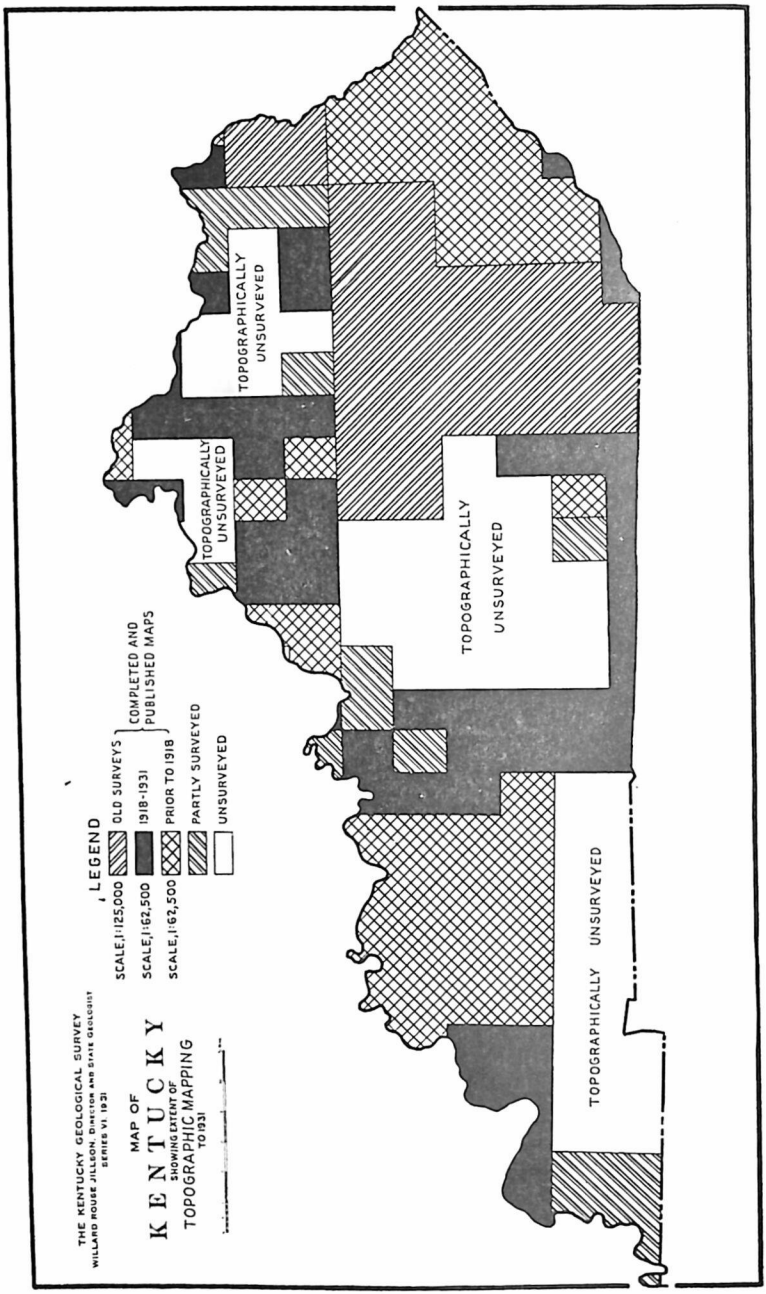
1. The field surveys shall be made and the maps resulting therefrom shall be prepared under the supervision of the DIRECTOR of the U. S. Geological Survey, who shall determine the scale and the methods to be employed in the field and office to insure accuracy in the construction of the final map.

2. The order in which different areas are to be surveyed shall be agreed upon in detail by the above-named officials, or their representatives.

3. The field surveys shall be executed in a manner sufficiently elaborate to prepare maps for reproduction on scales which may be agreed upon for different localities, exhibiting the relief (by means of contour lines), watercourses, public culture, and all civil boundaries, including township and section lines as marked upon the ground at the time the field survey is executed.

4. The relief shall be shown by contour lines with vertical intervals ranging from 5 to 100 feet as may hereafter be mutually agreed upon for specific areas, and the elevations above mean sea level of all bench marks and important points shall be determined and furnished to the cooperating official.

5. The total expense of executing field surveys and the office preparation of the resulting maps for publication shall be divided



SKETCH SHOWING EXTENT OF TOPOGRAPHIC MAPPING IN KENTUCKY TO 1931

between the two contracting parties in such manner as to equalize all expenses, provided that the Kentucky Geological Survey shall expend TWO HUNDRED THOUSAND DOLLARS ($200,000.) during the biennium April 1, 1930, to March 31, 1932, and that the U. S. Geological Survey shall expend TWO HUNDRED THOUSAND DOLLARS ($200,000.) during the period July 1, 1930, to June 30, 1932, contingent upon the Congress appropriating funds to cover, ONE HUNDRED THOUSAND DOLLARS ($100,000.) of which amount is to be expended during the period July 1, 1930, to June 30, 1931, and the remaining ONE HUNDRED THOUSAND DOLLARS ($100,000.) during the period July 1, 1931, to June 30, 1932. The Federal allotment shall bear a charge of 12½ per cent which shall be set aside to pay certain administrative and operating expenses incidental to cooperative mapping for which no charge is made against the cooperative funds and the State allotment shall bear a charge of 5 per cent to be set aside to pay certain State administrative and operating expenses. All accounts shall be approved by a representative of the U. S. GEOLOGICAL SURVEY and settled in conformity with rules and regulations governing the payment of Federal or State accounts.

6. During the progress of the work free access to the field sheets and records shall be afforded to the cooperating official or his representative, for examination and criticism; and should said official deem that the work is not being executed in a satisfactory manner, then he may on formal notice, terminate this agreement.

7. The resulting maps shall fully recognize the cooperating agency.

8. When the work is completed, the cooperating official shall be furnished by the U. S. Geological Survey with photographic copies of the manuscript sheets; and at any time after the final publication is completed he shall be furnished by the said SURVEY with transfers from the plates of the maps for use in printing editions of said maps.

Washington, D. C.
Mar. 11, 1930
3/14/30
FLEM D. SAMPSON
3/22/1930
Approved:
Governor

GEO. OTIS SMITH,
Director, U. S. Geological Survey
W. R. JILLSON,
Director, Kentucky Geol. Survey

On April 17, 1930, the Chairman of the State Highway Commission, Mr. Ben Johnson, of Bardstown, Kentucky, supported by an adverse resolution of the State Highway Commission based upon an oral opinion of an Assistant Attorney General of Kentucky, notified the State Geologist in writing not to enter into any agreement for cooperation with the U. S. Geological Survey on behalf of the Highway Commission in this matter.

The resolution further requested the Hon. Clell Coleman, Auditor of Public Accounts, not to pay any accounts that might be developed as a result of agreement so entered into between the Kentucky Geological Survey and the U. S. Geological Survey, basing its action upon the assertion of an Assistant Attorney General that the law was unconstitutional and invalid. The chairman's letter and the pertinent excerpt from the Minutes of the State Highway Commission follow:

STATE HIGHWAY COMMISSION
BEN JOHNSON, CHAIRMAN
BARDSTOWN, 4TH DIST.
A. P. PLUMMER, SECRETARY
FLEMINGSBURG, 7TH DIST
R. M. SHELBOURNE, MEMBER
BARDWELL, 1ST DIST.
J. K. WALLER, MEMBER
MORGANFIELD, 2ND DIST

COMMONWEALTH OF KENTUCKY
STATE HIGHWAY DEPARTMENT
FRANKFORT

STATE HIGHWAY COMMISSION
E. G. DENT, MEMBER
BOWLING GREEN, 3RD DIST.
J. L. DONALDSON, MEMBER
CARROLLTON, 5TH DIST.
CHARLES F. MONTGOMERY, MEMBER
LIBERTY, 6TH DIST.
ZACH JUSTICE, MEMBER
PIKEVILLE, 8TH DIST.

April 17, 1930.

Dr. W. R. Jillson,
State Geologist,
Frankfort, Kentucky.

Dear Sir:--

For your information I am enclosing herewith an order passed by the State Highway Commission of Kentucky in its meeting of this date.

Very truly yours,
Ben Johnson
BEN JOHNSON
CHAIRMAN.

AMS
Encl.

FACSIMILE OF CORRESPONDENCE ENCLOSING COMMISSION'S ORDER

EXCERPTS FROM THE MINUTES OF THE
MEETING OF THE STATE HIGHWAY COMMISSION HELD

APRIL 17, 1930.

Upon advice and recommendation of the Attorney General, on motion made, duly seconded and unanimously carred, the Chairman of the Commission is directed to notify Dr. W. R. Jillson, State Geologist, and the Hon. Clell Coleman, Auditor of Public Accounts, that the provision in the Appropriation Bill making appropriation to the State Highway Commission for the biennial period from April 1, 1930 to March 31, 1932, which purports to appropriate $100,000.00 per year for topographical mapping to be done under the direction of the State Director of the Geological Survey, $2,000.00 of which per year to include the salary of the State Geologist, is invalid and unconstitutional; and that the said State Geologist be directed not to incur or undertake to incur any obligations to be paid from the said purported appropriations, and the Auditor of Public Accounts is to be requested not to make any payments for topographical mapping done under the direction of the State Geologist from the State Road Fund.

It is further ordered by the State Highway Commission that said topographical mapping not be done as a charge against the State Road Fund or any part thereof, because the same would constitute the use of the road fund for purposes other than that for which the taxes constituting said fund were levied and an expenditure wholly unconnected with the construction, reconstruction or maintenance of State Primary roads and which would be of no value to the State Highway Commission of Kentucky in the construction, reconstruction, repair or maintenance of State roads.

It is further ordered that the Chairman furnish the State Geologist and the State Auditor a certified copy of this order.

CC-- Dr. W. R. Jillson
Hon. Clell Coleman.
April 17, 1930.

I hereby certify that the above and foregoing is a true, complete and exact copy of an order passed by the State Highway Commission in its meeting of above date.

STATE HIGHWAY COMMISSION
BY Ben Johnson, Chm.,
Anne M. Schoolfield
Chief Clerk.

CERTIFIED FACSIMILE OF COMMISSION'S ORDER.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON April 19, 1930.

Dr. W. R. Jillson,
State Geological Survey,
Frankfort, Kentucky.

My dear Doctor Jillson:

There is inclosed, in response to your telegram of today, copies of letters and some correspondence received from various State highway engineers and others interested in road building, which show the value and importance of our topographic maps. I trust that this information will be of service to you in your battle with the Kentucky State Highway Commission.

I hope that you will appreciate our situation here with reference to the ruling of your Attorney General in that we plan to withdraw our topographic parties immediately should the State Highway Commission's decision be adverse. Our Federal regulations are mandatory to the effect that no overdraft in any State cooperative program can be allowed unless we are certain that such State funds are forthcoming after the close of the fiscal year. In the case of Kentucky the situation is so undecided that in case the court decision should go against you, a large overdraft would be very embarrassing to us to explain to either the Committee on Appropriations or our Comptroller General, and I for one would not care to get into that sort of a mess. I have the support in this of the Director.

The parties now at work in Kentucky have all been reallocated and as soon as definite information is received that the State Highway Commission will not approve vouchers will be immediately withdrawn and returned later in case the court decision is in your favor.

The overdraft also applies to any office drafting and, inasmuch as the Federal balance will be used up this month, there will be no funds available for the office drafting on the sheets which have not yet been lithographed and they will be held up until such time as State funds are available.

Very truly,

(Inclosures)

J. G. Staack

J. G. STAACK
Chief Topographic Engineer.

FACSIMILE OF J. G. STAACK CORRESPONDENCE

Finally on May 1, 1930—the April accounts being unpaid though having been presented formally to the Highway Commission on the 22nd of April, 1930, were refused payment—the U. S. Geological Survey recognized a breach of contract as between the State of Kentucky and the U. S. Government in the matter of the topographical survey in Kentucky and withdrew every man. The following letter advising that this action was contemplated had been received by the State Geologist April 22, 1931: (See letter on preceding page.)

As a natural result of the failure of the State Highway Commission to cooperate with the Geological Survey throughout the past biennium, Kentucky, about 70% topographically mapped and now provisioned with an appropriation of $400,000.00 for a continuation of this work, has witnessed a complete cessation of its topographical mapping program. While this is greatly to be regretted in view of the importance of completing this program in Kentucky where road building and mineral development are only in their infancy, one must look deeper than the mere statement that "the act is unconstitutional" or that "topographical mapping would be of no value to the State Highway Commission of Kentucky" The facts relative to the use of topographical maps of Kentucky by the State Highway Commission, and its employees during the past ten or twelve years, are in the main summarized as follows:

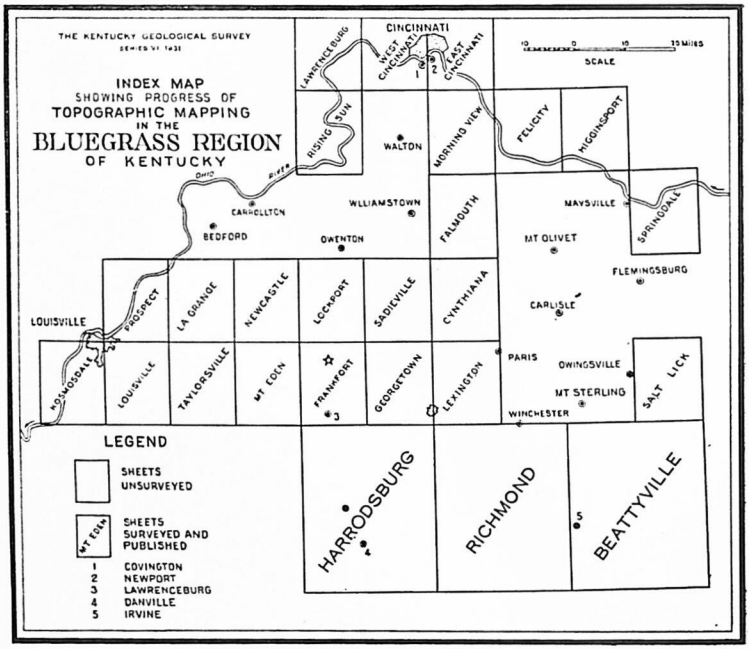
(Memoranda relative to use of U. S. Geological Survey topographical data, maps, levels, etc., by Kentucky State Highway Department 1918-1930).

(1) Since 1918 to date—12 years—the Kentucky Geological Survey has been supplying, gratis on a cooperative basis, under the direction of the present State Geologist, to the Kentucky State Highway Department upon request topographical sheets. Specifically from July 15, 1929, to April 24, 1930, records kept by the Kentucky Geological Survey show that a minimum of 884 maps have been supplied upon request to the Kentucky State Highway Department. The total number of maps delivered to the Kentucky State Highway Department upon request, by the Kentucky Geological Survey during the last twelve years is not known exactly, but the figure extends well up into the thousands.

(2) At various intervals since 1918—12 years—the Kentucky Geological Survey has supplied to the Kentucky State Highway Department upon request copies and manuscripts of Standard U. S. G. S.

bench marks together with description of same. These bench marks are a part of the topographic work and data.

(3) In November, 1929, the Kentucky Geological Survey supplied directly from the Topographical Branch of the U. S. Geological Survey a single consignment of unpublished (manuscript) precise level data



TOPOGRAPHIC MAPS IN KENTUCKY'S BLUEGRASS AREA

scattered throughout Kentucky totaling about 10,000 or 15,000 bench marks. These data were secured for the single purpose of standardizing many previous road surveys and all future road surveys to the accepted U. S. G. S. sea level datum.

(4) During 1928-1929 Mr. R. O. Parsons, Chief Locating Engineer of the Kentucky State Highway Department, requested the immediate mapping of the Cynthiana, Falmouth and Morning View Quadrangles for purposes of relocation of the Eastern Dixie Highway No. 27. This was done and these sheets have already been used in connection with this proposal.

Major E. S. Helburn, Commissioner, in 1926 requested the mapping of the Middlesboro Quadrangle for road purposes. This has been completed.

Mr. W. C. Hanna, Commissioner, requested in 1926 the mapping of

the Taylorsville and LaGrange quadrangles; and in 1928 the mapping of the Pleasureville quadrangle (now the New Castle quadrangle). This work was done.

Mr. W. C. Montgomery, Commissioner, in 1928 requested the mapping of the Big Clifty quadrangle This sheet was mapped and has been used by the highway department.

Mr. W. C. Owen, Commissioner, in 1928 requested the mapping of the following quadrangles: Smithland, Paducah, LaCenter and Mound City. This considerable amount of topographical mapping was completed forthwith and the resulting sheets have been used in State highway work.

Mr. Con Craig, Commissioner, in 1929 requested the mapping of the Eddyville, Wickliffe, Hickman, Blandville and Water Valley quadrangles. The Eddyville sheet was mapped and the others named in this report were in process when the cooperative work was slowed down by failure of the Highway Department to meet the financial obligations entailed by the work as provided by the law.

The Bridge Department, through Mr. H. R. Creal and Mr. John Lynch, requested that the Burnside sheet be completed during 1928-1929. This was done and this sheet was advanced to the State Highway Department some time ago.

Mr. R. O. Parsons, Chief Locating Engineer, Kentucky State Highway Department, requested the completion of the Creelsboro, Burkesville and other adjacent quadrangles in 1929. These were in progress when the topographical work ceased in April, 1930.

(5) Since 1926 when the first Kentucky Highway Department cooperative agreement became effective the Kentucky Geological Survey has supplied to the Kentucky State Highway Department, upon urgent request, preliminary photographs of the completed fractional and full topographical sheets as they were inked and in process. This indicates the rapidity with which these topographical data were in demand, produced and absorbed by the Kentucky State Highway Department—Engineering Division.

USE OF TOPOGRAPHIC MAPS IN ROAD WORK

The certainty of the primary importance of topographical maps in State and Federal road building, if it is not immediately evident and understandable by any intelligent person, is established by the following affidavit and correspondence:

AFFIDAVIT

State of Kentucky }
County of Franklin } Set:

I hereby certify that during the summer and fall of 1925, I was engaged, as a representative of the United States Geological survey in making topographic contour maps in the state of Tennessee, and in

cooperation with the Tennessee Highway Commission, J. G. Creveling, Commissioner.

These topographic maps extended from Nashville, Tennessee, to Clarksville, Tennessee, and covered several hundred square miles.

I further certify that the United States Geological survey has cooperated with numerous states and municipalities in the United States during the past ten years in making topographic contour maps for the purpose of location of highways and bridges.

I further certify that the highway department of the state of Kentucky has used very extensively in the past these topographic maps and level bench marks as established by the United States Geological Survey.

R. L. HARRISON

Subscribed and sworn to before me by R. L. Harrison Senior Engineer, United States Geological Survey, this 19th day of April, 1930.

(Seal) GLADYS E. ELLIS,
Notary Public, Franklin County, Ky.

My commission expires May 31, 1932.

United States
DEPARTMENT OF THE INTERIOR
Geological Survey
Washington

Oct. 10, 1930

Dr. W. R. Jillson,
State Geologist and Director,
Kentucky Geological Survey,
Frankfort, Kentucky.

My dear Doctor Jillson:

Reference is made to your letter of October 6.

The States of Delaware, New Hampshire, Oklahoma, and Tennessee are the only ones in which the United States Geological Survey has entered into cooperative agreements directly with the State Highway Departments.

At the present time, the Highway Departments of Michigan and Missouri have pooled their funds with other State agencies and are cooperating in topographic surveys through their respective State Geological Survey organizations, but no maps have been published so far under this arrangement.

Very truly yours,
JULIAN D. SEARS,
Acting Director.

Throughout the latter part of April the Director of this Survey personally urged the Chairman and Members of the

State Highway Commission to meet and pay the topographical payroll which he had received from the U. S. Geological Survey at Washington, D. C., and had approved. The payment of this payroll presented by the State Geologist to the Chairman of the Highway Commission, personally, was finally and flatly refused. The correspondence advising of this action was received on May 8 and 9, 1930 by the State Geologist. It is reproduced herewith.

STATE HIGHWAY COMMISSION
BEN JOHNSON, CHAIRMAN BARDSTOWN, 4TH DIST.
A. P. PLUMMER, SECRETARY FLEMINGSBURG, 7TH DIST.
R. M. SHELBOURNE, MEMBER BARDWELL, 1ST DIST.
J. K. WALLER, MEMBER MORGANFIELD, 2ND DIST

COMMONWEALTH OF KENTUCKY
STATE HIGHWAY DEPARTMENT
FRANKFORT

STATE HIGHWAY COMMISSION
E. G. DENT, MEMBER BOWLING GREEN, 3RD DIST.
J. L. DONALDSON, MEMBER CARROLLTON, 5TH DIST.
CHARLES F. MONTGOMERY, MEMBER LIBERTY, 6TH DIST.
ZACH JUSTICE, MEMBER PIKEVILLE, 8TH DIST.

May
Seven
1 9 3 0

Dr. W.R. Jillson,
Director and State Geologist
Frankfort, Kentucky

Dear Sir:

On April 23rd, the State Highway Commission passed the following order which is self-explanatory:

> "GEOLOGICAL SURVEY. The Chairman presented to the Commission for its consideration a payroll amounting to $10, 199.90, submitted by Dr. W. R. Jillson, State Geologist, for payment out of the Road Fund. Acting upon advice heretofore given by the Attorney General's office, the Commission declines to approve said payroll. None of those whose names appear upon the payroll was employed or authorized to be employed by the Highway Commission, nor was the compensation fixed by the Commission."

Yours very truly,

H.D. Palmore

H.D.PALMORE
CHIEF ENGINEER

LIGON:FW

FACSIMILE CORRESPONDENCE OF H. D. PALMORE

EXCERPTS FROM THE MINUTES OF THE MEETING OF THE STATE HIGHWAY COMMISSION HELD April 23, 1930

GEOLOGICAL SURVEY.

The Chairman presented to the Commission for its consideration a payroll amounting to $10,199.90, submitted by Dr. W. R. Jillson, State Geologist, for payment out of the Road Fund.

Acting upon advice heretofore given by the Attorney General's office, the Commission declines to approve said payroll. None of those whose names appear upon the payroll was employed or authorized to be employed by the Commission, nor was the compensation fixed by the Commission.

CC—Dr. W. R. Jillson

May 9, 1930.

I hereby certify that the above and foregoing is a true, complete and exact copy of an order passed by the State Highway Commission in its meeting of above date.

STATE HIGHWAY COMMISSION,
By Anne M. Schoolfield, Chief Clerk.

Faced with these difficulties the efforts of the State Geologist were then actively extended over a period of nearly a month through many friends of the Survey and its progressive program for the completion of the Topographical Survey in Kentucky, but without success. The aid of the Attorney General, the Hon. J. W. Cammack, was sought but he orally declared himself to be opposed to the continuation of this Survey and further indicated that he would avail himself of all legal prerogatives to render negative any action which might be taken looking towards an interpretation by the Courts of the Constitutionality and legality of this Budget enactment. The fact that the law was essentially the same as that under which the Survey had been operating for the past four years was called to the attention of the Attorney General but without avail. However, on August 8, 1930, the Kentucky State Budget Commission, answering a written request by the State Geologist for a construction of intent in the topographic appropriation enactment, replied favorably to a continuation of the project, as may be seen below.

CONSTRUCTION OF THE STATE BUDGET COMMISSION AS TO TOPOGRAPHIC MAPPING

At a meeting of the Budget Commission of Kentucky, held at the office of the Governor on August 8, 1930, there was presented for con-

sideration by the Commission the appeal of Dr. W. R. Jillson, State Geolgist of the Geological Survey, from a construction of the Act of the General Assembly, known as House Bill No. 92, for the fiscal years ending March 31, 1931, and March 31, 1932, as set forth in the communication from said State Geologist to the Hon. Clell Coleman, Auditor of the State of Kentucky, in a letter of date May 20, 1930, the appeal therefrom being indicated and set forth in a letter to this Commission from the said State Geologist of the Geological Survey of date May 28, 1930. The Commission having considered said matters presented to it in said appeal, and construes the aforesaid acts of the General Assembly as follows:

(a) The meaning of the term in said Act "that $100,000.00 be set aside and expended, etc", is not that the Highway Department may in its discretion or judgment determine what part, or any, of said sum of $100,000.00 shall or may be so expended. It is furthermore the construction of the Commission that the true intent, meaning and purposes of said Act is that upon the Governor's advice and recommendation so much of said sum as does not exceed $100,000.00 for each of said fiscal years shall be set apart to the said State Geologist of the Geological Survey for the purposes as stated in said Act, and that such recommendation of the Governor in connection with the terms of the said Act are conclusive and binding on the Highway Department, as well as upon the Auditor of the State.

(b) Under the terms of the said Act the State Geologist of the Geological Survey determines and selects what employees are engaged in doing said surveying and mapping. The Highway Department does not determine either of said facts.

(c) Said employees are to be paid their wages and expenses upon a certificate of the said State Geologist of the Geological Survey and not upon the certificate of the Highway Department.

PARAGRAPH II.

That the construction be set up on the appropriation books in the budget account in the State Geologist of the Geological Survey of the said appropriation of $100,000.00 for the purposes mentioned in said Act for the fiscal year ending March 31, 1931.

PARAGRAPH III.

The foregoing interpretation and construction of said Act for the fiscal year 1931 is applied to the said appropriation under said Act for the fiscal year ending March 31, 1932.

All of which is directed to be entered upon the records of the proceedings of this Commission, a copy certified to the State Geologist of the Geological Survey, Auditor of the State of Kentucky, and the State Highway Commission.

This August 8, 1930.

BUDGET COMMISSION OF KENTUCKY,

Flem D. Sampson, Chairman

Jno. B. Lewis, Member

Attest:

R. E. Keown, Budget Officer.

Although no progress in breaking the impasse in the matter of the Topographical Survey in Kentucky was made during the field season of 1930—which from a climatic standpoint was excellent—the State Geologist endeavored in the Spring of 1931 to revive active field work by suggesting that the incomplete Sadieville Quadrangle (parts of Scott, Franklin, Owen and Harrison Counties) be brought to a finished state. He addressed Mr. J. G. Staack, Chief Topographic Engineer, c/o the U. S. Geological Survey, Washington, D. C., relative to this matter May 15, 1931. The following reproduction of Mr. Staack's letter was received May 20, 1931, indicating that until Kentucky provided funds, the co-operative (dollar for dollar) topographic mapping in Kentucky is at an end. No topographical work in Kentucky has been done, therefore, since the various parties were disbanded in the State on April 30, 1930. The order names of all completed topographical sheets are given in the list of available publications in the latter part of this report.

United States
DEPARTMENT OF THE INTERIOR
Geological Survey
Washington

May 20, 1931.

Dr. W. R. Jillson,
Director, Kentucky Geological Survey,
Frankfort, Ky.

My dear Doctor Jillson:

In reply to your letter of May 15 regarding the status of the Sadieville, Kentucky, quadrangle:

The unmapped portion of the Sadieville quadrangle amounts to approximately 30 square miles and it will require approximately $1,400 to complete the field work, office inking, etc., including the photolithography of the finished map.

It would, however, be out of the question on the part of the Geological Survey to take up the completion of the mapping of this quadrangle until the Kentucky portion ($7,026) of the existing overdraft incurred on account of cooperation in April and May of 1930 has been liquidated. I am sure that the Acting Director would not sign another cooperative agreement for the amount necessary to complete the Sadieville quadrangle unless this is done.

Very truly,

J. G. STAACK,
Chief Topographic Engineer.

MINERAL RESOURCE PRODUCTION

STATISTICAL SUMMARY OF KENTUCKY'S MINERAL RESOURCES[1]

Calendar Year of 1928

Name	Volume	Value
Asphalt (natural rock)	292,777 tons	2,342,216.00
Carbon Black	484,000 lbs.	24,000.00
Clay (raw)	120,000 tons	663,000.00
Clay products		7,217,991.00
Coal*	61,860,379 tons	96,722,000.00
Fluorspar	69,747 tons	1,426,766.00
Gasoline (from natural gas)	6,900,000 gals.	544,000.00
Hydro-electric Power	290,000,000 K. W. hrs.	730,000.00
Iron (pig)	225,545 tons	4,398,127.00
Natural gas	18,750,000 M. cu. ft.	6,000,000.00
Petroleum	7,301,089 bbls.	11,208,022.00
Sand and gravel	2,100,907 tons	1,589,617.00
Stone (All grades)	2,800,000 tons	3,080,000.00
Miscl. (Abrasives, artificial gas, barite, calcite, coke, lead, cement, mineral fertilizers, mineral waters, zinc, and minerals consumed in operation and without sale		5,550,000.00
Total		$141,495,739.00

[1] All figures secured from U. S. Bureau of Mines and U. S. Dept. of Census except those for natural gas which are estimates of the writer.
* U. S. Bureau of Mines.

STATISTICAL SUMMARY OF KENTUCKY'S MINERAL RESOURCES[1]

Calendar Year of 1929

Name	Volume	Value
Asphalt	240,346 tons	$2,785,772.00
Clay (raw)	153,618 tons	793,099.00
Clay products		7,062,220.00
Coal	60,462,600 tons	93,283,000.00
Fluorspar	70,827 tons	1,390,603.00
Gasoline (from natural gas)	6,006,000 gals	486,000.00
Hydro-electric Power	299,435,000 K. W. hrs.	1,045,000.00
Iron (pig)	194,150 tons	3,397,625.00
Lead	287 tons	36,162.00
Natural gas	27,588,000 M. cu. ft.	8,822,000.00
Petroleum	7,775,000 bbls.	13,220,000.00
Sand and gravel	2,350,430 tons	1,581,501.00
Stone (All grades)	2,447,540 tons	2,587,592.00

Miscl. (Abrasives, artificial gas, barite, calcite, coke, cement, mineral fertilizers, mineral waters, zinc, and minerals consumed in operation and without sale	7,260,435.00
Total value, year 1929	$143,751,009.00
Total value, year 1928	141,495,739.00
Total value, year 1927	167,086,186.00

[1] All figures secured from the U. S. Bureau of Mines except those on hydro-electric power and minerals consumed in operation which are the estimates of the writer.

PRODUCTION OF PETROLEUM IN BARRELS IN KENTUCKY[1]
From 1883 to 1928, inclusive

Year	Bbls.
1883	4,755
1884	4,148
1885	5,164
1886	4,726
1887	4,791
1888	5,096
1889	5,096
1890	6,000
1891	9,000
1892	6,500
1893	3,000
1894	1,500
1895	1,500
1896	1,680
1897	322
1898	5,568
1899	18,280
1900	62,259
1901	137,259
1902	185,331
1903	554,286
1904	998,284
1905	1,217,337
1906	1,213,548
1907	820,844
1908	727,767
1909	639,016
1910	468,774
1911	472,458
1912	488,368
1913	526,568
1914	502,441
1915	437,274
1916	1,144,750

Year	Bbls.
1917	3,088,160
1918	4,035,950
1919	9,226,437
1920	8,546,027
1921	9,080,845
1922	8,889,303
1923	8,087,250
1924	7,437,232
1925	6,658,803
1926	6,264,502
1927	6,628,110
1928	7,325,291
1929	7,728,947
1930	7,280,819
Total	110,955,402

The volume and value of a few of the outstanding minerals of Kentucky is given herewith:

COAL PRODUCTION IN KENTUCKY†

	Volume	Value
1921	30,282,659 tons	$81,460,352.00
1922	42,134,175 tons	127,037,000.00
1923	43,149,962 tons	113,542,000.00
1924	43,387,732 tons	88,745,968.00
1925	54,689,932 tons	89,404,450.00
1926	63,630,955 tons	110,081,552.00
1927	72,626,000 tons	125,642,980.00
1928	61,634,243 tons	96,732,000.00
1929	60,462,600 tons	93,283,000.00

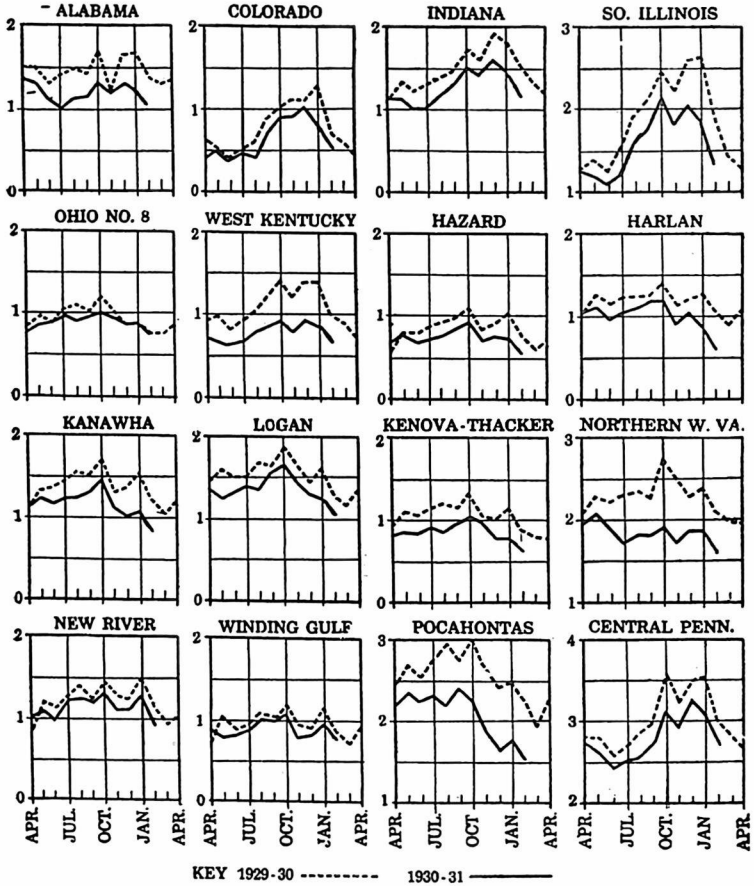
In coal produced Kentucky is now third in the United States.

OIL PRODUCTION IN KENTUCKY*

	Volume	Value
1921	9,080,845 bbls.	$33,556,241.00
1922	8,889,303 bbls.	17,532,766.00
1923	8,087,250 bbls.	15,189,916.00
1924	7,437,232 bbls.	14,418,982.00
1925	6,658,803 bbls.	15,290,167.00
1926	6,264,502 bbls.	15,190,844.00
1927	6,628,110 bbls.	10,315,276.00
1928	7,325,291 bbls.	9,338,738.00
1929	7,728,947 bbls.	13,141,686.00
1930	7,280,819 bbls.	10,426,925.00
Total	75,381,102 bbls.	$154,401,541.00

† Statistics compiled from reports of State Inspector of Mines.
* Statistics compiled from Kentucky State Tax Commission Record.

TWO YEARS' COAL PRODUCTION COMPARED



The trend of production month by month in the sixteen principal coal producing fields of the country is shown in these graphs. In each diagram the dotted line represents the coal year 1929-30, and the heavy black line the coal year 1930-31. The figures at the left indicate millions of tons. The charts were prepared by the United States Bureau of Mines.

COMPARATIVE MOVEMENT OF BITUMINOUS COAL

ROCK ASPHALT

	Tons	Value
1923	139,401	$1,115,208.00
1924	245,929	1,967,932.00
1925	286,850	2,500,000.00
1926	320,430	2,530,480.00
1927	344,220	3,156,700.00
1928	292,777	2,342,216.00
1929	240,346	2,785,772.00

In rock asphalt production Kentucky leads the United States.

FLUORSPAR PRODUCTION IN KENTUCKY

	Volume	Value
1921	18,670.11 tons	$360,146.42
1922	63,322.20 tons	1,170,194.25
1923	56,803.34 tons	1,181,509.47
1924	46,728.07 tons	965,869.20
1925	44,826.00 tons	883,794.00
1926	62,495.00 tons	1,167,129.00
1927	57,495.00 tons	1,040,338.00
1928	71,840.00 tons	1,365,000.00
1929	70,827.00 tons	1,390,603.00
1930	39,181.00 tons	763,370.00
	532,187.72 tons	$10,237,953.34

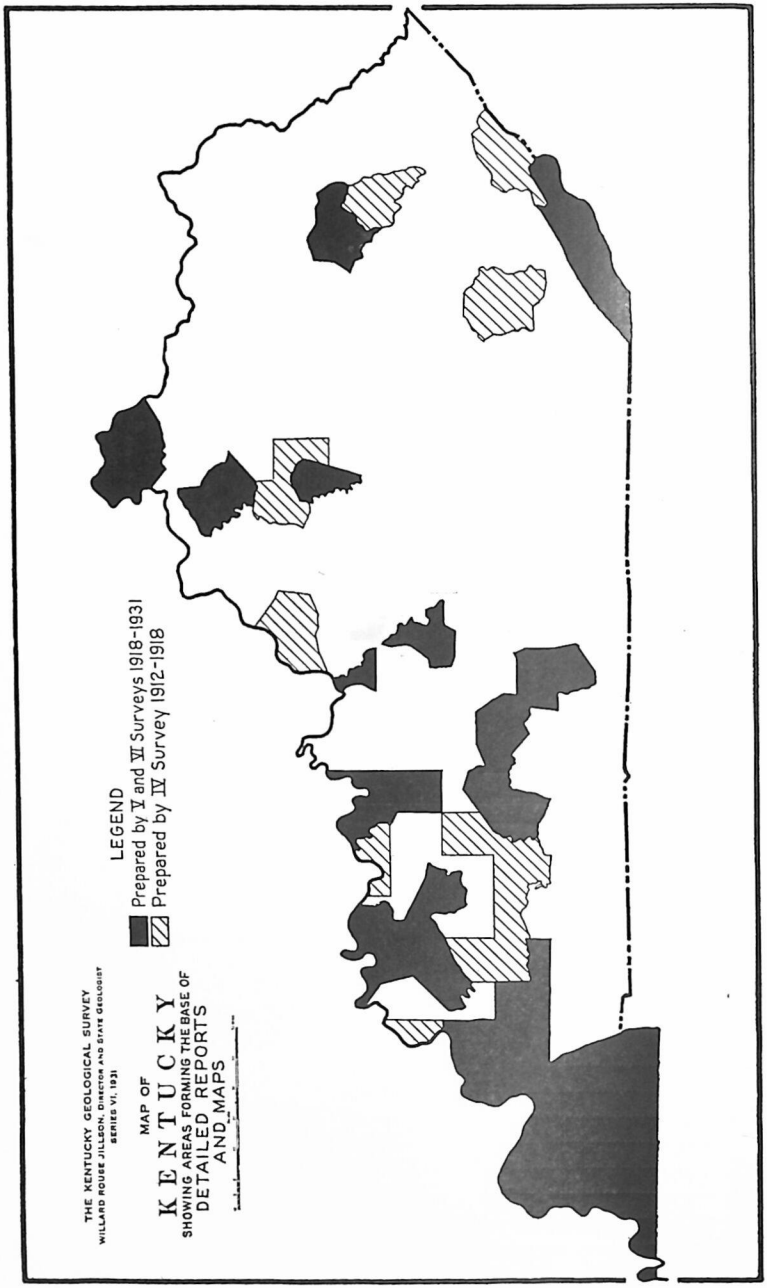
In Fluorite (CaF_2) production Kentucky led the United States until 1930.

NATURAL GAS PRODUCTION IN KENTUCKY

	M. Cu. Ft. Volume	Value
1921	4,820,000	$1,597,000.00
1922	5,872,000	1,879,000.00
1923	11,953,000	3,156,000.00
1924	12,875,000	3,432,000.00
1925*	14,275,000	3,924,250.00
1926**	15,800,000	4,355,000.00
1927**	17,000,000	5,200,000.00
1928**	18,750,000	6,000,000.00
1929	27,588,000	8,822,000.00

CLAY PRODUCTION IN KENTUCKY

	Volume	Value
1921	35,591 tons	$204,400.00
1922	67,591 tons	270,858.00
1923	102,195 tons	428,021.00
1924	115,644 tons	500,349.00
1925	121,917 tons	548,015.00
1926	128,585 tons	706,776.00
1927	119,829 tons	662,149.00
1928	120,000 tons	663,000.00
1929	153,618 tons	793,099.00



DISTRIBUTION OF DETAILED REGIONAL MAPS AND REPORTS OF THE KENTUCKY GEOLOGICAL SURVEY

Of the above recently executed units all maps have been published but the written reports on the following areas still exist as manuscript. Boone, Kenton, Campbell, Owen, Larue, Butler, and Henderson Counties; Cannelton, Fordsville, Smithland and Eddyville quadrangles; and the Jackson Purchase region as a whole.

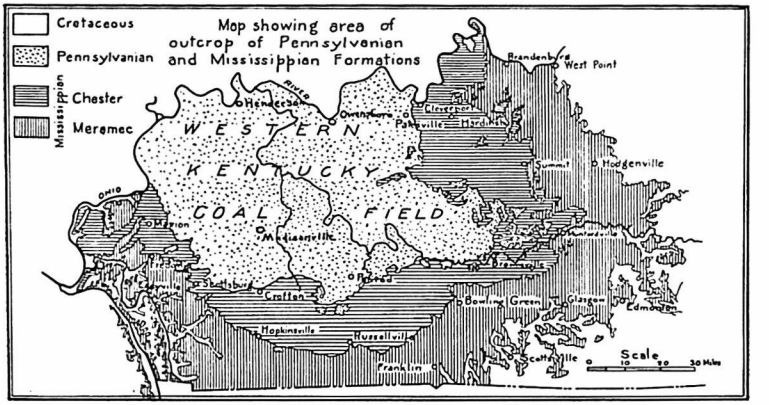
PRODUCTION OF CLAY PRODUCTS IN KENTUCKY: 1930.*

Product	Number of Establishments	Production		Stocks on Hand Dec. 31, 1930
		Quantity	Value	Quantity
Total			$6,119,845	
		Thousands		Thousands
Common brick	17	28,644	289,867	17,827
Face brick	5	7,622	79,247	4,949
		Tons		Tons
Hollow building tile (partition, load-bearing, etc.)	8	12,478	76,194	5,489
Roofing, floor, and faience tile	.....	.....	179,875	.....
Drain tile	7	3,338	22,986	3,636
Sewer pipe	3	32,317	442,970	31,884
		Thousands		Thousands
Fire-clay, brick, block, or tile, for locomotives, etc.	10	91,343	4,111,344	27,718
Other clay products, including pottery	.....	.....	787,745	.....
		Tons		
Clay sold raw or prepared	10	22,254	129,257	.....

*Source: Annual Census of Clay Products, U. S. Bureau of the Census, 1931.

RECOMMENDATIONS TO THE GOVERNOR

Although the United States is at the present time in what has been styled "a temporary or periodic depression," the demand for the maps and reports of the Kentucky Geological



AREAL GEOLOGY OF WESTERN KENTUCKY AND SURROUNDING COAL FIELD.

Much of the detailed economic geology of the Survey during the past two years has centered about this part of the State which has been so productive of oil, gas and coal.

Survey, particularly the recent ones, is continuous and in reality increasing. While for the time being there is witnessed a slackening of interest on the part of industry, this has been more than offset by the growing demand of students and teachers in schools, educational institutions and public libraries in Kentucky. This demand is fundamental in that it represents an awakening at home to the importance of the mineral wealth of the State. It should be cultivated since by so doing the general standard of knowledge of our resources will be increased within the next generation, thereby making possible additional income and better standards of living for the people of the State. Furthermore it is now recognized as beyond argument that the natural resource revealing work of a State Geological Survey should go on in some active and well directed manner continuously over a long period of years, since interruptions of any kind or duration always result in unavoidable losses of sequential data, such as stream gauging, and other geologic information of various descriptions.

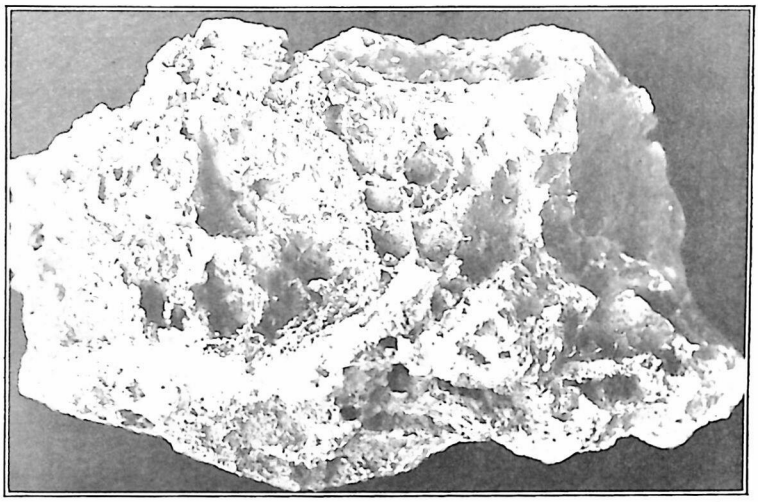
The following definitely outlined program is recommended:

1. A continuation of the activities of the Kentucky Geological Survey throughout the oncoming biennium.

2. New and immediate legislation providing a small emergency fund of $10,000.00 to refund the Survey for printing losses sustained in the fire of the old Capitol—"Executive Wing"—of February 23, 1929, and to refund to the Survey moneys it has expended, upon the authorization of the State Sinking Fund Commission, in making absolutely necessary internal repairs to fire damage in its suite of offices.

3. A direct appropriation as previously for the general maintenance of all of the activities of the Geological Survey during each of the years of the oncoming biennium of $40,000.00.

4. A direct appropriation, rather than from any other departmental fund, for the purposes of advancing the co-operative topographical survey during each of the years of the oncoming biennium of $75,000.00.



WESTERN KENTUCKY FLUORSPAR

This Commonwealth mined during the year 1930, 39,181.00 tons of Fluorite, CaF_2, valued at $763,370.00 and continued to lead the mining industry, other than coal, in Western Kentucky.

LIST OF AVAILABLE MAPS AND REPORTS
JANUARY 1, 1932

Instructions for Ordering: Single copies of any and all maps and reports listed hereunder will be mailed to any interested individual, corporation, company, or institution requesting same, providing the exact fee as indicated is forwarded with the request. Packages will not be sent express collect. The survey will not bill any applicant for required charges. Avoid delay and confusion by accompanying your letter of request with money order or check in the proper amount, addressing: Kentucky Geological Survey, Frankfort,Ky. Please remit in advance. The prices given here supersede those on all previously published lists.

GEOLOGIC REPORTS
SERIES VI.
(1920-1932)

"WILLARD R. JILLSON SURVEY"

Vol. 1.—Glass Sands of Kentucky. C. Richardson. 1920 ..... Edition Exhausted
Vol. 2.—Economic Papers on Kentucky Geology. W. R. Jillson. 1921 ..... Edition Exhausted
Vol. 3.—Oil Fields Stratigraphy of Kentucky. W. R. Jillson ..... Edition Exhausted
Vol. 4.—Geology of the Golconda Quadrangle. Stuart Weller. 1921 ..... Edition Exhausted
Vol. 5.—Geology and Coals of Webster County. L. C. Glenn. 1921 ..... Edition Exhausted
Vol. 6.—Sixth Geological Survey. W. R. Jillson and others. 1921 ..... Edition Exhausted
Vol. 7.—Mississipian Series in Eastern Kentucky. Chas. Butts. 1922 ..... Edition Exhausted
Vol. 8.—Clay Deposits of Kentucky. H. Ries. 1922.. Edition Exhausted
Vol. 9.—Geography of the Jackson Purchase. D. H. Davis. 1923 ..... Edition Exhausted
Vol. 10.—Geology of Princeton Quad. Stuart Weller. 1923 ..... Edition Exhausted
Vol 11.—Building Stones of Kentucky. C. H. Richardson. 1923 ..... Edition Exhausted
Vol. 12.—New Oil Pools of Kentucky. W. R. Jillson. 1927 ..... $1.25
Vol. 13.—Fluorspar Deposits of Kentucky. L. W. Currier. 1923 ..... Edition Exhausted
Vol. 14.—Surface Waters of Kentucky. W. R. King. 1923 ..... $1.25
Vol. 15.—Geological Research in Kentucky. W. R. Jillson. 1923 ..... Edition Exhausted

Vol. 16.—Wild Life in Kentucky. W. D. Funkhouser. 1925 ..... Edition Exhausted
(revision in Mss.)

Vol. 17.—Geology and Mineral Resources of Kentucky. W. R. Jillson. 1928 ..... $1.25

Vol. 18.—Geography of the Mountains of Kentucky. D. W. Davis. 1923 ..... Edition Exhausted

Vol. 19.—Geography of the Kentucky Knobs. W. G. Burroughs. 1926 ..... $1.25

Vol. 20.—Coal Industry in Kentucky. W. R. Jillson. 1924 ..... $1.25

Vol. 21.—Oil Shales of Kentucky. Thiessen, White and Crouse 1925 ..... Edition Exhausted

Vol. 22.—Road Materials of Kentucky. C. H. Richardson. 1924 ..... Edition Exhausted

Vol. 23.—Geography of the Blue Grass. D. H. Davis. 1927 ..... $1.25

Vol. 24.—Geography of the Western Coal Field. W. G. Burroughs. 1925 ..... Edition Exhausted

Vol. 25.—Geography of the Pennyroyal. C. O. Sauer. 1927 ..... $1.25

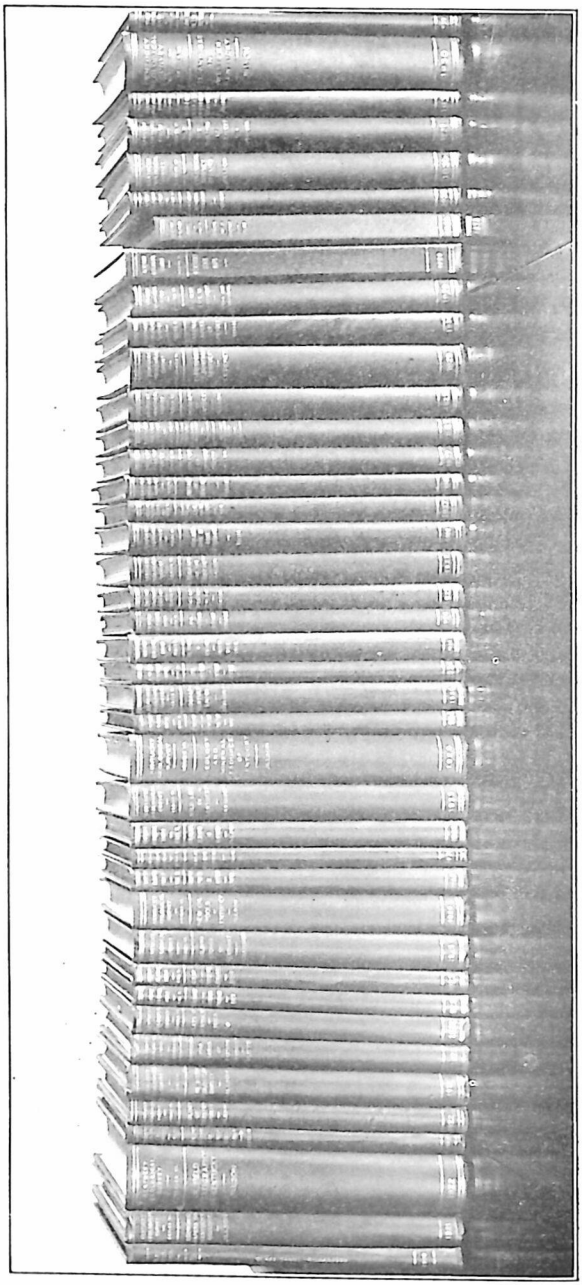
Vol. 26.—Geology of Cave-in-Rock Quadrangle. S. Weller.
—The Elm Lick Coal Bed. James H. Gardner.
—Geology of the Berea Region. W. G. Burroughs.
—Coals of Martin County. J. S. Hudnall.
—Geology of Morgan County. L. C. Robinson.
—Indian Burial Ground, Fullerton, Ky. Lucien Beckner. 1927 ..... $1.25

Vol. 27.—Mineralogy of Kentucky. C. H. Richardson.
—The Elkhorn Coal Field. J. S. Hudnall.
—Coal Losses in Kentucky. F. E. Cash and C. A. Allen. 1925 ..... $1.25

Vol. 28.—Geology of Edmonson Co. J. M. Weller..... $1.25

Vol. 29.—Molding Sands of Kentucky. C. H. Richardson.
—Cement Materials of Kentucky. C. H. Richardson.
—Geology and Coal Resources of the Middlesborough Basin. C. K. Wentworth. 1927 ..... $1.25

Vol. 30.—Topography of Kentucky and other papers on: Cannel Coals, Asphalt, Mineral De-



CLOTH BOUND REPORTS OF THE "SIXTH" KENTUCKY GEOLOGICAL SURVEY, 1920-1931

velopment, State Parks, Glaciation, Ashland Gas Field, Fire and other Clays, Oil Shales, etc. W. R. Jillson. 1927 ..... $1.25

Vol. 31.—Pleistocene of Northern Kentucky. F. Leverett.
—Climate of Kentucky. S. S. Visher
—Geology of the S. Part of the Dawson Springs Quad. A. H. Sutton.
—The Cretaceous Deposits of Trigg, Lyon and Livingston Cos., Ky. J. K. Roberts.
—Geology and Physiography of the Mammoth Cave National Park. A. K. Loebeck. 1929 ..... $1.25

Vol. 32.—Mineral Operators of Kentucky. W. G. Burroughs $1.25

Vol. 33.—Devonian Rocks of Kentucky. T. E. Savage.
—The Geology of the Midland Trail. A. K. Loebeck. 1929 ..... $1.25

Vol. 34.—Ancient Life in Kentucky. Webb and Funkhouser. 1928 ..... $1.25

Vol. 35.—Administrative Report and other Papers on Correlation of Coals in Western Ky., Early Carbonic Deformation in Western Ky., Geology of the Island Creek Oil Pool, Peneplains in Ky., Early Sketches on Ky. Geology, and Kentucky Fluorites. W. R. Jillson. 1930 ..... $1.25

Vol. 36.—Paleontology of Kentucky. (A. Symposium). 131 ..... $4.00

Vol. 37.—Building of Kentucky. W. H. Twenhofle. 1931 ..... $1.25

Vol. 38.—Natural Gas in Western Kentucky. W. R. Jillson. 1931 ..... $1.25

Vol. 39.—Oil and Gas in Western Kentucky. W. R. Jillson. 1931 ..... $1.50

Vol. 40.—Oil and Gas in the Bluegrass Region. W. R. Jillson. 1931 ..... $1.25

Vol. 41.—Vein Deposits in Central Kentucky. L. C. Robinson.
—Insoluble Residues from some Mississippian Limestones. H. G. Martin.
—The Story of the Discovery of Big Bone Lick. E. M. Kindle.
—A Brief Report on the Geology of Hancock County. D. B. Chisholm.

—Tertiary Deposits of Western Kentucky. Joseph K. Roberts.

—Surface Waters of Kentucky—Supplement I.

—Founding of the Survey. J. W. Townsend. $1.25

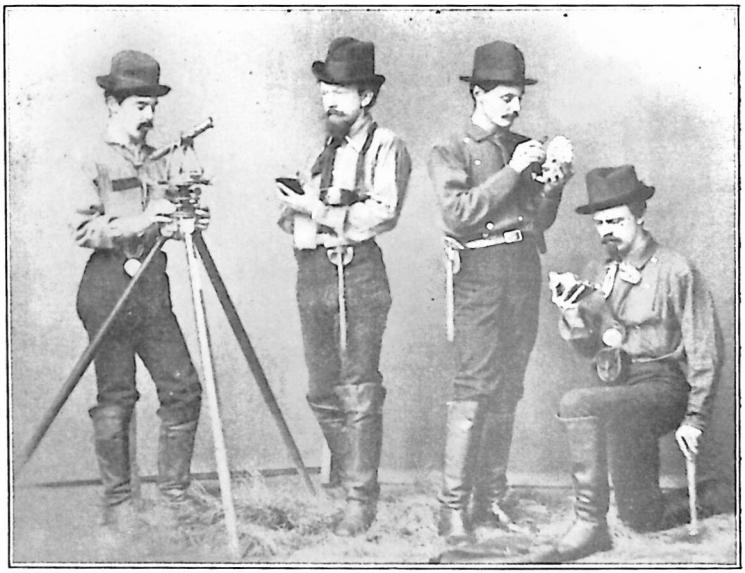
Vol. 42.—Geology of the Deep Wells in Kentucky. W. R. Jillson. 1931 ..... $3.00

Vol. 43.—After Thirteen Years: An Administrative Report with which are presented several separate papers on structural geology and oil and gas, etc. W. R. Jillson. 1931 $1.50

SERIES III. (1904-1912)
"CHARLES J. NORWOOD SURVEY"

Bulletin No. 7.—Silurian, Devonian and Irvine Formation of East Central Kentucky. A. F. Foerste. 1906.. $1.25

Bulletin No. 16.—The Waverlain Formation of East Central Kentucky. W. C. Morste and A. F. Foerste. 1912 ..... .50



W. B. Page C. N. Moore C. J. Norwood Jno. R. Procter

A GROUP OF THE FIELD PERSONNEL OF THE SECOND "PROCTER" GEOLOGICAL SURVEY OF KENTUCKY, 1884

Bulletin No. 18.—Coals of Quicksand Region. F. Julius Fohs. 1912 ..... $ .50

Note: All publications of the First, Second, Fourth and Fifth Surveys (1854-1892; 1912-1920) are completely exhausted in edition.

SERIES VI. PAMPHLETS

PAPER BOUND PUBLICATIONS ON KENTUCKY GEOLOGY

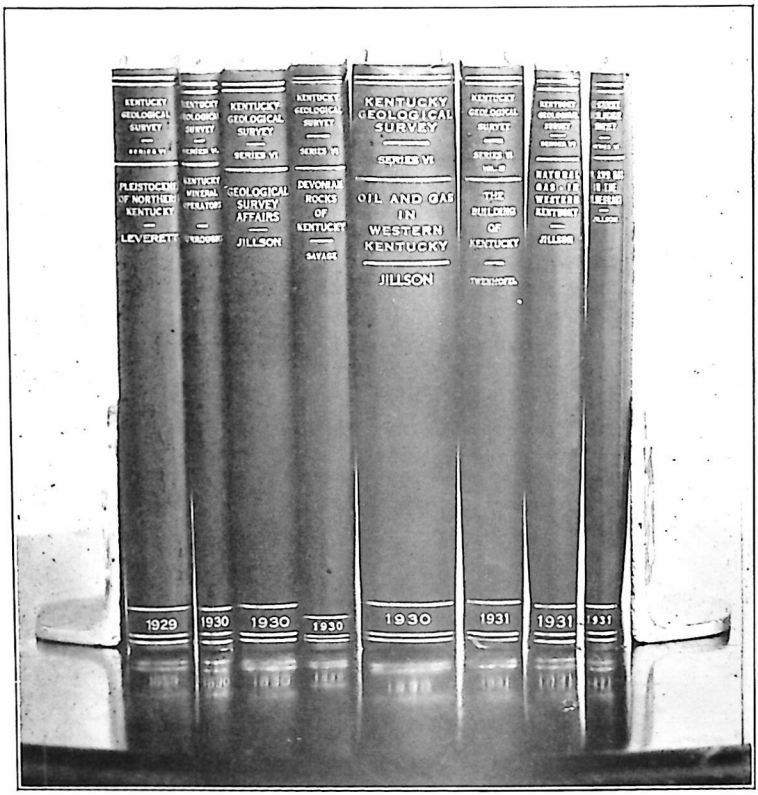
Numbers 1 to 5, inclusive, and 14, 20 and 21 are exhausted.

6. State Parks in Kentucky. Pam. VI. 1926 ..... $0.15
7. Resume of Kentucky's Mineral Resources. Pam. VII. 1926 ..... .15
8. Fireclays of Northeastern Kentucky. Pam. VIII. 1926 ..... .15
9. Clays of Kentucky, The Pam. IX. 1926 ..... .15
10. Oil Shales of Eastern United States. Pam. X. 1926 ..... .15
11. A Bibliography Relating to Geology. Pam. XI. 1926 ..... .15
12. Geology Island Creek Oil Pool. Pam. XII. 1927 ..... .15
13. Kentucky's Mineral Resources. Pam. XIII. 1927 ..... .15
15. Bentonite Deposits of Kentucky. Pam. XV. 1928. (In Press) ..... .20
16. Kentucky Rock Asphalt. Pam. XVI. 1928. (In Press) .15
17. Kentucky State Parks (Geol. of). Illustrated. 1927 ..... .50
18. Hypothesis of a Lost Ozarkia. Maps and Illustrations. 1928. (In Press) ..... .15
19. Geology and Geography of Kentucky. A topical outline. 1928. (In Press) ..... .15
22. Geology and Physicgraphy of the Midland Trail in Kentucky. 1929. Pam. 22 ..... .50
27. The Legrande Oil Pool. W. R. Jillson. 1930 ..... 1.25
28. Geology and Industry. W. R. Jillson. 1931 ..... .50
29. Examination and Comparative Work of the Kentucky Geological Survey. 1930 ..... .15
30. Filson's Kentucke. 3d Ed. W. R. Jillson (In Press) 1.25

REPRINTS

1. Agricultural Perspective of Ky. Geology. Geol. Map. 1925 ..... $0.35
2. American Karst Country. 1924 ..... .15
3. Bibliography, A., of the John Day Region. Oregon. 1923 ..... Exhausted
4. Early Glaciation in Kentucky. 1925 ..... .15
5. Fault Pattern of Kentucky. 1924 ..... Exhausted
6. Glaciation in Eastern Kentucky. 1924 ..... .15
7. Kentucky Cannel Coals. 1924 ..... .15
8. Kentucky Geological Survey, The. 1927 ..... Exhausted
9. Major Drainage Modifications of Big Sandy River. 1926 ..... .15

10. Natural Resources of Kentucky. 1926 ..... $ .15
11. Nest of Sinking Streams. 1927 ..... .15
12. Oil Domes of Ashland. 1926 ..... .15
13. Primeval Tracts of Kentucky, 1924 ..... .15
14. Principal Scientific Achievements of Year 1923. 1923.... .15
15. Shaded Topographic Maps. 1927 ..... .15
16. Unique Devonian Sandbar. 1923 ..... .15
17. Unused Wealth—An Opportunity. 1926 ..... .15
18. Trans. Ky. Academy of Science. 1924 .....Exhausted
19. Kentucky Fluorites. W. R. Jillson 1930 15
20 Geology in the Service of A New National Park W. R. Jillson ..... .15
21. The Geographic Surveys of Kentucky. W. Elmer Ekblaw ..... .15



CLOTH BOUND REPORTS ISSUED DURING THE PAST BIENNIUM

22. Structural Geology of North-Central Kentucky ..... $ .15
23. Early Carbonic Deformation in Western Kentucky. W. R. Jillson ..... .15
24. Peneplains in Kentucky. W. R. Jillson ..... .15

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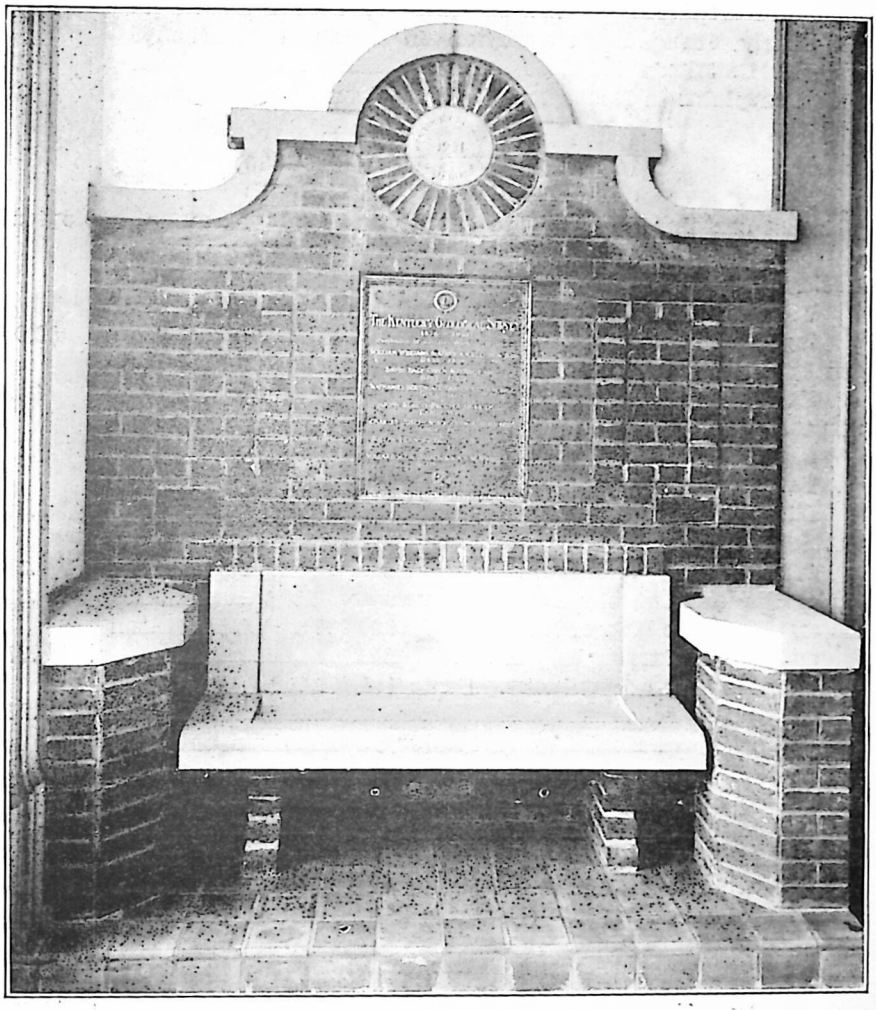

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IN THE NAME AND BY THE AUTHORITY OF THE

COMMONWEALTH OF KENTUCKY

FLEM D. SAMPSON,

GOVERNOR OF SAID COMMONWEALTH.

To all to Whom These Presents Shall Come, Greeting:

Know Ye, That reposing especial trust and confidence in the integrity and ability of Dr. W. R. Jillson of Frankfort Kentucky, I hereby appoint him a Delegate to represent the State of Kentucky at The International Geographical Congress to be held at Paris, France on the 16–24 day of September 1931

Witness my hand at Frankfort, this 28th day of August 1931

Flem D. Sampson Governor

(This appointment does not carry any compensation from the State)

FACSIMILE OF GOVERNOR'S APPOINTMENT TO INTERNATIONAL GEOGRAPHICAL CONGRESS

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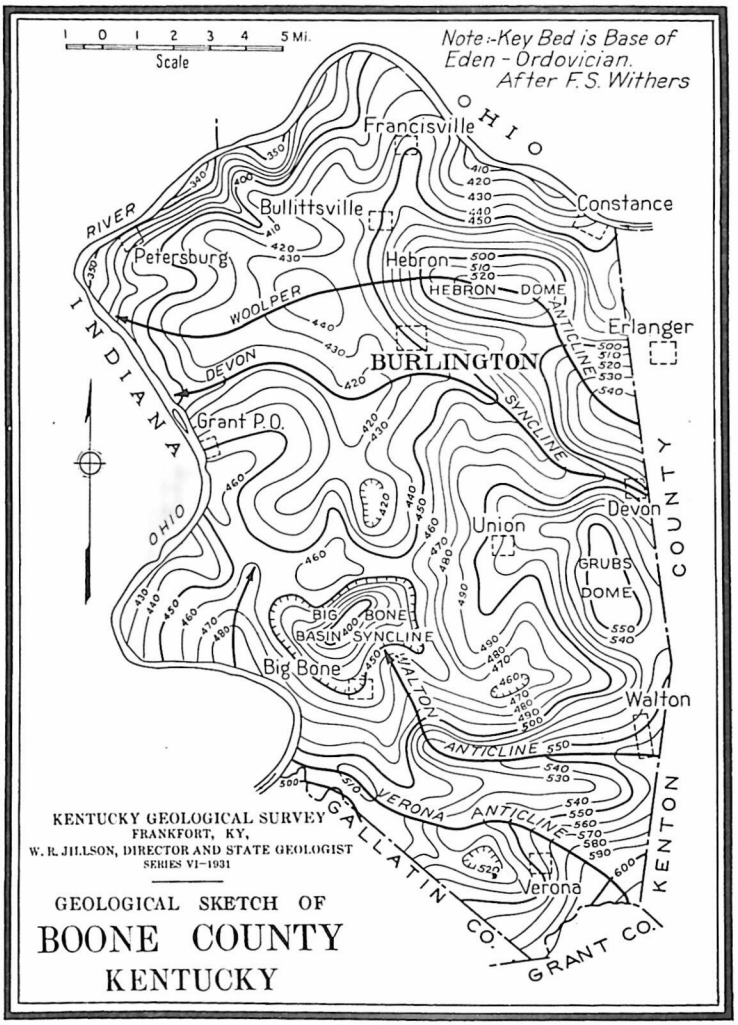

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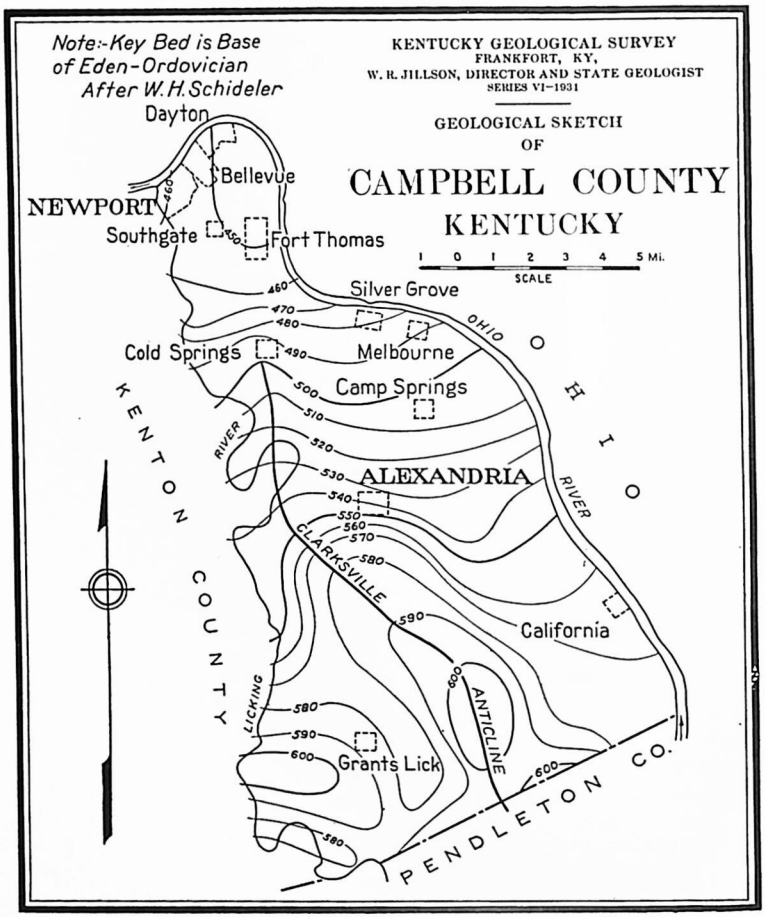

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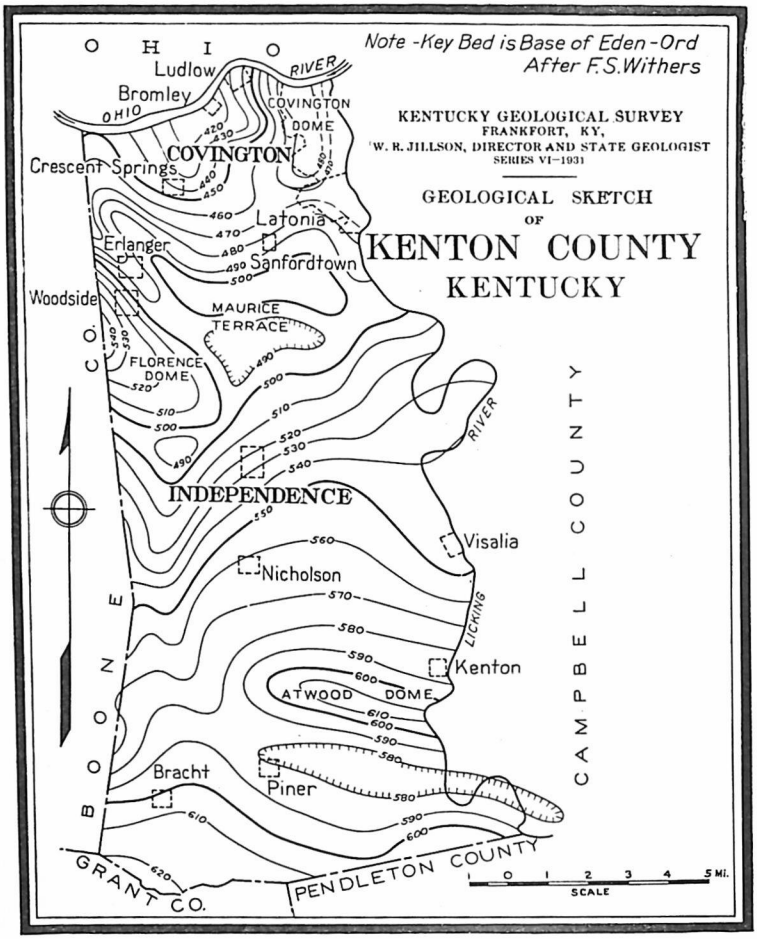

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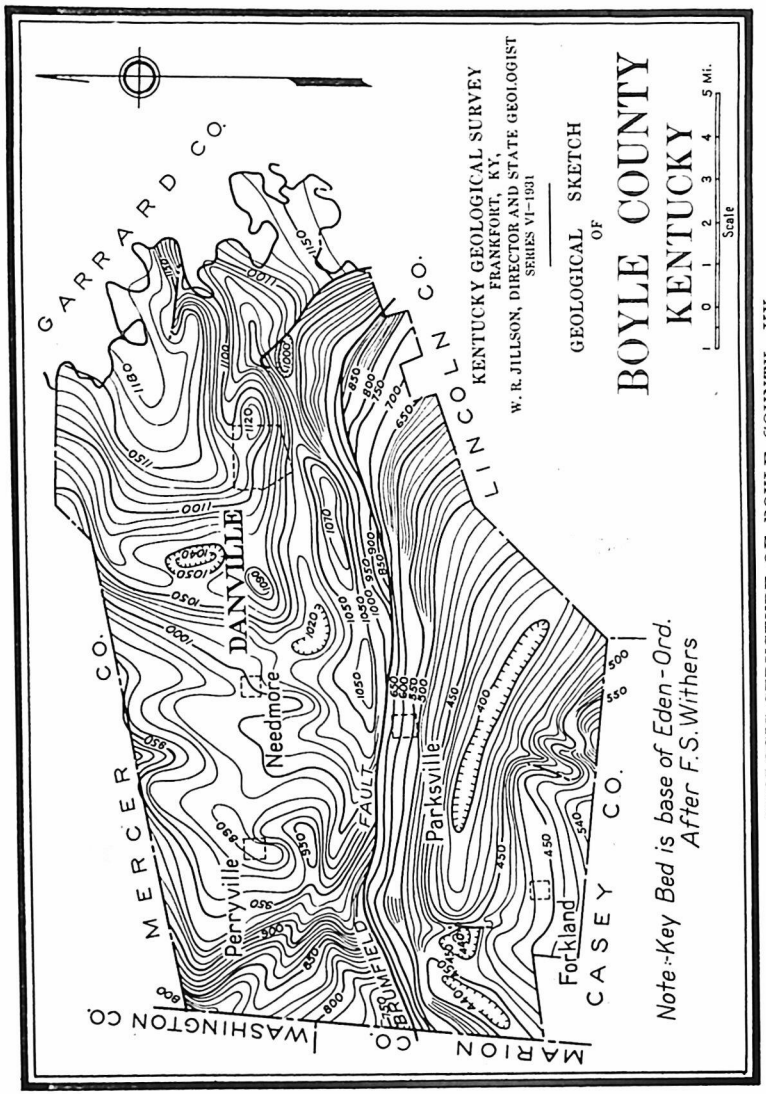
15 Cents Each, Remit in Advance.

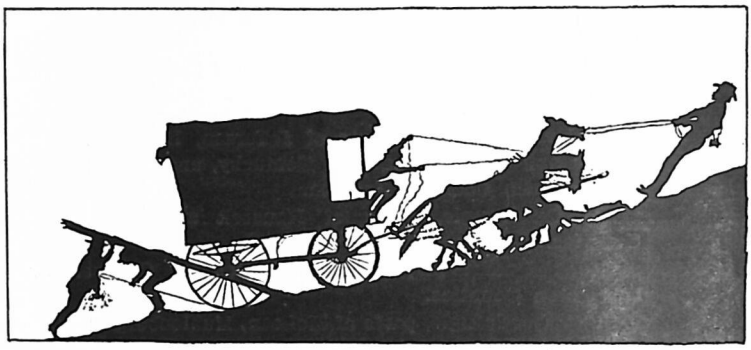
Kentucky Geological Survey and U. S. Geological Survey in Cooperation.

1. Adolphus Quadrangle, parts of Simpson and Allen Counties.
2. Lafayette Quadrangle, parts of Allen County.
3. Barthell Quadrangle, parts of Wayne and McCreary Counties.
4. Beattyville Quadrangle, parts of Powell, Estill, Montgomery. Menifee, Lee, Wolfe, Breathitt, Clark, Owsley, Jackson and Morgan Counties.
5. Big Clifty Quad., parts of Hardin, Grayson, Breckinridge.
6. Big Stone Gap Quad., parts of Harlan and Letcher.
7. Bowling Green Quadrangle, Warren, Allen and Simpson Counties.
8. Brownsville Quadrangle, Warren, Edmonson and Butler Counties.
9. Buckhorn Quadrangle, parts of Perry, Leslie and Breathitt Counties.
10. Bucklodge Quad., parts of Allen and Simpson Counties.



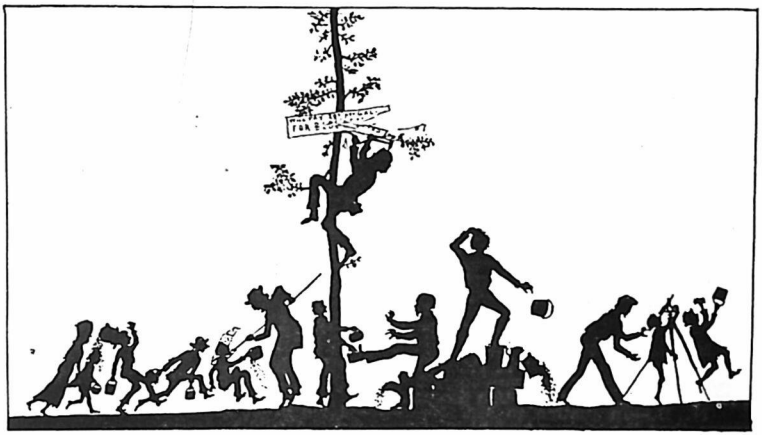
GEOLOGIC STRUCTURE OF BOYLE COUNTY, KY.

11. Burnside Quadrangle, parts of Wayne, Pulaski and McCreary Counties.
12. Byrdstown Quad., parts Cumberland, Clinton, Wayne.
13. Calhoun Quad., parts of Webster, McLean, Henderson, Daviess, Hopkins Counties.
14. Camp Taylor Quadrangle, parts of Jefferson, Bullitt, Spencer, Shelby and Oldham Counties, Kentucky, and Taylor, Posey and Franklin Counties, Indiana.
15. Cannelton Quadrangle, parts of Hancock and Breckinridge Counties.
16. Cave-in-Rock Quadrangle, parts of Crittenden, Caldwell and Livingston Counties.
17. Central City Quadrangle, parts of McLean, Muhlenberg and Ohio Counties.
18. Cincinnati E. & W. Quadrangle, parts of Boone, Kenton and Campbell Counties, Kentucky, and Hamilton and Clermont Counties, Ohio. 20 cents each.
19. Clintwood Quad., parts of Pike County, Ky., Dickenson and Wise Counties, Va.
20. Cornettsville Quadrangle, parts of Leslie, Knott, Perry and Letcher Counties.
21. Corydon Quadrangle, part of Meade County.
22. Cub Run, parts of Grayson, Edmonson, Hart and Hardin Counties, Kentucky.
23. Cumberland Gap Quadrangle, parts of Laurel, Knox, Clay, Leslie, Harlan, Bell and Whitley Counties, Ky., Lee Co., Va., Claiborne and Campbell Counties, Tenn.
24. Cynthiana Quadrangle, parts Harrison, Scott and Bourbon Counties.
25. Dawson Springs Quadrangle, parts of Hopkins, Christian and Caldwell Counties.
26. Drakesboro Quadrangle, parts of Muhlenberg, Todd and Logan Counties.
27. Dunmor Quadrangle, parts of Muhlenberg, Butler, Ohio and Logan Counties.
28. Earlington Quadrangle, parts of Webster and Hopkins.
29. Eddyville Quad., parts of Caldwell, Crittenden, Livingston and Lyon Counties.
30. Estillville Quad., small part of Harlan Co., Ky.; Lee, Scott and Wise Counties, Va.
31. Falmouth Quadrangle, parts of Pendleton, Grant and Harrison Counties.
32. Felicity Quadrangle, parts of Campbell, Bracken and Pendleton Counties.
33. Fordsville, part of Hancock, Breckinridge, Ohio and Grayson Counties.



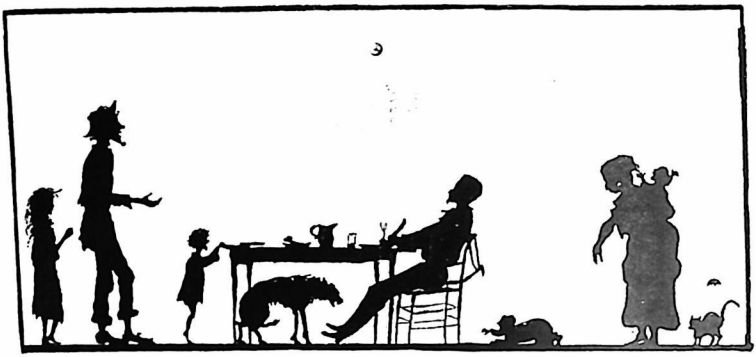
"GETTING UP STEAM"
Original Sketch and Title by John R. Procter, 1874.

34. Frankfort Quad., parts of Franklin, Woodford, Shelby and Anderson Counties.
35. Georgetown Quadrangle, parts of Scott, Fayette, Woodford and Franklin Counties.
36. Gilbert Quadrangle, part of Pike County.
37. Golconda Quadrangle, parts of Livingston and Crittenden Counties, Ky., and Pope and Hardin Counties, Illinois.
38. Greenup Quad., part of Greenup County.
39. Hagan Quad., parts of Bell and Harlan Counties.
40. Hardinsburg Quadrangle, parts of Breckinridge and Hancock Counties.
41. Harlan Quadrangle, parts of Harlan, Leslie and Bell Counties.
42. Harold Quadrangle, parts of Martin, Floyd and Pike Counties.
43. Harrodsburg Quadrangle, parts of Woodford, Jessamine, Boyle, Mercer, Fayette, Garrard, Lincoln and Anderson Counties.
44. Hartford Quadrangle, parts of Butler, Ohio and Muhlenberg Counties.
45. Henderson Quadrangle, parts of Henderson County.
46. Higginsport Quadrangle, parts of Bracken and Mason Counties.
47. Hindman Quadrangle, parts of Knott and Floyd Counties.
48. Hurley Quadrangle, parts of Pike County, Ky., and Buchanan County, Va.
49. Hyden Quadrangle, parts of Leslie, Clay and Perry Counties.
50. Inez Quadrangle, parts of Lawrence, Martin and Johnson Counties.
51. Ironton Quad., parts of Greenup County, Kentucky, Lawrence and Scioto Counties, Ohio.
52. Jonesville Quadrangle, parts of Letcher, Leslie and Harlan Counties, Ky.; Lee County, Va., and Claiborne and Hancock Counties, Tenn.



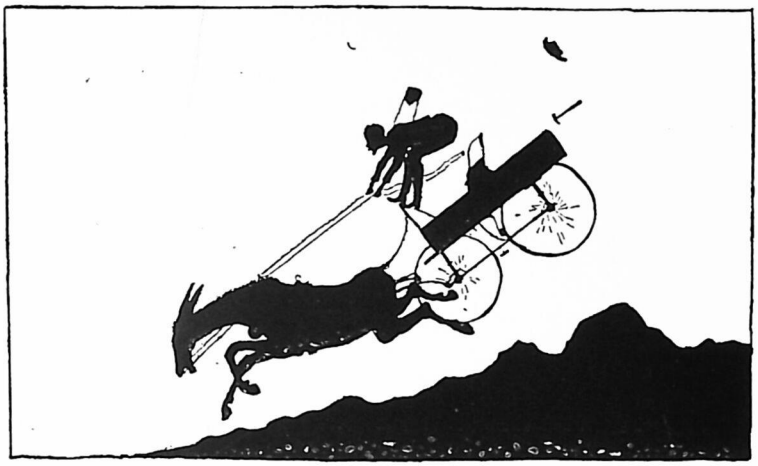
A BLACKBERRY FIASCO
Original Pen and Ink Sketch by John R. Procter, 1874.

53. Kenova Quadrangle, parts of Greenup, Boyd, Carter, Lawrence and Elliott Counties.
54. Kosmosdale Quadrangle, parts of Jefferson and Bullitt Counties.
55. La Center Quadrangle, parts of Ballard and McCracken Counties.
56. Lafayette Quadrangle, part of Allen County.
57. La Grange Quadrangle, parts of Shelby, Oldham, Henry, Jefferson, Trimble Counties.
58. Lawrenceburg Quadrangle, part of Boone County.
59. Leitchfield Quad., part of Grayson, Edmonson, Butler Counties.
60. Lexington Quad., Fayette, Clark, Bourbon and Scott in part.
61. Lillydale Quad., parts of Cumberland, Clinton, Monroe Counties.
62. Little Muddy Quadrangle, parts of Butler, Warren and Logan Counties.
63. Lockport Quadrangle, part of Owen, Henry, Shelby and Franklin Counties.
64. London Quad., Rockcastle, Pulaski, Lincoln, Garrard, Jackson and Laurel Counties.
65. Louisville Quadrangle, parts of Jefferson, Bullitt and Spencer Counties.
66. Madisonville Quad., parts of Hopkins, Muhlenberg, McLean and Webster Counties.
67. Mammoth Cave Quadrangle, parts of Edmonson, Barren, Warren and Hart Counties.
68. Manchester Quad., Jackson, Owsley, Clay, Leslie, Laurel, Perry, Breathitt, Knox Counties.
69. Mattewan Quadrangle, parts of Pike County, Ky.; Mingo and Logan Counties, W. Va.
70. Middlesboro Quad., part of Bell County.



A HUNGRY GEOLOGIST
"I declare, mister, you've got the powerfulest appetite I ever seen. You've eat up all of wee'uns dinner."
N. B.—In justice to Mr. N—r—w—d we must state that he was not aware that the dinner had been cooked for the whole family.
Original sketch and title by John R. Procter, 1874.

71. Monticello Quad., parts of Wayne, Russell and Pulaski Counties.
72. Morehead Quadrangle, parts of Rowan, Carter, Elliott, Morgan and Menifee Counties.
73. Morganfield Quad., parts of Union, Webster and Henderson Counties.
74. Morning View Quadrangle, parts of Campbell, Kenton and Pendleton Counties.
75. Mound City Quad., part of Ballard County.
76. Mt. Eden, parts of Shelby, Anderson, Franklin and Spencer Counties, Kentucky.
77. Naugatuck Quadrangle, part of Martin and Lawrence Counties.
78. Newberg Quadrangle, parts of Henderson and Daviess Counties.
79. Newcastle, parts of Henry and Shelby Counties.
80. New Haven Quadrangle, part of Union County.
81. Nolansburg Quadrangle, parts of Harlan and Letcher Counties, Ky., and Lee County, Va.
82. Nortonville Quadrangle, parts of Hopkins, Muhlenberg, Christian and Todd Counties.
83. Owensboro Quadrangle, part of Daviess County.
84. Paducah Quad., part of McCracken and Livingston Counties.
85. Paintsville Quadrangle, parts of Lawrence, Johnson, Morgan and Magoffin Counties.
86. Pikeville Quadrangle, parts of Pike, Floyd, Knot and Letcher Counties.
87. Pound Quadrangle, parts of Pike and Letcher Counties.
88. Princeton Quadrangle, parts of Caldwell, Lyon and Hopkins Counties.
89. Prestonsburg Quadrangle, parts of Johnson, Floyd, Magoffin and Knott Counties.



Our Mineralogist thought he'd like to see the mule he couldn't drive.
Original sketch and title by John R. Procter, 1874.

90. Providence Quad., parts of Crittenden, Union, Webster, Caldwell and Hopkins Counties.
91. Red Boiling Springs Quad., parts of Monroe and Allen Counties.
92. Prospect Quadrangle, parts of Jefferson and Oldham Counties.
93. Regina Quad., parts of Pike County, Ky.; Dickenson and Buchanan Counties, Va.
94. Richmond Quad., parts of Jessamine, Fayette, Madison, Estill, Jackson, Garrard Counties.
95. Rising Sun Quadrangle, parts of Boone, Gallatin and Grant Counties.
96. Sadieville Quad., parts of Owen, Scott, Harrison and Franklin Counties.
97. Salt Lick Quad., parts of Bath, Rowan, Menifee Counties.
98. Salyersville Quad., parts of Menifee, Morgan, Wolfe, Magoffin and Breathitt Counties.
99. Scottsville Quadrangle, parts of Allen, Barren and Warren Counties, Kentucky.
100. Sebree Quadrangle, parts of Henderson, Webster and Union Counties.
101. Shawneetown Quad., Union, Crittenden Counties, Ky.; Hardin, Gallatin Counties, Ill.
102. Smithland Quad., parts of Livingston, Marshall and McCracken Counties.
103. Sneedville Quad., part of Harlan County.
104. Somerset Quad., parts of Pulaski and Casey Counties.
105. Springdale Quad., parts of Lewis, Fleming and Mercer Counties.

106. Spring Lick Quad., parts of Ohio, Butler and Grayson Counties.
107. Sunnybrook Quad., parts of Clinton and Wayne Counties.
108. Sutherland Quadrangle, parts of Daviess, McLean and Ohio Counties.
109. Taylorsville Quad., parts of Spencer, Shelby, Jefferson and Bullitt Counties.
110. Tell City Quad., parts of Hancock and Daviess Counties.
111. Tompkinsville Quad., part of Monroe County.
112. Troublesome Quadrangle, parts of Perry, Breathitt and Knott Counties.
113. Uniontown Quadrangle, parts of Union and Henderson Counties.
114. Whitesburg Quadrangle, parts of Letcher, Knott and Harlan Counties.
115. Whitesville Quadrangle, parts of Daviess, Hancock and Ohio Counties.
116. Williamsburg Quadrangle, parts of McCreary, Whitley, Pulaski, Laurel, Knox and Bell Counties, Kentucky, and Scott, Campbell, Claiborne Counties, Tennessee.
117. Williamstown Quadrangle, parts of Pike and Martin Counties, Ky., and part of Mingo County, W. Va.
118. Mammoth Cave National Park, part of Edmonson County.
119. Index to Topography in Kentucky. 1929. Free.

THE ANSWERING SILHOUETTES

Time was, and not so remotely, when good people generally, particularly those who earned their livelihood to some extent at least by the sweat of their brow and the honest toil of foot and hand, looked with disfavor and not a little distrust upon the pedestrious movements of the geologist. In the prosecution of his observations afield along cool moss-hung ledges bordering some meandering creek or river; while scrambling up and over precipitous cliffs stretching on across a sky-swept mountain; or during his more leisurely rambles over pebbled beach and boulder-strewn meadow, he has been watched, furtively and continually.

In the remote country places or beside the noisy tourist-ridden thoroughfares, his observers, self-appointed and spurred on by an amazing diligence, have been legion. Dressed in tawny habiliments peculiar to his kind, his coming especially to out-of-the-way towns has frequently been anticipated, while his going has long thereafter been an important subject of remark. From every convenient thicket and hedgerow, from half-closed doorway and shaded upstairs window, he has been stared at in

W. B. Page C. W. Beckham

I say! Mister Will that thing shoot! Take it away, it skeers my critter.
Original sketch and title by John R. Procter, 1874.

whispered silence, half-suspected of being either a little, perhaps harmlessly, unbalanced, or quite considerably the fool.

If it were otherwise, and the question remains, why should he go about with hammer and bag so seriously, so almost clandestinely, so certainly unconcerned as to the usual amenities of life, pounding and tapping on all kinds of stones? Can he not see, does he not know as do other people of assured rationality, the nature of these mundane substances? Some rocks beyond doubt, are solid and have been deeply buried since the day the earth was finished and flung breezily into space to take its place in cosmic affairs. Others, by obvious intent as every one knows, are loose and slabby and widely spread over plowed field and pasture. Not a few are rounded and bouldery, stream-washed and abraided throughout all upland courses by every springtime freshet. What is to be gained by the endless striking of such old worthless flints, the spying out of granites and marbles with odd little pocket glasses, and the collection and preservation of all kinds of natural freaks, antidiluvian fossils and bits of pitch and coal-bearing rocks? Is not all of this some deeply mysterious business aided by tripoded instruments and tapes, described by a language quite beyond ordinary understanding,

and dedicated to interests which, if the best be told, must be dark and devious?

Repeatedly recurring, unanswered and unanswerable to their proponents, mere simple souls with minds untrammeled by the abstract technicalities of a modern day, these inquiries and others of similar vein, persistently addressed themselves to an erstwhile Director of the Kentucky Geological Survey, then but a lad, John Robert Procter. Seated in the shade of a wind-swept pine on old Dismal Rock, overlooking the placidly moving waters of Nolin River in the heart of Edmonson, while others of the staff took note of iron ore, asphaltic sandstone and bituminous coal in separate outcrop below him, he made answer, but not in the conventional style of refined English prose. Nor had he recourse to the lilting verse!

Instead, his pen moving rapidly, figures bespeaking animation, and scenes portraying quiet but humorous situations, inescapably geological, delineated themselves in black and white across his page. Silhouettes they were, variable in motive and unique in design. What a jolly hour in camp as these sketches passed from one hand to another! Here in the leaping flare of the open fire, amid much good-natural banter and boast by the evening's assemblage, this odd assortment of caricatures became the pictoral diatribe, the classic reply of the geologist to the persistent, the age-old, and all surrounding inquiry of an ardently curious humanity.

Preserved with a fitting sense of their value and importance during the latter part of his lifetime in the dust-covered personal files of the late Professor Charles Joseph Norwood, himself from 1904 to 1912 the State Geologist of Kentucky, these unusual drawings in silhouette, from the versatile pen of Procter, have recently come to light through the Kentucky State Historical Society. Here, in the concluding pages of an Administrative Report they are given for the first time to the public as a whole. Cleverly executed, these all but forgotten items of inspired artistry present in an interesting light the droll philosophical reflections of a geologist in happy mood, personal and professional attributes he has quite generally been regarded as

without. Abstractly considered, these sketches afford to him who admires originality for its own sake, not only a bright spot in the drab eternity of geologic time, but serve—in lieu of a better and more genial Christmas Cheer—to illuminate with what difficulty and humor were attended the activities of the Kentucky Geological Survey in the field under the direction of Nathaniel Southgate Shaler, Anno Domini, 1874.

II

STUART WELLER—A TRIBUTE

II

PROFESSOR STUART WELLER—A TRIBUTE

Geologists and Friends:

Stuart Weller first existed for me as a signature. In the Summer of 1915 I was working on the United States Geological Survey in the State of Washington. I had done some graduate work in geology and wanted to do more. The University of Chicago and its great leaders Chamberlin and Salisbury had been in my mind for a long time. Finally I wrote Professor Rollin D. Salisbury. In due time it was not Professor Salisbury but Professor Weller, a man then little known to me, who answered, outlining certain advanced courses. I accepted his proposal and came to Chicago in the fall. Professor Salisbury gave me a fellowship in the graduate school, and among others there I met Stuart Weller and became one of his many fascinated students. As I look back on those days on the Midway Campus, Professor T. C. Chamberlin was my beau-ideal, Professor S. M. Williston, in whose private office I had my desk, was my mentor and my constant inspiration in fact, while Professor Weller was my Moses in a real wilderness of invertebrate fossils.

Two years later I went to Kentucky, not to answer a professional call or at the behest of friends or relatives, but simply to fulfill a personal desire. The geology and general atmosphere of the Commonwealth appealed to me and I stayed. In the course of later events I became the head of the Kentucky Geological Survey. As an administrative officer of a technical bureau I soon saw that it would be necessary to frame a definite plan and organization. After reviewing the geological work that had been completed in the State, I began to visualize those things which were yet to be undertaken in Kentucky. It was soon apparent that something really fine needed to be done for the western fluorspar field. With this determined as a matter of policy, it became necessary to get a man who could do a first class piece of areal and structural work for this very complicated region

Without question I turned to my former teacher, Professor Weller, as the one best qualified. Preliminaries were soon most agreeably settled. Stuart Weller was selected for the work, and our more mature friendship began. During each field season from 1920 onward up until almost the present, Dr. Weller worked for the Kentucky Geological Survey as an assistant geologist. Throughout the late fall, winter and spring he returned to his classes at the University of Chicago. In this time he completed in Kentucky four detailed quadrangles at a scale of 1:62,500—a most monumental piece of work. Throughout this project, his has been the inspiring master hand. His enthusiasm grew with the work until I began to realize that I had scarcely known the real Professor Weller prior to his work on the Kentucky Geological Survey. I came to appreciate him as one of the most patient, the most careful and the most exacting of men in his field and office labors.

Throughout this period of intensive geological investigation in the western Kentucky fluorspar field, my admiration grew for him, and I can only say that the half concerning Stuart Weller has not been said. It will take years to allow a full appreciation of the value of his work in Kentucky. Our people are just beginning to understand the real contribution which has been made to the complex structure of our fluorspar field. His work began with the Golconda quadrangle. The Princeton, the Cave-in-Rock and Smithland followed in rapid succession. At all times he had the regional problem and the local detail squarely before him, and always well in hand. Could he have finshed an additional sheet—the Eddyville—it would have completed an areal unit that would have been quite as unique in scope and detail as it was different.

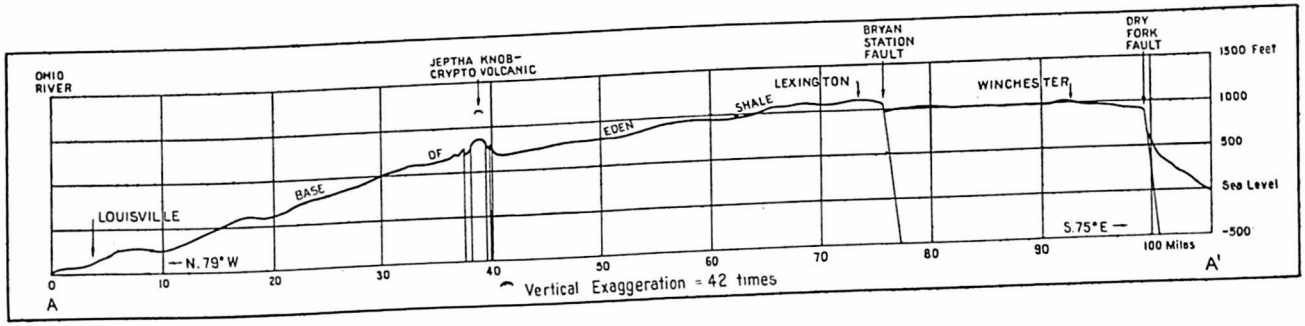
All of Dr. Weller's Kentucky reports have been published. Some of his maps are now available and all will soon be issued. I want to say that if any one here desires any of his publications, they need but communicate with me and the requested maps or reports will be sent at once with the compliments of the Kentucky Geological Survey, as a testimonial of the close friendship which was ours. As the days pass by, though his hand and heart are stilled, it seems to me nevertheless that he actually lives. Alone in the field or in my office it seems he walks with me,

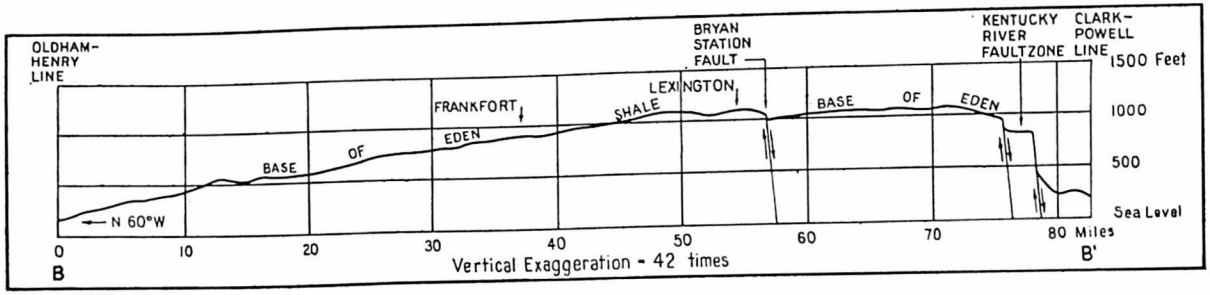
thinks with me and advises me. It will be impossible for me ever to forget his strong, manly, positive personality. Toward the close of the day of August 5th last Summer, his summons came unannounced during active field work on the Smithland Quadrangle in Western Kentucky. Conscious that his labors were unfinished, he fell like a gladiator—aware but unafraid. There is something glorious about it, gentlemen!

An extemporaneous address
delivered before a group of
American and European Geologists
and Friends of the late Dr. Stuart Weller,
at the University of Illinois, Urbana,
Illinois in the fall of 1927 by
Willard Rouse Jillson, State
Geologist of Kentucky.

III

STRUCTURAL GEOLOGY OF NORTHERN CENTRAL KENTUCKY





STRUCTURAL SECTIONS FOR NORTHERN CENTRAL KENTUCKY

III

STRUCTURAL GEOLOGY OF NORTHERN CENTRAL KENTUCKY [1]

By Willard Rouse Jillson

Scores of papers and pamphlets, one might also say volumes, have been written appertaining to the general geology and paleontology of the Cincinnati arch. In all this collection of printed scientific intelligence relative to this major flexure, which, traversing a half-dozen states east of the Mississippi River, has its northern axial extension in the vicinity of the Great Lakes and its southern tip beneath the sediments of the lower Gulf of Mexico embayment, nothing much has been said about its structure, particularly in detail. Physiographers, stratigraphers, paleontologists, sedimentationists have had their day since the middle of the last century jotting down this and that about this great anticline, but no one has yet seriously attempted to map its structure.

There is a reason, and a very good one, for this state of affairs, namely, that he who would produce anything like an accurate map of the structure of the Cincinati arch must necessarily cover a broad areal compass and involve himself in no little amount of tedious, painstaking and time-consuming effort. During the summer of 1928 the writer, as the leader of a group of assistants working on the geology of the Bluegrass region of Kentucky, began to lay down in black and white something of the nature of the structure of the Jessamine dome, a project that had long been in mind. As a result of that initial effort, continued through the season of 1930, and down to the present time, a total of forty counties, the entire area of the Bluegrass region of Kentucky, has been mapped geologically. For most of this area, twenty-nine counties, areal, geological maps are now available bearing recent dates of publication. Others have been prepared and are in course of drafting or printing.

In order to present the detailed outline of the structural

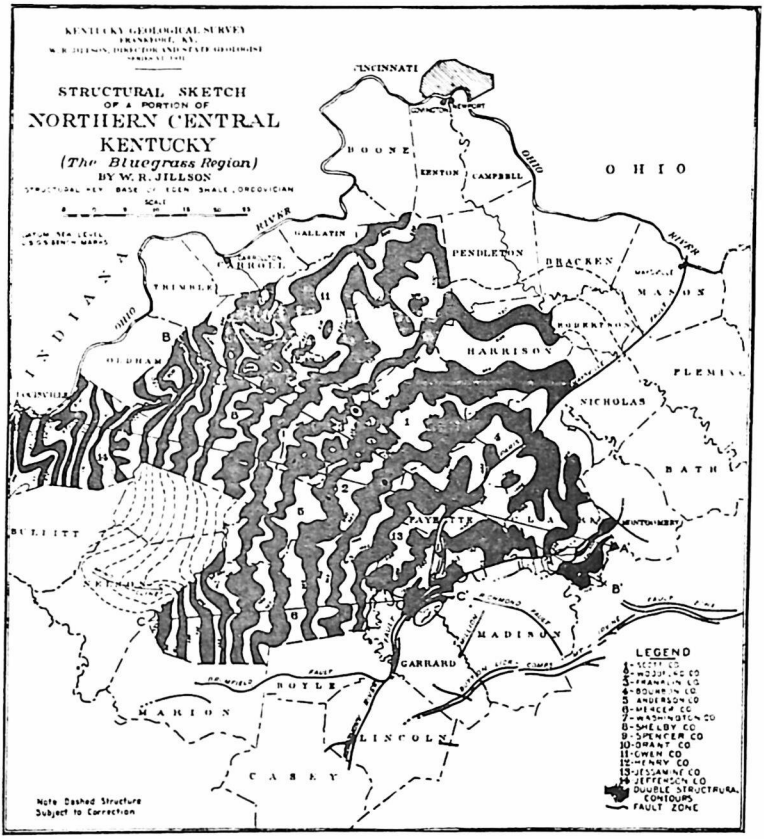
[1] Paper presented before the joint meeting of the Ohio, Indiana and Kentucky Academies of Science at Miami University, April 4, 1931. Republished from the Pan-Am. Geologist, Vol. LV, pp. 337-341, June, 1931.

geology of the Jessamine dome in north-central Kentucky, the writer has merged all of the above referenced structural maps into a unit-sketch of the Bluegrass region in Kentucky, and presents this structural map herewith. A novel drafting scheme calculated to aid in the visualization of its structure has been incorporated into this drawing whereby every other fifty-foot interval is laid out in solid black. In this way the structural levels on this map between 1050 and 1000 are shown in white, while the structural levels between 1000 and 950 are shown in solid black. Again each elevation on this general structure between 950 and 900 are in white, while the next fifty feet lower is again displayed in solid black. Recognizing the limitations of such a scheme of structural depiction, the writer points with some satisfaction to the ease with which the general outline of regional flexing is followed by the eye.

In contouring this structure, it has not been possible in all instances to make use of the Eden Shale itself as a key-bed in the field since in many areas, especially high points on the Jessamine dome, the Eden shale has been removed by erosion. In such localities recourse has been had to the projection from other definite key-beds lower in stratigraphic section up to the base of the Eden shale. In the sketch-map attached to this article it will be noted that the structure in Spencer and part of Nelson counties, on the western side of the dome, and the structure again along the axis of the arch, in Pendleton, Bracken and parts of Robertson and Harrison counties, is shown as subject to correction since these areas have not been structurally detailed.

It is interesting to note further, as from this map, the well-rounded outline of the high uplift about southern Jessamine, northern Garrard and northwestern Madison counties. Here, had it not been for the Kentucky River-Paris-Maysville, and associated faults, the Cincinnati arch would locally have presented an almost perfect domal symmetry. The highest point structurally is near Ambrose, Kentucky, and is calculated in absence of the Eden shale to be slightly in excess of 1250 feet above sea-level. The structural fall to the west is more gradual than to the east. In the heart of Louisville the base of the Eden shale is 350 feet below sea-level, while similar structural levels, aided by faulting, are attained in the northern part of the close-

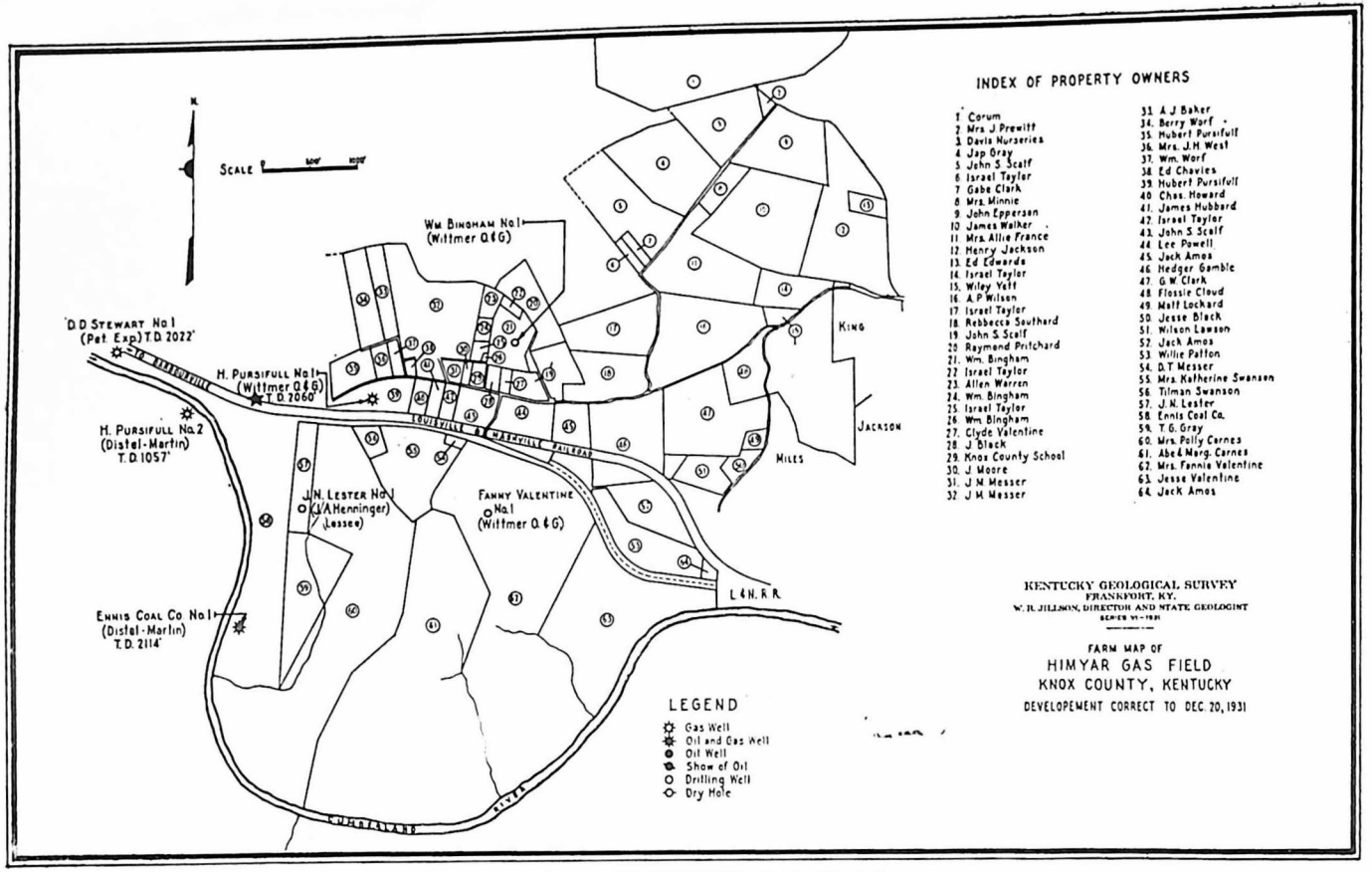
in county of Estill. It may be observed in this connection and without exception as the attached profiles show that the down faulting along this great system through north-central Kentucky is always on the southeastern side of the Kentucky River-Paris-Maysville fault the displacement in most instances being 100 to 150 feet, on the upper part of the structure and less, diminishing to as little as 20 feet, at points lower down to the northeast.



Geologic Structure of Northern-Central Kentucky

IV

THE HIMYAR GAS FIELD



FARM MAP OF HIMYAR GAS FIELD

The location of Himyar Station, Knox County, Ky., is indicated by the star.

IV

THE HIMYAR GAS FIELD

By Willard Rouse Jillson

Introduction

It is an interesting fact, frequently encountered by those who have occasion to investigate oil and gas producing fields, that the search for these more or less elusive mineral fuels is usually by "sands" and areas rather than otherwise. So it is generally true that in any given field where production has been won from a certain "sand" about 95 per cent of the drilling will be directed to that particular producing horizon and no lower—except once in a while a well dry in the "sand" of expectancy will be drilled somewhat lower in hope of better fortune.

In Knox County, Kentucky, the drilling for oil and gas that had been completed up to the beginning of the passing year of 1931 followed the same rule of exploration as elsewhere. Pottsville oil in large quantity, good quality and dark color was found years ago in four divisions of this "Salt Sand" Series—the Wages, Jones, Knox and Epperson. All of these were from the lowest part of the Pennsylvanian section in this region. The oil horizons ranged from about two hundred and fifty feet to seven hundred and fifty feet approximately and were easily recognized and drilled. Of the many wells drilled in Knox County probably less than ten per cent were drilled any distance into the underlying Mississippian measures. Carrying the comparison further, it is safe to say that hardly two per cent of the drilled wells pierced the entire Carboniferous section and penetrated to any depth into the Devonian and Silurian.

Older Deep Wells

Of the deeper Knox county wells the outstanding records prior to 1930 are (1) the C. P. Kennedy No. 1 drilled to a total depth of 2,500 feet just south of the Cumberland river within the southern limits of Barbourville, (2) the William Carver No. 1 drilled to a total depth of 1,610 feet on the Road Fork of Stinking Creek, (3) the J. G. Baker No. 1 well drilled

to a depth of 1,797 feet on Stinking Creek, (4) the Madeline Gray No. 1 at Gray's Station, drilled to a depth of 1,974 feet, (5) the G. W. Mayhew No. 1 drilled to an unrecorded depth of about 1,800 or 1,900 feet about a mile west of Barbourville, (6) the John Faulkner No. 1 well drilled to an unrecorded depth of about 1,850 feet about a mile and a quarter southwest of Barbourville, and (7) the James Walker No. 1 drilled on Amandas Branch of the Road Fork of Stinking Creek to a total depth of 2,577½ feet in the year 1920. This last drilling is the deepest in Knox County today.

The records on each of these older deep wells, except the Mayhew and the Faulkner, have fortunately been preserved and can be examined in detail. Since the Mayhew well—so many years the chief source of natural gas for Barbourville—was undoubtedly the best gas well drilled to date in Knox county, it is too bad that an accurate and detailed record was not kept. It would have been of much value in present day and future deep-well drilling. It is a matter of some regional gratification that the deep exploration now in progress in this area is resulting in the keeping of good and sufficiently detailed records for all practical purposes in each instance.

Fieldwork

Prior to assembling the data presented in this sketch the writer has personally visited the field now producing natural gas at Himyar and its western extension near Artemus in central southern Knox County, Kentucky, on a number of occasions. His first field work here was executed in May, 1919, the resulting report thereon being published in the same year.[1] Subsequently the area has been crossed and recrossed in the progress of other field studies. Finally the writer visited this region December 15 to 19, inclusive, 1931, at which time all of the producing gas wells and drillings in the Himyar-Artemus field were inspected in company during a part of the time by Messrs. Henninger and Distel, who are now the principal operators. At this time a number of the gas wells were opened, blown and gauged.

[1] Geology and coals of Stinking Creek, Knox County, Ky., by W. R. Jillson and J. M. Hodge. Dept. of Geol. and Forestry, Bull. 3, p. 89, 1919.

General Geology

Sandstones, shales and coals of the Upper Pottsville series (Pennsylvanian) are the only outcropping sediments in the area surrounding Himyar and Artemus, small stations located on the Louisville & Nashville Railroad near the Cumberland River between Barbourville and the Bell County line. The lowest exposed bed is the Flat Lick sandstone just below the Lily coal. It is about 180 feet from the top of this pronounced clastic to the base of the Blue Gem coal and somewhat over six hundred feet from the Blue Gem coal up to the Dean or Fire Clay coal. At the head of Stinking Creek and at some points along the Bell County line the maximum exposure ranging to about 200 feet above the Helton coal (Allegheny) can be measured to a total depth of about 1,855 feet. Of this rather considerable thickness only the lower portion is present in the Cumberland valley proper near Himyar and Artemus.

The subsurface stratigraphic section in the vicinity of the Himyar gas wells is variable in detail, as might be expected, but similar in all general respects. The Pottsville or upper division ranges from 920 feet as shown in the Ennis Coal Mining Co. No. 1 to 1,069 feet in the Josh Parrott No. 1. The Mississippian or lower Carboniferous shows to be 860 feet thick in the Parrott well, 847 feet in the Pursifull well and 874 feet in the Ennis well. In these three wells in the same order the Chattanooga black shale (Devonian) shows to be 155 feet, 178 feet and 165 feet. The Corniferous limestone of definitely undetermined thickness is recorded somewhat variably below this bed.

Structural Geology

The surface structural geology as delineated on the Dean (Fireclay—No. 4) coal in the vicinity of Himyar is pronouncedly anticlinal. As a matter of fact the axis of the Artemus—Flat Lick anticline plunges from the crest of the Flat Lick Dome at an elevation of about 2000 feet above sea level on the Bell county line to the northwest in the vicinity of Himyar, thence eastwardly across the lower waters of Stinking Creek, through Artemus and the Artemus dome, and southwestwardly across the Cumberland river towards the Whitley county line where elevations are attained of opproximately 1610 feet.

In the vicinity of Flat Lick a small dome 100 feet lower than the top of the major structure on the Bell county line is indicated where the Moore's Creek anticline a southwestward continuation of the White Mountain fault crosses the axis of the Artemus—Flat Lick anticline. This doming structure has been drilled dry only to the shallow depth of about 800 feet. In the vicinity of Himyar the axis of the major anticline takes a trend about a mile north of the river and attains an elevation of about 1735 feet.

A well defined structure, this productive anticlinal fold is bordered on the south by Little Poplar Basin, the Brush Creek Basin and the Branch Basin Synclines. These cup-like depressions fall far below the recent gas well contours to a depth of 1530 feet. On the north the eastern Kentucky Geo-syncline rises to the southwest from the Road Fork of Stinking Creek on an axial line which penetrates Barbourville, thus marking the limit of the major folding at Himyar and Artemus.

There is some evidence from the small amount of deep drilling which has been done in the vicinity of Himyar and Artemus that the subsurface structure, particularly that of the Mississippian and Devonian sediments may not be in exact accordance with that delineated on surface coals as portrayed on the recent "Reconnaissance map of the Structural Geology of Knox County, Kentucky" which was published by the Survey in 1925, at the scale of 1:62,500, as developed by the field work of C. V. Theis. The close proximity of the Himyar area to the major deformational movements associated with the Pine Mountain overthrust fault close by on the southeast may be responsible for this suggested lack of conformity of surface and subsurface structure. Adequate drilling and careful calculation will eventually establish the fact of discordance if it really exists.

Natural Gas Development

At the time of this writing five commercially important natural gas wells have been drilled and are producing in this area and three wells are now in course of drilling. Of this development four wells are located close to the Cumberland River in the vicinity of Himyar, while a fifth is found about ¾ of a mile east of Artemus Station. The Himyar wells are:

The Ennis Coal Co. No. 1 drilled by the Distel-Martin Oil and Gas Co., and now producing with 300 pound rock pressure 1,400,000 cubic feet of gas from the Corniferous and 400,000 cubic feet of gas from the Maxon sand according to tests made by the writer on December 18, 1931. This drilling was the discovery well in the Himyar field. At the present time it is close-in and unused.

The W. H. Pursifull when gauged on the same date as the Ennis Coal Co. No. 1, exhibited a working rock pressure of 250 pounds and showed a volume of 744,000 cubic feet after blowing 15 minutes. At the time of gauging it was firing the boilers of two drilling rigs closely adjacent. This well is owned by the Wittmer Oil and Gas interests of Pittsburgh, Pa., and is producing gas from the Corniferous (Devonian) limestone formation. While being drilled this well picked up according to its record, about 2 barrels of good but dark oil in the Epperson (lower Pottsville) sand at shallow depths.

The Petroleum Exploration, Inc., of Lexington, Kentucky and Sistersville, West Virginia drilled in on November 26, 1931, the D. D. Stewart No. 1 well into the Corniferous. This well though not gauged by the writer is reported as producing about 527,530 cubic feet of gas open flow and is said to have a rock pressure of 290, apparently the same as all other good wells in this field which now gauge about 300 pounds. The depth of the Stewart No. 1 is 2022 feet.

The Distel-Martin No. 2, Known as the Hubert Pursifull well drilled south of the Cumberland River between its Ennis Coal Co.'s No. 1 and Stewart heirs No. 1 was not gauged but is reported to be producing from the Maxon with about 300 pounds rock pressure, 800,000 cubic feet of natural gas. It is 1057 feet deep.

The fifth well, this producing from the several sands, is the Josh Parrott No. 1 drilled by J. A. Henninger and others of Butler, Pa., near Artemus. It produced 94,000 cubic feet natural in the "Big Lime" (Mississippian). Following a shot the volume increased to a reported 1,200,000 cubic feet. A small amount of gas was produced in the Devonian black shale in this well, but although it was shot, this volume was not bettered. At the present time the Parrott well is bridged by a broken

liner, but at the time it was visited by the writer on December 19, 1931 it gave evidence by test of producing about 300,000 or 400,000 cubic feet although it had been flowing open for several weeks.

A recapitulation of the producing status of the Himyar field at this moment indicates that it has a total production of about 4½ million cubic feet open flow. This amount will undoubtedly be added to quite considerably by one or more of the three close-in wells now drilling.

Up to this writing no deep wells have been drilled either on the top of the Flat Lick Dome or the Artemus Dome. Neither have crestal positions on the Artemus-Flat Lick anticline yet been drilled. So far as the writer is able to ascertain no deep wells have been drilled on the Northern flank on this major anticline fold at relatively high positions, such as those occupied by productive wells at Hymar and Artemus on the South side.

A deep well drilled on the property of the American Coal Lands Co., in Bell County on the East flank of the Flat Lick Dome by the Wittmer interests to a depth reported slightly in excess of 2700 feet found a small amount of oil in the "Maxon" and has been abandoned.

Another nearby deep drilling carried forward by the Wittmer interests was the Creech No. 1 near Four Mile Creek and Cumberland River in Bell county, Kentucky which produced 100,000 cubic feet of gas in the "Big Lime" was drilled to a total depth of 2748 feet. A good log of the well may be seen in a recent report of this Survey.[1] This well also produced gas in the Devonian.

It is the writer's opinion that the development of the area in the vicinity of Himyar and Artemus, now in its initial stages, will result eventually in the opening up of an important natural gas field on favorable structural locations. Production will be mainly from the Corniferous limestone and the Maxon sand. In addition to these shallow and deep seated formations, some gas may be expected to be found in the "Big Injun" and the "Big Lime." Whether any of the four salt producing sands, the "Wages", "Jones", "Knox" and "Epperson" will pro-

[1] "Geology of the deep wells in Kentucky," pp. 11 and 12. 1931.

duce Pottsville gas in commercial quantity certainly remains to be seen. They should be closely watched in drilling. In this connection the Devonian black Shale should also be carefully drilled and given the attention which this important gas producing horizon in Eastern Kentucky merits when even small amounts of gas are naturally produced from it.

In the opinion of the writer, natural gas production along this major fold in southern Knox county, Kentucky will eventually be considerably extended. In the course of this development as in all exploratory drilling, oil in commercial quantities may be found in some of the sands penetrated below the base of the Pottsville (coal measures) and not improbably in the Corniferous. Should petroleum be found in this deep Devonian limestone which has such good repute in Kentucky it would mark a new and interesting departure in the drilling proposals for the Eastern coal field, no considerable amounts of commercial oil have been found in the Corniferous in this part of the State at such depths up to the present time.

Records of Drilled Wells

For the convenience of those who may wish to examine the detailed records of drilling to date in the Himyar field the following logs are presented. The kind cooperation of all of the operators in this field in making this group of records complete is here acknowledged.

KNOX COUNTY

Log No. 1

Josh Parrott No. 1 Well, Lessor. J. A. Henninger, et al, Butler, Pa., Lessees. Location: ¾ mi. East of Artemus, Knox County, Kentucky. Contractor and Driller: Paul Ensslin. Elevation: ———. Production: Gas, 94,000 cubic feet before shot; Gas, 1,200,000 cubic feet after shot. Liner bridged in hole, but this well was producing about 400 or 500 M. cubic feet open flow through obstruction Dec. 19, 1931. Rock pressure: 300 lbs. Commenced: October 1, 1931. Completed: Dec. 6, 1931. National No. 2 Rig used.

Strata	Thickness	Depth
Recent		
Soil	8	8
Pennsylvanian System		
Shale	31	39
Sandstone	51	90

	Thickness	Depth
Pennsylvanian System		
Shale	25	115
Sandstone	103	218
Sandstone and shale	6	304
Sandstone	10	314
Coal	3	317
Sandstone	269	586
Shale	4	590
Sandstone	125	715
Shale and Sandstone	48	763
Shale	3	766
Sandstone, "Salt"	154	920
Shale and Sandstone	7	927
Sandstone	51	978
Shale	34	1012
Sandstone	3	1015
Shale	6	1021
Sandstone, hard	4	1025
Shale	2	1027
Sandstone, white, "Salt"	41	1068
Shale	1	1069
Mississippian System		
Limestone	11	1080
Shale, "Red Rock"	20	1100
Shale, Limestone and Sandstone	16	1116
Limestone, sandy, green	25	1131
Shale, "Red Rock"	14	1145
Limestone	5	1150
Shale and Sandstone, shelly	55	1205
Sandstone } "Maxon" {	20	1225
Shale } "Maxon" {	5	1230
Sandstone } "Maxon" {	24	1254
Shale and Limestone, shelly	50	1310
Limestone, broken	44	1354
Shale, soft	21	1375
Limestone	35	1410
Shale, (soft)	7	1417
Limestone, "Big Lime"	211	1628
Shale, "Red Rock", sandy	100	1728
Shale and Limestone, shelly	47	1775
Limestone, blue, sandy	50	1825
Shale, Limestone, shelly	103	1928
Devonian System		
Shale, brown	155	2083
Limestone, "Corniferous"	21	2104
Shale and Limestone, green	35	2139
Shale	38	2177

Devonian System	Thickness	Depth
Limestone, shelly	5	2182
Shale	34	2216
Total depth		2216

NOTE: Casing Record—10 inch, 25 feet; 8¼ inch, 999 feet; 6⅝ inch, 135 feet. Producing sand, "Big Lime". Shot with 800 pounds Gelatine. 8¼ inch casing at 1000 ft., 10 inch casing at 25 ft. Fresh water at 140 feet. Oil at 160 feet. Oil at 375-425-432 feet. Gas at 525 ft. Salt water at 530 feet. Oil at 860 to 870 feet (heavy).

Drillers: Harry Dakon, Henry Ensslin, Paul Ensslin, Lee Owens, Bob Brown, C. C. Brown.

Log No. 2

W. H. Pursifull No. 1, Well Lessor. Wittmer Oil and Gas Co., Lessee. Location: Near Himyar Station, North of Cumberland River, Knox County, Kentucky. Rock Press: 300 lbs. Production: Gas, 1,000,000 cubic feet after shot: Open flow from the "Corniferous" sand. The "Epperson" sand (Pottsville) produced some oil. Contractor: M. J. McEroy. Authority: J. A. Henninger and driller's record.

Strata		
Pennsylvanian System	Thickness	Depth
Shale	6	6
Sandstone	29	35
Sandstone	315	350
Shale	18	368
Sandstone	212	580
Shale	60	640
Sandstone	9	649
Sandstone	201	850
Sandstone, "Salt"	50	900
Shale	35	935
Mississippian System		
Limestone	10	945
Shale	3	948
Shale "Red Rock"	134	1082
Sandstone "Maxon"	30	1112
Shale	133	1245
Limestone "Little Lime"	37	1282
Shale "Pencil Cave"	5	1287
Limestone "Big Lime"	258	1545
Shale "Red Rock"	52	1597
Sandstone "Big Injun"	123	1720
Sandstone	42	1762
Shale	20	1782

Devonian System	Thickness	Depth
Shale "Chattanooga"	173	1955
Shale "Chattanooga"	5	1960
Limestone "Corniferous"	95	2055
Shale	5	2060
Total Depth		2060

Casing Record: 10 inch, 8 feet; 8¼ inch, 748 feet; 6⅝ inch, 1017 feet.

Gas Production Record: In the Big Lime, 1468-1470 a little gas; in the Big Injun, 1602-1608 gas; in the Corniferous, 1970-1973 and 2030-2060 gas.

This well was shot with 80% Gelatine. This well gauged after shooting 6 in. water 3 in. pipe. In 6⅝ in. casing—2065 feet. Pick up 22 pounds first minute and 102 pounds in five minutes. Oil and Gas at 512-515 feet. Gas at 415 feet. Water and Salt Sand at 882-890 feet. Gas at 1470 feet. Gas at 1602-1608 feet. Gas at 1930-1973 feet. On Dec. 18, 1931, while being drawn on for two drilling rigs this well gauged .37 mercury in 3" tube = 744,120 cubic feet open flow after blowing 15 minutes.

Log No. 3

Ennis Coal Mining Co. No. 1 Lessor. Distel-Martin Oil and Gas Co. No. 1, Lessee. Location: North of Cumberland River near Himyar Station, Knox County, Kentucky. Commenced: Oct. 26, 1930. Completed: Feb. 23, 1931. Elevation: 999 feet. Production: 400,000 cubic feet after shot from "Maxon" sand, and "Corniferous" 1,400,000 cubic feet open flow. Total 1,800,000 cubic feet of natural gas. Rock pressure: 300 pounds.

Strata	Thickness	Depth
Recent		
Soil	35	35
Pennsylvanian System		
Sandstone	25	60
Shale	50	110
Sandstone	30	140
Shale	30	170
Sandstone	155	325
Shale	5	330
Sandstone	85	415
Shale	5	420
Sandstone	140	560
Sandstone, broken	40	600
Sandstone	250	850
Shale	20	870
Sandstone	50	920

Mississippian System	Thickness	Depth
Shale	5	925
Shale, "Red Rock"	6	931
Shale	49	980
Shale, "Red Rock"	10	990
Shale	33	1023
Sandstone	17	1040
Shale	35	1075
Sandstone, "Maxon"	21	1096
Shale	38	1134
Sandstone	11	1145
Shale	30	1175
Limestone, "Little Lime"	100	1275
Shale, "Pencil Cave"	9	1284
Limestone, "Big Lime"	266	1550
Shale, "Red Rock"	55	1605
Shale	189	1794
Devonian System		
Shale, black, "Chattanooga"	165	1959
Limestone, "Corniferous"	116	2075
Shale	33	2108
Limestone	6	2114
Total Depth		2114

Note: Casing Record: 10 in. casing, 40 ft.; 8¼ in. casing, 577 ft.; 6⅝ in. casing, 1244 ft. Show of gas at 1085-1091 ft.; show of gas 1500 ft.; show of gas 1979-1984 ft.; show of gas 2009-2014 ft.; fresh water at 80 ft.; show of oil at 600 ft.; salt water at 700-850 ft. Shot Feb. 27, with 2000 pounds 90% DuPont Gelatine; open flow after shot 1,400,000 cubic feet gas. (1690 Chocolate 100 above shale.)

Log No. 4

C. P. Kennedy No. 1, Lessor and Lessee. Location: Southern limits of Barbourville, Kentucky, just south of the Cumberland River. Production: Natural Gas, 500 M. cubic feet approximately. Rock Press, 300 lbs. This well was drilled before 1919 and is reported never to have been used.

Strata	Thickness	Depth
Soil	38	38
Pennsylvania System		
Sandstone, Black	22	60
Coal	3	63
Shale, Black	7	70
Sandstone, Gray	15	85
Shale, Black	70	155
Coal	4	159
Shale, Black	6	165
Sandstone, Gray	21	186

	Thickness	Depth
Pennsylvanian System		
Shale, Black	19	205
Sandstone, Gray—oil show at 210	35	240
Shale, Black	68	308
Sandstone, Gray	27	335
Shale, Black slate	15	350
Sandstone, White—oil show at 385	95	445
Shale, Black slate	18	463
Sandstone, Gray	107	570
Shale, Black and shells	25	595
Sandstone, White	75	670
Shale, Black	10	680
Shale, Black	40	720
Sandstone, White—salt water at 743	43	763
Shale, Black	37	800
Sandstone, Brown	60	860
Shale, Black shale	10	870
Sandstone, White	105	975
Shale, Black	47	1022
Sandstone, White	15	1037
Shale, Black	23	1060
Sandstone, White (base of Pottsville)	15	1075
Mississippian System		
Limestone, Blue	15	1090
Shale, "Red rock"	18	1108
Sandstone, White	5	1113
Shale, "Red rock"	32	1145
Shale, Black and shells	63	1208
Shale, "Red rock"	20	1228
Shale, Blue	32	1260
Sandstone, Brown—oil show at 1270	26	1286
Shale, Blue	32	1260
Limestone, Blue	15	1325
Shale, Blue	65	1390
Limestone, Brown—gas show at 1395	12	1402
Shale, White	10	1412
Limestone, White, "Big Lime"—gas show at 1470	143	1555
Shale and shells	260	1815
Flint, Blue	15	1830
Sandstone, Gray	55	1885
Shale, White and shells	20	1905
Devonian System		
Shale, Black, "Chattanooga"	145	2050
Shale, White and Limestone	135	2185
Shale, Pink	55	2240
Shale, White	15	2255

Devonian System	Thickness	Depth
Shale, "Red rock"	25	2270
Slate and shells	230	2500

Note: Base of Devonian undefined.

Log No. 5

Jim Walker, No. 1, lessor. E. J. Wyrick, No. 1, Lessee. Location: On Amandas Branch of the Road fork of Stinking Creek, Knox County, Kentucky. Commenced: January, 1920. Completed: March 31, 1920. Authority: The Associated Producers Oil Co.

Strata

Pennsylvanian System	Thickness	Depth
Soil	47	47
Sandstone, white	10	57
Shale, blue, hard	103	160
Shale, hard, sandy	40	200
Shale, blue, hard	20	300
Shale, hard, dark	20	320
Shale, blue, hard	20	340
Shale, hard, and limestone shells	70	410
Shale, hard	20	430
Shale, black, hard	35	465
Shale and limestone shells, hard	35	500
Shale, blue, hard	25	535
Shale, limy, sandy	10	545
Sandstone (salt sand, white, oil 550 and 830)	515	1060
Shale, limy, black, hard	10	1070
Shale, blue, hard	10	1080
Sandstone, white (Beaver)	175	1255
Shale, limy, hard	10	1265
Shale, black, hard	5	1270
Shale, gray, limy	10	1280
Shale, black, hard	5	1285
Sandstone, white (salt)	75	1360
Shale, gray, limy	10	1370
Mississippian System		
Shale, red, sandy	50	1420
Shale, red, shelly	20	1440
Shale, red, limy	5	1445
Sandstone, blue, "Maxon"	55	1500
Limestone, red	5	1505
Shale, red, sandy	15	1520
Sandstone, white, "Maxon"	55	1575
Shale, black, hard	40	1615
Limestone, dark "Little Lime"	105	1720
Shale, "Pencil Cave"	3	1723
Limestone, "Big Lime", white	127	1850

Mississippian System	Thickness	Depth
Sandstone, white, "Big Injun"	70	1920
Sandstone, red, hard, "Big Injun"	10	1930
Shale, red, sandy, "Big Injun"	15	1945
Sandstone, red, "Big Injun"	50	1995
Limestone, blue, "Big Injun"	5	2000
Shale, hard, and limestone shells	100	2100
Devonian System		
Shale, black, "Chattanooga"	344	2444
Limestone (Irvine sand), (1st 10 feet gritty then mostly limestone, gas 2249)	53	2497
Silurian System		
Limestone	20	2517
Shale, hard, and limestone shells	60½	2577½
Total depth		2577½

NOTE: This drilling on the Walker farm is the deepest well to date, December 20, 1931, in Knox County, Kentucky. W. R. J.

Log No. 6

Hubert Pursifull, No. 1, Lessor. Distel-Martin Oil and Gas Co., Lessee. This well is drilled to Maxon Sand only. Location: Near Himyar, Knox County, Kentucky. Commenced: July 28, 1931. Completed: September 21, 1931. Production: Natural Gas from 1050 to 1057 feet, by gauge 800,000 cubic feet open flow. Rock pressure: 310 pounds.

Strata	Thickness	Depth
Recent		
Quicksand	52	52
Pennsylvanian System		
Sandstone	5	57
Shale	10	67
Sandstone	68	135
Sandstone, white	374	509
Shale	7	516
Sandstone	84	610
Shale	10	620
Sandstone	85	705
Shale	5	710
Sandstone	65	775
Shale	12	787
Sandstone	28	815
Shale	15	830
Sandstone, shell	27	857
Sandstone	33	890
Shale	5	895
Sandstone	33	928

Mississippian System	Thickness	Depth
Shale	32	960
Shale, "Red Rock"	5	965
Shale	75	1040
Sandstone, "Maxon"	17	1057
Total depth		1057

NOTE: Fresh water at 90 feet; salt water at 660 feet, one bailer per hour. Tubed with 3 in. tubing. Hook wall packer set at 1045 feet. Elevation: 991 feet. 513 ft. 1 in. of 8 in. casing left in well. Drilled under supervision of E. L. Johnston, Field Manager.

Log No. 7

D. D. Stewart Well No. 1, Lessor. Petroleum Exploration Inc., Lessee. Location: Near Himyar, Knox County, Ky. Drillers: M. S. Littrell, Walter Williams, Hudell Townsend. Tool Dresser: Wayland Littrell. Commenced: October 1, 1931. Completed: November 26, 1931. Production: Gas, 527,520 cubic feet. Rock Pressure: 294 pounds. Authority: A. H. Wagner.

Strata

Pennsylvanian System	Thickness	Depth
Soil and shale	27	27
Sandstone	53	80
Shale, shelly	40	120
Sandstone	45	165
Shale	30	195
Sandstone	195	390
Limestone, white	10	400
Sandstone	40	440
Sandstone, black	35	475
Sandstone, white	90	565
Shale, "Pencil Cave"	17	582
Sandstone, broken	35	617
Shale, "Pencil Cave"	30	647
Sandstone	163	810
Shale, broken	25	835
Limestone, black	7	842
Shale, broken	37	879
Limestone, sandy	41	920
Shale	17	937
Shale, black	6	943
Sandstone, very hard	19	962
Mississippian System		
Shale, shelly	20	982
Shale, "Red Rock"	8	990
Shale	9	999
Shale, "Red Rock"	21	1020

Mississippian System	Thickness	Depth
Shale	16	1036
Sandstone	8	1044
Shale	18	1062
Sandstone, "Maxon"	25	1097
Shale	14	1111
Sandstone, "Maxon"	11	1122
Shale, shelly	83	1205
Limestone, "Little Lime"	74	1279
Shale, "Pencil Cave"	6	1285
Limestone, "Big Lime"	242	1527
Shale, "Red Rock"	70	1597
Shale, Shelly	93	1690
Limestone, blue, gritty	75	1765
Shale	15	1780
Shale, black	164	1944
Sandstone, "Corniferous"	62	2006
Shale	16	2022
Total depth		2022

NOTE: Show of oil and gas at 583 feet. Gas at 1070 feet. Water at 82 feet. More water at 120 feet. 3x6⅝ in Parmaco special gas anchor packer, 1956 ft. Gauge set at 1978 ft. Three joints 3 in. tubing below packer for anchor. Well gauged 400,000 cubic feet gas through the tubing, and gauged 127,520 cubic feet in the casing after shot.

BELL COUNTY

Log No. 8

Asher Coal Mining Company No. 4, Lessor. Wittmer Oil and Gas Co., Lessee. Location: Near Beverley, Bell County, Kentucky. Commenced: May 14, 1931. Completed: September 11, 1931. Elevation: ———. Production: Dry, plugged and abandoned. Authority: J. A. Henninger, Butler, Pa.

Strata	Thickness	Depth
Recent		
Soil	20½	20½
Pennsylvanian System		
Sandstone, white	106½	127
Coal	4	131
Sandstone, white	99	230
Sandstone, hard, white	360	590
Sandstone, white	80	670
Sandstone, dark	70	740
Sandstone, white	80	820
Shale	220	1040
Sandstone, dark, soft	103	1143

	Thickness	Depth
Pennsylvanian System		
Sandstone, white	109	1252
Sandstone, hard, yellow	328	1580
Shale, break	8	1588
Sandstone, hard, yellow	168	1756
Sandstone, hard, white	42	1798
Sandstone, yellow	160	1958
Shale, blue	4	1962
Sandstone, dark	8	2000
Shale, break	2	2002
Sandstone, yellow	144	2146
Shale	68	2214
Sandstone, white	210	2424
Shale, "Pencil Cave"	34	2458
Sandstone, black	27	2485
Limestone, black	29	2514
Mississippian System		
Limestone, "Little Lime"	44	2555
Shale, "Pencil Cave"	3	2558
Limestone	12	2570
Limestone, "Cave"	4	2574
Limestone, "Big Lime"	245	2819
Shale, "Red Rock"	55	2874
Sandstone, "Big Injun"	131	3005
Shale, "Red Rock"	10	3015
Shale, light	105	3120
Devonian System		
Shale, black	235	3355
Shale, break	5	3360
Limestone, "Corniferous"	103	3463
Sediments unrecorded	37	3500
Total depth		3500

NOTE: Casing Record—8 in. casing at 673 ft. Salt water at 2080 ft. Show of dark oil at 2240 ft. Salt water at 2286 ft. 6⅝ in. casing at 2574 ft.

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