STATE OF ARKANSAS

ANNUAL ADMINISTRATIVE REPORT

OF THE

STATE GEOLOGIST

For the Period from December 1, 1927
to December 1, 1928

LITTLE ROCK

1929

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Contents

Letter of Transmittal

ARKANSAS GEOLOGICAL SURVEY
LITTLE ROCK, ARK.
January 15, 1929

HON. HARVEY PARNELL,
Governor, State of Arkansas,
Little Rock, Arkansas.

Sir:

In compliance with the law which requires the State Geologist to submit an annual progress report to the Governor I hand you herewith a statement of the work of the Office of State Geologist from December 1, 1927, to December 1, 1928.

I wish at the same time to thank you for the support and co-operation which this office has received from you at all times.

Respectfully submitted,

GEORGE C. BRANNER,
State Geologist

Foreword

During the period from December 1, 1927, to December 1, 1928, the Office of State Geologist has made progress toward the completion of the program outlined July 1, 1927, and has undertaken three new projects not then begun. Of the geological surveys undertaken, one map has been completed and two reports and the geological map of the State are in the hands of the printer, two geological reports are nearing completion, and the field work on two others is still in progress. In topographic mapping, a survey of one quadrangle has been completed, a photolithographed map of it has been published, and the engraved edition will be ready for distribution in January, 1930. In stream gaging, one report has been submitted to the printer and the routine field work has been continued.

The completion of the two unfinished geological reports has involved much field and office work and has taken more time than that originally assigned to them, but it is believed that the delay in their publication will be more than justified by the increase in their comprehensiveness and thoroughness.

The operation of Act No. 142 of the Genenral Assembly of 1927 provided funds for this office amounting to $32,829.15 for the fiscal year ending June 30, 1928. This is 54 per cent of the amount appropriated by the Legislature for the support of the office during that period. The estimated income based on the production of petroleum in the State during the fiscal year ending June 30, 1929, is $28,000.00, a decrease of $4,829.15 or 15 per cent less than the income during the preceding fiscal year. This is due almost entirely to the decrease in the production of petroleum, as 97.8 per cent of the income of the office during the fiscal year 1927-28 was derived from this source. The estimated decrease in income has of necessity led to a curtailment of work for the next fiscal year.

In three branches of work undertaken active co-operation has been maintained with Federal and private agencies. The co-operative funds available for geological work during the fiscal year ending June 30, 1929, are approximately $10,000.00; for topographic work approximately $2,000.00; and for stream gaging $1,517.62, a total of $13,517.62, or 46 per cent of the estimated annual tax income provided for the support of the office during the fiscal year ending June 30, 1929.

Federal and private funds have increased the usefulness of the office about one-half.

As stated in the annual administrative report of this office for the period from December 1, 1926, to December 1, 1927, the practice of allocating a substantial part of the funds available to the stimulation of the production of oil, natural gas, and natural-gas gasoline has been continued. The reasons for this practice are (1) that about 80 per cent of the value of the mineral output of the State in 1927 was derived from oil, natural gas, and natural-gas gasoline, (2) that approximately 98 per cent of the revenue of this office is derived from taxes levied on these products, and (3) that cheap fuels are important to many industries of the State.

WORK UNDERTAKEN

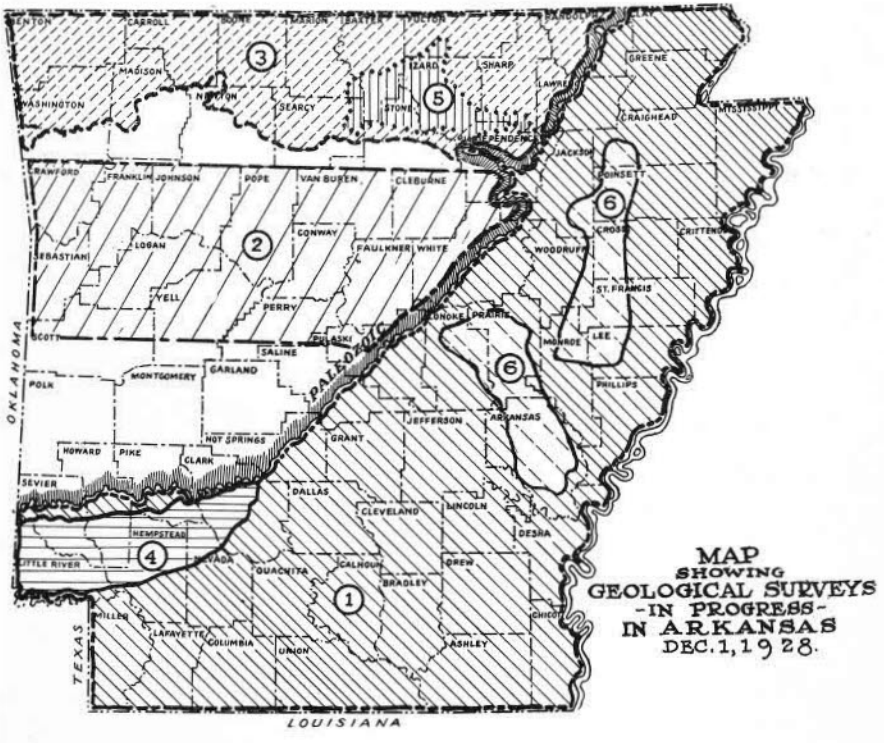
The work undertaken by the State Geological Survey may be divided into geological surveys, topographic mapping, stream gaging, and office administration.

GEOLOGICAL SURVEYS

The geologic work done during the year has covered the following subjects:

1. The oil and gas resources of the lowland or coastal plain area of southern and eastern Arkansas.

2. The structural conditions favorable to the accumulation of gas and oil in the Arkansas River valley region of western Arkansas.



Map showing the areas covered by geological surveys now in progress in Arkansas, namely:

1. A survey of the possible oil and gas resources of the lowland or coastal plain area of southern and eastern Arkansas, by W. C. Spooner.
2. A survey of the structural conditions favorable to the accumulation of gas and oil in the Arkansas River Valley region of western Arkansas, by Carey G. Croneis.
3. A survey of the zinc and lead region of northern Arkansas, by E. T. McKnight.
4. A survey of the Upper Cretaceous formations of southwestern Arkansas, by Carle H. Dane.
5. A survey of the St. Peter and older Ordovician sandstones of north Arkansas, by Dr. Albert W. Giles.
6. A survey of the ground-water conditions in the rice irrigation district of eastern Arkansas, by D. G. Thompson and D. W. Weber.

3. The zinc and lead region of northern Arkansas.

4. The Upper Cretaceous formations of southwestern Arkansas.

5. The St. Peter and older Ordovician sandstones of norh Arkansas.

6. The ground-water conditions in the rice irrigation district of eastern Arkansas.

7. A detailed geological map of Arkansas.

8. A sectionized map of Arkansas showing the location of all oil and gas wells and producing fields in the State.

9. An isometric projection map of Arkansas showing the geology in surface, perspective and in sections.

1. A Survey of the Possible Oil and Gas Resources of the Lowland or Coastal Plain Area of Southern and Eastern Arkansas

PERSONNEL

W. C. Spooner, Geologist in charge; Consulting Geologist; graduate of Polytechnic Institute of Brooklyn, N. Y. Author of reports on the geology of oil and gas in Louisiana.

Garland O. Grigsby, Field Assistant; graduate of Louisiana State University, Geological Department.

M. B. Helm, Draftsman.

W. W. Gillis, Draftsman.

This project was described in detail in the annual administrative report of this office for 1926-27. The field work was completed during the fall of 1928. The text of the report is now nearing completion.

Mr. W. C. Spooner, geologist in charge, has submitted to this office a subsurface map showing contours on the surface of the Nacatoch sand in northern Louisiana and southern and eastern Arkansas, with a 200-foot contour interval, 12 cross sections with correlations, and 28 typed pages of text on the paleontology of the area, together with four plates of wash drawings, which are to be included in the report. The remainder of the text of the report, which will probably consist of about 500 pages of printed text, will probably be submitted within the next month, and the report should be ready for distribution about March 15, 1929. It is believed that this report will be an important contribution to the oil and gas geology of the southern United States.

2. A Survey of the Structural Conditions Favorable to the Accumulation of Gas and Oil in the Arkansas River Valley Region of Western Arkansas

PERSONNEL

Carey G. Croneis, Geologist in charge; Assistant Professor of Paleontology, Chicago University, Chicago, Ill. Author reports on geological formations of northern and western Arkansas.

Cecil D. Robinson, Field Assistant; graduate University of Arkansas, Geological Department.

Bryan Parks, Field Assistant; graduate University of Arkansas, Geological Department.

Homer L. Anderson, Field Assistant; graduate University of Arkansas, Geological Department.

Edward A. Schmitz, Draftsman.

The field work of this survey was completed late in 1927. The maps, sections, and text, which have been in preparation by Mr. Croneis, are now nearing completion. Mr. Croneis has submitted one sectionized structure map of the Arkansas Valley region, which in that area extends from the north line of Township 2 North to the north line of Township 12 North and covers an area of about 9,000 square miles. This area includes what appears to be the most promising part of northern and western Arkansas for the production of oil and gas. The structure map shows about 73 anticlines, 61 synclines and 34 faults. Structure maps of the entire Ozark Plateau and Ouachita Mountain regions are also being compiled to supplement this map. The combination of these maps will show the structural relations between the Ozark Plateaus, the Ouachita Mountain region, and the Arkansas River Valley area. Mr. Croneis has also submitted to this office four cross sections and two columnar sections of the region. A portion of the report is now in the hands of the printer. This report should be ready for distribution about April 1, 1929.

Active prospecting in the Arkansas River Valley has been stimulated by the successful development of the Clarksville gas field, and operators are now preparing to drill deep prospecting wells for oil in the northern part of the Valley. The report will fill an increasing need for information on the geologic structure of the Valley. There has been a continual demand at this office for the information obtained by this survey.

3. A Survey of the Zinc and Lead Region of Northern Arkansas

PERSONNEL

Edwn T. McKnight, Field Geologist; Assistant Scientist, U. S. Geological Survey.

Cecil D. Robinson, Field Assistant; graduate University of Arkansas, Geological Department.

The Federal-State co-operative arrangement for the survey of the zinc and lead region of Arkansas, which was begun during the fiscal year 1927-28, is being continued as planned during the fiscal year 1928-29. Both the Federal and State survey are contributing $5,000.00 annually toward the cost of the field work. Mr. E. T. McKnight, who is doing the field work required for this report, states that the detailed mapping of the areal and structural geology of the Yellville quadrangle, which covers about 975 square miles in the zinc and lead region, will be completed by the end of January, 1929. The report of this survey will include the data available relative to the prospects, openings, shafts and underground workings, and the production in this region. On completing his work in this quadrangle Mr. McKnight expects to make an economic survey of the remainder of the zinc and lead region, including parts of Marion, Boone, Newton, Carroll, Madison, Searcy, Stone, Independence. Izard, Sharp, Lawrence, and Randolph counties.

Mr. W. C. Mendenhall, Chief Geologist of the U. S. Geological Survey, Mr. H. D. Miser, Geologist in charge of the Fuels Division of the U. S. Geological Survey, and Mr. E. F. Burchard, Geologist in charge of the Iron and Steel Division of the U. S. Geological Survey, spent several days with Mr. McKnight in the field during the summer of 1928.

The preparation of the text of the report on this area will probably be begun during the fall of 1929. No arrangement has yet been made for its publication.

4. A Survey of the Upper Cretaceous Formations of Southwestern Arkansas

PERSONNEL

Carle H. Dane, Field Geologist; Assistant Scientist, U. S. Geological Survey.

P. D. Torrey, Rodman; U. S. Geological Survey.

The field work on this report was completed in 1926 as a Federal project by C. H. Dane, of the U. S. Geological Survey, and the text is being published by the State Survey. The area covered includes

either all or parts of Sevier, Howard, Pike, Clark, Nevada, Hempstead, Miller, and Little River counties. The report, which includes about 350 pages of text, is now in the hands of the printer ready for final page proof. A detailed sectionized geologic map of the the Cretaceous area in southwestern Arkansas, together with one geologic section of this area, has been printed and an edition of 3,000 copies has been delivered to this office. The scale of this map is 1:250,000 and the engraving has been done under the direction of S. J. Kubel, Chief Engraver of the U. S. Geological Survey. The locations of seventy deep test wells in this area are shown. The report should be ready for distribution about March 1, 1929.

5. A Study of the St. Peter and Older Ordovician Sandstones of North Arkansas

PERSONNEL

Dr. Albert W. Giles, Geologist in charge; Professor of Geology, University of Arkansas.

Bryan Parks, Field Assistant; graduate University of Arkansas, Geological Department.

Eugene Brewster, Field Assistant; undergraduate University of Arkansas Geological Department.

After the St. Peter and older Ordovician beds of sandstone in northern Arkansas had been mapped by Dr. A. W. Giles, Bryan Parks, and Eugene Brewster during July and August, 1927, 54 representative samples of the rock were collected from different parts of the St. Peter, Calico Rock and Kings River sandstone formations of northern Arkansas and a report on the distribution and economic value of these sandstones was prepared. These formations extend over a large area in northern Arkansas, covering parts of Baxter, Marion, Searcy, Stone, Izard, Fulton, Independence, Sharp and Lawrence counties. The report has been completed and is in the hands of the printer. It consists of 165 typed pages of text, 52 tables showing the physical characteristics of the samples collected, 54 graphs showing the results of screening tests of the St. Peter sandstone, 36 graphs showing the results of similar tests of the Calico Rock sandstone, and 6 photomicrographs of the St. Peter sandstone.

It is expected that this report will be useful in supplying detailed information concerning the nature and distribution of these beds of sandstone in the State and may lead to the greater development of parts of them for use as glass sand, molding sand, filter sand, etc.

6. An Investigation of the Ground Water Conditions in the Rice Irrigation District of Eastern Arkansas

PERSONNEL

Dr. O. E. Meinzer, Geologist in charge; Ground-water Division, Water Resources Branch, U. S. Geological Survey.

David G. Thompson, Field Geologist; Geologist, Water Resources Branch, U. S. Geological Survey.

D. W. Weber, Engineer Field Aide, Topographic Branch, U. S. Geological Survey.

As the result of a request made in April, 1927, by Senator T. C. Caraway for a study of the ground-water conditions in the rice growing district of eastern Arkansas, the U. S. Geological Survey and the Arkansas Geological Survey agreed to co-operate in such a study. The field work is under the direction of Dr. O. E. Meinzer of the Division of Ground Waters, Water Resources Branch, U. S. Geological Survey, and is being done by Mr. David G. Thompson and Mr. D. W. Weber of that Survey.

This co-operative arrangement provides for an investigation covering two years. During this period the Federal and State Surveys are each to contribute $2,000.00 a year to defray the expense of the investigation, $1,000.00 is to be furnished annually by the Arkansas Power and Light Company, and $2,000.00 annually by other local interests in the rice district.

Mr. Thompson, with headquarters at Stuttgart, spent four months in the summer of 1928 collecting data in the rice fields and will continue this work in 1929. Information is being obtained in regard to the character, thickness, and extent of the water-bearing strata, the yield of wells, and the total quantity of water used in the rice district. Instruments have been installed in wells to obtain continuous records of the ground-water level. The rice-growing industry is confined principally to Arkansas County, and most of Mr. Thompson's work has been done there, but the survey includes parts of Prairie, Lonoke, and Monroe counties, where much rice is grown, and may include other counties in northeastern Arkansas.

The object of this survey is to determine whether the rice industry of the State, which depends upon ground water for irrigation, is likely to deplete greatly the ground-water supplies now available for other uses in this area. If the depletion should appear to be of serious consequence, recommendations will be made for artificial recharge of the water and the quantity economically available will be determined.

The results of this survey may have important economic consequences, dealing as it does with the underground water supply of the larger part of the rice-growing district of the State.

7. Compilation and Publication of a Geological Map of Arkansas

A detailed geological map of the State of Arkansas on a scale of 1:500,000 or about 8 miles to the inch, has been in preparation during the fiscal year 1927-28 and is now in the hands of the engraver. The results of the geologic mapping and the locations of oil and gas fields, mines and quarries, oil and gas pipe lines, power lines and power dams have been shown on the map. The final editing of the proof of the map has been supervised by Mr. Hugh D. Miser and Mr. George W. Stose, both of the United States Geological Survey. The edition of 3,000 copies will be delivered to this office about the middle of May.

This map is the result of about three years work in compiling published and unpublished geological information. The scale adopted, 1:500,000, is the same as that of the geological maps of Oklahoma, Missouri and Tennessee. The base used is the recently revised two-color edition of the United States Geological Survey's base map of Arkansas. This map was drawn by Pearle L. Blackman of the Arkansas Geological Survey. No other detailed large-scale geological map of Aransas has ever been published. For many years there has been a widespread demand for a map of this type.

8. Base Map of Arkansas Showing the Location of all Oil and Gas Wells and Producing Fields in the State

This map, which was prepared co-operatively by the Department of Conservation and the Arkansas Geological Survey, was completed in August, 1928. It is about 7 by 8 feet in size and shows the locations of all oil and gas wells drilled in the State up to August 24, 1928, for which drilling permits have been issued by the State Department of Conservation and the locations of all wells drilled prior to that date concerning which data could be obtained. The map is being sold by this office, in whole or in part, that is, for the northern or the southern half of the State for approximately the cost of printing and mailing.

9. An Isometric Projection Map of Arkansas

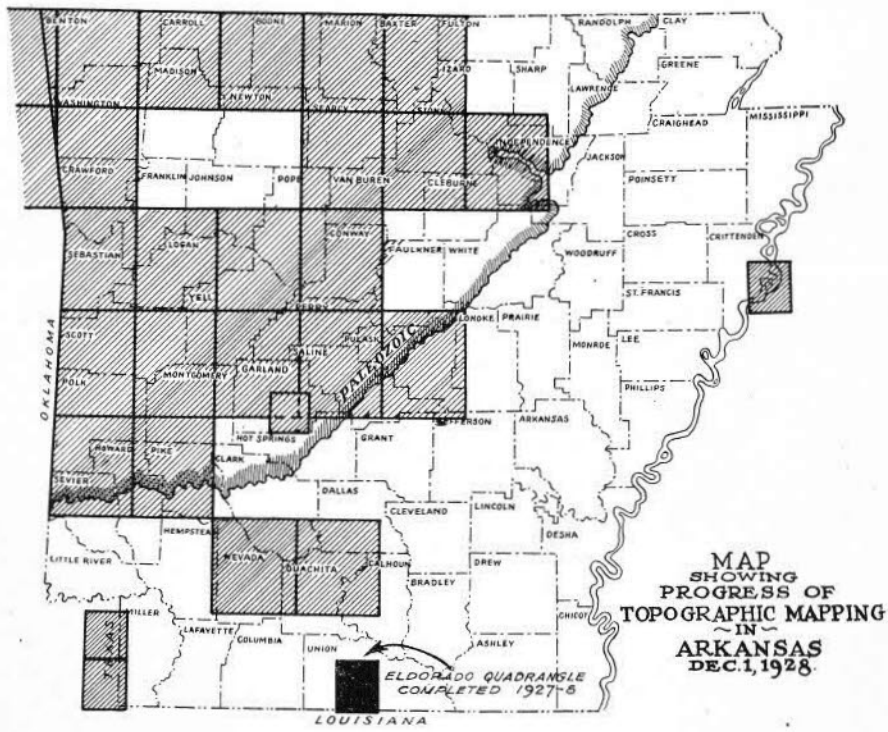
An isometric projection map of the State, in four sections, is being prepared by Mr. Carl Blacklock of this department. The map

shows both the topography and geology of the State. This map shows the relation between the surface features and the subsurface geology and includes vertical sections to a depth of approximately 10,000 feet. It makes the main features of the structural geology of the State clear. The horizontal scale adopted is 1:500,000, or about 8 miles to the inch, and the vertical scale is about 2,700 feet to the inch. Work on this map is progressing, and it will probably be completed by February 15. On its completion, a tracing will be made and copies will be available to the public.

2. TOPOGRAPHIC MAPPING

Three topographic projects have been undertaken during the year, namely:

1. Topographic mapping of the El Dorado quadrangle.
2. Topographic mapping of the coastal plain area of southern and eastern Arkansas.
3. Topographic mapping of the State.



Map showing the areas in Arkansas that have been mapped topographically by the United States Geological Survey. The shaded quadrangles were mapped prior to July, 1927; the solid black square representing the El Dorado quadrangle, was completed 1927-28 as Federal-State co-operative work.

1. Topographic Map of the El Dorado Quadrangle

FIELD PERSONNEL

C. L. Sadler, Topographic Engineer, U. S. Geological Survey, and a party consisting of F. L. Whaley, D. Kennedy, H. S. Milsted, A. T. Munson, J. M. Lawson, B. H. Yoakum, Henry Dodge, Rodman and John Steward, Rodman.

The drafting on the El Dorado quadrangle, which was mapped topographically during the summer and fall of 1927 was completed by engineers of the U. S. Geological Survey early in 1928 and the advance lithographic copy of the map was received at this office in May, 1928, for checking. This map is the outcome of a Federal-State co-operative agreement made in July, 1927, under which each Survey contributed $5,050.00 toward the field work. About 150 advance copies have been supplied to this office for distribution. The engraved edition, the expense of which is being paid by the U. S. Geological Survey, will be ready for distribution in January, 1930.

No new topographic mapping has been definitely planned for the year 1928-29 on account of lack of funds for this work.

2. Topographic Map of the Coastal Plain Area of Southern and Eastern Arkansas

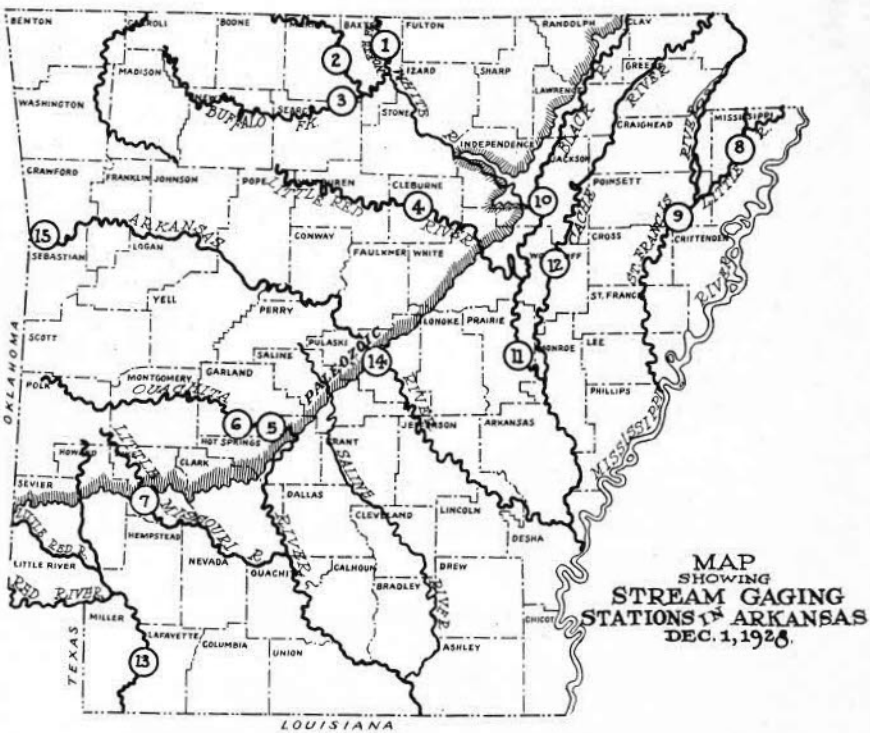
A contour map of the coastal plain region of Arkansas on the scale of 1:500,000, with a 100-foot contour interval, is being prepared at Washington as a Federal-State co-operative project. Many of the contours on this map will be based on the known elevations along railroads, highways, and in drainage districts, which have been assembled by this office. The information compiled has been submitted to the United States Geological Survey and will be placed on the 1928 base map of the State of Arkansas. This information will be shown in three colors, drainage in blue, culture in black and topography in brown. The cost of compiling, drafting, and printing this map will be borne by this Survey; the Federal Survey is providing the personnel and equipment for the work.

Copies of the map should be delivered to this office about March 15, 1929.

3. Topographic Map of the State

After the topographic map of the coastal plain area of southern and eastern Arkansas has been compiled the data shown on that map and such other data as has been compiled will be used to prepare a contour map of the entire State on the scale of 1:500,000, with

a contour interval of 250 feet. The same base and color system will be used as that on the map of the coastal plain area. This project will be carried out in co-operation with the United States Geological Survey, which will bear the cost of compiling, drafting, and preparing the map for photolithographing. The State Survey will contribute about $400.00, which covers the cost of printing an edition of 3,000 copies. If the topographic map of the coastal plain area is completed by March 15, 1929, the State topographic map should be ready for distribution from this office by June 15, 1929.



Map showing the location of the stream gaging stations that have been installed in Arkansas up to December 1, 1928. These are located on the following streams:

1. North Fork of White River at Henderson.
2. White River near Flippin.
3. Buffalo River near Rush.
4. Little Red River near Heber Springs.
5. Ouachita River at Remmel Dam near Malvern.
6. Ouachita River near Hot Springs.
7. Little Missouri River near Murfreesboro.
8. Big Lake Outlet near Manilla.
9. St. Francis River near Marked Tree.
10. White River near Newport.
11. White River at DeValls Bluff.
12. Cache River at Patterson.
13. Red River at Garland City.
14. Arkansas River at Little Rock.
15. Arkansas River at Van Buren.

3. STREAM GAGING

The stream gaging carried on in the State may be classed as follows:

1. Field work.
2. Publication of stream-gaging report.

PERSONNEL

H. C. Beckman, District Engineer, U. S. Geological Survey, Rolla, Mo.

W. S. Frame, Acting District Engineer, U. S. Geological Survey, Federal Building, Fort Smith, Ark.

V. L. Austin, Assistant Engineer, U. S. Geological Survey, Rolla, Mo.

1. Field Work

The co-operative Federal-State stream gaging work, which was begun in July, 1927, and continued through the fiscal year 1927-28 will, funds permitting, be continued through the fiscal year, 1928-29. The co-operative funds of the Water Resources Branch of the United States Geological Survey alloted to Arkansas for 1928-29 were increased. The present ratio of the funds available under the co-operative arrangement, which is two to one, is an increase over that of the previous year, which was five to one. The total contribution of the United States Geological Survey for such work is $1,250.00, as against $2,500.00 contributed by this Survey. The Arkansas Power & Light Company also contributed $227.62 toward the maintenance of the following gaging stations:

Little Red River near Heber Springs.
Ouachita River at Remmel Dam.
Ouachita River near Hot Springs.
Little Missouri River near Murfreesboro.
White River near Flippin.
North Fork at Henderson.
Buffalo River near Rush.

In addition, M. W. Greeson contributed $40.00 for the construction of a gaging station on the Little Missouri River at Murfreesboro, making a total amount from all sources of $4,017.62 for carrying on stream-gaging work in Arkansas during the fiscal year 1928-29.

The installation of the gaging stations and their reading and maintenance was in charge of Mr. H. C. Beckman, District Engineer of the United States Geological Survey, until September, 1928, when such work, except that done at stations on the White River, Buffalo and North Fork, was put in charge of Mr. W. S. Frame, Acting U. S. District Engineer, with offices in the Federal Building, Fort Smith, Arkansas. The stations on White River, Buffalo, and North Fork, will for a time remain in charge of Mr. H. C. Beckman, Rolla, Mo.

2. Compilation of Stream Gaging Information

Mr. W. S. Frame has compiled a statistical report that includes all available information concerning stream gaging in Arkansas. This report is the first one of this kind yet attempted. It includes records kept of stream gaging, estimates of stream flow, and records of miscellaneous measurements, as well as a text and a bibliography. The manuscript of the report, which consists of 248 typewritten pages, is now in the hands of the printer, and the report should be ready for distribution from this office about March 1, 1929.

The accompanying table gives detailed information concerning stream-gaging stations in Arkansas up to December 1, 1928.

1. GAGING STATIONS FOR DETERMINING WATER POWER AVAILABLE DECEMBER 1, 1928

	River	Name of Station	Location Sec. Twp. Range	Type of Gage	When Installed	When Read	Cost of Installation	Cost of Gage Reading
1	North Fork	Henderson	SW. ¼ Sec. 26, T. 20 N., R 12 W.	Staff	Installed Oct. 1, 1928	Daily	$ 600.00 Estimated	Furnished by White River Power Co.
2.	White	Flippin		Staff	Installed Oct. 1, 1928	Daily	700.00 Estimated	Furnished by White River Power Co.
3.	Buffalo	Rush		Staff	Installed Oct. 1, 1928	Dai'y	800.00 Estimated	Furnished by White River Power Co.
4.	Little Red	Heber Springs	NE. ¼ Sec. 1, T. 10 N., R. 10 W.	Staff	Installed Sept. 15, 1927	Daily	60.00	Furnished by Arkansas Power and Light Co.
5.	Ouachita	Remmel Dam near Malvern	SW. ¼ NW. ¼, Sec. 36 T. 3 S., R. 19 W.	Recording	Installed Jan. 28, 1925 Washed out April 21, 1927 Replaced Jan. 20, 1928	Continuous	2200.00	Furnished by Arkansas Power and Light Co.
6	Ouachita	Hot Springs	SW. ¼ Sec. 29, T. 3 S., R. 19 W.	Chain	Installed June 27, 1922	Daily	40.00	$15.00 per month paid by Arkansas Power and Light Co.
7.	Little Missouri	Murfreesboro	SE. ¼ Sec. 13, T. 8 S., R. 26 W.	Chain	Installed Jan. 15, 1928	Daily	40.00	$2.50 per month by Ark. Geol. Survey $5.00 per month by Arkansas Power and Light Co.

2. GAGING STATIONS FOR ACQUIRING FLOOD CONTROL DATA

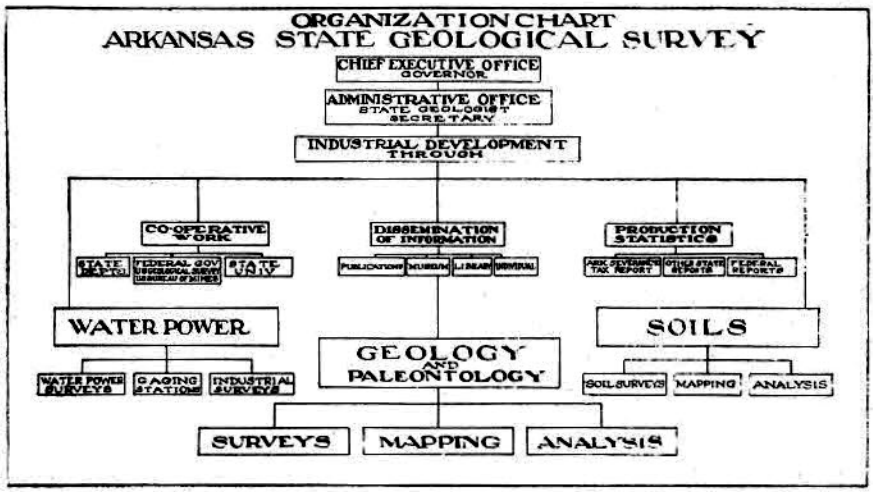
8.	Big Lake Outlet	Manilla	SE. ¼ Sec. 9, T. 14 N., R. 9 E.	Chain	Installed Sept. 22, 1927	Daily	40.00	Furnished by Mississippi County Drainage Dist. No 17
9.	St. Francis	Marked Tree	SE. ¼ Sec. 10, T. 11N., R. 6 E.	Staff	Installed July 30, 1927	Daily	No cost to Ark. Geol. Survey	Furnished by Poinsett County Drainage Dist. No. 7
10.	White	Newport	On line between Sec's 16 and 17, T. 11 N., R. 3 W.	Chain	Installed Sept. 18, 1927	Daily	40.00	$3.00 per month
11.	White	DeValls Bluff	At highway bridge at Devalls Bluff	Staff	Installed Apr. 14, 1928	Daily	No cost to Ark. Geol. Survey	Furnished by U. S. Weather Bureau
12.	Cache	Patterson	At Mo. Pac. Ry. bridge at Patterson	Staff	Installed Feb. 1, 1928	Daily	No cost to Ark. Geol. Survey	Furnished by U. S. Weather Bureau
13.	Red	Garland City	At SL-SW Ry. bridge at Garland City	Chain	Installed Sept. 30, 1927	Daily	40.00. Installed by Ark. Geol. Survey	$3.00 per month

3. GAGING STATIONS FOR DETERMINING AVAILABLE WATER POWER AND OBTAINING DATA FOR FLOOD CONTROL

14.	Arkansas	Little Rock	At Main Street bridge Little Rock	Staff	Installed July 28, 1927	Daily	No cost to Ark. Geol. Survey. U. S. W. B.	Furnished by U. S. Weather Bureau
15.	Arkansas	Van Buren	At highway bridge at Van Buren; Sec. 24, T. 9 N., R. 32 W.	Chain	Installed Oct. 4, 1927	Daily	40.00. Installed by Ark. Geol. Survey	$5.00 per month

4. OFFICE ADMINISTRATION

The following chart shows the organization of the work of the Arkansas Geological Survey:



PERSONNEL

George C. Branner, State Geologist, 1923.
Margaret Richards, Clerk-Stenographer.
Lucy C. Marion, Stenographer.
Carl Blacklock, Draftsman.

The administration of office work may be divided into:

1. Work of State Geologist.
2. Routine Office Service.

1. Work of State Geologist

In addition to handling the routine work of the office during the past year, the State Geologist has taken numerous field trips through the State for the purpose of keeping in touch with field work in progress or examining mineral properties which appeared to be worthy of immediate attention. He also attended several annual meetings and conferences.

The State Geologist attended the field trip of the Tulsa Geological Society to northwest Arkansas in May, 1928, in connection with the study of the Pennsylvanian and Mississippian formations there. In September, 1928, he was in charge of the Arkansas portion of the annual field trip of the Kansas Geological Society which was com-

posed of some seventy-five geologists, including the State geologists of Missouri, Texas and Kansas. In May, 1928, he made a geological field trip with E. O. Ulrich of the United States Geological Survey, H. A. Buehler, Director of the Missouri State Survey, C. K. Dake and J. Bridge of the Missouri School of Mines, and H. S. McQueen of the Missouri Survey. The purpose of the trip was to study the Ordovician formations in a part of northeast Arkansas. A two-day field trip was made with H. D. Miser, head of the Fuels Division of the United States Geological Survey, and E. T. McKnight of that Survey in connection with the field work of the co-operative zinc and lead survey of north Arkansas.

He attended the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York in February, 1928, as well as the annual conference of the American Association of State Geologists with the Director of the United States Geological Survey during the same week in Washington.

The State Geologist has prepared for publication in newspapers numerous articles on the mineral resources of the State and has submitted a paper on "Occurrence of Bentonite in Southern Arkansas" to be read at the meeting of the American Institute of Mining and Metallurgical Engineers in 1929. A revised reprint of a part of the booklet "Outlines of Arkansas Mineral Resources" has been issued relative to the metallic minerals of the State.

At the International Petroleum Exposition held in Tulsa, Oklahoma, during the week of October 22, 1928, this Survey had an exhibit of about sixteen maps and geologic sections as well as bulletins and pamphlets on the geology and mineral production of Arkansas. Approximately the same collection of maps, sections and bulletins was exhibited for six days at El Dorado, Arkansas, during the same month, at the Union County Fair.

2. Services Maintained as Part of the Routine Work of the Office

Requests for information answered.—During the past year the Survey has handled approximately 4,500 requests for geological, mineralogical and industrial information bearing on the mineral, soil and water-power resources of the State and has sent out approximately 2,000 publications, reports, and maps. Information has been continually supplied by this office concerning the possibilities of the commercial development of the mineral products of Arkansas.

Complete analyses are made of mineral specimens submitted when analyses seem to be desirable. An index is kept of the names of owners of mineral properties who report the existence of certain mineral deposits and ask for assistance in their development, as well as an index of mining organizations, manufacturers, and buyers who inquire concerning the location of mineral properties.

Tax reports.—This department has compiled the State Severance Tax statistics every quarter since March 23, 1923, and production figures from the monthly reports of taxes on sand and gravel removed from State-owned stream beds. These statistics are so arranged as to show the name of each producer and the quantity and value of each mineral produced in the State. These items include oil, gas, natural-gas gasoline, coal, bauxite, clay, lime, manganese, sand, stone, gravel, diamonds, chalk, zinc and lead.

Other statistics.—Other statistics relative to the mineral production of the State kept on file are taken from the following sources:

1. U. S. Geological Survey.
2. American Petroleum Institute.
3. U. S. Department of Commerce.
4. U. S. Census Bureau.
5. Various trade publications.

Well log file.—A collection of miscellaneous well logs is maintained by the Survey. Most of these are the logs of wells drilled prior to March 23, 1923, when the law first provided that they be filed with a State department. There are now approximately 500 logs in this file.

Geologic library.—A geologic library containing over 750 books and pamphlets bearing on the minerals, soils, and water power of Arkansas and other States is maintained for reference.

Bibliography of the geology of Arkansas.—A subject and author index of all books, pamphlets, reports, etc., bearing on Arkansas geology is maintained. This index includes about 800 books and articles and is of assistance in locating reports and records that have been made of the minerals, soils, water power, etc.

Mineral collection.—A collection of the representative minerals of the State is kept, which now includes over 300 specimens.

Representative core collection.—A collection of cores from wells drilled in southern Arkansas is maintained, which now includes about 800 feet of core.

Publications on hand.—The publications listed below are now on hand in the Office of State Geologist for distribution to the public. They are sent on receipt of postage.

NUMBER COPIES OF PUBLICATIONS ON HAND DECEMBER 1, 1928

1. Marbles and Other Limestones, by T. C. Hopkins, Ann. Rept. Arkansas Geol. Survey 1890, Vol. IV 356
   Atlas accompanying report on Marbles and Other Limestones 180
2. Mineral Waters of Arkansas, by J. C. Branner, Ann. Rept. Arkansas Geol. Survey, 1891, Vol. I 34
3. Miscellaneous reports by various authors Ann. Rept. Arkansas Geol. Survey 1891, Vol. II 350
4. Tertiary Geology of Southern Arkansas, by Gilbert D. Harris, Ann. Rept. Arkansas Geol. Survey 1892, Vol. II 415
5. Slates of Arkansas, by A. H. Purdue, with a bibliography of the Geology of Arkansas, by J. C. Branner, Arkansas Geol. Survey 1909.. 629
6. Coal Mining in Arkansas, Part I, by A. A. Steel, Arkansas Geol. Survey 1910 26
7. Outlines of Arkansas Mineral Resources, by George C. Branner, Arkansas Geol. Survey 1927 1400
8. An Outline of the Physical Features of Arkansas, revised reprint from No. 7 above, 1927 750
9. An Outline of the Petroleum and Natural Gas Resources of Arkansas, revised reprint from No. 7 above, 1927 450
10. An Outline of the Metallic Minerals of Arkansas, revised reprint from No. 7 above, 1928 800

FUTURE WORK

GEOLOGICAL SURVEYS

Plans for work for the year beginning December 1, 1928, include both the completion of work now under way and new work. Projects under way are:

1. The publication of the report on the possible oil and gas resources of the lowland or coastal plain area of southern and eastern Arkansas, by W. C. Spooner.

2. The publication of the report on the structural conditions favorable to the accumulation of gas and oil in the Arkansas River Valley region of Western Arkansas, by Carey G. Croneis.

3. The publication of the report on the Upper Cretaceous formations of southwestern Arkansas, by Carle H. Dane. (Co-operative.)

4. The completion of field work in connection with the report on the zinc and lead region of northern Arkansas. (Co-operative.)

5. The completion of field work in connection with the ground-water conditions in the rice irrigation district of eastern Arkansas. (Co-operative.)

6. The publication of a State geological map.

New projects will be undertaken so far as funds may permit. Plans are being made to begin the following:

1. A survey of the commercial clays of the State. The field work of this survey will probably be begun July 1, 1929. This department has been in correspondence with several of the leading ceramic engineering departments of universities in the United States in order to determine what personnel is available for this survey.

2. Detailed work on oil and gas geology.

3. A survey of the sand and gravel deposits of the State.

4. A survey of the building stones of the State, with special attention to black marble.

5. A survey of the phosphate-bearing rocks of northern Arkansas.

6. A study of the loss of soil by erosion and of means of its prevention.

7. A survey of the tripoli deposits of the State.

8. A survey of the antimony region of southwestern Arkansas.

9. A survey of certain parts of the iron-bearing region of northern Arkansas.

TOPOGRAPHIC MAPPING

All topographic maps made during the next year will be undertaken as State-Federal co-operative projects. These include a topographic map of the coastal plain area of southern and eastern Arkansas and a topographic map of the entire State, both of which are described above and, provided sufficient funds are available, the topographic mapping of a quadrangle having an area of about 250 square miles.

STREAM GAGING

Co-operative State-Federal stream-gaging work, which was begun July 1927 and continued during 1928, will be continued through 1929.

FINANCES

APPROPRIATION

During the period from December 1, 1927, to December 1, 1928, the income of the Office of State Geologist continued under the provisions of Act No. 142 of the Acts of 1927, which provides for the support of the office from a percentage of the severance tax. The appropriation granted by Act No. 329 of the Acts of 1927 for the fiscal year 1927-28 is as follows:

For the Geological Survey:

For the salary of State Geologist	$4,000.00
For the salary of one assistant Geologist	4,000.00
For the salary of one assistant Geologist	3,600.00
For the salary of one assistant Geologist	3,000.00
For the salary of two assistant Geologists	3,600.00
For the salary of one draftsman	1,560.00
For the salary of one clerk-stenographer	1,560.00
Services of chemist as required	500.00

For the Water Power Survey:

For the salary of one civil engineer	1,800.00
For the salary of four assistants	720.00

For the Soil Survey:

For the salary of one chief field man	1,800.00
For the salary of one assistant	1,320.00

For Topographic Mapping:

One-half of the cost of field expenses of surveyors, to be expended co-operatively with the U. S. Geological Survey	3,750.00
For maintenance of office, including printing of reports and bulletins, postage, telephone, telegraph, freight, express, traveling and field expenses, premium on bonds, and other necessary expenses not otherwise provided for herein	29,970.00
	$61,180.00

RECEIPTS

According to the State Treasurer's office, the income for the support of this department under the provisions of Act 142 of the General Assembly of 1927 has been as follows:

Collected during the quarter ending—

September 30, 1927	$9,635.70	
December 31, 1927	8,965.32	
March 31, 1928	8,036.00	
June 30, 1928	6,192.13	$32,829.15 Total for first four quarters of operation
September 30, 1928	6,693.18	
December 31, 1928	7,874.71	$14,567.89 Total for last two quarters of operation
Total		$47,397.04

During 1928 the sources of the office income were as follows:

Collected During the Quarter Ending	OIL AND GAS		BAUXITE		ALL OTHERS	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
March 31, 1928	$ 7,823.99	97.3	$165.40	2.1	$ 46.61	.6
June 30, 1928	5,984.87	96.7	175.78	2.9	31.48	.4
September 30, 1928	6,492.47	97.0	166.83	2.5	33.88	.5
December 31, 1928	7,569.61	95.7	262.46	3.7	42.64	.6
Total	$27,870.94	96.8	$770.47	2.7	$154.61	.5

The foregoing figures show that the amount available for the "State Geologist Fund" is dependent almost wholly on the oil and gas production of the State.

The total amount available for 1928, $28,796.02, is 47 per cent of the amount appropriated, a deficiency of $32,383.98.

Errors made by the Department of Taxation and Revenue in the allocation of funds to the State Geologist Fund were found by this office in checking the Severance Tax Records. These errors were rectified and the necessary transfers was made. The amounts involved were as follows:

For the Quarter Ending—	
June 30, 1928	$ 44.24
September 30, 1928	528.98
December 31, 1928	736.72
	$1,309.94

ESTIMATED FUTURE RECEIPTS

The following figures show the close relation between the percentage of decrease in the income of this office and the percentage of decrease in the value of the oil produced in the State.

	Value of oil Produced	Decrease in value	Percentage of decrease	Income of Office	Decrease in income	Percentage of decrease
Last three quarters of 1927	$30,255,580.00	$		$26,637.02[1]	$	
First three quarters of 1928	22,040,775.00[2]	8,214,805.00	24	20,760.02	5,877.00	22

As will be seen, the decrease during the periods compared amounts respectively to 22 per cent and 24 per cent. For this reason a consideration of the possible decrease in the production of oil in the State becomes necessary in making estimates of the future income of the State Geologists Office. The future production of oil is, of course, uncertain, but if the decrease is relatively constant the following table shows the actual output and value of oil for the years 1925-1928, the actual income for half of 1927 and for 1928, and the estimates for 1929-1931:

Year	Quantity (barrels)	Value	Estimated Income of Office under Act No. 142	
1925	77,398,000	$68,880,000.00		
1926	58,332,000	64,600,000.00		
1927	40,005,000	42,400,000.00	$18,601.02[3]	(2 quarters)
1928	32,011,000	29,450,000.00	28,796.02	
1929	24,000,000	23,040,000.00	23,000.00	
1930	16,000,000	16,000,000.00	16,000.00	
1931	10,000,000	10,500,000.00	10,000.00	

[1] Derived from production during last three quarters of 1927.
[2] Average price per barrel of $0.90 is used. Estimate according to "Oil Weekly."
[3] Income received during last two quarters of 1927.

EXPENDITURES

The actual expenditures of this department during the fiscal year 1927-28, the expenditures from July 1, 1928 to December 1, 1928, the estimated expenditures from December 1, 1928 to June 30, 1929, and the estimated total cost to the State Survey of projects now in progress are shown in the following table:

	July 1, 1927 June 30, 1928	July 1, 1928 Dec. 1 1928	Est. Dec. 1, 1928 June 30, 1929	Est. cost of project to Ark. Geol. Survey
Geological Projects:				
1. Survey of coastal plain region	$ 4,263.05	$1,011.44	$.....	$ 9,774.49
2. Survey of Arkansas Valley region	5,778.85	111.00	.....	9,889.85
3. Survey of zinc and lead region	2,270.35	1,467.07	5,000.00	8,737.42[1-3]
4. Report on Upper Cretaceous formations of southwest Arkansas	455.40	1,044.96	.....	3,500.36[2]
5. Report on St. Peter and older Ordovician sandstones	7.20	353.65	.....	2,160.85
6. Survey of ground-waters in rice district	.....	.....	2,000.00	4,000.00[1-3]
7. Geological map of Arkansas	1,830.89	731.02	5,370.00	7,931.91
Topographic Mapping:				
1. El Dorado quadrangle	4,931.57	118.43	.....	5,050.00[3]
2. Coastal plain area	.....	.....	.....	1,250.00[3]
3. State Topographic Map	.....	.....	.....	400.00[3]
Stream Gaging:				
1. Stream gage installation and maintenance	1,794.00	754.21	2,500.00	5,048.21[2]
2. Publication of stream-gage data	.....	.....	.....	400.00
	$21,331.31	$5,591.78	$14,870.00	$58,143.09
Office maintenance and administration	$13,158.47	$10,500.00[4]		

[1] Does not include publication of the report.

[2] No field costs included.

[3] Co-operative project. Figures represent total estimated cost to State Survey.

[4] Cost for fiscal year 1928-29.

CO-OPERATIVE FUNDS

Funds available from contributing agencies during the fiscal year year 1928-29 are as follows:

	U.S.G.S.	Firms and Individuals	Total Co-op.	Ark. G. S.	Total Co-op. and A. G. S.
Geological Surveys:					
Survey of zinc and lead region	$ 5,000.00	$.....	$ 5,000.00	$ 5,000.00	$10,000.00
Survey of rice district	2,000.00	3,000.00	5,000.00	2,000.00	7,000.00
Topographic Mapping:					
Coastal plain area map	.....	.....	.....	1,250.00	1,250.00
State topographic map	2,000.00	.....	2,000.00	400.00	2,400.00
Stream Gaging:					
Stream gage installation and maintenance	1,250.00	267.62	1,517.62	2,500.00	4,017.62
	$10,250.00	$3,627.62	$13,517.62	$11,150.00	$24,667.62

BUDGET FOR FUTURE WORK

The estimated income for the support of this office for the fiscal year 1929-30 under Act 142 of the General Assembly of 1927 will be approximately $23,500. The total estimated expenditures for the fiscal year 1929-30 include co-operative work proceeding according to contract, office maintenance, and the publication of completed reports. The items are as follows:

Survey of ground waters in rice district	$ 2,000.00
Stream gage installation and maintenance	2,500.00
Topographic map of coastal plain area	1,250.00
Topographic map of entire State	400.00
Office maintenance	10,000.00
Publication of report on Upper Cretaceous formations of southwest Arkansas	2,000.00
Publication of report on St. Peter and older Ordovician sandstones	1,800.00
Publication of stream gaging data	400.00
Publication of report on coastal plain area	4,500.00
Publication of report on oil and gas possibilities of Arkansas River Valley region	4,000.00
	$28,750.00

Since the estimated income for the office during the period 1929-30 is $23,500.00, the estimated expenditures exceed the estimated receipts by $5,250.00. Consequently, unless legislative provision is made for an increase in revenue for the support of this office, it will be necessary to defer publication of some of the reports and drop all plans for new work during the period 1929-30. If, however,

sufficient funds are provided for the fiscal year 1929-30 the following new projects will be undertaken:

1.	Survey of the commercial clays of Arkansas	$9,050.00
2.	Detailed work on oil and gas geology	3,500.00
3.	Survey of building stones of Arkansas with special reference to black marble	3,500.00
4.	Study of strip in which coal may be minable	2,000.00
		$18,050.00

In summary, the amount required for co-operative work, office maintenance, and the publication of completed reports is $28,750, and the amount required for new work is $18,050. The sum of these is $46,800, which is the total amount required to carry out the above program for the fiscal year 1929-30. The estimated income during this period is $23,500, which sum is $23,000 short of the amount required.

RECOMMENDATIONS

Owing to the rapid decrease in the production of oil in the State, the operation of Act No. 142 of the General Assembly of 1927 has proved inadequate to support the Office of the State Geologist. In order that the office may be able to function as a reasonably effective public service its income should be increased. Two plans are suggested to accomplish this: (1) a supplemental appropriation from the General Revenue Fund; (2) an increase in the severance tax on minerals now taxed for the support of the office together with an increase in the severance tax on coal and timber, which have not heretofore contributed to the support of this office. It is not believed that a supplemental appropriation from the General Revenue Fund is practicable. It is believed, however, that an increase in the revenue from the severance tax for the support of this office is both logical and practical, and the enactment of legislation to this end is therefore recommended.

In order to increase the annual income of this office to $46,800, which is considered a reasonable amount for its maintenance during the fiscal year 1929-30, the following procedure is suggested:

1. An increase of the severance tax on all minerals except coal and manganese from $0.026 to $0.027.

2. An increase in the tax on coal from $0.01 per ton to $0.011 per ton.

3. An increase in the tax on manganese from $0.101 to $0.102 per ton.

4. An increase in the tax on timber from $0.07 per thousand feet to $0.071 per thousand feet.

The estimated income of this office for the years 1929-1932 under Act No. 142, as supplemented by the above tax revenue, would be approximately as follows:

Year	Estimated Income under Act 142	Added 1/10 of 1 per cent tax	Added tax of 1 mill per ton on coal	Added tax of 1 mill per 1,000 feet on timber	Added tax of 1 mill per ton on manganese	Total Income
1929-30	$23,500.00	$23,500.00	$1,500.00	$1,500.00	$ 5.00	$50,005.00
1930-31	16,300.00	16,300.00	1,500.00	1,500.00	5.00	35,605.00
1931-32	10,700.00	10,700.00	1,500.00	1,500.00	5.00	24,405.00

The above estimate is based on the assumption of a constant rate of decrease in the total value of petroleum produced in the State.

In order that this office may receive the full taxes due under the provisions of Act No. 142 and that more accurate statistical information concerning mineral production and value may be made available, it is further recommended that the Department of Insurance and Revenues, Severance Tax Division, be furnished with funds and personnel sufficient to permit that office (1) to make field checks of the quantities and values of the minerals produced in Arkansas as reported to them; (2) to conduct an active search for operating firms not now listed on the severance tax records; and (3) to make a more careful check of records submitted to that department, both as to the accuracy of data and the allocation of funds to this office. These suggestions apply particularly to the records of oil and gas producers. It is believed that these recommendations, if carried out, will increase the tax revenue for the support of this office. These recommendations have been discussed with Mr. David A. Gates, Commissioner of Revenues, Department of Insurance and Revenues, and meet with his entire approval.