MISSOURI
BUREAU OF GEOLOGY
AND MINES

BIENNIAL REPORT *of the*

STATE GEOLOGIST

TRANSMITTED BY THE

BOARD OF MANAGERS OF THE BUREAU
OF GEOLOGY AND MINES TO THE
FIFTY-THIRD GENERAL
ASSEMBLY, 1925

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DIRECTOR AND STATE GEOLOGIST
ROLLA, MISSOURI

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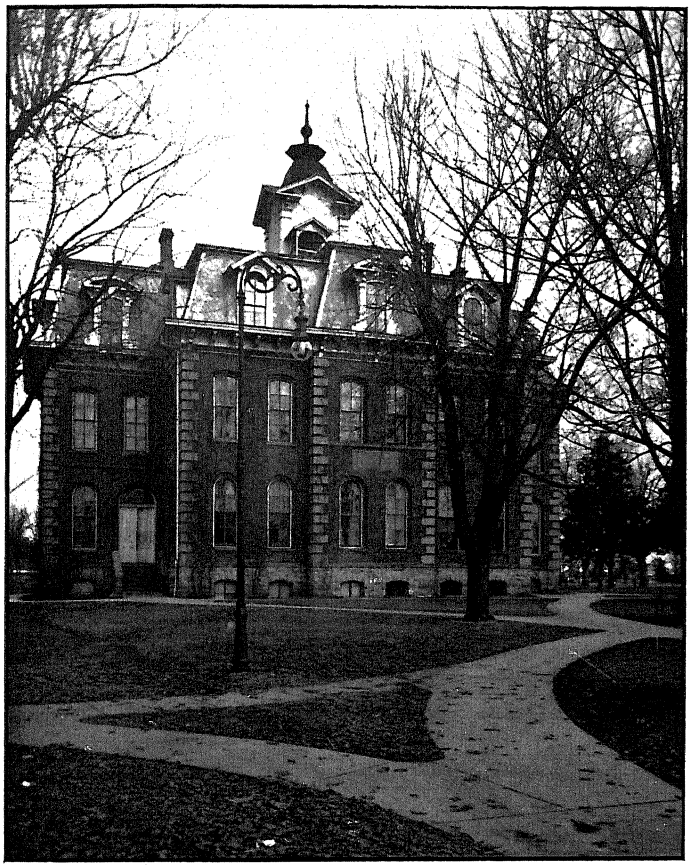

HEADQUARTERS MISSOURI BUREAU OF GEOLOGY AND MINES, ROLLA, MO.

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LETTER OF TRANSMITTAL

To the President, Arthur M. Hyde, and the Honorable Members of the Board of Managers of the Bureau of Geology and Mines:

Gentlemen:—I have the honor to submit herewith a brief report covering the work of the Bureau of Geology and Mines for the years 1923 and 1924.

The pamphlet also contains a brief tabulated resume covering the mineral production for the same period as well as tables showing the stream flow covering a majority of the principal rivers of the State.

Respectfully submitted,

H. A. BUEHLER.

CHAPTER I

WORK OF THE BUREAU OF GEOLOGY AND MINES DURING 1923 AND 1924.

The following brief summary outlines the activities of the Bureau of Geology and Mines (Geological Survey) during the past biennial period. The work of the department which is devoted to engineering problems fundamental to the continued development of the natural resources, is divided into the following three branches:

(1) Geology and mining,

(2) Topographic mapping,

(3) Water power and flood control.

Field work by the staff and federal engineers assigned to cooperative investigations has been carried on in all parts of the State.

The increased interest in the possible development of water powers, the urgent demands for topographic maps, and the many requests for information relative to the mineral deposits of the State, have materially increased the demands on the Bureau during the past two years.

PERSONNEL.

The personnel of the Bureau has not changed materially since the last biennial period. While there have been resignations in the minor positions, and in summer field parties, the regular staff has continued throughout the period with but little change.

The following is the general personnel of the permanent and summer field staff of the three divisions of the survey. The engineers in charge of topographic field work, and the chief engineer and assistants in the Water Power Branch, are members of the United States Geological Survey, who are assigned work in this State under cooperative agreement.

GEOLOGY AND MINING.

Permanent Staff:

H. A. Buehler, State Geologist,
W. F. Pond, Geologist.
J. M. Thiel, Geologist.
H. S. McQueen, Assistant Geologist.
H. W. Mundt, Chemist.
C. O. Reinoehl, Draftsman and Instrument man.
Jean I. McCaw, Clerk.
D. B. Jones, Clerk (Resigned).
E. E. Hawkins, Janitor.

Summer Field Parties:

C. L. Dake, Potosi Region.
Josiah Bridge, Eminence Region.
G. L. Knight, Jefferson County.
R. B. Rutledge, Southwest Missouri.
E. B. Branson, Mississippian formation, Boone and Callaway Counties.
J. S. Williams, Perry County, Mississippian formation.
W. A. Tarr, Econ. Geology, Boone and Callaway Counties, Geology Iron Mountain Region.

WATER POWER AND FLOOD CONTROL.

H. C. Beckman, District Engineer.
V. L. Austin, Assistant Engineer.
W. S. Frame, Assistant Engineer.
J. A. Zoller, Part time assistant (office).

TOPOGRAPHY.

C. L. Sadler and party, Topographic engineer.
F. L. Whaley and party, Topographic engineer.
J. B. Leavitt and party, Topographic engineer.
J. M. Rawls and party, Topographic engineer.
J. L. Sanders and party, Topographic engineer.
C. R. Fisher and party, Topographic engineer.
W. R. Broaddus and party, Topographic engineer.
E. C. Metzeroth and party, Topographic engineer.
C. E. Bardsley and party, Topographic engineer.

COOPERATION.

The Bureau has continued cooperation with other State and government departments throughout the biennial period.

(1) With the United States Geological Survey.
   (a) In studying the geological formation of the Southeast Ozark Region.
   (b) In topographic mapping—The Federal Survey appropriating a sum equal to the State Appropriation.
   (c) In compiling mineral statistics showing the value of the production in Missouri each year.
   (d) In maintaining gaging stations for the purpose of determining water power possibilities and flood control.

(2) With the Illinois Geological Survey in a study of structural conditions in Northeast Missouri, showing possible oil and gas territory.

(3) With the City of St. Louis in making a large scale topographic map of the northern portion of St. Louis County (The City paid the added cost due to increased scale of the map).

(4) With the Missouri School of Mines Experiment Station in collecting samples of low grade iron ores for testing.

(5) With the U. S. Weather Bureau of St. Louis in establishing rain gages and maintaining gaging stations.

(6) With the State Fair Board in maintaining a mineral exhibit at the State Fair.

(7) With the State Museum Committee in furnishing material for the Museum at the Capitol, and installing exhibits.

(8) With the State Park Commission in examining sites for proposed State Parks throughout the Ozark Region.

(9) With corporations and drainage districts in maintaining gaging stations for the purpose of determining runoff and water supply.

Cooperation of this character has proven very valuable to all parties concerned and has advanced the field work much beyond any possibility were cooperation not carried on.

PUBLICATIONS.

The final results of the field investigations of the Bureau are published as bulletins and maps describing the geology and occurrence of the various mineral deposits; as reports, tables, and maps showing stream flow and water power possibilities, and as topographic base maps.

These reports and maps are in constant demand and constitute the most important means of furnishing reliable information to those interested. The former series of reports are out of print, and of the present series several are no longer available for distribution. During the biennial period there have been over 7,500 reports and maps distributed.

Since the last biennial period the following publications have been issued:

State geological map,
Ste. Genevieve Co., topographic map,
Livingston Co., topographic map,
Ste. Genevieve Co., geological map,
Daviess Co., topographic map,
Oil and Gas possibilities of Missouri,
Devonian Formations of Missouri,
Geology of the Mississippi area of Northeast Missouri (Cooperation with the Geological Survey of Illinois).

The report on Oil and Gas possibilities has been in demand by the oil geologists throughout the country. It indicates those areas in which there are possibilities of commercial pools as well as showing the parts of the State where there is no possibility of success. The Devonian report describes in detail the occurrence of the Devonian formation in the State, and is particularly devoted to the paleontology of the series. The report on the Mississippi River area north of St. Louis covers the stratigraphy and structure contiguous to the Mississippi River in Missouri and Illinois. This work was carried on in cooperation with the Geological Survey of Illinois.

In addition to the above publications a new edition of the base map is being printed. This base has been utilized by the Highway Department and the Department of Agriculture in issuing special road and soil maps. Reports and maps covering Vernon and Lawrence counties and the report on Ste. Genevieve County are practically ready for the State Printer. These publications have not been issued, due to the lack of funds.

FIELD INVESTIGATIONS.

The following is a brief outline of the field investigations carried on during the biennial period.

Southwest Missouri:

The geological mapping in Southwest Missouri is carried on from a branch office maintained at Joplin, office space being furnished through the courtesy of the Joplin Chamber of Commerce.

The original topographical map published by the Federal Geological Survey on a scale of one inch per mile is too small to show the various mining districts in detail. In order to furnish a map of sufficient size, the region extending from the Kansas state line to east of Webb City in townships 27, 28, and 29 has been mapped and published on a scale of four inches per mile. Nine maps embracing the principal lead and zinc mining areas of Jasper County, covering these townships have been issued. During the present biennial period the surface geology has been mapped and many of the old mine maps copied and transferred in order that the actual area mined may be shown.

With the revival of prospect drilling in the district there are many requests for these maps and the field work is being completed as rapidly as possible.

The ore bodies of the southwest district lie chiefly in the Upper Burlington limestone. The southern limit of this formation is important in prospecting. In order to determine the surface distribution a reconnaissance survey was made from the Oklahoma-Kansas line eastward through Newton, McDonald, Barry, Stone, and Taney counties. The results of this field work show the southern extension of the Upper Burlington series.

In mapping the geology of Lawrence County an area of major faulting was encountered, striking southeast through the Turnback hills. Some years ago a major fault along which considerable prospecting had been done was mapped from the Arkansas state line northwest to Stone County. During the present field season this fault was traced northward to Lawrence County, and the fault from the Turnback country followed to the south. At one point they are within one-half mile of each other, the White River fault having a throw to the west while the Lawrence County fault has a throw to the east. These

faults are the strongest structural features thus far found in Southwest Missouri. In the reconnaissance work other faults were encountered but these have not been mapped in detail.

Southeast Ozark Region:

The deposits of barytes, copper, lead, cobalt, and nickel are closely related to the surface distribution of the various formations in Southeast Missouri. The stratigraphy of this area is probably the most complex in the State, and much field work will be required in order to outline the distribution accurately.

The geologic mapping of the Potosi quadrangle has been completed and connecting lines run westward to Phelps County and southward to Shannon County. Also reconnaissance work extending southward from the Flat River mining area through Madison, northern Wayne, and Iron counties. This work has shown areas of Bonneterre limestone outcropping on the southern and western flanks of the St. Francois mountains, and indicates possibilities of deposits of lead throughout that region.

The Sutton mine southeast of Eminence has again centered interest in possible copper production in the Shannon County area. Large chunks of chalcocite coated with malachite have, during the past year, been mined from a solution channel directly above the porphyry in a small valley between two porphyry knobs. This occurrence has created much interest in the geology of the region and the Bureau has pushed its field work on the Eminence quadrangle to completion. The region has been correlated with the Potosi-Bonne Terre mining areas and the relation of the formations to the productive lead fields determined. With the completion of additional topographic maps the entire western and southern flanks of the St. Francois mountains should be studied, as prospecting and development will no doubt soon be carried on in that general region.

In order to correlate the Southeast Missouri region with the older formations outcropping in the Decaturville area of Camden County, a base map of the latter area has been made during the present field season. Geologic field work will be done in this area during the coming year.

Lawrence County:

During the past year much interest has been manifested in the revival of mining in the Aurora district of Lawrence County. The topographic map of the county has been in demand, the preliminary edition having been exhausted. The entire county has been mapped geologically, and a county report prepared. The geology of the area is similar to the main productive field of Jasper County and is typical of Southwest Missouri. The surface geology shows typical shale areas and a long sandstone ridge of the Pennsylvanian series extending north and south through the eastern portion of the country. One of the most pronounced structural features of Southwest Missouri, in the form of a normal fault, strikes through the Turnback hills, extending northward into Dade County and to the southeast this structural feature has been mapped to the Arkansas line, a distance of approximately 60 miles.

Northeast Missouri:

The Trenton limestone occurs at varying depths in Northeast Missouri and Northwest Illinois. Much interest has been manifested in each state with regard to the possibilities of encountering commercial pools of oil and gas in this region. In order to determine the structure and stratigraphy, a cooperative agreement was entered into with the Director of the Illinois Geological Survey whereby the area bordering the Mississippi from north of the Missouri River to the Iowa state line was mapped, and a report prepared and printed. The maps accompanying this report show the more prominent structural features and the many drill records give accurate data on the succession of formations not exposed.

Clay Deposits:

With the resignation of the assistant in charge of the clay investigation, this work was not continued during the early part of the biennial period. One assistant is now devoting time to the completion of work on the diaspore and flint clays.

The clay report issued by the former Geological Survey is now out of print. The industry has developed in many parts of the State, and is now one of the chief mineral industries. There are a few states that have a greater variety of clays and none that excel in quality. The investigation under way will show

the geologic relation of the various types and indicate the possible development in new territory. In connection with this field work a method of mechanical analysis has been worked out whereby the foreign minerals can be separated by means of heavy solutions, and the different constituents of the clay determined in the laboratory. By this method the percentage of pyrites, iron carbonate, dolomite, sand, and other injurious impurities can be shown.

Jefferson County:

One season's work was done on the formation in the eastern part of Jefferson County. This work will be continued next season and carried to completion. The area is a part of a geological province bordering the Mississippi River in Southeast Missouri and Western Illinois, and finally a co-operative map should be published jointly by the Surveys of both States. New marble quarries are being opened in this region and the geology of the area is of importance in showing the surface distribution of the various formations.

The belt of important faulting, mapped through Ste. Genevieve County, strikes to the southeast through the eastern part of Perry County. In order to determine the direction and character of this structure, mapping was carried on covering the northern portion of Perry County during the past season. The topographic mapping of this county has been completed and the geologic mapping should be extended to cover the entire county.

Boone and Callaway Counties:

The necessary field work to complete these counties was done during the present biennial period. The economic geology has been described and the geological map prepared. The manuscript covering the geology is in preparation.

Iron Mountain Iron Ore Deposits:

With the revival of mining at Iron Mountain many inquires have been received regarding the origin of these ores. A part of one field season was devoted to a study of the area and many samples collected. Thin sections have been made and the study will be completed during the coming biennial period.

Mississippian Series:

The Mississippian formations underlie large areas in southwest and northeast Missouri, being connected by a rather narrow strip extending through the central part of the State. These formations have been studied in the past at widely separated points in this and adjoining states, and the correlation has not been made throughout the entire region. During the past two seasons the series has been studied in considerable detail and the lower portion especially made the subject of close attention. This work requires the services of a paleontologist, and will be continued until the entire area is covered and a monograph prepared similar to that recently issued on the Devonian series.

SPECIAL INVESTIGATIONS.

Members of the staff have been called to various parts of the State for the purpose of examining prospects and advising on the mineral possibilities of many areas. This work is very important in helping develop the various mineral resources and in discouraging unwarranted prospecting where there is no hope of success. We have made special endeavor to co-operate on deep drilling in the State and have received throughout the period many drill cuttings from various wells. The Bureau not only receives valuable information, but is able to advise with the drillers regarding the depth and character of the water-bearing horizons. There are some 2,000 records covering drilling in the southwest lead and zinc field in the Joplin office, and approximately the same number of records at the Survey headquarters. This data is invaluable for reference in future work.

CHEMICAL ANALYSES.

Many samples of iron, lead, zinc, and copper ores, mineral and well waters, clays, drill cuttings, and asphaltic sandstones are submitted for examination from every part of the State. Many of these require analysis and the chemist has been kept busy making such determinations, as well as testing samples of material brought in from the field by members of the staff.

A start has been made on the analysis and determination of the composition of large size typical samples of the various formations. In addition to the chemical analysis a close study is being made of the residue left after solution, in order to determine the character of the impurities.

Detailed chemical analysis have been made of six deep well waters for Southwest Missouri. Careful determinations have been made of the small metallic contents of copper, lead, and zinc. This work should be extended to include many of the deep underground waters. The chemical work of the Bureau has increased during the past biennial period. Commercial work is not undertaken, the examinations being restricted to specimens received from undeveloped prospects.

TOPOGRAPHIC MAPPING.

The preparation of accurate topographic maps, made in co-operation with the U. S. Geological Survey, has continued throughout the biennial period. The Federal Survey not only furnishes a trained personnel and engraves the maps without cost to the State, but pays one-half of all field and office expenses.

About one-fourth of the State has been accurately surveyed, the maps covering 15′ of latitude and longitude. They are published on the scale of one inch to the mile and show all drainage and ordinary culture, such as roads, houses, railroads, school houses, churches, etc., and picture accurately the surface features as the elevation above the sea level is shown in brown lines. Bench marks showing the accurate elevation are placed in every township.

Complete county maps of Livingston and Daviess counties have been published this year. Platte, Lawrence, and Ste. Genevieve counties have already been published. Field work was completed covering Clinton, DeKalb, Caldwell, Buchanan, Andrew, and Holt counties, and as soon as inked and engraved county maps will be published. In Southeast Missouri, Perry county was completed, also the Edge Hill quadrangle in Washinton and Iron counties. The Bonfils and Alton quadrangles north of St. Louis have been mapped on a large scale, the City of St. Louis cooperating in the cost of the increased size of the map. The Meramec Spring quadrangle in Phelps County was completed and the Shell Knob in Stone and Barry counties is being mapped.

Primary traverse has been completed covering Linn County, and lines run from Cape Girardeau to Eminence and from Williamsville to Bismarck, and complete traverse run covering several quandrangles in Southeast Missouri region.

WATER POWER AND FLOOD CONTROL.

The collection of stream flow records to serve as a basis for water power, drainage, and flood control work which was started in 1921 has been continued by the Bureau throughout the biennial period. The work has been carried on in cooperation with the Water Resources Branch of the United States Geological Survey with Mr. H. C. Beckman, District Engineer, in charge and two junior engineers assisting.

During the period, fifty-six gaging stations have been maintained on the principal streams of the State. At each place a local resident reads a gage once or twice a day to determine the height of the water. The engineers make occasional measurements of the flow, or discharge, of the stream in terms of cubic feet per second, prepare rating curves and tables showing the flow for any gage height, and then compute the flow for each day of the year from the daily gage heights.

During this period the U. S. Geological Survey contributed $8,200 to the work. The U. S. Weather Bureau office at St. Louis paid a part of the salaries of two gage readers and sent free of charge numerous telegrams regarding rainfall, which were a help in planning the field work. By paying the salaries of gage readers and the cost of some of the gaging equipment, several private parties interested in the work contributed $1,750. The following is a list of those who co-operated in this way, and the number of gaging stations they helped to maintain:

Little River Drainage District	5
Ozark Power and Water Co	2
Empire District Electric Co	1
Central Missouri Power and Water Co	2
Western Tie and Timber Co	1
West Missouri Power Co	2
Dixie Power Co	1
Hugh L. Cooper & Co	1
Chicago Great Western Railroad	1

The Bureau has also made some topographic surveys to locate feasible dam sites and to determine how much land would be overflowed by the dams, and what the storage capacity of the reservoirs so formed would be. Early in 1923 a map of the Gasconade River between Arlington and Rich Fountain, on a scale of four inches per mile and contour interval of ten feet, was published. During the summer of 1924 Mr. H. C. Beckman made a preliminary investigation of Current River between Cedar

Grove and Van Buren. That part of Current River between Eminence and Van Buren is now being surveyed and the map will be published on a scale of four inches per mile.

The stream flow records and river surveys have done much to attract attention to the water power possibilities of the State. Much more interest is now being manifested in water power development than ever before. The stream flow records and topographic survey of Gasconade River have been the foundation of a preliminary permit issued by the Federal Power Commission to the Central Missouri Power & Water Co., for the construction of two hydro-electric plants between Arlington and Rich Fountain. The capacity of the proposed plants is reported to be 38,000 horse-power. The Empire District Electric Co., has a preliminary permit from the Commission for a project on the White and James rivers. The report of the Commission states that the estimated primary capacity of the proposed plant is 31,000 horse-power, and the installed capacity 80,000 horse-power. Investigations for power developments of considerable size have been made, or are now in progress, on the Osage, Current, and Sac Rivers.

The estimated hydro-electric power which can be developed economically in the State, is from 200,000 to 300,000 horse-power. Of this amount only 18,472 horse-power is developed at the present time. Thus it is apparent that there is a wide field for development, and that the work of the Bureau is doing much to bring about the use of these natural resources and thus fulfill a very widespread aspiration in the State.

The stream flow records have also been of considerable value to operating water power companies. The Ozark Power & Water Co., co-operates with the Bureau in maintaining gaging stations on the White and James Rivers. By receiving advance knowledges of changing stages at least 24 hours before they reach their dam at Forsyth, the Company is able to so regulate the operation of their plant as to appreciably increase its output of power. Such advance knowledge of one approaching flood alone is reported to have saved some 300,000 to 400,000 kilowatt hours of power, which could otherwise not have been realized. This indicates the benefits that will accrue from stream gaging to other water power plants when they are constructed.

The stream flow records have also been a benefit in drainage and flood control work. The Bureau maintains five gaging stations in co-operation with the Little River Drainage District.

The District has used these records in planning the additional improvements estimated to cost about $4,000,000, which they have recently started to construct.

FUTURE WORK OF THE BUREAU.

The work of the three branches of the Bureau is basic and fundamental to the development of the natural resources of the State. It is the only department devoted to the (1) investigation and expansion of the mineral resources, (2) the making of accurate base and topographic maps, and (3) the study of the water power possibilities.

Missouri is one of the chief mining states in the union. There is a continual rational development of the mineral deposits and a steady increase in output. New industries are developed and old districts expanded, as shown by the production during the past 25 years, which has increased from $13,000,000 to $70,000,000 annually.

There is a corresponding increase in the demands made on this Bureau for information. Investors turn to the records of a geological survey for reliable information, and by supplying their needs a survey can be of the greatest benefit in the development of the State.

As already pointed out in the work undertaken during the past two years, there are a number of geological investigations now under way. New problems are continually coming up, requiring field work to show the detailed geological relations.

The Bureau now has a number of volumes and maps ready for publication, and during the coming two years others will be completed. As soon as completed the maps of the Joplin district should be published as this area is again attracting widespread attention, and new leases are being made in many parts of the district. The detailed geology and the new base maps will be a material help in this development work.

The clay investigation should be made one of the chief problems of the Bureau during the coming biennial period. The more extended utilization of the high grade clays of the State is bringing many inquiries to the Department, and the old report is no longer available for distribution.

The field work of the past season in Southeast Missouri has shown an important area of Bonneterre limestone on the south flanks of the St. Francois mountains. This formation is favorable to the occurrence of disseminated lead deposits, and the area should be mapped in detail in order to guide future prospecting.

Additional county topographic maps have been completed, and many of these areas should be mapped.

The work in geology and mining should be expanded to include the new problems confronting the Bureau.

The making of an accurate base map of the State in co-operation with the U. S. Geological Survey, has been in progress for a number of years, and about one-fourth of the State has now been completed. There are continual requests for areas not yet finished.

These maps are by far the most accurate published; they are made from actual field surveys, and are printed on the scale of one inch per mile.

The Federal Geological Survey appropriates an equal amount for this work, and engraves and prints the maps without cost to the State. The Bureau has requests for new maps covering many times the area that it is possible to survey with the funds allotted to this branch of the work. In mapping the geology of the southeast part of the State, these maps are essential, and this area alone would require the total funds of any former biennium. The maps are utilized by almost every State department. They form the basis for all surveys or investigations in which any land area is involved, and their utilization can not be over-emphasized. During the past biennial period, the Bureau of Soils mapped two counties having topographic maps, at a very material saving in field costs. By the use of one quadrangle map in South Missouri, the location of a few miles of State primary highway was changed, the route being shortened more than a mile, and an ideal railroad and river crossing obtained. In addition to a much better routing, the lesser distance will save the State at least $35,000—more than the entire appropriation for Topographic Mapping.

The above examples illustrate the saving effected through the use of topographic maps.

As discussed in the preceding pages, the work covering the investigation of Water Power and Flood Control is well under way. There are at the present time fifty-six (56) gaging stations established on the more important streams of the State, and accurate data is being gathered covering the daily flow of each stream.

The further development of water power possibilities will depend upon obtaining this data over a number of years. Capital can not be induced to invest in water power enterprises until

reliable data is obtained upon which profitable operations can be determined. Heretofore no reliable data was available and there has been developed only 18,472 horse-power in the entire State. The fact that there is from 200,000 to 300,000 potential horse-power in the Ozark region, is indicative of the fact that there has been a lack of data in the past.

Up to the present time only flow data has been obtained. In order to show possible dam sites, the character and extent of country constituting the river valleys, and the size of possible reservoirs, detailed topographic maps should be made covering the more important rivers of the Ozark region.

The importance of these maps is illustrated by the results of the survey of the Gasconade River from Arlington to Rich Fountain, where a detailed power project has been worked out and a preliminary permit granted by the Federal Power Commission, on the data of stream flow and map issued by this Bureau. In order that the main rivers of the Ozark region may be mapped, the Board of Managers is requesting an additional appropriation of $10,000 for this work.

APPROPRIATION REQUESTED.

In order that the Bureau may continue to enlarge its work to meet the increased demands, the Board of Managers earnestly requests the following appropriation:

Geology and Mining	(for salaries of permanent and temporary employees, field and traveling expenses, equipment, chemicals, stationery, engraving maps, and printing reports).....	$88,060.00
Topographic Mapping	(For making topographic maps in cooperation with the U. S. Geological Survey, the latter to meet the State appropriation dollar for dollar)..	45,000.00
Water Power and Flood control	(For engineers' salaries, office expenses, equipment, and making river surveys to determine dam sites, etc.....	30,000.00
	Total.....	$163,060.00

VALUE OF MINERAL PRODUCTION OF MISSOURI, 1914-1922.

Commodity.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.
Lead ore	$11,143,104	$14,579,361	$24,172,965	$34,038,976	$21,988,567	$12,107,731	$20,284,921	$11,825,280	$14,934,548
Zinc	7,766,911	19,625,978	24,228,596	17,708,604	5,473,483	2,429,235	2,142,564	491,365	952,411
Coal	6,802,325	6,595,918	9,044,505	13,755,864	17,126,498	12,766,366	22,230,000	13,915,500	11,153,000
Clay products	6,074,284	5,428,403	7,634,559	10,328,374	9,198,184	11,016,333	17,443,458	10,668,691	11,649,495
Cement	4,495,744	4,007,697	6,333,567	8,248,007	7,132,470	9,264,017	10,980,453	8,034,540	10,457,557
Limestone	2,160,958	2,049,772	1,990,419	1,679,677	1,359,755	1,759,129	2,776,936	2,269,457	2,409,202
Marble	(d)	(d)	156,942	227,520	238,111	360,287	616,550	627,729	816,098
Mineral paints	2,147,579	4,745,246	1,141,665	(c)	(c)	(c)	(c)	(c)	(c)
Sand and gravel	1,020,903	675,684	877,634	1,101,745	772,753	873,333	1,356,352	1,018,325	1,063,370
Lime	686,051	547,025	956,300	1,435,914	1,376,046	1,333,085	1,735,002	1,169,391	1,402,337
Lime, hydrated	(e)	(e)	(e)	(e)	201,737	402,620	584,283	487,169	551,187
Clay	463,703	641,040	988,884	1,386,338	1,192,996	1,004,033	1,413,189	938,135	1,238,622
Chats	340,616	346,378	433,456	214,007	135,319	206,353	167,028	259,571	285,290
Barytes	112,231	158,597	365,111	391,373	393,738	640,398	1,013,570	217,913	421,568
Copper	5,914	70,378	95,005	99,649	142,683	300,799	278,307	17,749	107,649
Mineral waters	74,793	83,363	109,814	57,175	38,478	39,641	50,892	45,670	40,149
Tripoli	81,434	68,451	99,248	90,293	81,728	8,926	(a)	(a)	(a)
Iron ore	75,696	99,853	116,484	134,906	270,337	223,144	230,827	169,516	244,928
Granite	77,971	85,624	80,390	58,241	54,523	(a)	114,663	81,389	85,093
Silver	33,826	29,282	85,178	50,747	46,939	101,249	121,130	69,902	212,656
Sandstone	3,588	10,104	14,991	6,862	(a)	(f)	(a)	(f)	(a)
Natural gas	5,319	5,077	17,594	8,230	5,548	3,000	2,600	2,130	780
Pottery	2,944	3,166	(a)	(a)	(a)	20,817	31,084	89,657	96,513
Miscellaneous (b)	16,768	37,256	37,165	33,051	98,489	118,184	169,680	4,484	21,062
Totals	$43,585,667	$59,794,615	$78,558,422	$91,056,173	$67,674,136	$54,978,580	$83,743,489	$52,313,906	$58,044,502

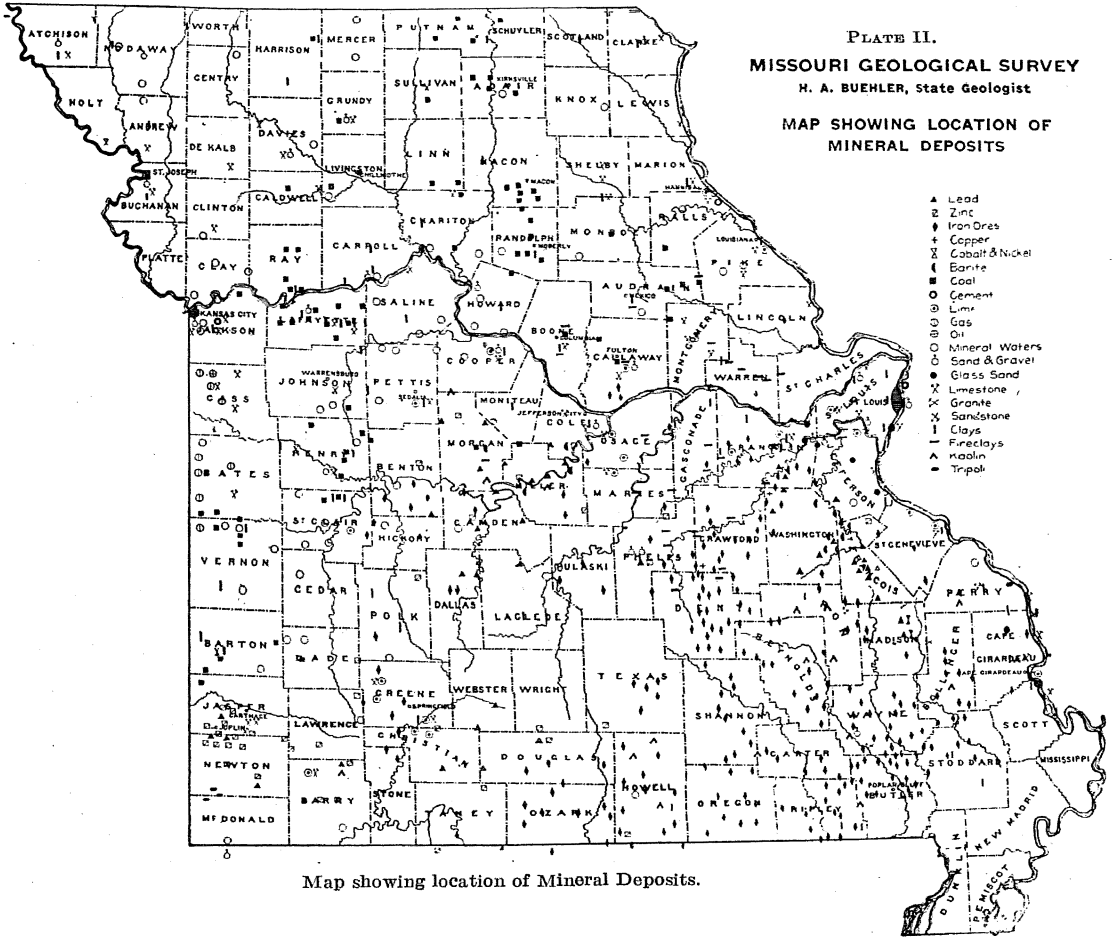
(a) Included in miscellaneous.
(b) 1914-1915 includes petroleum and pyrite.
1916-1917 includes pyrite, petroleum, pottery, cobalt, nickel, and tungsten.
1918 includes potash, pottery, pyrites, sandstone and miscellaneous stone.
1919 includes pyrites, granite, potash and petroleum.
1920-1922 includes pyrites, tripoli, potash, petroleum, sandstone and miscellaneous stone.
(c) Mineral paints are manufactured from raw material listed elsewhere.
(d) Included under limestone.
(e) Included under lime.
(f) No production.

PLATE II.

MISSOURI GEOLOGICAL SURVEY

H. A. BUEHLER, State Geologist

MAP SHOWING LOCATION OF MINERAL DEPOSITS



Map showing location of Mineral Deposits.

CHAPTER II

MINERAL PRODUCTION OF MISSOURI.

By W. F. POND.

The mineral industry of Missouri experienced a decided slump during the depression of 1921 and 1922, the value of the production dropping to about that of 1919. In 1921 the value was $52,313,906, the lowest since 1914. In 1922 there was a recovery to $58,044,502 and the preliminary figures for 1923 indicate that the total value was about $70,000,000 which would be about the normal increase over pre-war years. Those minerals most closely allied with the building industries suffered least and in 1923 cement valued at $13,237,141, limestone at $3,173,622, marble at $1,085,122, sand and gravel at $2,007,529, lime at $1,830,937, hydrated lime at $674,848 and clay at $1,624,789, each made a new record in valuation of yearly production.

The table on page 22 gives a summary of the output from 1914 to 1922, inclusive, and in the following pages detailed discussions and figures for the different minerals are given. The figures were collected in co-operation with the United States Geological Survey and the Bureau of the Census at Washington.

ASPHALTIC SANDSTONE.

Interest has continued in the deposit of asphaltic sandstone in Barton, Vernon, Bates, Cass and Lafayette counties, and since the publication of a general description of the deposits in "Oil and Gas Possibilities in Missouri" (Vol. XVI, 2d ser.) by this Bureau, a number of companies have sent representatives into the state to investigate the region.

Two local companies have been organized to develop the deposits in Vernon County. One of them, the National Asphalt Refining Co., has reached a preliminary production stage in the treatment of the sands and is laying experimental sections of roadway.

The amount of bitumen varies to a considerable extent and analyses made by this Bureau indicate that approximately 75 per cent of the organic content is petrolene, and 25 per cent

asphaltine. In order to use the material in road construction it is evident that the sand must be treated before it will prove satisfactory as a road metal.

BARYTES.

The production of crude barytes increased from the extreme low in 1921 of 25,200 tons to 66,421 tons in 1922, being the third largest yearly production on record. The total value nearly doubled. These increases are the more remarkable because the average value per ton decreased from $8.64 in 1921 to $6.35 in 1922. In 1923 the production again increased, being 81,701 tons valued at $629,097, the average value increasing at about the same rate to $7.70. This is the second largest yearly tonnage and the third largest total value. The market has improved further through 1924, prices running up to $8.00 and $8.50 per ton during the latter part of the year. The quick and continued recovery after the depression of 1921 indicates that the consumption of barytes is steadily increasing. The increase is largely in lithopone, the national consumption of barytes therein having increased from 44 per cent in 1918 to 61 per cent in 1923, while that used in ground barytes has decreased from 34 per cent to 23 per cent, and in barium chemicals from 20 per cent to 16 per cent in the same period. The manufacture of titanox, a paint composed of titanium and barium, by the National Pigments and Chemical Company, has established an important new paint industry in which a large tonnage of barytes is used.

An interesting development in the mining of barytes in Missouri is the introduction of steam shovels and washing plants. The Eagle-Picher Lead Company is using a one-yard shovel at Mineral Point, and has erected a 500-ton mill equipped with log washers and jigs. The National Pigments & Chemical Company is also installing a steam shovel and washing plant near Adelbert Station. Previously, practically all of the production has come from "gophering" by small operators, the process being to sink a pit in the sticky, red, residual clay overlying the limestone until the "tiff" is found near bed rock, and then mushrooming out as far as safety permits. When the possibilities of a pit have been exhausted another is sunk nearby, and the process is continued as long as enough mineral is found.

As shown by the tables, Washington County continues to produce approximately four-fifths of the output. Cole, Miller and adjoining counties continue a comparatively small produc-

tion, which is shipped to St. Louis and other eastern points for refining. The grinding plant at Eldon has not been in operation during the past two years. During the past year shipments have been made from east of Weaubleau in Hickory County; a good quality of ore is produced in this new territory.

The following grinding and refining plants are at present in operation in this state. The plant at Eldon is closed.

Point Milling & Mfg. Co., Mineral Point, Mo., National Pigments & Chemical Co., St. Louis, Mo., C. P. DeLore Co., St. Louis, Mo.

BARYTES—TABLE OF PRODUCTION, 1907—1923.

Year.	Number producers reporting.	Stock on hand Dec. 31.	Shipments, tons (short).	Value.	Average per ton.
1907	.....	.....	44,039	$163,459	$3.69
1908	.....	.....	16,319	56,768	3.48
1909	.....	.....	34,815	119,818	3.44
1910	.....	.....	25,431	85,624	3.32
1911	.....	.....	21,500	81,380	3.79
1912	.....	.....	24,530	117,035	4.77
1913	.....	.....	31,131	117,638	3.75
1914	.....	.....	33,317	117,738	3.53
1915	.....	.....	39,113	158,597	4.05
1916	.....	.....	58,407	365,111	6.25
1917	.....	.....	59,046	391,363	6.62
1918	.....	.....	49,094	393,738	8.02
1919	.....	8,090	73,247	640,398	8.74
1920	70	3,154	99,654	1,013,570	10.17
1921	68	10,136	25,200	217,913	8.64
1922	61	5,202	66,421	421,568	6.35
1923	85	6,111	81,701	629,097	7.70

REFINED BARYTES SHIPPED.

	Shipments, tons (short).	Value.	Average per ton.
1920	51,965	$1,150,464	$22.14
1921(a)	23,000	529,000	23.00
1922	38,827	823,157	21.20
1923(a)	31,700	748,000	23.60

PRODUCTION OF BARYTES IN MISSOURI, BY COUNTIES, FOR 1920-1923.

County.	1920		1921		1922		1923	
	Quantity sold.	Value.	Quantity sold.	Value.	Quantity sold.	Value.	Quantity sold.	Value.
Cole	6,482	$64,017	504	$4,780	475	$2,612	(a)	(a)
Jefferson	3,773	38,796	1,115	7,561	1,187	6,890	2,467	$20,003
Miller, Morgan, Franklin and Cole (a)	2,997	31,317	715	6,320	791	4,517	(a) 785	6,068
St. Francois	1,320	13,588	594	4,354	637	4,593	521	3,682
Washington	57,290	583,207	22,272	194,898	53,136	338,218	62,987	484,307
Undistributed	27,792	282,645	.....	.....	10,195	64,738	14,941	115,037
Totals	99,654	$1,013,570	25,200	$217,913	66,421	$421,568	81,701	$629,097

(a) Cole included with Miller, Morgan and Franklin in 1923 only.

Recent producers of barytes are as follows:

PRODUCERS OF CRUDE BARYTES.

Producer.	Location of mine.
BENTON COUNTY—	
Consolidated Chemical Products Co	Cole Camp
COLE COUNTY—	
American Barytes Corp	Lohman
J. C. Johnson	Lohman
S. M. Templeton	Eugene
Curtis B. Samuel	Henley
O. S. Reaves	Henley
National Pigments & Chemical Co	Henley
FRANKLIN COUNTY—	
S. H. Sullivan, Sr	Morrellton
J. H. Johnson	Morrellton
Ill-Mo Mineral Products Co	St. Clair
B. Duckworth	St. Clair and Beaufort
C. H. Rose and H. O. Hollow	Sullivan
JEFFERSON COUNTY—	
G. F. Engledow	Blackwell
Cordia & Jones	DeSoto
H. W. Hamel	DeSoto
A. E. Stocking	Fletcher
Tom Pinnell	Fletcher
H. C. Carter & Co	Halifax
Valle Mining Co	Valle Mines
Bernhardt & Cole	Vineland
T. L. Dapron	Vineland
MILLER COUNTY—	
American Barytes Co	Bagnell
P. M. Ritchie	Tuscumbia
MORGAN COUNTY—	
J. H. Phillips	Gravois Mills
E. Jobe	Rocky Mount
American Barytes Co	Versailles
Geo. H. Bubbard	Versailles
Stevenson & Marriott	Versailles
ST. FRANCOIS COUNTY—	
L. E. Cole	Blackwell
C. E. Boyer	Blackwell
Joshua Cole	Blackwell
R. B. Cole	Blackwell
Cole & Brown	Blackwell

PRODUCERS OF CRUDE BARYTES—*Continued.*

Producer.	Location of mine.
ST. FRANCOIS COUNTY—*Continued.*	
James Donald	Blackwell
Ode Engledow	Blackwell
J. R. Politte	Blackwell
Adolph Portell	Blackwell
Clarence Bess (W. C. Ashburn Est.)	Blackwell
Edwin Flueck	Blackwell
WASHINGTON COUNTY—	
H. E. Brown	Baryties
John C. Boyer	Baryties
C. H. & F. A. Clancy	Baryties
Mrs. Lizzie Aubuchon	Bellfontaine
John Degonia	Blackwell
John C. Boyer	Blackwell
Thomas Maddin	Blackwell
A. D. Politte	Blackwell
J. R. Politte	Blackwell
Washington Land & Mining Co	Bliss
Aubuchon Mining Co	Cadet
John Long & Son	Cadet
M. E. Rhodes	Cadet
White & Bro	Cadet, Old Mines
Anthony Recar	Cruise
Geo. Cook	Fertile
J. H. Higginbotham	Fertile
Richwoods Dev. Co	Fletcher
A. E. Stocking	Fletcher, Richwoods
J. P. Lombard	Hopewell
St. Joe Lead Co	Hopewell
Mrs. P. C. Aly	Mineral Point
Mrs. D. Aubuchon	Mineral Point
D. N. Baker	Mineral Point
Mrs. Agnes M. Boas	Mineral Point
Arthur Dale	Mineral Point
Eagle-Picher Lead Co	Mineral Point
Hugh McGregor	Mineral Point
Geo. B. H. Moor	Mineral Point
Chas. Nicholson	Mineral Point
Wm. Perkins	Mineral Point
Susan Pinson	Mineral Point
Southeast Missouri Lead Co	Mineral Point
C. C. Sparks	Mineral Point
Missouri Barytes Co	Mineral Point
Joe Patashnick	Mineral Point
Point Milling & Mfg. Co	Mineral Point
P. C. Walton & Co	Mineral Point
Mrs. M. J. Waugh	Mineral Point

PRODUCERS OF CRUDE BARYTES—*Continued.*

Producer.	Location of mine.
WASHINGTON COUNTY—*Continued.*	
E. P. Wells & Co	Mineral Point
Andrew White	Mineral Point
Ben White	Mineral Point
C. C. Rose and H. O. Hollow	Northcut
C. B. Groves	Old Mines
Murphy & Alden	Old Mines
C. M. Wells	Old Mines
White & Bros	Old Mines
T. F. Blount & Co	Potosi
Bugg, Eversole & Towl	Potosi
A. H. Carr	Potosi
B. G. Casey	Potosi
Evans & Russell	Potosi
Martin Higgins	Potosi
Rev. Clark Martin	Potosi
National Pigments & Chemical Co	Potosi, Cadet, Tiff, Blackwell
Pittsburg & Potosi Lead Co	Potosi
Wm. Kelsey	Potosi
J. W. Settle & Co	Potosi
J. W. Towl	Potosi
Benj. Wood	Potosi
Mrs. S. C. Coleman	Racola
C. P. Delore	Richwoods
Johnson Bros	Richwoods
Bust Bros	Tiff
Thurman & Banta	Tiff
Geo. W. Welch	Vineland

CEMENT.

The manufacture of cement has been greatly stimulated in the last biennial period, new records for both quantity and value being established. Missouri advanced from fifth place to fourth in state production. The increased demand has been caused by the stimulation in the building industry and in the increased use of cement in concrete roads. During the war and the period of inflation immediately thereafter the amount of building was inadequate to keep up with the natural growth of the country; consequently, as soon as costs began to decline a great deal of building was started and with the increased use of concrete for permanent structures the demand for cement was naturally increased.

There are five plants in Missouri operated by four companies. Since the previous report the Continental Portland Cement Company has been taken over by the Alpha Portland Cement Company, and the Cape Girardeau Portland Cement Company by the Marquette Cement Mfg. Co.

There are 39 rotary kilns in the five plants, varying in size from 60 x 6 ft. to 240 x 12 ft. The yearly capacity of these plants has been increased in past years by operating refinements, without additional kilns, from about seven million barrels of finished cement to nearly nine million barrels.

Materials suitable for the manufacture of cement occur in many different parts of the state, as shown by the wide distribution of the plants. The deposits are described in Vol. VI, 2nd series of this Bureau, on Lime and Cement.

The following tables give the figures on production and the list of manufactures.

PRODUCTION OF PORTLAND CEMENT, 1916-1923.

Year.	Stock on hand Jan. 1.	Manufactured.	Sold.	Value.	Price per barrel.
1915.....	.....	4,646,771	4,628,484	$4,007,679	$0.866
1916.....	.....	5,178,021	5,732,001	6,333,567	1.105
1917.....	.....	5,882,240	5,800,988	8,248,007	1.435
1918.....	404,624	4,738,596	4,515,695	7,132,470	1.579
1919.....	676,552	5,216,347	5,496,164	9,264 017	1.686
1920.....	160 123	6,017,517	5,605,952	10,980,453	1.96
1921.....	571,688	4,446,091	4,375,712	8,034,540	1.84
1922.....	640,932	6,170,633	6,239,144	10,457,557	1.68
1923.....	636,625	7,305,997	7,143,883	13,237,141	1.85

Stock on hand Dec. 31, 1923—798,739 barrels.

PORTLAND CEMENT PLANTS.

Firm name.	Material used.*a*	County.	Town.
Atlas Portland Cement Co....	ls & sh.....	Ralls.....	Hannibal.
Marquette Cement Mfg. Co...	ls. & clay.....	Cape Girardeau....	Cape Girardeau.
Alpha Portland Cement Co...	ls. & clay.....	St. Louis.....	Continental.
Missouri Portland Cement Co.	ls. & sh.....	St. Louis.....	Prospect Hill.
Missouri Portland Cement Co.	ls. & sh.....	Jackson.....	Sugar Creek.

a ls. = limestone; sh. = shale.

CLAY AND CLAY PRODUCTS.

Clay production showed a steady recovery and increase in 1922 and 1923, so that in the latter year a record valuation for raw clay of $1,624,789 was reached and the tonnage of 495,797 practically equalled the high point of 1917. In 1921 and 1922 Missouri was the second state in value of clay mined, being surpassed in 1921 by New Jersey, and in 1922 by Pennsylvania. In 1923 she stood third, there being less than two per cent difference between New Jersey, Pennsylvania, and Missouri. In production of raw fire clay Missouri stands first by a large margin.

Most of the clay mined in Missouri is manufactured into clay products by the same company that mines it, so that it is impossible to report the value of this clay as mined. The recovery in the clay products industry in Missouri has not been so favorable as in raw clay. From the record high of $17,474,542 in 1920, the value dropped to $10,668,691 in 1921 and recovered to only $11,649,495 in 1922.

Missouri stands second in production of fire brick and sewer pipe, sixth in face brick, ninth in drain tile, tenth in building tile, twelfth in common brick and ninth in total production of clay products.

The diaspore clay deposits of the northern Ozark region continue to attract attention, and the production is being increased each year. The clay deposits near Lutesville have not been operated during the biennial period, although there has been almost continuous production of the chinaware clays west of Poplar Bluff. Drilling and prospecting for fire clay have been carried on in Montgomery and adjoining counties. The Fulton Fire Brick Company has opened an exceptionally fine deposit south of Fulton, from which production is now being made.

The statistics on clay and clay products and lists of producers follow:

CLAY MINED AND SOLD, 1914-1923.

Year.	Fire Clay.						Miscellaneous. *c*		Total.	
	Plastic.		Flint.		Diaspore.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1914	203,755	$432,786	*a*	.....	*b*	.....	5,426	$30,917	209,181	$463,703
1915	303,432	604,777	*a*	.....	*b*	.....	4,953	36,263	308,385	641,040
1916	254,865	436,441	179,675	$501,708	*b*	.....	3,963	48,575	439,583	988,884
1917	491,674	1,306,721	*a*	.....	*b*	.....	5,593	79,617	497,267	1,386,338
1918	365,339	942,547	87,453	159,105	*b*	.....	11,654	91,444	464,446	1,192,996
1919	217,905	804,376	121,928	177,750	*b*	.....	1,552	21,907	341,385	1,004,033
1920	329,563	1,130,266	111,165	266,814	*b*	.....	8,256	16,109	448,984	1,413,189
1921	159,831	627,289	95,963	302,485	*b*	.....	989	8,361	256,783	938,135
1922	259,011	711,087	137,470	406,637	13,384	$109,229	12,263	11,669	412,128	1,238,622
1923	338,010	1,252,003	142,584	301,474	10,617	54,450	4,586	16,862	495,797	1,624,789

a Fire clay not divided in 1914, 1915 and 1917.
b Diaspore clay not separated before 1922.
c Includes kaolin, stoneware clay and clay for miscellaneous uses.

CLAY WORKING INDUSTRIES.

Value of Clay Products, 1919-1922.

Product.	1919.	1920.	1921.	1922.
Fire brick	$5,121,077	$8,525 807	$4,493,610	$4.698,064
Common brick	1,159,198	1,507,414	1,054,007	1,393,673
Hollow building tile or block	361,555	572,200	371,217	379,348
Sewer pipe	2,086,278	3,707,233	2,602,702	2,349,130
Drain tile	90,163	184,055	59,239	83,611
Front brick	762,470	912,535	449,158	1,057,354
Pottery	20,817	31,084	89,657	96,513
Miscellaneous	1,435,592	2,034,213	1,549,101	1,591,802
Totals	$11,037,150	$17,474,542	$10,668,691	$11,649,495

"Miscellaneous" includes vitrified brick, enameled brick, architectural terra cotta, tile other than drain tile, silica brick, clay gas retorts, stove lining and wall coping.

PRODUCERS OF CLAY IN MISSOURI, 1922-1923.

Operator.	Type of clay mined.	Location.
AUDRAIN COUNTY—		
Farber Fire Brick Co	Plastic fire clay	Farber.
A. P. Green Fire Brick Co	Flint fire clay, plastic fire clay	Mexico.
Walsh Fire Clay Products Co	Plastic fire clay	Vandalia.
BOLLINGER COUNTY—		
Frederick E. Bausch	Kaolin	Glen Allen.
American China Clay Co., Samson Plaster Board Co	Kaolin	Lutesville.
BUTLER COUNTY—		
Missouri Clay Mining Co	Kaolin	Poplar Bluff.
COLE COUNTY—		
J. K. Anderson	Kaolin	.....
CRAWFORD COUNTY—		
Laclede-Christy Clay Products Co	.....	Hofflin.
Watkins Mining Co	Flint fire clay	Hofflin.
W. S. Cox	Flint fire clay	Hofflin.
FRANKLIN COUNTY—		
Laclede-Christy Clay Products Co	.....	Beaufort and Leslie.
F. A. Toelke	Flint fire clay	Gerald.

PRODUCERS OF CLAY IN MISSOURI, 1922-1923—Continued.

Operator.	Type of clay mined.	Location.
FRANKLIN COUNTY—*Continued.*		
Western Fire Brick Co	Flint fire clay	Gerald.
J. P. Connell	Flint fire clay	Gerald.
Evans & Howard Fire Brick Co	Flint fire clay	Gerald.
Casper H. Meyer	Flint fire clay	Gerald.
Hydraulic-Press Brick Co	Flint fire clay	Johnson Spur.
GASCONADE COUNTY—		
Campbell & Lichte	Flint fire clay	Bland.
Chas. E. Sassman	Flint and plastic fire clay.	Ditman.
Watkins Mining Co	Flint fire clay	Canaan, Owensville and Rosebud.
Decker & Lacy	Flint fire clay	Canaan.
Evans & Howard Fire Brick Co	Flint fire clay	Owensville.
J. P. Connell	Flint fire clay	Owensville and Rosebud.
General Chemical Co	Flint fire clay	Owensville.
American Refractory Co		Owensville.
Sylvester Aytes		Owensville.
John A. Skornia	Flint fire clay	Owensville.
Chas. Brown	Flint fire clay	Rosebud.
Laclede-Christy Clay Products Co		Canaan, Owensville and Rosebud.
Gasconade Clay Products Co	Flint fire clay	Rosebud.
Louis Hidel	Flint fire clay	Rosebud.
John Wehmeyer	Flint and plastic fire clay.	Rosebud.
W. S. Cox	Flint and plastic fire clay.	Canaan, Owensville and Rosebud.
F. A. Toelke	Flint fire clay	Rosebud.
Gasconade Clay Co	Flint fire clay	
Owensville Fire Clay Co	Flint fire clay	Owensville.
HENRY COUNTY—		
James W. Edwards	Stoneware clay	Calhoun.
J. E. Guthridge	Stoneware clay	Calhoun.
JACKSON COUNTY—		
Builders Brick & Mfg. Co	Miscellaneous clay	
JOHNSON COUNTY—		
Knobnoster Brick, Tile, Light & Power Co	Brick and tile clay	Knobnoster.
LINCOLN COUNTY—		
Walsh Fire Clay Products Co		Whiteside.

PRODUCERS OF CLAY IN MISSOURI, 1922-1923—Continued.

Operator.	Type of clay mined.	Location.
MARIES COUNTY—		
General Chemical Co.	.....	Belle.
Evans & Howard Fire Brick Co.	Flint fire clay.	Belle.
Jim Heck	Flint fire clay.	Belle.
Laclede-Christy Clay Products Co.	.....	Belle.
W. S. Cox	Flint and plastic fire clay.	.....
J. P. Connell	Flint fire clay.	.....
MILLER COUNTY—		
C. P. Tellman	Kaolin, flint fire clay.	Marys Home.
MONTGOMERY COUNTY—		
Supreme Fire Clay Co	Flint fire clay.	Jonesburg.
Hydraulic Press Brick Co	Flint fire clay.	New Florence.
Laclede Christy Clay Products Co.	.....	Wellsville.
Wellsville Fire Brick Co	Plastic fire clay.	Wellsville.
Parker-Russell Mng. & Mfg. Co.	Flint and plastic fire clay.	Wellsville.
MORGAN COUNTY—		
Geo. H. Hubbard	Kaolin	Versailles.
W. S. Dickey Clay Mfg. Co	Flint fire clay.	Versailles.
Versailles Coal and Clay Co	.....	Versailles.
OSAGE COUNTY—		
H. H. Heck Clay Co	Kaolin, flint fire clay.	.....
General Chemical Co.	Flint fire clay.	.....
Marquette Mining Co.	Flint fire clay.	.....
PHELPS COUNTY—		
Thomas E. Woolsey	.....	St. James.
St. Louis County—		
Missouri Fire Brick Co	Plastic fire clay.	Cheltenham, St. Louis.
Laclede-Christy Clay Products Co.	Plastic fire clay.	Christy, Cheltenham, St. Louis and St. Louis.
Geo. W. Gittins Clay Products Co.	Plastic fire clay.	Clayton.
Frederick E. Bausch	Plastic fire clay.	Clayon.
Evan & Howard Fire Brick Co.	Flint fire clay.	Overland.
Lavinia Shalleros	.....	Clayton.
Superior Clay & Quarry Co.	.....	Clayton.
Volz Fire Clay Co	Plastic fire clay.	Clayton.
Glencoe Clay Co	Flint and plastic fire clay.	Glencoe.
Murray & Siems	Flint and plastic fire clay.	Oakhill.
Walsh Fire Clay Products Co.	Plastic fire clay.	St. Louis.
St. Louis Vitrified & Fire Brick Co.	Plastic fire clay.	Maryland Hts.

PRODUCERS OF CLAY IN MISSOURI, 1922-1923—Continued.

Operator.	Type of clay mined.	Location.
ST. LOUIS CITY—		
Mutual Press Brick Co	Miscellaneous clay	Shrewsbury.
Cheltenham Fire Clay Co	Plastic fire clay	St. Louis.
Grand View Fire Clay Co	Flint fire clay	St. Louis.
Grand View Fire Clay Mines	Plastic fire clay	St. Louis.
Highlands Fire Clay Co	Flint and plastic fire clay	St. Louis.
Parker-Russell Mng. & Mfg. Co	Plastic fire clay	St. Louis.
Henry Shaw Estate		St. Louis.
Wade Bros. Construction Co		St. Louis.
WARREN COUNTY—		
James Kelly	Flint and plastic fire clay	Truesdale.
Walsh Fire Clay Products Co	Flint fire clay	Truesdale and Jonesburg.
Aluminum Flake Co	Flint fire clay	Truesdale.

PRODUCERS OF CLAY PRODUCTS, 1922-1923.

Operator.	Name of product.	Location of works.
AUDRAIN COUNTY—		
Farber Clay & Mining Co	Fire brick	Farber.
A. P. Green Fire Brick Co	Fire brick	Mexico.
Western Stove Lining Co	Stove lining	Mexico.
Walsh Fire Clay Products Co	Fire brick	Vandalia.
BARTON COUNTY—		
Universal Brick & Tile Co	Common brick	Oskaloosa.
BATES COUNTY—		
W. S. Dickey Clay Mfg. Co	Drain tile	Rich Hill.
BUCHANAN COUNTY—		
Herman Brick Co	Common brick; hollow building tile or block	St. Joseph.
St. Joseph Pressed Brick Co	Common brick; hollow building tile or block	St. Joseph.
CALLAWAY COUNTY—		
Fulton Fire Brick Co	Fire brick	Fulton.
CAPE GIRARDEAU COUNTY—		
Cape Girardeau Press Brick Co	Common brick	Cape Girardeau.
Kasten & Schmuke Press Brick Co	Common brick; drain tile	Jackson.

PRODUCERS OF CLAY PRODUCTS, 1922-1923—Continued.

Operator.	Name of product.	Location of works.
CARROLL COUNTY—		
L. A. Harding	Common brick	Carrollton.
CASS COUNTY—		
Creighton Brick & Tile Co	Common Brick; hollow building tile or block	Creighton.
George E. Nicholson	Face brick; hollow building tile or block	Harrisonville.
CHARITON COUNTY—		
Brunswick Brick & Tile Co	Common brick; drain tile; hollow building tile or block	Brunswick.
COLE COUNTY—		
Dawson Brick Yard	Common brick	Jefferson City.
COOPER COUNTY—		
Boonville Brick Co	Common brick	Boonville.
Missouri Reformatory	Common brick	Boonville.
FRANKLIN COUNTY—		
Washington Dry Pressed Brick Works	Common brick	Washington.
GA CONADE COUNTY—		
Korff Bros Brick Mfg. Co	Common brick	Rosebud.
HENRY COUNTY—		
W. S. Dickey Clay Mfg. Co	Drain tile; hollow building tile or block; sewer pipe; wall coping; segm nt blocks	Deepwater.
HOWARD COUNTY—		
Fayette Brick & Tile Co	Common brick; drain tile; hollow building tile or block; fire brick	Fayette.
JACKSON COUNTY—		
Hydraulic Press Brick Co	Face brick	Diamond.
Builders Brick & Mfg. Co	Common brick	Kansas City.
W. S. Dickey Clay Mfg. Co	Sewer pipe; hollow building tile or block; wall coping; miscellaneous	Kansas City.
Lyle Rock Co	Common brick	Kansas City.
B-V Brick Co	Common brick	Vale.
Kansas City Brick Co., Inc	Common brick; face brick; hollow building tile or block	Vale.

PRODUCERS OF CLAY PRODUCTS, 1922-1923—Continued.

Operator.	Name of product.	Location of works.
JEFFERSON COUNTY—		
Pittsburgh Plate Glass Co.	Clay pots; miscellaneous.	Crystal City.
Festus Pressed Brick Co.	Common brick.	Festus.
JOHNSON COUNTY—		
Knobnoster Brick, Tile, Light & Power Co.	Common brick.	Knobnoster.
LAFAYETTE COUNTY—		
Higginsville Brick & Tile Co.	Common brick.	Higginsville.
LINCOLN COUNTY—		
Winfield Tile & Brick Factory.	Drain tile.	Winfield.
LIVINGSTON COUNTY—		
Shale Hill Brick & Tile Co.	Drain tile; hollow building tile or block.	Utica.
MACON COUNTY—		
J. C. Brown.	Common brick.	Macon.
MONTGOMERY COUNTY—		
New Florence Fire Brick Co.	Fire brick.	New Florence.
Wellsville Fire Brick Co.	Fire brick.	Wellsville.
MORGAN COUNTY—		
Versailles Fire Brick & Clay Mfg. Co.	Fire brick.	Versailles.
NODAWAY COUNTY—		
R. N. Barber.	Common brick; drain tile; hollow building tile or block.	Burlington Jct.
PIKE COUNTY—		
Philip Schurfeld.	Common brick; drain tile; hollow building tile or block.	Louisiana.
RANDOLPH COUNTY—		
Moberly Paving Brick Co.	Common brick; brick for paving and other uses.	Moberly.
ST. LOUIS COUNTY—		
Alton Brick Co.	Common brick; face brick; hollow building tile or block.	Clayburn.
Evans & Howard Fire Brick Co.	Fire brick.	Clayton.
Continental Brick Co.	Common brick.	Continental.
Wm. H. Warmann.	Common brick.	Eden.
St. Louis Vitrified & Fire Brick Co.	Fire brick.	Maryland Hgts.
Excelsior Press Brick Co.	Common brick.	St. Louis.

PRODUCERS OF CLAY PRODUCTS, 1922-1923—Continued.

Operator.	Name of product.	Location of works.
ST. LOUIS COUNTY—*Continued.*		
Jacon Maes	Common brick	St. Louis.
Missouri Pressed Brick & Imp. Co.	Common brick	St. Louis.
Walsh Fire Clay Products Co	Fire brick	St. Louis.
Mutual Press Brick Co	Common brick	Shrewsbury.
American Press Brick Co	Common brick	Wellston.
ST. LOUIS CITY—		
Missouri Fire Brick Co	Fire brick	Cheltenham.
Blackmar & Post Pipe Co	Sewer pipe	St. Louis.
Evans & Howard Fire Brick Co	Drain tile; sewer pipe; fire brick	St. Louis.
Hydraulic Press Brick Co	Common brick; vitrified brick for paving and other uses; fire brick; face brick; enameled brick; hollow building tile or block	St. Louis.
Laclede-Christy Clay Products Co.	Sewer pipe; hollow building tile or block; clay gas retorts; fire brick; miscellaneous	St. Louis.
Mitchell Clay Mfg. Co	Fire brick	St. Louis.
Mound City Roofing Tile Co	Roofing tile	St. Louis.
Parker-Russell Mng. & Mfg. Co.	Hollow building tile or block; fire brick; clay gas retorts; silica brick.	St. Louis.
Progress Press Brick & Machine Co.	Common brick	St. Louis.
St. Louis Terra Cotta Co	Architectural terra cotta.	St. Louis.
H. H. Schweer Brick Co	Common brick	St. Louis.
Superior Press Brick Co	Common brick; face brick.	St. Louis.
Winkle Terra Cotta Co	Architectural terra cotta.	St. Louis.
Walsh Fire Clay Products Co	Fire brick	St. Louis.
SCOTT COUNTY—		
Post Bros. Tile Co	Drain tile	Commerce.
Illmo Pressed Brick Co	Common brick	Illmo.
STODDARD COUNTY—		
Dickman Brick & Tile Co	Common brick	Dexter.
Bloomfield Tile Company	Drain tile	Bloomfield.
VERNON COUNTY—		
Norman Clay Tile Co	Hollow building tile or block	Nevada.
H. Pohl	Common brick; face brick.	Nevada.
Deerfield Tile Co	Drain tile; hollow building tile or block	Deerfield.

PRODUCERS OF POTTERY, 1922-1923.

Operator.	Name of product.	Location of works.
ST. LOUIS COUNTY—		
Western Pottery Company	Red earthenware	St. Louis.
Missouri Pottery & Supply Co.	Red earthenware	St. Louis.
St. Louis Pottery & Mfg. Co.	Red earthenware	St. Louis.
National Lead Co.	Corroding pots	St. Louis.
STODDARD COUNTY—		
Evans Pottery	Stoneware and yellow and Rockingham ware	Dexter.

COAL.

The production of coal in Missouri in 1922 was 2,924,750 tons valued at $11,153,000, an average price per ton of $3.81. This is a decrease of 17.7 per cent from the 1921 production of 3,551,621 tons, valued at $13,915,500, an average price per ton of $3.92. A large part of the decrease is accounted for by the big strike of 1922, which was nearly complete in the state. The average number of days worked per man dropped from 166 to 113. The estimated production for 1923 is 3,800,000 tons, an increase of about 30 per cent and slightly more than that of 1921, but still far below the record production in 1920 of 5,369,-565 tons.

Barton County with its large strip pits continues to lead with 658,092 tons, with Ray County second with 423,881 tons, and Macon third with 352,137 tons. Adair County, which has been consistently third, dropped to fourth place with 221,703 tons. The reason is shown by the decrease in average days worked per man from 225, the second highest in 1921, to 86, the lowest in 1922.

The possible coal productive territory in Missouri is in the northwestern third of the state. The "Coal Measures" of Pennsylvanian age in which the beds are found, lie northwest of a line drawn roughly from southwest Barton County to the northeast corner of the state, with a large tongue extending into Boone, Callaway, and Audrain counties, and leaving out Knox County.

The distribution, thickness, and character of the beds are described in "Coal Deposits," Vol. XI, 2nd series, published by this Bureau.

The following tables give the detailed figures on production, number of employees, days employed, and list of producers.

COAL PRODUCED IN MISSOURI IN 1921 AND 1922.

County.	Net tons.				Value.		Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Total.	Average per ton.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1921.[b]											
Adair	509,561	8,998	9,245	527,804	$1,659,000	$3.14	663	257	114	1,034	225
Audrain	2,341	8,076	121	10,538	45,500	4.32	34	7	4	45	226
Barton	680,698	6,447	39,202	726,347	2,934,000	4.04	106	22	778	906	107
Bates	37,350	1,120	1,220	39,690	125,000	3.15	51	16	71	138	74
Boone	2,000	14,128	.....	16,128	45,000	2.79	41	11	5	57	179
Caldwell, Clay, Dade, and Platte	65,589	23,088	2,969	91,646	372,000	4.06	158	55	20	233	177
Callaway	10,776	19,882	1,533	32,191	130,000	4.04	64	18	34	116	128
Henry	88,025	6,354	900	95,279	327,000	3.43	33	7	95	135	163
Howard, Moniteau and Pettis	2,314	1,630	570	4,514	17,400	3.85	5	1	12	18	66
Grundy and Harrison	3,170	8,177	307	11,654	68,000	5.83	52	5	5	62	159
Johnson	12,969	1,934	337	15,240	50,000	3.28	35	26	9	70	72
Lafayette	491,450	30,153	18,818	540,421	2,316,000	4.29	1,006	480	145	1,631	162
Linn	66,198	22,948	601	89,747	428,000	4.77	177	99	13	289	157
Macon	443,659	20,180	10,146	473,985	1,784,000	3.76	931	219	69	1,219	151
Putnam	11,703	1,138	1,080	13,921	52,000	3.74	55	13	8	76	84

COAL PRODUCED IN MISSOURI IN 1921 AND 1922—Continued.

County.	Net tons.				Value.		Number of employees.				Average number of days worked.
							Underground.		Surface.	Total.	
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Total.	Average per ton.	Miners.[a]	All others.			
Randolph	306,052	12,711	6,073	324,836	$1,274,000	$3.92	627	192	52	871	194
Ray	420,402	49,679	6,036	476,117	2,058,000	4.32	979	372	98	1,449	189
Vernon	39,182	2,073	771	42,026	166,000	3.95	94	24	29	147	101
Other counties [c]	16,057	3,420	60	19,537	64,600	3.31	30	6	23	59	147
Total	3,209,496	242,136	99,989	3,551,621	$13,915,500	$3.92	5,141	1,830	1,584	8,555	166
1922.											
Adair	202,586	15,088	4,029	221,703	$728,000	$3.28	720	299	58	1,077	86
Audrain	6,065	11,347	114	16,526	73,000	4.16	29	11	3	43	252
Barton	620,292	6,343	31,457	658,092	2,441,000	3.71	106	26	711	843	89
Bates	143,334	1,153	2,560	147,047	453,000	3.08	132	30	78	240	129
Boone, Chariton, and Moniteau	1,890	11,367	300	13,557	38,000	2.80	27	6	10	43	214
Caldwell, Clay, Dade, and Platte	71,958	13,138	3,017	88,113	458,000	5.20	221	105	33	359	155
Callaway	5,115	35,368	772	41,255	170,000	4.12	111	16	37	164	159
Grundy, Harrison, and Schuyler	4,152	8,763	344	13,259	68,000	5.13	82	15	6	103	128

Henry	110,384	3,506	1,484	115,374	392,000	3.40	14	6	110	130	161
Johnson	41,549	1,792	860	44,201	170,000	3.84	60	14	33	107	113
Lafayette	371,330	27,287	17,766	416,383	1,678,000	4.03	1,011	454	122	1,587	121
Linn	32,637	20,776	394	53,807	255,000	4.74	184	85	17	286	104
Macon	330,511	16,281	5,345	352,137	1,257,000	3.57	827	177	71	1,075	105
Randolph	144,998	9,622	4,072	158,692	612,000	3.86	564	143	45	752	93
Ray	376,642	43,839	3,400	423,881	1,774,000	4.19	1,188	430	113	1,731	123
Vernon	28,440	1,881	327	30,648	106,000	3.46	66	18	15	99	92
Other counties *d*	52,773	776	108	53,657	178,000	3.22	28	13	70	111	151
Total, excluding wagon mines	2,544,656	228,327	76,349	2,849,332	$10,851,000	$3.81	5,370	1,848	1,532	8,750	113
Wagon mines served by rail	75,418	.....	.....	75,418	302,000	4.00	.....	.....	.....	.....	.....
Grand total	2,620,074	228,327	76,349	2,924,750	$11,153,000	$3.81	.....	.....	.....	.....	.....

a Include also loaders and shot firers.
b Exclusive of product of wagon mines.
c Chariton, Franklin, Ralls, and St. Clair.
d Franklin, Lincoln, Putnam, Ralls, and St. Clair.

COAL PRODUCED IN MISSOURI, 1919-1922.

County.	1919.	1920.	(a) 1921.	1922.
Adair	517,910	777,986	527,804	221,703
Audrain	16,683	18,626	10,538	17,526
Barton	887,174	965,757	726,347	658,092
Bates	57,050	115,621	39,690	147,047
Boone, Chariton and Moniteau (b)	18,416	18,950	16,128	13,557
Caldwell, Clay, Dade and Platte	(c) 68,119	(c) 86,617	91,646	88,113
Callaway	51,010	58,462	32,191	41,255
Chariton	2,908	(d)	(d)	(e)
Cooper, Howard, Moniteau, Morgan and Pettis	(f) 21,970	29,300	4,514	(g)
Dade	6,324	6,342	(g)	(h)
Grundy, Harrison and Schuyler (i)	31,728	23,080	11,654	(i) 31,259
Henry	136,872	203,200	95,279	115,374
Johnson	77,958	45,434	15,240	44,201
Lafayette	651,193	885,569	540,421	416,383
Linn	99,991	142,290	89,747	53,807
Macon	384,846	720,227	473,985	352,137
Putnam	37,973	30,867	13,921	(d)
Randolph	320,835	422,903	324,836	158,692
Ray	408,148	578,694	476,117	423,881
Vernon	47,978	74,771	42,026	30,648
Other counties (d)	69,567	61,869	19,537	53,657

COAL PRODUCED IN MISSOURI, 1919-1922—Continued.

County.	1919.	1920.	(a) 1921.	1921.
Small mines	65,145	103,000	(k)	75,418
Tons	3,979,798	5,369,565	(a) 3,551,621	2,924,750
Value	$12,766,366	$22,230,000	$13,915,500	$11,153,000
Average value per ton	$3.21	$4.16	$3.92	$3.81

Estimated production for 1923 is 3,800,000 tons.

(a) Exclusive of product of wagon mines. (b) 1919-1921, Boone only, Chariton given elsewhere; no production reported from Moniteau until 1922. (c) Production for Dade given separately. (d) Other counties include Franklin, Ralls and St. Clair in 1919; Chariton, Ralls and St. Clair in 1920; Chariton, Franklin, Ralls and St. Clair in 1921; Franklin, Lincoln, Putnam, Ralls and St. Clair in 1922. (e) Grouped with Boone and Moniteau. (f) No production in Morgan for 1919. (g) No production reported from Cooper, Howard, Morgan and Pettis; Moniteau given with Boone and Chariton. (h) Production for Dade given with Caldwell, Clay and Platte. (i) Including Schuyler in 1922 only. (k) No production reported.

LIST OF PRINCIPAL COAL PRODUCERS IN MISSOURI.

	General office.	Location of mines.
ADAIR COUNTY—		
Adair County Coal Company	Novinger	Novinger.
Arctic Coal Company	Novinger	Novinger.
Big Creek Coal Company	Kirksville	Kirksville.
Billys Creek Coal Co	Novinger	Novinger.
Chariton Coal Company	Novinger	Novinger.
Kansas City Midland Coal & Mining Co.	Novinger	Novinger.
Union Coal Company	Novinger	Novinger.
AUDRAIN COUNTY—		
A. P. Green Fire Brick Co	Mexico	Mexico.
Big Four Coal Company	Farber	Farber.
Eagle Coal Company	Vandalia	Vandalia.
Lampton & Shinn	Vandalia	Vandalia.
Martinsburg Coal Company	Martinsburg	Martinsburg.
Vandalia Coal Co	Vandalia	Vandalia.
BARTON COUNTY—		
Bailey & Wassen	Mulberry, Kan.	
Domestic Coal Company	Pittsburg, Kan	Ardath.
Liberal Coal Co	Liberal	Liberal.
Mokan Coal Co	Pleasanton, Kan.	
Mulberry Coal Co	Mulberry, Kan.	
Norton & Lecomte	Mindenmines	Mindenmines.
Clemens Coal Co	Pittsburg, Kan	Mindenmines.
Ellsworth Coal Co	Pittsburg, Kan	Mindenmines.
Minden Coal Co	Mindenmines	Mindenmines.
Pittsburg-Midway Coal Co	Pittsburg, Kan	Midway.
Pittsburg-Oskaloosa Coal Co	Pittsburg, Kan	Oskaloosa.
Swedish Coal Co	Mindenmines	Mindenmines.
United States Coal Co	Pittsburg, Kan.	
Independent Coal Co	Pittsburg, Kan.	
Carney-Cherokee Coal Co	Mulberry, Kan.	
Sherwood-Lester Coal Co	Liberal, Mo	Liberal.
BATES COUNTY—		
A. H. Garr Coal Co	Rich Hill	Rich Hill.
Atlas Coal Co	Sprague	Sprague.
Anthony Coal Co	Foster	Foster.
Bates Coal Co	Rich Hill	Rich Hill.
Globe Coal Co	Worland	Worland.
J. Elmer Jones Coal Co	Rich Hill	Rich Hill.
Klaner Coal Co	Sprague	Sprague.
Leonard Coal Co	Pleasanton, Kan.	
Hickory Hill Coal Co	Foster	Foster.
McComb Coal Co	Rich Hill	Rich Hill.
Payten Coal Co	Amoret	Amoret.
Peacock Coal Co	Hume	Hume.
Perry McMahan Coal Co	Kansas City, Mo	Rich Hill.

LIST OF PRINCIPAL COAL PRODUCERS IN MISSOURI—Continued.

	General office.	Location of mines.
BATES COUNTY—Continued.		
Small & McGuire	Pleasanton, Kan.	
Sprague Coal Co	Sprague	Sprague.
Ritchie Coal Co	Rich Hill	Rich Hill.
Rees Coal Co	Rich Hill	Rich Hill.
Standard Coal Co	Pleasanton, Kan.	
Sunshine Coal Company	Hume	Hume.
T. J. Eagles Coal Company	Rich Hill	Rich Hill.
Worland Coal Company	Worland	Worland.
BOONE COUNTY—		
Columbia Coal Company	Columbia	Columbia.
Clemens Coal Company	Pittsburg, Kan.	
Ellsworth Coal Company	Pittsburg, Kan.	
CALLAWAY COUNTY—		
Callaway County Coal Company	Fulton	Carrington.
Crosby-Snyder Coal Co	Fulton.	
Fulton Fire Brick Co	Fulton	Fulton.
Hy Gohring	Fulton	Fulton.
Neal Griffiths	Stephens	Stephens.
C. M. Michelson	Stephens	Stephens.
J. F. Reed	Fulton	Fulton.
Simmons Coal Co	Fulton	Fulton.
Sims Bros	Fulton	Fulton.
CHARITON COUNTY—		
Lunce Bros. Coal Co	Salisbury.	
CLAY COUNTY—		
Missouri City Coal Co	Missouri City	Missouri City.
Clay Coal Mining Co	Excelsior Springs	Excelsior Springs.
CLINTON COUNTY—		
Plattsburg Vibbard Coal Co	Plattsburg.	
DADE COUNTY—		
Bishop Coal Company	Lockwood	Lockwood.
GRUNDY COUNTY—		
Trenton Mining Co	Trenton.	
HARRISON COUNTY—		
Melbourne Coal Co	Melbourne	Melbourne.
HENRY COUNTY—		
Joe England	Deepwater	Deepwater.
Harry Daubreeze	Windsor	Windsor.
Lee Feaster	Clinton.	
Reliance Coal Co	Clinton	Brownington.
Lewis Coal Co	Lewis	Lewis.

LIST OF PRINCIPAL COAL PRODUCERS IN MISSOURI—Continued.

	General office.	Location of mines.
LAFAYETTE COUNTY—		
Elmore Coal Co	Corder	Corder.
Atwood & Son	Lexington.	
Edward Aull Coal Company	Lexington	Lexington.
Bonanza Coal Company	Higginsville	Higginsville.
Imperial Coal Company	Corder	Corder.
Farmers Fuel Company	Kansas City	Higginsville.
McGrew Coal Company	Lexington	Lexington.
Perry & Son	Lexington	Myrick.
Arthur Piper	Lexington.	
Plattensburg Coal Co	Lexington	Lexington.
Wegener Coal Co	Higginsville	Higginsville.
Western Coal & Mining Co	St. Louis	Myrick.
LINN COUNTY—		
Bucklin Coal Company	Bucklin	Brookfield.
Chas. Barr	Brookfield	Brookfield.
W. E. Crandall	Brookfield	Brookfie d.
Marceline Coal Co	Marceline	Marceline.
Peoples Coal Co	Brookfield	Brookfield.
Schaefer Coal Co	Brookfield	Brookfield.
MACON COUNTY—		
Central Coal & Coke Co	Kansas City	Keota, Ardmore, Bevier, Macon.
Home Coal Co	Macon	Macon.
E. M. Browning	Macon	Macon.
John N. Jones	Macon.	
R. W. Dodson	Macon	Macon.
Conety & Baker	Macon	Macon.
John Smith	Macon	Macon.
A. P. Johnson & Son	New Cambria	New Cambria.
Bevier Star Coal Co	Bevier	Bevier.
Pierce Coal Co	Bevier	Bevier.
MONTGOMERY COUNTY—		
Wellsville Fire Brick Company	Wellsville	Wellsville.
MORGAN COUNTY—		
Hubbard & Mills	Versailles	Versailles.
PUTNAM COUNTY—		
Armstrong Coal Co	Mendota	Mendota.
Rogers Coal Co	Mendota	Mendota.
Acme Block Coal Co	Mendota	Mendota.
RALLS COUNTY—		
Clark Coal Co	Perry	Perry.
Ralls County Coal Co	Perry	Perry.

LIST OF PRINCIPAL COAL PRODUCERS IN MISSOURI—Continued.

	General office.	Location of mines.
RANDOLPH COUNTY—		
Ben Harvey	Moberly	Moberly.
Bradley Coal Co	Huntsville	Huntsville.
Cronan Coal Co	Moberly	Moberly.
Albert Dolesky	Moberly	Moberly.
Jacksonville Coal Co	Jacksonville	Jacksonville.
John C. Eagle	Moberly	Moberly.
Mariott Coal Co	Moberly	Moberly.
Powhattan Coal Co	Huntsville	Huntsville.
Harris & Leathers	Huntsville	Huntsville.
Northern Central Coal Co	Higbee	Huntsville.
Walton Coal Co	Higbee	Higbee.
RAY COUNTY—		
Hubbell Coal Co	Richmond	Richmond.
Belt Line Coal Co	Richmond	Camden.
Clark Coal Company	Hardin	Hardin.
Conrow & Williams	Richmond	Richmond.
Crawford-Wilson Coal Co	Richmond	Richmond.
3 W's Coal Co	Henrietta	Henrietta.
Martin & Hubbel	Camden	Camden.
Pickering Coal Company	Richmond	Richmond, Camden, Swanick.
Ray County Coal Company	Richmond	Richmond.
Thomas Bros	Orrick	Orrick.
Vibbard Coal Co	Vibbard	Vibbard.
Watson & Velkema	Richmond	Richmond.
ST. CLAIR—		
T. L. Greathouse	Osceola	Osceola.
SCHUYLER COUNTY—		
David Horton	Coatsville	Coatsville.
Providence Coal Co	Coatsville	Coatsville.
Valley View Coal Co	Glenwood	Glenwood.
VERNON COUNTY—		
Moundville Coal Co	Moundville	Moundville.
Lavery Coal Co	Moundville	Moundville.
Garland Coal Co	Garland, Kan	Swart.
C. B. Jenkins Coal Co	Eve	Eve.
Boyd Coal Co	Bronaugh	Bronaugh.

COBALT AND NICKEL.

The complex ore of cobalt, nickel, copper, lead, and iron sulphides which has been mined in recent years east of Fredericktown by the Missouri Cobalt Company is known to be present

in other places in the district, notably at Mine La Motte. This is the only nickel producing area which has been worked to any extent in the United States and is one of two producing cobalt. The ores occur in the lower part of the Bonne Terre dolomite and the upper part of the La Motte sandstone near the contact with the underlying Pre-Cambrian porphyry.

Although not in operation at the present time, this district with a revival in metal prices will be an important factor in the production of these metals.

COPPER.

The entire production of copper in Missouri at present comes from a middling table product in the lead mines of southeast Missouri and matte in lead refining.

There has been some activity in Shannon County in late 1922 and 1923 where prospecting has discovered a solution channel containing copper sulfides and carbonates. Development is being carried on at the Sutton property south of Eminence and a small mill is to be installed. The ore which is chiefly chalcocite, coated with malachite, occurs in large chunks in mud openings in a solution channel at a depth of about 30 feet. The opening occurs directly above the conglomerate zone at the surface of the porphyry.

MINE PRODUCTION OF COPPER IN MISSOURI, 1910-1923.

Year.	Pounds.	Value.
1910-1918	3,527,293	$667,666
1919	1,617,200	300,799
1920	1,512,539	278,307
1921	137,591	17,749
1922	797,400	107,649
1923	202,556	29,776

IRON ORE.

The production of iron ore dropped off greatly in 1921, there being no shipments of brown ore reported and only two shippers of hematite. In 1920, although the price of ore dropped to $4.28 per ton lower costs permitted the production of hematite

to recover to about an average figure, although brown ore production was low. In 1923 the price of ore rose to $5.15, the highest recorded, and production of hermatite remained at about the recent average, while brown ore production advanced to 12,966 tons, the second largest year since 1910.

Two concentrating plants have been erected in the limonite district both of which have produced during the past year. Production continued at Iron Mountain with a remodeling of the mill. The lack of market during recent months has practically stopped the various operations. Considerable interest was manifest in the red ores of the Carboniferous and drilling done in Callaway county. The ore was not found in sufficient quantity to warrant mining operations. At the present time an extensive drilling campaign is in progress in the central red ore district. At the Bronson mine in Phelps County, the red ore produced has been sold chiefly to paint manufacturers.

IRON.

The following table shows the production and value for 1908 to 1923:

PRODUCTION OF IRON ORE IN MISSOURI, 1908-1923.

Year.	Total tons (long) shipped.	Value.	Average price per ton.	Hematite (red ore) tons.	Limonite (brown ore) tons.
1908.....	98,414	$218,182	$2.22	77,400	21,014
1909.....	89,954	210,853	2.35	67,391	22,563
1910.....	78,341	168,697	2.47	55,832	22,509
1911.....	72,810	153,716	2.11	57,201	8,214
1912.....	42,120	92,996	2.20	39,721	3,756
1913.....	37,134	93,628	2.26	33,709	5,645
1914.....	37,554	75,696	2.02	32,054	5,500
1915.....	40,290	99,853	2.47	35,145	5,145
1916.....	34,914	116,484	3.34	27,568	7,346
1917.....	38,776	134,906	3.48	26,866	12,042
1918.....	71,968	270,337	3.76	55,955	16,013
1919.....	53,626	223,144	4.16	44,867	8,759
1920.....	50,825	230,827	4.54	41,154	9,671
1921.....	36,431	169,516	4.65	(a)	(a)
1922.....	58,320	244,928	4.28	57.038	1,282
1923.....	54,348	247,975	5.15	(a)	(a)

(a) Figures not given to conceal individual production.

PRODUCERS OF IRON ORE IN MISSOURI.

Operator.	Name of mine.	Kind of ore.
BUTLER COUNTY—		
Granite Bend Mining and Mercantile Co	Keener (Luke)	Secondary limonite.
CRAWFORD COUNTY—		
Cherry Valley Iron Co	Cherry Valley	Red hematite.
Sligo Furnace Co	Walker	Red hematite.
DENT COUNTY—		
Ozark Iron Ore Mining Co	Hawkins Bank	Red hematite.
Jas. A. Green & Son	Hawkins Bank	Red hematite.
FRANKLIN COUNTY—		
Southern Acid & Sulphur Co	Ruepple	Red hematite.
HOWELL COUNTY—		
South Missouri Mining & Development Co	Davidson.	
IRON COUNTY—		
Pilot Knob Iron Co	Pilot Knob	Red hematite.
OREGON COUNTY—		
Rowden & Ball	Rowden	Secondary limonite.
South Missouri Mining & Development Co	Rowden	Secondary limonite.
OSAGE COUNTY—		
Iron Exploration Co	Miller	Hematite & limonite.
PHELPS COUNTY—		
L. G. Bronson		Red hematite.
ST. FRANCOIS COUNTY—		
Iron Mountain Co	Iron Mountain	Red hematite.
STODDARD COUNTY—		
Mississippi Valley Iron Co	Puxico	Secondary limonite.

LEAD ORE.

Production of lead ore concentrates remained about the same during 1922 and 1923 as in 1921. It was considerably lower than war time production but in advance of pre-war figures. Examination of details shows that the loss has been entirely in the southwestern part of the state, for the southeast lead belt

in St. Francois County is mining at a rate comparable with the latter years of the war. The production of lead in the Joplin district is to a considerable extent dependant on that of zinc as the two are usually mixed in the natural ore. In 1922 about 21 per cent of the total mine concentrates in the latter region were lead and in 1923 about 14 per cent. Thirty-eight per cent of the lead mined in the United States in 1922 and 31 per cent in 1923 came from southeast Missouri.

The high price of lead has stimulated prospecting in many of the outlying districts. Drilling has been done in Ste. Genevieve, Washington, Wayne, Madison and other outlying areas. The purchase of the Federal Lead Company by the St. Joseph Lead Company resulted in a consolidation that makes the latter company the most important lead producing company in the United States and gives it the distinction of producing more pounds of metal per month than any other company producing non-ferrous metals.

VALUE AND TENOR OF LEAD ORES, 1910-1923.

	All in Missouri.		Southeast Missouri only.				
Year.	Total concentrates.	Total value conecntrates.	Total crude ore.	Galena concentrates in crude ore.	Lead in crude ore	Average lead in concentrates.	Average value per ton concentrates.
1910	248,058	$11,286,750	3,693,523	5.7 %	3.5 %	62.3 %	$44.35
1911	258,240	12,469,460	3,974,712	5.5	3.7	67.3	46.94
1912	256,838	11,948,358	4,064,366	5.3	3.35	67.1	45.01
1913	255,723	11,444,935	4,250,800	5.15	3.45	67.2	43.63
1914	279,854	11,143,104	4,718,300	5.27	3.56	67.6	38.96
1915	312,567	14,579,361	5,067,800	5.47	3.62	66.5	45.89
1916	347,869	24,172,965	5,467,500	5.60	3.68	65.66	67.47
1917	345,513	34,038,976	5,887,900	5.03	3.47	66.70	98.01
1918	287,983	21,988,567	5,532,600	5.01	3.39	66.8	75.53
1919	237,428	12,107,731	4,301,930	5.32	3.65	68.4	50.46
1920	247,205	20,284,921	4,803,630	5.04	3.35	66.6	81.72
1921	282,122	11,825,280	5,058,800	5.54	3.60	65.0	41.87
1922	273,381	14,934,548	5,152,400	5.26	3.50	66.5	54.48
1923	262,246	19,692,318	5,314,900	4.88	3.21	65.9	74.94

TENOR OF CRUDE LEAD ORE AND CONCENTRATES IN SOUTHWESTERN MISSOURI, 1921-1923.

	1921.	1922.	1923.
Total crude ore, short tons	243,300	727,300	784,000
Total lead concentrates in crude ore, per cent	0.73	0.31	0.4
Lead content of crude ore, per cent	0.57	.23	.3
Average lead content of galena concentrates, per cent	78.4	75.7	75.6
Average lead content of carbonate concentrates, per cent	58.8	56.1	60.2
Average value per ton:			
Galena concentrates	$50.15	$69.44	$83.40
Carbonate concentrates	32.76	56.36	69.60

PRODUCTION OF LEAD IN MISSOURI IN 1921-1923.

	Lead concentrates, 1921.				Lead concentrates, 1922.				Lead concentrates, 1923.			
	Galena.		Carbonate.		Galena.		Carbonate.		Galena.		Carbonate.	
	Quantity (short tons).	Value.	Quantity (short tons).	Value.	Quantity (short tons).	Value.	Quantity (short tons).	Value.	Quantity (short tons).	Value.	Quantity (short tons).	Value.
Southwestern Missouri:												
Alba, Neck City	35	$1,556	.....	.....	.....	.....	.....	.....	86	$7,144	.....	.....
Ash Grove	.....	.....	.....	.....	18	$972	.....	.....	16	960	.....	.....
Carthage	16	736	.....	.....	10	710	.....	.....	5	400	.....	.....
Cave Springs, Belleville	30	1,286	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Duenweg, Porto Rico	62	2,540	.....	.....	71	4,549	72	$3,845	74	6,100	3	$180
Granby	.....	.....	.....	.....	257	17,778	.....	.....	596	50,273	.....	.....
Joplin	396	20,461	33	$1,090	266	19,308	91	5,505	829	69,338	116	8,120
Oronogo	143	7,693	.....	.....	672	46,481	.....	.....	449	38,311	.....	.....
Spring City, Beef Brch	.....	.....	.....	.....	.....	.....	.....	.....	90	7,650	77	5,340
Spring City, Spurgeon	.....	.....	.....	.....	32	1,911	10	400	33	2,640	.....	.....
Spurgeon, Seneca and Racine	.....	.....	1	24	.....	.....	.....	.....	.....	.....	.....	.....
Stark City	20	1,050	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stark City and Christian County	.....	.....	.....	.....	8	585	.....	.....	.....	.....	.....	.....
Stark City and Wentworth	.....	.....	.....	.....	.....	.....	.....	.....	10	800	.....	.....
Waco (Mo.)	145	5,604	.....	.....	160	10,521	.....	.....	139	10,663	.....	.....
Webb City, Carterville, Prosperity	790	40,646	.....	.....	593	42,114	.....	.....	551	45,746	.....	.....
Other counties (a)	.....	.....	.....	.....	.....	.....	.....	.....	48	4,020	.....	.....
Totals	1,730	$86,766	34	$1,114	2,087	$144,929	173	$9,750	2,926	$244,045	196	$13,640
Central and Southeastern Missouri	280,358	11,737,400	.....	.....	271,294	$14,779,869	.....	.....	259,320	$19,434,633	.....	.....
State totals	282,088	$11,824,166	34	$1,114	273,381	$14,924,798	173	$9,750	262,246	$19,678,678	196	$13,640

(a) Includes Hickory and Christian for 1923.

LIME.

The production of both lime and hydrated lime has steadily increased until in 1923 record figures were reached in each and the combined total came to over two and a half million dollars. Indications are that 1924 has been equally as good, all of the plants working to capacity.

PRODUCTION AND VALUE OF LIME, 1914-1923.

Year.	Lime.			Hydrated lime.		
	Quantity. (tons).	Value.	Average value per ton.	Quantity (tons).	Value.	Average value per ton.
1914.....	155,630	$686,051	$4.40	19,960	$93,414	$4.68
1915.....	135,901	547,025	4.21	(a)	89,417	(a)
1916.....	199,260	956,300	4.81	24,647	128,903	5.24
1917.....	234,936	1,435,914	6.48	32,120	219,600	6.88
1918.....	166,795	1,376,046	8.25	34,942	345,754	9.90
1919.....	141,504	1,333,095	9.42	39,245	402,620	10.26
1920.....	157,126	1,735,002	11.04	51,987	584,283	11.24
1921.....	113,291	1,169,391	10.32	45,903	487,169	10.61
1922.....	147,960	1,402,337	9.48	56,024	551,187	9.84
1923.....	182,503	1,830,937	10.03	63,823	674,848	10.57

OUTPUT, VALUE AND DISPOSAL OF LIME BURNED IN 1921-1923. (a)

	1921.		1922.		1923.	
	Quantity (tons).	Value.	Quantity (tons).	Value.	Quantity (tons).	Value.
Building.....	46,916	$469,144	61,399	$577,527	80,806	$789,085
Agriculture....	(b)	(b)	1,081	11,736	(b)	(b)
Paper Mills....	6,326	60,203	11,241	100,841	13,668	125,147
Tanneries.....	(b)	(b)	3,885	37,861	4,200	44,953
Metallurgy....	4,676	39,546	8,643	76,145	13,024	124,070
Other chemical uses.....	51,878	510,214	61,330	575,696	(b)	(b)
Other uses.....	49,398	577,453	46,405	533,718	148,296	1,547,677
Totals....	159,194	$1,656,560	203,984	$1,953,524	246,326	$2,505,785

(a) Including hydrated lime.
(b) Included in "other uses."

PRODUCERS OF LIME IN MISSOURI.

Producers.	Location.
FRANKLIN COUNTY—	
Washington Lime Kiln Co	Washington.
GREENE COUNTY—	
*Ash Grove Lime & Portland Cement Co	Ash Grove and Gallaway.
*The Marble Head Lime Co	Springfield.
JEFFERSON COUNTY—	
Glencoe Lime and Cement Co	Byers, Glen Park.
LAWRENCE COUNTY—	
Peirce City Lime Co	Peirce City.
MARION COUNTY—	
The Marblehead Lime Co	Hannibal.
PIKE COUNTY—	
*Marblehead Lime Co	Louisiana.
RALLS COUNTY—	
Bluff City Lime & Stone Co	.....
ST. CLAIR COUNTY—	
Osceola White Lime Co	Osceola.
STE. GENEVIEVE COUNTY—	
Arrowhead Manufacturing Co	Brickeys.
*Peerless White Lime Co	Mosher.
*Ste. Genevieve Lime and Quarry Co	Ste. Genevieve.
Western Lime Works	Ste. Genevieve.
ST. LOUIS COUNTY—	
*Glencoe Lime and Cement Co	Mincke, Glencoe.
*Centaur Lime Co	Glencoe.

*Produces hydrated lime also.

MANGANESE.

Manganese ore has been found in Iron, Madison, Shannon, and other counties in southeastern Missouri. The deposits are mostly low grade, although small pockets of rich ore are found. There have been no commercial shipments in the last biennium.

MINERAL PAINTS.

Mineral paints produced in Missouri are largely from lead and zinc ores, the figures on which are given elsewhere. From

time to time a small amount of iron ore or ochre, which is a clayey low grade iron ore, is mined in the central Ozark regions. It brings a slightly higher price than iron ore.

MINERAL WATERS.

Missouri is abundantly supplied with mineral waters of every variety. Many of the springs and deep wells are only used locally, and do not appear among the producers listed.

Excelsior Springs in Clay County, and Eldorado Springs in Cedar County, are the most widely known watering places in Missouri. Both are well equipped with hotels, baths and drinking fountains.

The production and number of wells has remained about the same for the last six years, as shown by the following tables:

MINERAL WATERS.

Year.	Gallons produced.	Total value.	Medicinal use.	Table use.	Average price per gallon.	No. of springs.
1910.....	657,035	$96,488	$67,547	$28,941	$.147	27
1911.....	542,892	86,747	57,303	29,444	.159	25
1912.....	608,385	81,114	54,782	26,332	.133	30
1913.....	697,467	84,316	61,044	23,272	.120	34
1914.....	583,288	74,793	56,647	18,146	.128	36
1915.....	1,000,961	83,363	65,394	17,969	.088	33
1916.....	1,394,092	109,814	74,828	34,986	.079	36
1917.....	401,176	57,175	43,883	13,292	.148	33
1918.....	306,299	38,478	30,137	8,341	.126	26
1919.....	212,871	39,641	34,797	4,844	.186	26
1920.....	323,628	50,892	45,677	5,215	.157	28
1921.....	176,541	45,670	39,570	6,100	.26	24
1922.....	141,369	40,149	31,760	8,389	.28	24
1923.....	174,636	38,145	32,634	5,511	.22	27

MINERAL SPRINGS REPORTING PRODUCTION IN 1921-1923.

Proprietor.	Name of spring.	Location.
BARRY COUNTY—	Radium Springs.....	Near Seligman.
CARROLL COUNTY— Sam H. Minnis.....	Carrollton Mineral Well..	Carrollton.

MINERAL SPRINGS REPORTING PRODUCTION IN 1921-1923—Continued.

Proprietor.	Name of spring.	Location.
CEDAR COUNTY—		
E. M. Musick	Laxation Mineral Well	Eldorado Springs.
.....	Aperient Well	Eldorado Springs.
.....	Eldorado Laxative Well	Eldorado Springs.
CLAY COUNTY—		
Crystal Mineral Water Co	Crystal Mineral Spring	
	Saline Soda Well	Excelsior Springs.
Excelsior Saline Water Co	Excelsior Saline	Excelsior Springs.
W. R. Dempsey	Lithia No. 1	Excelsior Springs.
Natrona Springs Water Co	Natrona Wells	Excelsior Springs.
Excelsior Springs Mineral Water & Bottling Co	Regent, Siloam, Soterian Sulpho-Saline	Excelsior Springs.
.....	Pansy Hill Twin Springs	Excelsior Springs.
.....	Claymont	Randolph.
Relief Water Company	Salax Well	Excelsior Springs.
Salt Sulphur Water Co	Salt Sulphur Well	Excelsior Springs.
.....	White Sulphur Springs	Excelsior Springs.
COOPER COUNTY—		
E. A. Windsor	Chouteau Springs	Chouteau Springs.
JACKSON COUNTY—		
Cusenbary Mineral Water Co	Cusenbary	Mt. Washington.
Jackson-Lithia Spring Water Co.	Jackson Lithia	Mt. Washington.
.....	Crystal	Kansas City.
JEFFERSON COUNTY—		
Bokert Springs Mineral Water Co.	Bokert Springs	DeSoto.
LAWRENCE COUNTY—		
Paris Springs Bottling Co	Chalybeate	Paris Springs.
LEWIS COUNTY—		
Silas Lake	Ponce de Leon Well	LaGrange.
MERCER COUNTY—		
David Walker	Grand River Mineral	Mercer.
J. S. Haymaker	Haymaker	Lineville.
NODAWAY COUNTY—		
.....	Morris Mineral Well	Burlington Jct.
PIKE COUNTY—		
The Bowling Green Mineral Springs Co	B. B., Epzo, Fonzo and Bowling Green Lithia Water	Bowling Green.
Amos & Margaret Turner	Hornet	Bowling Green.

MINERAL SPRINGS REPORTING PRODUCTION IN 1921-1923—Continued.

Proprietor.	Name of spring.	Location.
ST. LOUIS COUNTY—		
Belcher Water Bath & Hotel Co.	Belcher Artesian Well....	St. Louis.
Old Orchard Mineral Springs....	Old Orchard Mineral.....	St. Louis.
SALINE COUNTY—		
F. W. York.....	Blue Lick Springs.....	Blue Lick.
E. R. Blair.....	McAllister Springs.....	Houstonia.
Missouri Mineral Water Co.....	Sweet.....	Sweet Springs.

NICKEL.

See "Cobalt and Nickel."

PETROLEUM AND NATURAL GAS.

The production of oil and gas in Missouri is not on a commercial scale. There are about 20 to 30 wells in the western tier of counties between Barton and Jackson counties which supply gas to farm houses for light and heat, and a few wells which produce a small supply of oil used locally.

The possible oil producing territory is largely in the Pennsylvanian or "Coal Measures" formations in the northwestern third of the state. These are the same formations which yield most of the oil and gas in Kansas and Oklahoma. Approximately 125 shallow wells have been drilled in the western part of Vernon County, near Richards. A majority of these encountered oil, but the field has not been developed to production.

The general possibilities in the state are described in Vol. XVI, 2nd series, and the possibilities in the Trenton area in northwest Missouri in Vol. XVIII, 2nd series, of the reports of this bureau.

PYRITES.

Pyrites occurs in Missouri in the central Ozark region in filled ancient sink holes. Many of the filled sink hematite deposits contain unleached pyrites below the iron and in some there is only a capping of the leached iron ore.

There has been no production of pyrites in Missouri during the last biennial period as the large native sulphur deposits of Texas and Louisiana are mined so cheaply that pyrites deposits cannot compete unless located very close to the market and capable of being mined at low cost.

SAND AND GRAVEL.

The production of sand and gravel in 1923 increased to nearly 200 per cent of that in 1922 and nearly 150 per cent of the previous record of 1920. Most of the growth was due to increased building, road and railroad construction as shown by the detailed figures published below.

There are many small pits in the southern part of the state furnishing sand and gravel for local consumption which do not report their output, consequently the figures are somewhat incomplete.

PRODUCTION OF SAND AND GRAVEL, 1911-1923.

Year.	Quantity (short tons).	Value.	Average value per ton.
1911	3,605,912	1,042,674	$0.29
1912	3,682,280	1,083,704	.29
1913	4,126,126	1,109,233	.27
1914	3,528,678	1,020,903	.29
1915	2,889,211	675,684	.23
1916	3,643,205	877,634	.24
1917	2,274,072	1,101,745	.48
1918	1,743,616	772,753	.44
1919	1,665,295	873,333	.52
1920	1,909,314	1,356,352	.71
1921	1,539,073	1,018,325	.51
1922	*1,970,345	1,063,370	.54
1923	3,719,243	2,007,529	.54

OUTPUT AND VALUE OF SAND AND GRAVEL FOR 1922-1923.

	1922.		1923.		
	Quantity (short tons).	Value.	Quantity (short tons).	Value.	Average price per ton.
Building sand	495,594	$236,477	795,598	$395,767	$.50
Building gravel	346,289	142,546	418,748	180,794	.45
Paving sand	316,834	137,630	773,237	400,361	.52
Paving gravel	353,979	137,525	719,599	379,980	.53
Glass sand	116,859	166,693	145,769	203,931	1.39
Molding sand	110,984	110,857	117,541	107,726	1.09
Engine sand	4,855	3,380	14,350	8,676	.60
Other sands[a]	122,443	101,417	107,890	81,040	.51
Railroad ballast	102,508	26,845	626,511	249,254	.40
Totals	1,970,345	$1,063,370	3,719,243	$2,007,529	$0.54

[a]Includes grinding and polishing, fire or furnace, filter sand and others in 1922; grinding and polishing, and fire or furnace sand in 1923.

LIST OF SAND AND GRAVEL PRODUCERS, 1922-1923.

Operator.	Name of product.	Location.
ATCHISON COUNTY—		
Jas. M. Whitham	Building sand, railroad ballast, gravel	Rockport.
BOLLINGER COUNTY—		
Lutesville Sand & Gravel Co.	Paving sand, gravel	Lutesville.
Missouri Pacific Railway	Railroad ballast	.....
BUCHANAN COUNTY—		
Chicago, Burlington & Quincy R. R. Co.	.....	St. Joseph.
Pioneer Sand Co.	Building sand, paving	St. Joseph.
BUTLER COUNTY—		
Randles Sand & Gravel Co.	Building sand, gravel	Poplar Bluff.
Energy Coal & Supply Co.	Building sand, paving sand, gravel	Poplar Bluff.
CAPE GIRARDEAU COUNTY—		
Cape Girardeau Sand Co.	Building sand	Cape Girardeau.
Edw. Hely Estate	Paving sand	.....
CLARK COUNTY—		
Sherwood Sand Co.	Building sand, paving sand, gravel	Kahoka.

LIST OF SAND AND GRAVEL PRODUCERS, 1922-1923—Continued.

Operator.	Name of product.	Location.
COLE COUNTY—		
Jefferson City Sand & Gravel Co.	Building sand.....	Jefferson City.
COOPER COUNTY—		
Chas. Dunnivant.....	Building sand.....	Boonville.
Missouri River Sand & Gravel Co.	Building sand, paving sand.....	Boonville.
State Highway Dept.....	Road gravel.....	.....
FRANKLIN COUNTY—		
The St. Louis Material & Supply Co.....	Building sand, gravel.....	Moselle and Pacific.
J. W. Glaser.....	Molding sand, furnace sand.....	Pacific.
W. W. Goran.....	Molding sand.....	Pacific.
Tavern Rock Sand Co.....	Glass sand, molding sand.	Gray Summit.
Dr. D. E. Williams.....	Glass sand, molding sand.	.....
Macks Creek Sand & Clay Co..	Molding sand.....	.....
Denton Sand and Gravel Co.....	Building sand and gravel..	.....
GRUNDY COUNTY—		
Jno. Newman.....	Building sand.....	.....
HOWARD COUNTY—		
Glasgow Sand Co.....	Building sand.....	Glasgow.
JACKSON COUNTY—		
Stewart Sand Co.....	Building sand.....	Kansas City.
JEFFERSON COUNTY—		
Pittsburgh Plate Glass Co.....	Glass sand.....	Crystal City.
Hematite Sand & Gravel Co.....	Building sand, gravel.....	Hematite.
American Silica Sand & Mining Co.....	Molding sand, glass sand.	Herculaneum.
Silica White Sand Co.....	Molding sand, grinding and polishing sand.....	Silica.
Denton Sand & Gravel Co.....	Building and paving sand and gravel.....	.....
Missouri Silica Mng. & Mfg. Co..	Molding sand.....	.....
MARION COUNTY—		
Geo. W. Camery.....	Engine sand, railroad ballast, gravel.....	Hannibal.
MILLER COUNTY—		
C. R. I. & P. R. R.....	Building gravel, railroad ballast.....	.....
OSAGE COUNTY—		
Chicago, Rock Island & Pacific R. R. Co.....	Railroad ballast.....	Argyle.

LIST OF SAND AND GRAVEL PRODUCERS, 1922-1923—Continued.

Operator.	Name of product.	Location.
PHELPS COUNTY—		
Little Piney Sand & Gravel Co...	Building sand, gravel.....	Newburg.
PIKE COUNTY—		
Louisiana Sand & Gravel Co....	Building sand, gravel.....	Louisiana.
ST. CHARLES COUNTY—		
Tavern Rock Sand Co.....	Glass sand.....	Klondyke.
Blaske, Carter & Day Sand, Gravel & Bldg. Material Co.	Building sand.....	.....
ST. LOUIS COUNTY—		
Missouri Portland Cement Co...	Gravel, building sand....	Drake.
Tavern Rock Sand Co.....	Glass sand, molding sand..	Pacific.
Meramec Portland Cement and Material Co.....	Building sand, gravel.....	Sherman.
St. Louis Material & Supply Co..	Building sand, gravel.....	.....
Continental Portland Cement Co.	Gravel.....	Valley Park.
ST. LOUIS CITY—		
John W. Allen & Son.....	Molding sand.....	St. Louis (Carondelet).
Meramec Portland Cement and Material Co.....	Molding sand.....	St. Louis.
Ed. E. Squier & Co.....	Molding sand.....	St. Louis.
Missouri Portland Cement Co...	Building sand.....	St. Louis.
St. Louis Material & Supply Co..	Building sand and gravel.	St. Louis.
STODDARD COUNTY—		
City of Dexter.....	Gravel.....	Dexter.
F. N. Norman.....	Building sand.....	Dexter.
WASHINGTON COUNTY—		
Missouri Pacific Ry. Co.....	Railroad ballast, sand.....	Savoy.
S. E. Newhouse.....	Paving gravel.....	.....
WAYNE COUNTY—		
Missouri Pacific R. R. Co.....	Railroad ballast.....	Leeper.
WORTH COUNTY—		
J. C. Harris.....	Building sand.....	Sheridan.
Henry Ray.....	Building sand, paving sand, gravel.....	.....

SILVER.

The production of silver in Missouri is at present entirely from the lead ores of the southeastern part of the state. The concentrates from that district run about one ounce of silver to the ton of concentrates. This is too small to be paid for by the smelters but is recovered as a by-product during the refining process. The silver is refined and sold at irregular intervals so that the production as reported does not represent the yearly output.

The Einstein mine in Madison County, which is the only silver mine in the state, has not been in operation during the past biennial period.

The following tabulation shows the silver production for 1919-1923:

Year.	Ounces.	Value.
1910	90,401	$101,249
1920	111,128	121.130
1921	69,902	69,902
1922	212,656	212,656
1923	177,270	145,361

STONE.

The production of stone has again increased by over $1,000,000 since the previous report. New records in value were established for limestone, marble and chats, as well as in total stone. The wide distribution of good stone is shown by the quarry locations in the lists of producers.

The following table shows the value of production for the years 1910 to 1923.

PRODUCTION OF STONE IN MISSOURI, 1910-1923.

Year.	Limestone.	Marble.	Granite.	Sandstone.	Chats.	Total.
1910....	$2,360,604	(a)	$120,663	$39,389	$243,048	$2,673,704
1911....	2,179,767	(a)	139,070	19,748	225,540	2,564,125
1912....	2,373,725	(a)	97,776	15,004	408,510	2,895,015
1913....	2,486,020	(a)	42,484	10,195	304,331	2,843,030
1914....	2,160,958	(a)	77,971	3,588	340,616	2,583,133

PRODUCERS OF STONE IN MISSOURI, 1910-1923—Continued.

Year.	Limestone.	Marble.	Granite.	Sandstone.	Chats.	Total.
1915....	$2,049,772	(a)	$85,624	$10,104	$346,358	$2,491,858
1916....	1,990,419	$156,942	80,390	14,991	433,645	2,676,387
1917....	1,679,677	227,520	58,241	6,862	214,007	2,186,307
1918....	1,359,755	238,111	54,523	(b)	135,319	(c) 1,787,708
1919....	1,759,029	360,287	(b)	(d)	206,353	(e) 2,325,669
1920....	2,776,936	616,550	114,663	(b)	167,028	(c) 3,675,177
1921....	2,269,457	627,729	81,389	(d)	259,571	3,238,146
1922....	2,409,202	816,098	85,093	(b)	282,790	(c) 3,593,183
1923....	3,173,622	1,085,122	83,804	(b)	(f)452,822	(c) 4,795,370

(a) Included in limestone.
(b) Not given, less than three producers.
(c) Not including sandstone.
(d) No production.
(e) Not including granite.
(f) Estimate on incomplete returns.

LIMESTONE.

Over half the limestone by value produced in Missouri is used for aggregate in concrete and road making. The desirable characteristics for stone for these uses are toughness, hardness, and resistance to weathering. This means that many stones of little or no use for building and other purposes can be used in the crushed stone industry. For building stone the appearance of the stone and its availability in large blocks are important factors. Building stones are produced mostly from the Mississippian limestones in Jasper and Greene counties at the famous Carthage and Phenix quarries.

The following table shows the output and value as utilized in the various industries.

VALUE OF LIMESTONE PRODUCED ACCORDING TO USES, 1920-1923.

Purpose.	1920.	1921.	1922.	1923.
Rough construction	.....	$70,991	$11,271	$11,125
Rough building	$312,329	(a)	.....	.....
Dressed building	(a)	171,171	161,626	.....
Rubble	199,435	178,993	323,887	273,111
Riprap	139,146	135,843	137,713	331,680
Railroad ballast	169,301	58,932	135,930	100,955

VALUE OF LIMESTONE PRODUCED ACCORDING TO USES, 1920-1923—Continued.

Purpose.	1920.	1921.	1922.	1923.
Concrete and road making	1,454,613	1,366,089	1,354,582	2,165,653
Flux	135,078	31,164	41,319	51,157
Sugar factories	19,941	8,183	(a)	(a)
Glass factories	74,842	36,593	46,757	40,646
Agriculture	32,941	55,534	36,122	42,285
Miscellaneous (b)	239,310	155,964	159,995	157,010
Totals	$2,776,936	$2,269,457	$2,409,202	$3,173,622

(a) Concealed under "Miscellaneous."

(b) Includes paper mills, lime burners, paving and curbing, sugar factories, whiting and other purposes.

PRODUCERS OF LIMESTONE IN MISSOURI, 1922-1923.

Firm.	Type and uses of stone.	Quarry location.
ANDREW COUNTY—		
Newell & Stewart	Riprap; concrete; railroad ballast; rubble	Amazonia.
St. Joseph Quarries Co	Concrete	.....
Reinert Bros. Const. Co., Inc	Rough construction; riprap; concrete; agricultural	Savannah.
BARRY COUNTY—		
Geo. E. Huntz	Concrete	.....
BOONE COUNTY—		
Boone County Stone Quarry	.....	.....
J. N. Fellows	Riprap, concrete, agricultural	Columbia.
Spencer-Whitlow Co	Concrete, rubble, agricultural	Columbia.
U. S. Engineer Office	Riprap	.....
BUCHANAN COUNTY—		
U. S. Engineer Office	Riprap	Wilton & Rocheport.
Metropolitan Paving Co	Concrete	St. Joseph.
Reinert Bros. Const. Co	Rubble, riprap, concrete, railroad ballast, agricultural	.....
The Buchanan Co. Quarry Co	Concrete	.....
BUTLER COUNTY—		
G. E. Hentz	Concrete	.....
John Rooks	Concrete	.....

PRODUCERS OF LIMESTONE IN MISSOURI, 1922-1923—Continued.

Firm.	Type and uses of stone.	Quarry location.
CALLAWAY COUNTY—		
U. S. Engineer Office	Riprap	Cedar City.
Oscal L. Taylor	Rough building	Fulton.
CAPE GIRARDEAU COUNTY—		
Tri-Cities Quarry Co	Riprap, concrete, agricultural	.....
Edward Hely	Concrete, railroad ballast, road making, agricultural	Cape Girardeau.
The Arnold Stone Co	Riprap	Neely's Landing.
john Barrett & Co	Riprap	Neely's Landing.
CASS COUNTY—		
West Lime Rock Co	Concrete	.....
CLAY COUNTY—		
S. H. Atwood & Son	Concrete, riprap	South Liberty.
C. Atwood	Railroad ballast	South Liberty.
CLINTON COUNTY—		
J. H. Anderson	Rubble, concrete	Lathrop.
COLE COUNTY—		
Missouri State Penitentiary	Rough building, rubble, riprap, road making, concrete	Jefferson City.
Pope Construction Company	Concrete	Cottonrock.
U. S. Engineer Office	Riprap	Osage City.
Edw. S. Ramsey	Concrete	.....
COOPER COUNTY—		
U. S. Engineer Office	Riprap	Arrow Rock.
F. Stretz & Sons	Concrete, agricultural	Boonville.
S. J. White Stone Co	Concrete, riprap	Blackwater.
Mo., Kans. & Texas Ry. Co	Railroad ballast, riprap	Sweeney.
DAVIESS COUNTY—		
Union Township	Roadmaking	.....
Blankenship Bros	Concrete, riprap	Pattonsburg.
FRANKLIN COUNTY—		
U. S. Engineer Office	Riprap	Berger.
City of Washington	Concrete	Washington.
L. G. Krull	Concrete	.....

PRODUCERS OF LIMESTONE IN MISSOURI, 1922-1923—Continued.

Firm.	Type and uses of stone.	Quarry location.
GREENE COUNTY—		
Phoenix Marble Co	Dressed stone, marble concrete, curbing, flagging, rubble	Phoenix.
Greene County	Roadmaking	Springfield.
Horton Stone Co	Roadmaking	Springfield.
Marblehead Lime Co	Lime, roadmaking, railroad ballast, concrete	Springfield.
Eight Mile Road District	Concrete	.....
Quarry Products Co	Concrete, agricultural	.....
HARRISON COUNTY—		
Bethany City Quarry	Concrete	Bethany.
Allain & Davis	Concrete	.....
Rand Construction Co	Concrete	.....
HOLT COUNTY—		
Whitmer Mill & Stone Co	Concrete	.....
Joseph Shanks	Concrete	.....
HOWARD COUNTY—		
U. S. Engineer Office	Riprap	Glasgow-Lisbon.
JACKSON COUNTY—		
U. S. Engineer Office	Riprap	Eton.
Massman Construction Co	Riprap, miscellaneous	.....
W. M. Spencer	Concrete, riprap, rubble, agricultural	Independence.
Beyer Crushed Rock Co	Concrete	.....
Belt Line Crusher Co	Miscellaneous	Dodson.
Atlas Investment Co	Concrete	.....
Halpin-Dwyer Construction Co	Concrete	Kansas City.
Kansas City Park Quarries	Roadmaking, concrete	Kansas City.
Lyle Rock Co	Rubble	Kansas City.
Frank J. O'Hearn	Rubble	Kansas City.
Kansas City Railways Co	Concrete	Kansas City.
W. C. Mullen	Rubble, riprap	Kansas City.
The Phelps Stone & Supply Co	Concrete	Kansas City.
Norton Rock Co	Concrete	.....
M. F. Sullivan	Rubble	Kansas City.
Swenson Construction Co	Rubble, concrete	Kansas City.
Kansas City Board of Public Welfare	Rubble, concrete	Leeds.
Jas. O'Connor & Son	Rubble, concrete	Kansas City.
Independence Rock Co	Concrete	Independence.
McTernan-Halpin Const. Co	Concrete	.....
H. J. Nichols	Concrete	.....
Crusher Co	Concrete	.....
Thompson Bros	Concrete, rubble	.....

PRODUCERS OF LIMESTONE IN MISSOURI, 1922-1923—Continued.

Firm.	Type and uses of stone.	Quarry location.
JACKSON COUNTY—Continued.		
K. C. Quarries Co	Concrete, flux, railroad ballast	.....
E. H. Bradbury	Concrete, riprap	.....
John Twyman, Van Horn & Brookside	Rough construction, concrete	.....
Chas. Greenwood	Rubble	.....
JASPER COUNTY—		
Carthage Marble & Bldg. Stone Co	Dressed building, flagging, rubble, riprap, and for sugar factories	Carthage.
Carthage Marble & White Lime Co	Dressed building, curbing, rubble, and for sugar factories	Carthage.
Carthage Crushed Limestone Co.	Whiting, concrete, flux, glass factories, agricultural, miscellaneous	Carthage.
Consolidated Marble & Stone Co.	Rubble, sugar factories	Carthage.
The Ozark Quarries Co	Rubble	.....
Independent Gravel Co	Whiting, concrete, flux, glass factories, agricultural, miscellaneous	Joplin.
Spring River Stone Co	Dressed building, flagging.	Carthage.
F. W. Steadley & Co	Rough building	.....
Chas. Tull & H. T. Oltman	Road metal	.....
JEFFERSON COUNTY—		
Peter McLoon & Co	Fluxing, glass factories, riprap	Barnhart.
LAFAYETTE COUNTY—		
Diamond Coal Co	Concrete	Corder.
LINCOLN COUNTY—		
Crystal Carbonate Lime Co	Rubble, riprap, whiting, concrete, flux, glass factories, agricultural, miscellaneous	Elsberry.
MARION COUNTY—		
Hannibal Lime Co	Concrete, railroad ballast, roadmaking, riprap	White Bear and Hannibal.
Hueston-Blond Stone Co	Riprap, roadmaking, concrete	Hannibal.

PRODUCERS OF LIMESTONE IN MISSOURI, 1922-1923—Continued.

Firm.	Type and uses of stone.	Quarry location.
MARION COUNTY—Continued.		
Geo. A. Bronham	Riprap	.....
Marblehead Lime Co	Concrete, flux, railroad ballast, agricultural	.....
Central Stone and Coal Co	Concrete, agricultural	.....
MONROE COUNTY—		
G. N. Davis	Rough building	Paris.
Thos. Trussell	Rough building	Paris.
MONTGOMERY COUNTY—		
U. S. Engineer Office	Riprap	Bluffton.
High Hill Ground Limestone Co.	Agricultural	High Hill.
NEWTON COUNTY—		
Mrs. Cora L. Kirk	Rough building	Neosho.
Neosho Special Road District	Roadmaking	Neosho.
F. C. Hatler	Roadmaking	.....
OSAGE COUNTY—		
U. S. Engineer Office	Riprap	Chamois.
Anton Otto	Rough building	Koeltztown.
PIKE COUNTY—		
Bowling Green City Quarry	Roadmaking	Bowling Green.
Marblehead Lime Co	Riprap, railroad ballast, roadmaking	Louisiana.
PLATTE COUNTY—		
Park College	Riprap, rough building, paving	Parkville.
U. S. Engineer Office	Riprap	.....
RALLS COUNTY—		
Bluff City Lime & Stone Co.	Riprap, chemicals, lime	Hannibal.
Chicago & Great Western R. R.	Riprap, ballast	.....
RAY COUNTY—		
Pea Ridge Stone Co	Concrete	Richmond.
ST. CHARLES COUNTY—		
Rosendale Contracting & Supply Co	Rough building, riprap, roadmaking	St. Charles.
Weldon Springs Lime Co	Riprap, concrete, agricultural	Weldon Springs.
STE. GENEVIEVE COUNTY—		
Rozier Qy. & Mfg. Co	Riprap, flux, glass factories	Brickeys.
Southeast Mo. Quarries Co	Rough building, riprap, fluxing	Merrill.

PRODUCERS OF LIMESTONE IN MISSOURI, 1922-1923—Continued.

Firm.	Type and uses of stone.	Quarry location.
STE. GENEVIEVE COUNTY—Continued		
Peerless White Lime Co	Fluxing, sugar factories, glass factories	Mosher.
Ste. Genevieve Lime & Qy. Co.	Fluxing, sugar factories	Ste. Genevieve.
Arnold Stone Co	Riprap	Ste. Genevieve.
Missouri-Illinois R. R	Riprap	.....
Cliffdale Quarry & Mfg. Co	Glass factories	Brickeys.
McLoon-Ste. Genevieve Limestone Co	Riprap, flux	Mosher.
ST. LOUIS COUNTY—		
Geo. H. Knoche	Rough building, roadmaking	Fern Ridge.
John C. Heins	Riprap, roadmaking	Florissant.
Florissant Construction Co	Railroad ballast	Florissant.
Glencoe Lime & Cement Co	Roadmaking, fluxing	Glencoe, Mincke, Carondelet.
Henry E. Heintz	Roadmaking	Jefferson Barracks.
Wm. F. Ruprecht	Rough constr., riprap, concrete	.....
John Kassebaum	Roadmaking	Mattese.
Albert Bussen	Riprap, railroad ballast	Quarantine.
Jas. F. Rothwell	Rubble, riprap, roadmaking, miscellaneous	Vigus.
Sinclair Quarry & Constr. Co	Rubble, riprap, road making, paint grinders	Vigus.
Lamb Construction Co	Rough building, riprap	University City.
J. & W. Dillon	Riprap	.....
U. S. Engineer Office	Riprap	.....
New Jamestown Quarry Co	Concrete, agricultural	.....
John Steffen Bros	Rough building, concrete, riprap	.....
ST. LOUIS CITY—		
Bambrick Bros. Constr. Co	Rubble, roadmaking	St. Louis.
Big Bend Quarry Co	Rubble, riprap, concrete, miscellaneous	Maplewood.
T. E. Cavanaugh	Rubble, concrete	.....
Eyermann Construction Co	Rubble, roadmaking	St. Louis.
Fehlig Construction Co	Concrete, rubble	St. Louis.
Fruin-Bambrick Constr. Co	Concrete, rubble, asphalt dust	St. Louis.
Hoffman Bros. Constr. Co	Rough building, riprap, roadmaking, concrete	St. Louis.
St. Louis Workhouse Quarry	Riprap, roadmaking	St. Louis.
Tower Grove Quarry & Constr. Co	Riprap, roadmaking, concrete	St. Louis.
Union Quarry & Constr. Co	Rubble, concrete	St. Louis.
Independent Quarry Constr. Co.	Rubble, riprap, concrete	.....
Clayton Quarry Co	Rubble, riprap, concrete	.....

PRODUCERS OF LIMESTONE IN MISSOURI, 1922-1923—Continued.

Firm.	Type and uses of stone.	Quarry location.
SHELBY COUNTY—		
Shelby Co. Farmers Co-operative	Agricultural.....	.....
WARREN COUNTY—		
U. S. Engineer Office.....	Riprap.....	Bernheimer.
Mo. State Highway Dept.....	Road metal.....	.....

MARBLE.

The entire production of marble in Missouri comes from near Carthage, Jasper County; Phenix Greene County, and Ozora, Ste. Genevieve County. Both the quantity and value increased over 50 per cent in 1923 and for the first time the value was over $1,000,000.

The stone from Carthage is known as "Ozark Gray," "Colonial Gray," "Carthage Marble" and by other trade names. That from Phenix is marketed as "Napoleon Gray." The marble from Ozora in Ste. Genevieve County is sold as "Ste. Genevieve Rose" and "Ste. Genevieve Golden Vein."

The Consolidated Marble Corporation opened a quarry in the Kimmswick limestone about six miles west of Ste. Genevieve on the Missouri-Illinois railroad in 1922 and marketed considerable white and light gray stone. Mud pockets cut into the formation to a large extent in the upper part of the quarry and it has not been worked since 1923.

PRODUCTION OF MARBLE ACCORDING TO USES, 1919-1923.

	1919.		1920.		1921.		1922.		1923.	
	Quantity, cubic feet.	Value.	Quantity, cubic feet.	Value.	Quantity, cubic feet.	Value.	Quantity, cubic feet.	Value.	Quantity, cubic feet.	Value.
Rough building, exterior...	93,322	$70,202	(a)	(a)	83,179	$91,159	(a)	(a)	5,820	$16,625
Rough building, interior....	85,228	156,208	137,780	$310,166	67,130	110,217	94,640	$141,668	100,840	152,014
Dressed building, exterior..	(a)	(a)	20,250	68,733	24,691	97,141	210,900	299,402	424,300	541,794
Dressed building, interior...	11,947	43,882	13,850	79,746	71,369	251,790	100,840	332,935	118,060	342,446
Monumental, rough.....	61,818	74,028	59,150	102,336	.....	.....	26,290	39,985	.....	.....
Monumental, dressed.....	(a)	(a)	(a)	(a)	31,551	77,421	(a)	(a)	20,640	32,243
Other uses.....	5,669	15,967	44,240	55,569	.....	.....	3,040	2,108	.....	.....
Totals.....	257,984	$360,287	275,270	$616,550	277,920	$627,729	435,720	$816,098	669,660	$1,085,122

(a) Included in "other uses."

MARBLE PRODUCERS IN MISSOURI IN RECENT YEARS.

Producer.	Use.	Quarry location.
GREENE COUNTY—		
Phenix Marble Company	Rough building (interior), interior and exterior dressed building	Phoenix.
JASPER COUNTY—		
Carthage Marble & Building Stone Company	Interior and exterior rough building	Carthage.
Carthage Marble White Lime Co.	Interior dressed building	Carthage.
Carthage Quarry Co	Interior, rough and dressed building	Carthage.
Consolidated Marble & Stone Co.	Interior and exterior rough and dressed building	Carthage.
Missouri Quarries Company		Carthage.
Spring River Stone Co	Interior, dressed building	Carthage.
Ozora Marble Co	Interior	Ozora.

SANDSTONE.

The production of sandstone is restricted to one quarry operated by Benjamin Pickel at Warrensburg. Formerly a number of large quarries were operated in this area, but in recent years the demand has been limited, due to the competition of high grade limestone produced in other parts of the state.

GRANITE.

The granite industry in Missouri is about equally divided between rough monumental stone and paving blocks. The granites of the state have a deservedly good reputation for beauty and strength, and warrant a more extended use.

GRANITE PRODUCERS IN MISSOURI IN RECENT YEARS.

Name.	Purposes used for.	Quarry location.
IRON COUNTY—		
Iron County Red Granite Co	Rough monumental	Graniteville.
Schneider Granite Co	Rough monumental, rubble, rough building	Graniteville.
A. J. Sheahan Granite Co	Rough monumental, paving blocks, riprap, roadmaking	Graniteville.
J. H. Brod Granite Co	Monumental	Graniteville.

GRANITE PRODUCERS IN MISSOURI IN RECENT YEARS—Continued.

Name.	Purposes used for.	Quarry location.
ST. FRANCOIS COUNTY—		
Alexander Hanson	Paving blocks, curbing, riprap	Doe Run.
A. G. Asplof	Paving blocks, rubble	Syenite.
Wm. Milne	Rough monumental	Syenite.
WAYNE COUNTY—		
P. O'Keefe	Paving blocks, riprap, concrete	Kerrigan.
Granite Bend Mining & Merc. Co.	Paving blocks, riprap, concrete	Kerrigan.

CHATS.

Chats are the tailings or waste rock from the lead and zinc mines in southeast and southwest Missouri. They are used for road metal, concrete aggregate and railroad ballast. There are immense quantities available, freight rates being the controlling factor as to the distance to which they can be shipped.

UTILIZATION OF CHATS IN MISSOURI, 1909-1923.

Year.	Railroad use (tons).	Commercial use (tons).	Total.	Value.
1909	355,901	472,934	828,835	$124,325
1910	1,009,533	610,789	1,620,322	243,048
1911	865,011	638,592	1,503,603	225,540
1912	1,911,705	811,698	2,723,403	408,510
1913	1,231,005	797,884	2,028,889	304,333
1914	1,687,331	583,440	2,270,771	340,616
1915	1,713,884	595,307	2,309,191	346,379
1916	2,268,370	622,600	2,890,970	433,646
1917	1,010,620	416,096	1,426,716	214,007
1918	627,335	274,794	902,129	135,319
1919	827,700	548,057	1,375,757	206,353
1920	448,211	665,311	1,113,522	167,028
1921	585,680	606,643	1,730,473	259,571
1922	769,254	351,905	1,141,159	285,290
1923*a*	663,487	1,157,800	1,821,287	455,322

*a*Preliminary estimate.

TRIPOLI.

The Tripoli industry is centered about Seneca, Newton County, the quarries being located in both Missouri and Oklahoma.

The material is a white siliceous stone, which is used extensively for polishing powder, fillers, foundry facing, tire filler, and other purposes. During the past two years the Barnsdale Corporation has purchased the plant at Seneca and has increased production materially. The Independent Gravel Company of Joplin has opened quarries near Racine and Seneca, the product being ground and prepared for market at their Carthage plant.

The chief production is reported by less than three producers, and the value of the output is included under Miscellaneous, in the table at the beginning of this chapter.

ZINC.

The output of zinc concentrates has not increased materially since the disastrous slump following the record production up to 1918. The chief output has been from the Waco district, with but little production throughout the remaining area.

During the past year there has been much greater interest manifested, and much drilling has been done in the northern portion of the field. At Aurora, Wentworth, Duenweg, and other points drills have also been started. At Pierce City a large sheet ground deposit has been encountered at a depth of 30 feet. In view of the prospecting now in progress, a decided revival is looked for throughout the district.

PRODUCTION OF ZINC IN MISSOURI, 1921-1923.

	1921.				1922.				1923.			
	Sphalerite.		Silicate and Carbonate.		Sphalerite.		Silicate and Carbonate.		Sphalerite.		Silicate and Carbonate.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alba, Neck City	4	$78	.....	.....	.....	.....	.....	.....	179	$5,737	.....	.....
Ash Grove	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	33	$660
Carthage and Carl Junction (*a*)	30	690	.....	.....	91	$2,660	.....	.....	142	5,309	.....	.....
Cave Springs, Belleville	116	2,608	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Duenweg, Porto Rico (*b*)	4	105	9	$56	280	8,501	929	$19,990	120	4,800	308	7,685
Granby	.....	.....	.....	.....	222	8,119	1,836	39,112	553	21,252	2,865	77,110
Joplin	139	3,706	32	355	161	5,559	119	2,310	1,281	50,116	518	13,858
Oronogo	91	1,950	.....	.....	5,263	132,362	4	105	2,537	69,584	.....	.....
Spring City, Beef Branch	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20	400
Spurgeon, Seneca, Racine	.....	.....	19	223	.....	.....	.....	.....	.....	.....	5	110
Stark City, Wentworth	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18	309
Stark City and Christian County	.....	.....	.....	.....	80	2,800	120	2,400	.....	.....	.....	.....
Hickory and Christian Counties	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	140
Waco	18,277	465,894	.....	.....	21,038	709,743	.....	.....	27,096	1,138,637	.....	.....
Webb City, Carterville, Prosperity	281	5,366	.....	.....	607	15,870	.....	.....	248	7,658	.....	.....
Wentworth	548	10,334	.....	.....	102	2,880	.....	.....	.....	.....	.....	.....
Totals	19,490	$490,731	60	$634	27,844	$888,494	3,008	$63,917	32,156	$1,303,093	3,774	$100,272

(*a*) Carl Junction in 1922 only. (*b*) Duenweg only in 1922.

TENOR OF CRUDE ZINC ORE AND CONCENTRATES PRODUCED IN MISSOURI, 1921-1923.

	1921.	1922.	1923.
Total crude ore, short tons	243,300	727,300	784,000
Total zinc concentrates in crude ore, per cent	8.04	4.24	4.58
Zinc content of crude ore, per cent	4.95	2.47	2.65
Average zinc content of sphalerite concentrates	61.7	60.3	60.0
Average zinc content of silicate and carbonate	38.3	39.2	38.6
Average value per ton—			
Sphalerite concentrates	$25.18	$31.91	$40.52
Silicate and carbonate	10.57	21.25	26.57

PRODUCTION OF ZINC ORE IN MISSOURI, 1909-1923.

Year.	Sphalerite.			Carbonate and Silicate.			Total value.
	Quantity short tons.	Value.	Average price per ton.	Quantity short tons.	Value.	Average price per ton.	
1909	229,023	$9,445,826	$41.20	28,525	$677,213	$23.74	$10,123,039
1910	232,841	9,342,139	40.15	23,826	561,803	23.58	9,903,942
1911	217,812	8,680,559	39.81	20,119	447,420	23.76	9,157,979
1912	244,986	12,346,922	50.45	22,172	641,881	28.95	12,988,803
1913	225,850	9,180,960	43.10	21,531	483,463	22.45	9,664,423
1914	189,765	7,351,726	38.65	19,648	415,185	21.13	7,766,911
1915	241,111	18,382,520	76.23	25,412	1,243,458	45.00	19,625,978
1916	277,176	22,878,215	82.60	26,894	1,350,381	50.21	24,228,596
1917	231,588	16,453,629	70.80	30,986	1,254,975	40.50	17,708,604
1918	95,555	4,899,347	51.30	17,816	574,136	32.23	5,473,483
1919	51,813	2,108,382	40.69	11,741	320,853	27.33	2,429,235
1920	39,431	1,805,561	45.80	9,494	337,003	35.50	2,142,564
1921	19,490	490,731	25.18	60	634	10.57	491,365
1922	27,844	888,494	31.91	3,008	63,917	21.25	952,411
1923	32,156	1,303,093	40.52	3,774	100,272	26.57	1,403,365

Bureau of Geology and Mines, H. A. Buehler, State Geologist.
Map showing location of Gaging Stations, 1924.

CHAPTER III

STREAM FLOW RECORDS.

Explanation of Data.

The data presented on the following pages give a partial summary of the stream flow records collected by the Bureau in co-operation with the Water Resources Branch of the United States Geological Survey, during the period October 1, 1922, to September 30, 1924. It is not possible at this time to publish records for some of the gaging stations on account of not having been able so far to get all the necessary discharge measurements to complete the ratings—particularly those for flood stages, which are usually of very short duration. These will probably be obtained in the near future and then the records will be completed.

The tables give only monthly and yearly summaries of the records. The daily records forming the bases of these tables have been prepared, but are not included in this report on account of limited space and also because it is the intention to publish in 1926 a detailed report on the water resources of the state which will contain all the stream flow records collected in the state up to that time by public agencies.

The map and summary of gaging stations shown on page 83 indicate the places and periods for which stream flow records have been obtained. The complete detailed records for any of these stations may be had by interested parties upon application to the Bureau.

The base data collected at gaging stations consist of records of stage, measurements of discharge, or flow, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff or chain gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. The general methods are outlined in standard textbooks on the measurement of river discharge.

From the discharge measurements rating tables are prepared that give the discharge for any stage, and these rating

tables, when applied to the gage heights, give the discharge from which the daily, monthly and yearly means of discharge are determined.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miners' inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in inches, acre-feet, and millions of cubic feet. The principal terms used in this report are second-feet, second-feet per square mile, and run-off in inches. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which an area would be covered if all the water flowing from it in a given period were uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in inches.

In each table of monthly discharge in this report the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column headed "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet per second during the month.

The State is naturally divided into three major drainage basins. The streams which drain into Mississippi River above the Missouri are in the Upper Mississippi River Basin; those which drain into the Missouri are in the Missouri River Drainage

Basin; and those which drain into the Mississippi below the Missouri are in the Lower Mississippi River Drainage Basin. The records given hereafter are grouped according to this division of basins and in the same order of basins as described above.

GAGING STATION SUMMARY.

Gaging stations for which stream-flow records are available. (Stations are numbered to correspond with map on preceding page.)

Stream and station location.	Records available.	
	From.	To
UPPER MISSISSIPPI RIVER BASIN:		
1. Fox River near Wayland, Mo	Feb., 1922	Sept., 1924
2. Wyaconda River near Canton, Mo	Feb., 1922	Sept., 1924
3. North Fabius River at Monticello, Mo	Feb., 1922	Sept., 1924
4. Salt River near New London, Mo	Feb., 1922	Sept., 1924
5. Cuivre River near Troy, Mo	Feb., 1922	Sept., 1924
MISSOURI RIVER BASIN:		
6. Missouri River at Leavenworth, Kan	Mar., 1922	Sept., 1924
7. Nishnabotna River near Hamburg, Iowa	Mar., 1922	Sept., 1923
8. Tarkio River at Fairfax, Mo	Mar., 1922	Sept., 1924
9. Nodaway River near Burlington Jct., Mo	Mar., 1922	Sept., 1924
10. Platte River at Conception Jct., Mo	July, 1921	Sept., 1924
11. Platte River at Agency, Mo	May, 1924	Sept., 1924
12. Grand River near Gallatin, Mo	June, 1921	Sept., 1924
13. Grand River near Sumner, Mo	April, 1924	Sept., 1924
14. Thompson River near Hickory, Mo	June, 1921	Sept., 1923
15. Thompson River at Gee Bridge near Hickory, Mo.	May, 1924	Sept., 1924
16. Medicine Creek near Galt, Mo	July, 1921	Sept., 1924
17. Locust Creek near Milan, Mo	July, 1921	Sept., 1924
18. Chariton River at Elmer, Mo	July, 1921	Sept., 1924
19. Lamine River at Clifton City, Mo	June, 1922	Sept., 1924
20. Blackwater River at Blue Lick, Mo	June, 1922	Sept., 1924
21. Osage River at Osceola, Mo	July, 1921	Sept., 1924
22. Sac River near Stockton, Mo	July, 1921	Sept., 1924
23. Sac River near Collins, Mo	April, 1923	Sept., 1924
24. Cedar Creek near Pleasant View, Mo	April, 1923	Sept., 1924
25 Pomme de Terre River at Hermitage, Mo	July, 1921	Sept., 1924
26. South Grand River near Brownington, Mo	July, 1921	Sept., 1924
27. Niangua River near Roach, Mo	Nov., 1922	Sept., 1924
28. Hahatonka Spring at Hahatonka, Mo	Nov., 1922	Sept., 1924
29. Gasconade River near Waynesville, Mo	June, 1921	Sept., 1924
30. Gasconade River at Jerome, Mo	Jan., 1923	Sept., 1924
31. Gasconade River near Rich Fountain, Mo	Oct., 1921	Sept., 1924
32. Piney Creek near Big Piney, Mo	Oct., 1921	Sept., 1924

GAGING STATION SUMMARY—Continued.

Stream and station location.	Records available.	
	From.	To.
LOWER MISSISSIPPI RIVER BASIN:		
33. Meramec River near Steelville, Mo.	Dec., 1922	Sept., 1924
34. Meramec River near Sullivan, Mo.	Sept., 1921	Sept., 1924
35. Meramec River near Eureka, Mo.	Oct., 1921	Sept., 1924
36. Meramec Spring near St. James, Mo.	Nov., 1921	Sept., 1924
37. Bourbeuse River at Union, Mo.	June, 1921	Sept., 1924
38. Big River at Byrnesville, Mo.	May, 1922	Sept., 1924
39. Castor River at Zalma, Mo.	Sept., 1921	Sept., 1924
40. Whitewater River at Whitewater, Mo.	Sept., 1921	Sept., 1924
41. St. Francis River near Patterson, Mo.	June, 1921	Sept., 1924
42. Little River Ditch No. 1 at Kirk, Mo.	Sept., 1921	Sept., 1924
43. Little River Ditch No. 66 at Kirk, Mo.	Sept., 1921	Sept., 1924
44. Little River Ditch No. 81 at Kirk, Mo.	Sept., 1921	Sept., 1924
45. Spring River near Waco, Mo.	April, 1924	Sept., 1924
46. Shoal Creek near Joplin, Mo.	April, 1924	Sept., 1924
47. White River at Beaver, Ark.	May, 1923	Sept., 1924
48. James River at Galena, Mo.	Oct., 1921	Sept., 1924
49. North Fork of White River at Tecumseh, Mo.	Oct., 1921	Sept., 1924
50. Black River at Leeper, Mo.	June, 1921	Sept., 1924
51. Current River near Eminence, Mo.	Aug., 1921	Sept., 1924
52. Current River at Van Buren, Mo.	June, 1921	Sept., 1924
53. Current River at Doniphan, Mo.	June, 1921	Sept., 1924
54. Jacks Fork at Eminence, Mo.	Oct., 1921	Sept., 1924
55. Big Spring near Chicopee, Mo.	Jan., 1922	Sept., 1924
56. Eleven Point River near Bardley, Mo.	Oct., 1921	Sept., 1924
57. Greer Spring at Greer, Mo.	Nov., 1921	Sept., 1924

UPPER MISSISSIPPI RIVER BASIN.

FOX RIVER NEAR WAYLAND, MO.

Location.—In NE. ¼ sec. 25, T. 65 N., R. 7 W., at highway bridge, 1 mile above Chicago, Burlington & Quincy Railway bridge, 2½ miles northwest of Wayland, Clark County, 3 miles below Brush Creek, and 10 miles below Atchison, Topeka & Santa Fe Railway bridge.

Records Available.—February 22, 1922, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 13.32 feet August 6, 7, and 9, 1924 (discharge, 3,250 second-feet); minimum stage, 1.98 feet November 7, 1923 (discharge, 0.9 second-foot).

MONTHLY DISCHARGE OF FOX RIVER NEAR WAYLAND, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 392 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	2.2	1.0	1.50	0.0038	0.004
November	358.	6.	47.2	.120	.13
December	7.	2.	3.03	.0077	.009
January	107.	2.	15.3	.039	.04
February	61.	2.	9.29	.024	.02
March	1,700.	29.	457.	1.17	1.35
April	62.	21.	37.2	.095	.11
May	382.	9.	38.8	.099	.11
June	358.	3.6	40.9	.104	.12
July	90.	1.9	27.3	.070	.08
August	21.	1.6	7.16	.018	.02
September	1,050.	2.4	70.6	.180	.20
The year	1,700.	1.0	62.9	.160	2.19
1923-24					
October	230.	2.9	20.2	0.052	0.06
November	9.	1.1	3.45	.009	.01
December	135.	8.	41.2	.105	.12
January	470.	9.	105.	.268	.31
February	442.	135.	183.	.467	.50
March	2,700.	61.	438	1.12	1.29
April	358	22.	77.5	.198	.22
May	21.	7.	11.5	.029	.03
June	2,580	7.	599.	1.53	1.71
July	900.	11	177.	.452	.52
August	3,030.	18.	469.	1.20	1.38
September	100.	7.	29.4	.075	.08
The year	3,030.	1.1	180.	.459	6.23

WYACONDA RIVER NEAR CANTON, MO.

Location.—In SE. ¼ SW. ¼ sec. 33, T. 62 N., R. 6 W., at highway bridge on south road from Canton to Monticello, three-quarters of a mile below Sugar Creek, 2 miles below north road highway bridge, 3 miles southwest of Canton, Lewis County, and 15 miles above mouth.

Records Available.—February 20, 1922, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 12.26 feet June 27, 1924 (discharge, 3,520 second-feet); minimum stage, 0.96 foot September 30, 1924; minimum discharge, 0.5 second-foot January 8-9 and 19-23, 1924.

MONTHLY DISCHARGE OF WYACONDA RIVER NEAR CANTON, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 447 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	7	0.8	2.41	0.0054	0.006
November	465	1.0	83.2	.186	.21
December	9	1.8	4.00	.0089	.01
January	93	5.0	14.6	.033	.04
February	84	1.0	7.79	.017	.02
March	2,550	12.	514.	1.15	1.33
April	46	11.	25.6	.057	.06
May	315	4.0	43.4	.097	.11
June	102	2.4	19.5	.044	.05
July	860	1.5	122.	.273	.31
August	147	.8	23.4	.052	.06
September	2,390	.9	255.	.570	.64
The year	2,550	.8	92.9	.208	2.85
1923-24					
October	2,430	4.0	208.	0.465	0.54
November	30	1.9	8.91	.020	.02
December	770	28.	172.	.385	.44
January	490	.5	48.8	.109	.13
February	830	98.	230.	.515	.56
March	2,550	82.	563.	1.26	1.45
April	390	27.	105.	.235	.26
May	96	8.0	21.4	.048	.06
June	3,390	12.	682.	1.53	1.71
July	1,830	25.	216.	.483	.56
August	3,070	11.	483.	1.08	1.24
September	315	5.0	34.9	.078	.09
The year	3,390	.5	231.	.517	7.06

NORTH FABIUS RIVER AT MONTICELLO, MO.

Location.—In SE. ¼ sec. 6, T. 61 N., R. 7 W., at highway bridge 1 mile south of Monticello, Lewis County, and 22 miles above junction with Middle Fabius River.

Records Available.—February 18, 1922, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage determined from flood marks, 22.9 feet June 26, 1924 (discharge, 6,370 second-feet); minimum stage, 0.52 foot July 9, 1922 (discharge, 1 second-foot).

MONTHLY DISCHARGE OF NORTH FABIUS RIVER AT MONTICELLO, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 452 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	16	2	5.26	0.012	0.01
November	1,500	25	139.	.308	.34
December	37	2	12.4	.027	.03
January	175	8	34.9	.077	.09
February	76	5	18.8	.042	.04
March	2,730	21	516.	1.14	1.31
April	62	22	39.8	.088	.10
May	435	10	77.9	.172	.20
July	1,670	6	362.	.801	.92
September, 8-30	2,460	4	.....	.....	.....
1923-24					
October	148	32	67.2	0.149	0.17
November	268	4	38.2	.085	.09
December	1,240	40	248.	.549	.63
January	298	7	73.0	.162	.19
February	2,230	80	253.	.560	.60
March	3,870	66	576.	1.27	1.46
April	343	17	93.5	.207	.23
May	74	9	21.9	.048	.06
June	6,370	14	713.	1.58	1.76
July	1,340	20	214.	.473	.55
August	3,960	19	441.	.976	1.13
September	896	8	74.1	.164	.18
The year	6,370	4	234.	.518	7.05

CUIVRE RIVER NEAR TROY, MO.

Location.—In SW. ¼ sec. 18, T. 49 N., R. 1 E., at Frenchman's Bluff highway bridge, 1½ miles above Sugar Creek, 3 miles northeast of Troy, Lincoln County, 4 miles below West Fork, 10 miles above Big Creek, and 38 miles above mouth.

Records Available.—February 15, 1922, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 23.90 feet March 14, 1922 (discharge, 24,900 second-feet); minimum stage, 1.20 feet December 6, 1922 (discharge, 5 second-feet).

MONTHLY DISCHARGE OF CUIVRE RIVER NEAR TROY, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 908 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	5,340	6	371	0.409	0.47
November	1,040	24	196	.216	.24
December	2,820	5	208	.229	.26
January	499	30	85.4	.094	.11
February	1,090	23	162	.178	.19
March	22,000	48	1,580	1.74	2.01
April	2,260	74	370	.407	.45
May	855	56	121	.133	.15
June	3,060	26	279	.307	.34
July	613	10	103	.113	.13
August	18,000	10	1,990	2.19	2.52
September	2,660	30	235	.259	.29
The year	22,000	5	475	.523	7.16
1923-24					
October	1,290	16	116.	0.128	0.15
November	1,190	42	155.	.172	.19
December	19,000	212	1,340.	1.48	1.71
January	1,440	69	366.	.403	.46
February	4,710	87	619.	.682	.74
March	14,900	120	968.	1.07	1.23
April	580	74	180.	.198	.22
May	6,760	64	564.	.621	.72
June	14,600	224	2,670.	2.94	3.28

MONTHLY DISCHARGE OF CUIVRE RIVER—Continued.

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
July.....	2,620	66	305.	.336	.39
August.....	1,990	15	188.	.207	.24
September.....	650	14	80.4	.089	.10
The year....	19,000	14	628	.692	9.43

MISSOURI RIVER BASIN.

MISSOURI RIVER AT LEAVENWORTH, KAN.

Location.—In NW. ¼ sec. 36, T. 8 S., R. 22 E., at Leavenworth Terminal Railway & Bridge Co's bridge in Leavenworth, Leavenworth County, 2½ miles below Ft. Leavenworth and Ft. Leavenworth bridge, 4½ miles below Bee Creek, 6 miles above Platte River, and 425 miles above mouth.

Records Available.—April 1, 1922, to September 30, 1924. The Leavenworth Terminal Railway & Bridge Co. has obtained records of stage since 1878.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 349.3 feet June 28, 1924; maximum discharge, 344,000 second-feet July 7-8, 1923; minimum discharge, approximately 5,300 second-feet while river was frozen in December, 1922.

1878-1899: The Missouri River Commission published a maximum stage of 353.06 feet for the flood of April 29-30, 1881, and a minimum stage of 330.68 feet December 26, 1883.

Elevations refer to St. Louis city directrix.

MONTHLY DISCHARGE OF MISSOURI RIVER AT LEAVENWORTH FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 428,000 square miles.)

Month.	Discharge in second-feet.				F
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	19,200	16,900	17,700	0.041	
November	37,500	16,900	25,700	.060	
December	23,100	.....	12,900	.030	
January	25,500	13,200	18,700	.044	
February	.....	.....	20,900	.049	
March	106,000	15,600	39,700	.093	
April	140,000	46,600	73,300	.171	
May	64,900	40,800	47,500	.111	
June	302,000	64,900	166,000	.388	
July	344,000	78,600	189,000	.442	
August	190,000	50,200	97,600	.228	
September	83,000	25,500	36,400	.085	
The year	344,000	.....	62,100	.145	
1923-24					
October	138,000	42,700	71,300	0.167	
November	43,800	36,000	39,000	.091	
December	36,900	23,800	28,800	.067	
January	19,600	13,600	16,000	.037	
February	32,800	20,100	26,500	.062	
March	86,000	31,400	55,600	.130	
April	143,000	51,700	87,200	.204	
May	92,000	44,800	57,100	.133	
June	221,000	78,000	137,000	.320	
July	197,000	55,400	98,400	.230	
August	73,500	28,200	46,900	.110	
Septembe	33,800	22,600	25,600	.060	
The year	221,000	13,600	57,500	.134	

NISHNABOTNA RIVER NEAR HAMBURG, IC

Location.—In NW. ¼ NW. ¼ sec. 35, T. 67 N., R at highway bridge just south of Missouri-Iowa line, 1 above Chicago, Burlington & Quincy Railway bridge, southeast of Hamburg, Fremont County, 4 miles below Slough, 10 miles above mouth, and 20 miles below jui East and West Nishnabotna Rivers.

Records Available.—March 6, 1922, to September 30, 1923.

Extremes of Discharge.—1922-1923: Maximum stage recorded, 16.65 feet April 12, 1922 (discharge, 11,800 second-feet); minimum stage, 2.40 feet February 1, 1923; minimum discharge, 165 second-feet February 15-20, 1923.

MONTHLY DISCHARGE OF NISHNABOTNA RIVER NEAR HAMBURG IOWA, FOR THE YEAR ENDING SEPT. 30, 1923.

(Drainage area, 2,920 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
October	473	235	276	0.095	0.11
November	1,900	333	553	.189	.21
December	365	173	251	.086	.10
January	349	215	278	.095	.11
February	265	165	186	.064	.07
March	8,300	197	1,620	.555	.64
April	1,440	675	950	.325	.36
May	1,180	475	695	.238	.27
July 19-31	752	428	526	.180	.09
August	5,260	330	1,530	.524	.60
September	7,350	270	996	.341	.38

TARKIO RIVER AT FAIRFAX, MO.

Location.—On line between SW. ¼ SW. ¼ sec. 22 and NW. ¼ NW. ¼ sec. 27, T. 64 N., R. 40 W., at highway bridge half a mile west of Fairfax, Atchison County, and 8 miles below junction of East and West Tarkio Creeks.

Records Available.—March 8, 1922, to September 30, 1924.

Extremes of Discharge.—1922-1923: Maximum stage recorded, 13.06 feet April 9, 1922 (discharge, 2,850 second-feet); minimum stage 0.42 foot August 31, 1923 (discharge, 1.2 second-feet).

MONTHLY DISCHARGE OF TARKIO RIVER AT FAIRFAX, MO., FOR THE YEAR ENDING SEPT. 30, 1923.

(Drainage area, 508 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
October	437	6	78.7	0.155	0.18
November	955	39	362	.713	.80
December	68	26	41.9	.080	.09
January	72	6	36.7	.072	.08
February	29	5	13.2	.026	.03
March	68	27	48.1	.095	.11
April	134	37	56.0	.110	.12
May	1,030	28	122	.240	.28
June	457	19	116	.228	.25
July	149	3.8	31.3	.062	.07
August	319	1.5	62.3	.123	.14
September	265	6.	35.5	.070	.08
The year	1,030	1.5	83.6	.165	2.23

PLATTE RIVER AT CONCEPTION JUNCTION, MO.

Location.—In NE. ¼ sec. 11, T. 63 N., R. 34 W., at highway bridge, 1 mile above Wabash Railway bridge, 1 mile north of Conception Junction, Nodaway County, 6 miles below Honey Creek, and 14 miles above Long Creek.

Records Available.—July 11, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 20.62 feet July 10, 1922 (discharge, 8,730 second-feet); minimum discharge, 0.48 second-foot (measured with current meter) January 30, 1922.

MONTHLY DISCHARGE OF PLATTE RIVER AT CONCEPTION JUNCTION, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.
(Drainage area, 492 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	375	9	46.7	0.095	0.11
November	3,900	43	376	.764	.85
December	52	18	28.6	.058	.07
January	29	13	19.9	.040	.05
February	21	10	14.3	.029	.03
March	1,000	16	225	.457	.53
April	1,180	61	178	.362	.40
May	1,300	27	181	.368	.42
June	795	14	170	.346	.39
July	285	6	48.1	.098	.11
August	496	6	72.4	.147	.17
September	576	11	103	.209	.23
The year	3,900	6	122	.248	3.36
1923					
October	325	16	64.4	0.131	0.15
November	33	14	19.2	.039	.04
December 1-25	27	8	14.7	.030	.03

PLATTE RIVER AT AGENCY, MO.

Location.—In NE. ¼ sec. 29, T. 56 N., R. 34 W., at highway bridge in Agency, Buchanan County, 600 feet below Atchison, Topeka & Santa Fe railway bridge, 8 miles below Third Fork, and 13 miles above Castile Creek.

Records Available.—May 22 to September 30, 1924.

Extremes of Discharge.—Maximum stage recorded during period 20.38 feet June 27 (discharge, 10,200 second-feet); minimum stage, 1.88 feet May 22 and September 26 (discharge, 53 second-feet).

MONTHLY DISCHARGE OF PLATTE RIVER AT AGENCY, MO., FOR THE YEAR ENDING SEPT. 30, 1924.

(Drainage area, 1,790 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
May 22-31.....	108	53	66	0.037	0.01
June.....	10,200	59	3,540	1.98	2.21
July.....	4,850	190	1,350	.754	.87
August.....	1,930	100	320	.179	.21
September.....	2,630	55	391	.218	.24

GRAND RIVER NEAR GALLATIN, MO.

Location.—In NW. ¼ sec. 16, T. 59 N., R. 27 W., at highway bridge 1,000 feet above Chicago, Rock Island & Pacific Railway bridge, 2 miles east of Gallatin, Daviess County, 7 miles above Honey Creek, and 15 miles above Muddy Creek.

Records Available.—June 30, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 36.50 feet July 12, 1922 (discharge, 34,100 second-feet); minimum stage, 1.55 feet while river was dammed above gage May 15, 1924 (discharge, 10 second-feet).

The United States Weather Bureau has published a maximum stage of 39.3 feet for the flood of July, 1909.

MONTHLY DISCHARGE OF GRAND RIVER NEAR GALLATIN, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 2,250 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October.....	4,060	91	661.	0.294	0.34
November.....	19,000	386	3,830.	1.70	1.90
December.....	386	146	219.	.097	.11
January.....	206	106	155.	.069	.08

MONTHLY DISCHARGE OF GRAND RIVER—Continued.

Month.	Di charge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
February.....	141	77	98.8	.044	.05
March.....	2,900	146	986.	.438	.50
April.....	7,860	235	941.	.418	.47
May.....	1,920	162	398.	.177	.20
June.....	5,640	118	691.	.307	.34
July.....	10,500	98	1,010.	.449	.52
August.....	3,560	84	591.	.263	.30
September.....	2,460	80	385.	.171	.19
The year....	19,000	77	830.	.369	5.00
1923-24					
October.....	3,310	108	518.	0.230	0.27
November.....	190	89	113.	.050	.06
December.....	162	108	126.	.056	.06
January.....	176	80	118.	.052	.06
February.....	2,120	128	594.	.264	.28
March.....	8,150	222	1,420.	.631	.73
April.....	1,970	145	368.	.164	.18
May.....	222	10	96.6	.043	.05
June.....	22,200	105	5,300.	2.36	2.63
July.....	14,700	316	2,540.	1.13	1.30
August.....	2,670	100	360.	.160	.18
September.....	3,920	56	312.	.139	.16
The year....	22,200	10	985.	.438	5.96

GRAND RIVER NEAR SUMNER, MO.

Location.—In NE. ¼ sec. 29, T. 56 N., R. 21 W., on Chicago, Burlington & Quincy railroad bridge, 2 miles southwest of Sumner, Chariton County, 2½ miles below Locust Creek, and 5 miles above Yellow Creek.

Records Available.—April 19 to September 30, 1924.

Extremes of Discharge.—Maximum stage recorded during period, 28.56 feet July 1 (discharge, 36,600 second-feet); minimum stage, 2.95 feet May 17 and 22 (discharge, 321 second-feet).

MONTHLY DISCHARGE OF GRAND RIVER NEAR SUMNER, MO., FOR THE YEAR ENDING SEPT. 30, 1924.

(Drainage area, 6,880 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
April 19-30....	1,480	540	797	0.116	0.05
May.....	580	321	419	.061	.07
June.....	34,200	435	14,200	2.06	2.30
July.....	36,000	1,000	8,830	1.28	1.48
August.....	6,900	505	1,720	.250	.29
September.....	3,830	352	1,100	.160	.18

THOMPSON RIVER NEAR HICKORY MO.

Location.—In W. ½ sec. 17, T. 60 N., R. 24 W., at highway bridge, 1,000 feet above Chicago, Rock Island & Pacific Railway bridge, half a mile below Wolf Creek, 3 miles northeast of Hickory, Grundy County, 4 miles above Muddy Creek, and 14 miles below Weldon River.

Records Available.—June 29, 1921, to August 26, 1923, when station was discontinued.

Extremes of Discharge.—1921-1923: Maximum stage recorded, 24.05 feet July 13, 1922 (discharge, 16,000 second-feet); minimum stage, 1.66 feet November 18, 1921; minimum discharge measured with current meter, 21.4 second-feet January 28, 1922.

MONTHLY DISCHARGE OF THOMPSON RIVER NEAR HICKORY, MO., FOR THE YEAR ENDING SEPT. 30, 1923.

(Drainage area, 1,700 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
October.....	1,170	111	245	0.144	0.17
November.....	12,500	353	2,930	1.72	1.92
December.....	438	179	258	.152	.18
January.....	208	117	159	.094	.11
February.....	216	84	115	.068	.07
March.....	4,180	129	1,480	.871	1.00
April.....	4,660	319	809	.476	.53
May.....	1,460	153	341	.201	.23

MONTHLY DISCHARGE OF THOMPSON RIVER—Continued.

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
June	2,220	129	431	.254	.28
July	676	60	261	.158	.18
August 1-26	4,660	69	807	.475	.46

MEDICINE CREEK NEAR GALT, MO.

Location.—In NW. ¼ sec. 34, T. 62 N., R. 22 W., on Quincy, Omaha & Kansas City Railroad bridge, 1 mile above West (Little) Medicine Creek, and 1½ miles east of Galt, Grundy County.

Records Available.—July 6, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1923: Maximum stage recorded, 13.58 feet July 13, 1922 (discharge, 2,960 second-feet); minimum stage, 0.20 foot October 14, 15, 18 and 19, 1921; minimum discharge, less than 1 second-foot August 22 and 29, 1922.

MONTHLY DISCHARGE OF MEDICINE CREEK NEAR GALT, MO., FOR THE YEAR ENDING SEPT. 30, 1923.

(Drainage area, 225 square miles.)

Month.	Di charge in second feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
October	80	8.	15.7	0.070	0.08
November	2,230	17.	406.	1.80	2.01
December	53	18.	30.0	.133	.15
January	34	12.	20.5	.091	.10
February	34	8.	15.8	.070	.07
March	1,020	22.	297.	1.32	1.52
April	1,240	20.	164.	.729	.81
May	712	11.	72.5	.322	.37
June	740	7.	61.8	.275	.31
July	258	1.8	23.2	.103	.12
August	528	2.0	82.9	.368	.42
September	84	3.0	17.3	.077	.09
The year	2,230	1.8	101.	.449	6.05

LOCUST CREEK NEAR MILAN, MO.

Location.—In SW. ¼ sec. 8, T. 62 N., R. 20 W., at Booth's highway bridge, 3½ miles southwest of Milan, Sullivan County, 14 miles above East Locust Creek, and 22 miles above West Locust Creek.

Records Available.—July 2, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 16.90 feet July 18, 1922 (discharge, 2,880 second-feet); minimum stage, 0.96 foot September 30, 1922, when there was no flow.

MONTHLY DISCHARGE OF LOCUST CREEK NEAR MILAN, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 225 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	16	0.8	4.28	0.019	0.02
November	2,240	16.	365.	1.62	1.81
December	26	3.	10.7	.048	.06
January	38	5.	11.8	.052	.06
February	23	1.8	8.16	.036	.04
March	1,440	20.	319.	1.42	1.64
April	1,170	18.	99.3	.441	49
May	368	7.	35.0	.156	.18
June	354	3.8	36.7	.163	.18
July	886	1.4	48.3	.215	.25
August	754	1.5	85.3	.379	.44
September	78	1.6	16.1	.072	.08
The year	2,240	.8	86.4	.384	5.25
1923-24					
October	886	7	76.6	0.340	0.39
November	74	12	21.8	.097	.11
December	466	28	90.3	.401	.46
January	240	2	65.1	.289	.33
February	722	22	158.	.702	.76
March	1,910	37	294.	1.31	1.51
April	210	10	53.4	.237	.26
May	17	6	11.0	.049	.06
June	2,420	8	522.	2.32	2.59
July	786	11	74.3	.330	.38
August	958	3	78.3	.348	.40
September	180	3	10.8	.048	.05
The year	2,420	2	121.	.538	7.30

CHARITON RIVER AT ELMER, MO.

Location.—In SW. ¼ SW. ¼ sec. 2, T. 59 N., R. 16 W., on Atchison, Topeka and Santa Fe Railway bridge, three-quarters of a mile southwest of Elmer, Macon County, 1 mile below Walnut Creek, 3 miles below Cottonwood Creek, 3½ miles above Rock Creek, and 5 miles above Turkey Creek.

Records Available.—July 7, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 19.64 feet July 13, 1922 (discharge, 7,350 second-feet); minimum stage, 0.24 foot September 4, 1921, minimum discharge, 38 second-feet October 18, 1922.

MONTHLY DISCHARGE OF CHARITON RIVER AT ELMER, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 1,660 square miles).

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October.....	108	39	60.1	0.036	0.04
November.....	5,540	75	1,120.	.675	.75
February.....	620	490	544.	.328	.23
March.....	4,880	664	2,070.	1.25	1.44
April.....	1,020	131	382.	.230	.26
May.....	1,020	106	336.	.202	.23
June.....	1,840	100	306.	.184	.21
July.....	972	52	234.	.141	.16
August.....	1,300	50	301.	.181	.21
September.....	367	44	129.	.078	.09
1923-24					
October.....	1,610	59	234.	0.141	0.16
November.....	257	44	96.3	.058	.06
December.....	1,890	62	510.	.307	.35
January.....	460	95	212.	.128	.15
February.....	1,970	294	734.	.442	.48
March.....	5,890	333	1,540.	.928	1.07
April.....	3,970	187	593.	.357	.40
May.....	163	68	97.5	.059	.07
June.....	5,270	64	1,810.	1.09	1.22
July.....	4,320	204	836.	.504	.58
August.....	2,140	84	604.	.364	.42
September.....	625	54	120.	.072	.08
The year....	5,890	44	614.	.370	5.04

LAMINE RIVER AT CLIFTON CITY, MO.

Location.—In NW. ¼ sec. 16, T. 46 N., R. 19 W., at highway bridge 300 feet above Missouri, Kansas & Texas railway bridge, three-quarters of a mile east of Clifton City, Cooper County, 9 miles below Otter Creek, and 12 miles above Muddy Creek.

Records Available.—June 21, 1922, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 19.90 feet July 4, 1923 (discharge, 8,230 second-feet); minimum stage, 1.42 feet September 27, 1924 (discharge, 1 second-foot).

MONTHLY DISCHARGE OF LAMINE RIVER AT CLIFTON CITY, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 598 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	679	7	53.5	0.089	0.10
November	2,090	10	209.	.349	.39
December	142	17	40.8	.068	.08
January	464	18	145.	.242	.28
February	1,960	31	191.	.319	.33
March	5,950	44	767.	1.28	1.48
April	2,910	55	368.	.615	.69
May	1,910	40	200.	.334	.39
June	4,460	48	523.	.875	.98
July	7,800	15	571.	.955	1.10
August	270	6	31.4	.053	.06
September	1,190	8	75.4	.126	.14
The year	7,800	6	265.	.443	6.02
1923-24					
October	173	10	20.7	0.035	0.04
November	280	17	65.5	.110	.12
December	2,310	51	319.	.533	.61
January	2,000	40	303.	.507	.58
February	4,020	132	709.	1.19	1.28
March	1,830	87	275.	4.60	.53
April	526	37	143.	.239	.27
May	3,440	20	365.	.610	.70
June	6,910	111	1,380.	2.31	2.58

MONTHLY DISCHARGE OF LAMINE RIVER—Continued.

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1923-24					
July	5,200	40	632.	1.06	1.22
August	835	5	104.	.174	.20
September	87	1	11.0	.018	02
The year	6,910	1	358.	.599	8.15

BLACKWATER RIVER AT BLUE LICK, MO.

Location.—On line between sec. 27 and sec. 34, T. 49 N., R. 21 W., at highway bridge on Sedalia-Marshall road three-quarters of a mile below Finney's Creek, 1 mile southeast of Blue Lick, Saline County, and 12 miles above Salt Creek.

Records Available.—June 22, 1922, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage determined by levels to flood marks, 30.9 feet July 4, 1923 (discharge, 9,280 second-feet); minimum stage, 1.10 feet September 25-26, 1924; minimum discharge, 0.9 second-foot October 27, 1922.

MONTHLY DISCHARGE OF BLACKWATER RIVER AT BLUE LICK, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 1,120 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	186	1	23.6	0.021	0.02
November	1,220	10	162.	.145	.16
December	162	5	22.7	.020	.02
January	168	1	26.2	.023	.03
February	180	9	37.4	.033	.03
March	3,140	16	816.	.729	.84
April	1,530	14	314.	.280	.31

MONTHLY DISCHARGE OF BLACKWATER RIVER—Continued.

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-1923					
May	934	26	135.	.121	.14
June	6,770	120	2,540.	2.27	2.53
July	9,280	40	1,010.	.902	1.04
August	452	3	63.2	.056	.06
September	886	4	159.	.142	.16
The year	9,280	1	442.	.395	5.34
1923-24					
October	2,800	8	321.	0.287	0.33
November	248	17	69.1	.062	.07
December	4,800	69	850.	.759	.88
January	.....	21	557.	.497	.57
February	4,640	280	1,220.	1.09	1.18
March	1,890	188	473.	.422	.49
April	280	23	109.	.097	.11
May	3,670	17	464.	.414	.48
June	9,040	91	1,900.	1.70	1.90
July	4,440	71	1,140.	1.02	1.18
August	1,950	2	204.	.182	.21
September	2,690	1	332.	.296	.33
The year	9,040	1	633.	.565	7.73

OSAGE RIVER AT OSCEOLA, MO.

Location.—In NW. ¼ sec. 20, T. 38 N., R. 25 W., at highway bridge in Osceola, St. Clair County, a quarter of a mile above St. Louis-San Francisco Railway bridge, three-quarters of a mile above Gallinipper Creek, and three miles below Sac River.

Records Available.—July 23, 1921, to September 30, 1924. The United States Weather Bureau has records of stage since April 1, 1910.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 28.8 feet April 10, 1922 (discharge, 71,400 second-feet); minimum stage, 0.9 foot September 1-6 and October 5-6 and 20-31, 1922 (discharge, 120 second-feet).

Flood of December, 1895, reached a stage of 33.27 feet, and flood of 1844 a stage of 43.3 feet (determined by United States Weather Bureau). Minimum stage recorded by the Weather Bureau, 0.6 foot July 11, 1911.

MONTHLY DISCHARGE OF OSAGE RIVER AT OSCEOLA, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 8,180 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	420	120	172	0.021	0.02
November	5,550	140	1,500	.183	.20
December	760	210	331	.040	.05
January	1,010	260	459	.056	.06
February	1,700	530	972	.119	.12
March	18,200	530	5,420	.663	.76
April	7,290	640	2,090	.256	.29
May	20,300	640	3,770	.461	.53
June	38,700	1,850	19,100	2.33	2.60
July	20,300	700	4,100	.501	.58
August	832	164	319	.039	.04
September	7,490	158	793	.097	.11
The year	38,700	120	3,250	.397	5.36
1923-24					
October	17,300	260	4,170	0.510	0.59
November	10,900	1,460	3,700	.452	.50
December	28,400	2,040	8,450	1.03	1.19
January	14,800	1,520	3,760	.460	.53
February	25,500	2,600	8,660	1.06	1.14
March	10,300	1,780	3,160	.386	.44
April	7,090	1,260	2,830	.346	.39
May	35,400	1,020	7,670	.938	1.08
June	27,700	2,460	10,300	1.26	1.41
July	43,000	1,140	13,100	1.60	1.84
August	16,500	1,120	5,340	.653	.75
September	6,500	520	1,740	.213	.24
The year	43,000	260	6,070	.742	10.10

SAC RIVER NEAR STOCKTON, MO.

Location.—In W. ½ sec. 11, T. 34 N., R. 26 W., at highway bridge on Stockton-Fairplay road, 1½ miles above Bear Creek, 2½ miles east of Stockton, Cedar County, 3½ miles below Little Sac River, and 13 miles above dam at Caplinger Mills.

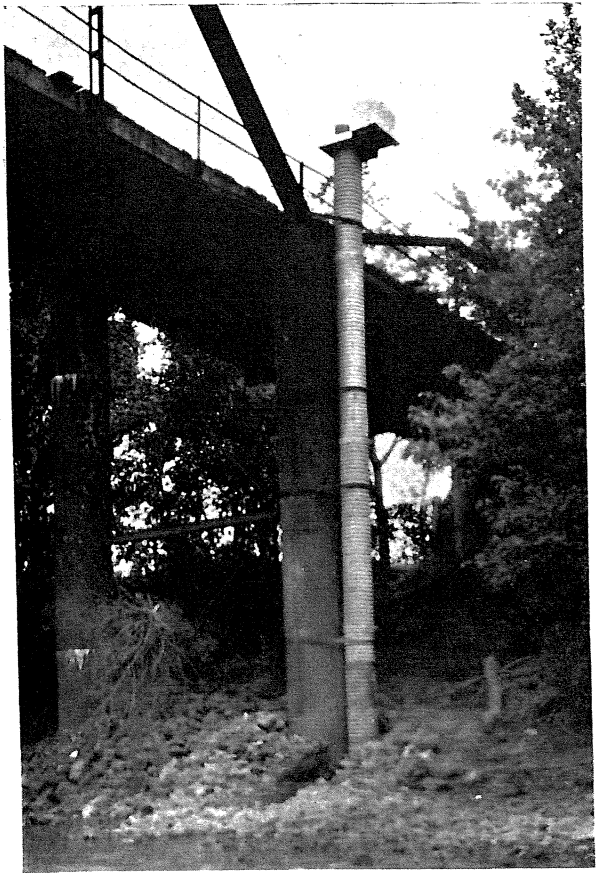
Records Available.—July 20, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 21.60 feet May 29, 1924 (discharge, 14,400 second-feet); minimum stage, 1.78 feet October 5, 1922; minimum discharge, 57 second-feet September 30, 1922.

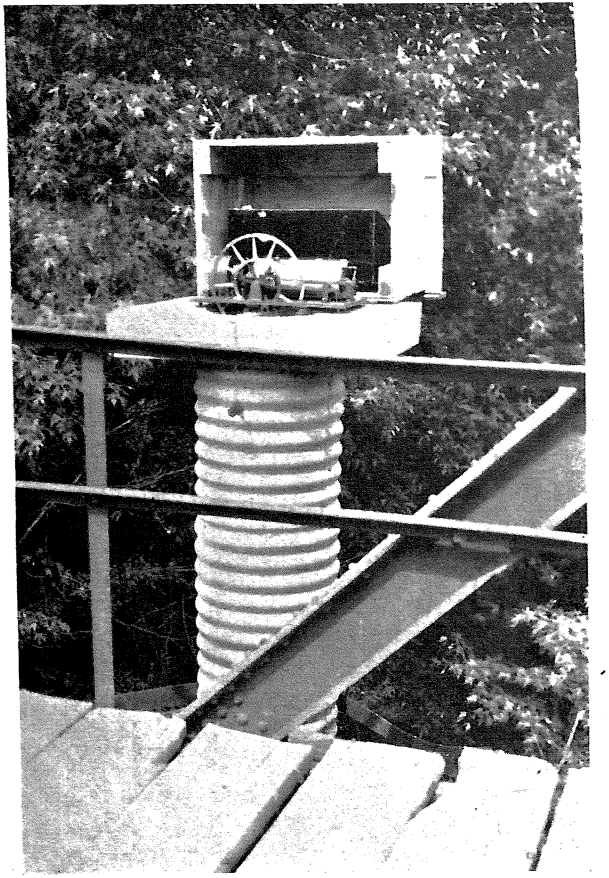
MONTHLY DISCHARGE OF SAC RIVER NEAR STOCKTON, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 1,160 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	282	66	91.9	0.079	0.09
November	391	65	150.	.129	.14
December	282	80	104.	.090	.10
January	806	103	244.	.210	.24
February	1,420	249	498.	.429	.45
March	3,700	249	1,050.	.905	1.04
April	1,780	316	626.	.540	.60
May	7,930	334	1,550.	1.34	1.54
June	5,820	592	2,490.	2.15	2.40
July	6,960	266	1,170.	1.01	1.16
August	266	74	137.	.118	.14
September	806	66	201.	.173	.19
The year	7,930	65	693.	.597	8.09
1923-24					
October	660	71	204	0.176	0.20
November	3,030	505	1,100	.948	1.06
December	8,320	785	2,090	1.80	2.08
January	3,220	448	876	.755	.87
February	2,670	740	1,310	1.13	1.22
March	2,550	412	707	.609	.70
April	1,500	376	670	.578	.64
May	13,300	253	1,870	1.61	1.86
June	8,790	930	3,300	2.84	3.17
July	13,200	620	2,550	2.20	2.54
August	13,200	500	3,400	2.93	3.38
September	2,130	306	617	.532	.59
The year	13,300	71	1,560	1.34	18.31



View of recording [illegible] Sac River near Collins, Mo., which gives a continuous [illegible] river. (Furnished by West Missouri Power Co.)



View of recording gage on Sac River near Collins, Mo., which gives a continuous graphic record of the stage of the river. (Furnished by West Missouri Power Co.)

SAC RIVER NEAR COLLINS, MO.

Location.—In sec. 12, T. 36 N., R. 26 W., at highway bridge 800 feet below site of former dam, half a mile east of former Cobb post office, 9 miles below Cedar Creek, and 10 miles west of Collins, St. Clair County.

Records Available.—April 22, 1923, to September 30, 1924.

Extremes of Discharge.—1923-1924: Maximum stage recorded, 26.40 feet May 30, 1924 (discharge, 35,700 second-feet); minimum stage, 1.40 feet August 25-26, 1923 (discharge, 68 second-feet.

MONTHLY DISCHARGE OF SAC RIVER NEAR COLLINS, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 1,900 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1923					
April 22-30	4,480	595	1,710	0.900	0.30
May	11,700	404	1,940	1.02	1.18
June	13,800	665	4,020	2.12	2.36
July	11,700	333	1,710	.900	1.04
August	404	70	176	.093	.11
September	735	97	238	.125	.14
1923-24					
October	920	83	281	0.148	0.17
November	3,670	693	1,390	.732	.82
December	13,500	1,220	3,100	1.63	1.88
January	6,650	672	1,400	.737	.85
February	7,850	1,140	2,620	1.38	1.49
March	5,200	623	1,100	.579	.67
April	2,260	508	987	.519	.58
May	32,600	735	4,350	2.29	2.64
June 1-23	15,900	1,220	5,910	3.11	2.66
September	2,340	398	765	.403	.45

CEDAR CREEK NEAR PLEASANT VIEW, MO.

Location.—In sec. 3, T. 35 N., R. 27 W., 2 miles northwest of Pleasant View, Cedar County, 2 miles below dam and mill, and 3 miles above mouth.

Records Available.—April 22, 1923, to September 30, 1924.

Extremes of Discharge.—1923-1924: Maximum stage recorded, 24.0 feet July 12, 1924 (discharge determined by extending rating curve for main channel and computing overflow by Kutter's formula, 9,400 second-feet); minimum stage, 0.45 foot September 3, 1923 (discharge, 2 second-feet).

MONTHLY DISCHARGE OF CEDAR CREEK NEAR PLEASANT VIEW, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 411 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1923					
May	2,240	23.	238.	0.579	0.67
June	4,370	35.	770.	1.87	2.09
July	1,700	22.	269.	.655	.76
August	32	2.4	9.41	.023	.03
September	534	2.0	60.4	.147	.16
1923-24					
October	515	8	65.7	0.160	0.18
November	1,040	41	154.	.375	.42
December	3,080	70	585.	1.42	1.64
January	2,360	56	323.	.786	.91
February	3,060	203	688.	1.67	1.80
March	1,590	102	224.	.545	.63
April	615	47	182.	.443	.49
May	5,680	24	829.	2.02	2.33
June	4,220	150	890.	2.17	2.42
July	5,880	32	912.	2.22	2.56
August	2,360	38	555.	1.35	1.56
September	1,080	12	111.	.270	.30
The year	5,880	8	460.	1.12	15.24

POMME DE TERRE RIVER AT HERMITAGE, MO.

Location.—In NW. ¼ sec. 26, T. 37 N., R. 22 W., at south highway bridge in Hermitage, Hickory County, 800 feet above Mill Creek, half a mile above east highway bridge, 8 miles below Lindley Creek, 35 miles above Little Pomme de Terre River, and 37 miles above mouth.

Records Available.—July 25, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1923: Maximum stage recorded, 20.90 feet September 2, 1921 (discharge, 20,800 second-feet); minimum stage, 1.18 feet October 29-30, 1922 (discharge, 9 second-feet.)

MONTHLY DISCHARGE OF POMME DE TERRE RIVER AT HERMITAGE, MO., FOR THE YEAR ENDING SEPT. 30, 1923.

(Drainage area, 630 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
October.....	13	9	10.3	0.016	0.02
November.....	291	10	75.9	.120	.13
December.....	188	18	36.1	.057	.07
January.....	238	33	106.	.168	.19
February.....	1,690	65	297.	.471	.49
March.....	4,900	45	577.	.916	1.06
April.....	542	178	279.	.443	.49
May.....	1,080	74	239.	.379	.44
June.....	6,300	178	1,290.	2.05	2.29
July.....	3,220	46	491.	.779	.90
August.....	43	9	25.7	.041	.05
September.....	140	10	35.8	.057	.06
The year....	6,300	9	287.	.456	6.19

SOUTH GRAND RIVER NEAR BROWNINGTON, MO.

Location.—In NW. ¼ sec. 17, T. 40 N., R. 25 W., at highway bridge on Brownington-Clinton road, 300 feet below St. Louis-San Francisco Railway bridge, 500 feet below Deepwater Creek, 1 mile north of Brownington, Henry County, and 40 miles above mouth.

Records Available.—July 24, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage determined by levels to flood marks 28.0 feet April 9, 1922 (discharge, 21,100 second-feet); minimum discharge, 1 second-foot October 28 and 29, 1922.

MONTHLY DISCHARGE OF SOUTH GRAND RIVER NEAR BROWNINGTON, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 1,660 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	870	1	92.6	0.056	0.06
November	2,230	27	331.	.199	.22
December	265	15	43.8	.026	.03
January	40	13	21.1	.013	.02
February	250	15	54.7	.033	.03
March	6,110	27	1,320.	.795	.92
April	3,700	52	467.	.281	.31
May	3,340	25	439.	.264	.30
June	17,400	90	3,330.	2.01	2.24
July	2,920	17	519.	.313	.36
August	75	8	31.8	.019	.02
September	505	5	73.7	.044	.05
The year	17,400	1	560.	.337	4.56
1923-24					
October	5,060	32	1,100.	0.663	0.76
November	1,550	128	335.	.202	.23
December	6,100	166	1,690.	1.02	1.18
January	5,380	95	969.	.584	.67
February	7,380	410	1,710.	1.03	1.11
March	3,220	176	653.	.393	.45
April	1,140	90	305.	.184	.21
May	2,190	49	329.	.198	.23
June	11,100	75	2,390.	1.44	1.61
July	7,380	94	1,830.	1.10	1.27
August	890	14	186.	.112	.13
September	590	5	78.8	.047	.05
The year	11,100	5	963.	.580	7.90

NIANGUA RIVER NEAR ROACH, MO.

Location.—In sec. 20, T. 38 N., R. 17 W., at highway bridge on Linn Creek-Roach road, 2½ miles above Little Niangua River, 4 miles northeast of Roach, Camden County, and 10 miles below Hahatonka Spring.

Records Available.—November 18, 1922, to September 30, 1924.

Extremes of Discharge.—1923-1924: Maximum stage recorded, 13.30 feet May 30, 1924 (discharge, 15,200 second-feet); minimum stage, 0.80 foot August 26 to September 2, 1923 (discharge, 160 second-feet).

MONTHLY DISCHARGE OF NIANGUA RIVER NEAR ROACH, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 698 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
November 18-30	280	242	258	0.370	0.18
December	300	225	239	.342	.39
January	300	225	255	.365	.42
February	425	260	314	.450	.47
March	1,410	242	523	.749	.86
April	425	300	340	.487	.54
May	520	242	313	.448	.52
June	1,600	300	721	1.03	1.15
July	1,410	242	396	.567	.65
August	340	160	235	.337	.39
September	300	160	211	.302	.34
1923-24					
October	340	175	221	0.317	0.37
November	1,540	300	506	.725	.81
December	7,480	425	1,270	1.82	2.10
January	1,410	280	485	.695	.80
February	2,030	520	846	1.21	1.30
March	2,190	340	571	.818	.94
April	2,810	448	939	1.35	1.51
May	14,700	320	2,110	3.02	3.48
June	7,330	1,030	2,250	3.22	3.59
July	4,720	595	1,160	1.66	1.91
August	10,500	402	1,710	2.45	2.82
September	1,540	320	497	.712	.79
The year	14,700	175	1,050	1.50	20.42

HAHATONKA SPRING AT HAHATONKA, MO.

Location.—In sec. 2, T. 37 N., R. 17 W., at Hahatonka, Camden County, a quarter of a mile below the spring outlet, and half a mile above mouth of the spring branch.

Records Available.—November 17, 1922, to June 30, 1924.

Extremes of Discharge.—1923-1924: Maximum discharge indeterminate on account of backwater from Niangua River; minimum discharge, 43 second-feet February 23, 1923.

MONTHLY DISCHARGE OF HAHATONKA SPRING AT HAHATONKA, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1922-23			
November 17-30	63	58	60.9
December	62	52	57.2
January	55	46	50.3
February	52	43	46.9
March	85	45	59.1
April	59	51	54.6
May	54	46	49.5
June	102	50	75.7
1923-24			
October	58	49	52.8
November	88	56	64.0
December	.....	61	.....
January	71	54	61.0
February	100	58	77.9
March 1-29	78	54	64.8
April	.....	63	.....
May	.....	56	.....
July	.....	74	.....
August	.....	58	.....
September	107	79	88.7
The year	.....	49	.....

GASCONADE RIVER NEAR WAYNESVILLE, MO.

Location.—In SE. ¼ sec. 3, T. 36 N., R. 12 W., at highway bridge on Waynesville-Crocker road, 2½ miles below Roubidoux Creek, and 4 miles north of Waynesville, Pulaski County.

Records Available.—June 9, 1921, to September 30, 1924.

The Missouri Engineering Experiment Station has records of discharge from August 15, 1914, to July 31, 1921.[1]

[1]See Missouri Univ. Eng. Exper. Sta. Bull., Ser. 22, Vol. 21, No. 35.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 14.14 feet March 31, 1922 (discharge, 19,200 second-feet); minimum stage, 2.08 feet September 27, 1922 (discharge, 77 second-feet).

The Missouri Engineering Experiment Station has published a maximum discharge of 36,400 second-feet in August, 1915.

MONTHLY DISCHARGE OF GASCONADE RIVER NEAR WAYNESVILLE, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 1,680 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	165	83	121	0.072	0.08
November	206	132	168	.100	.11
December	334	165	211	.126	.15
January	1,340	213	451	.268	.31
February	5,940	380	1,320	.786	.82
March	7,780	380	2,340	1.39	1.60
April	2,120	510	964	.574	.64
May	5,580	480	1,480	.881	1.02
June	6,120	635	2,050	1.22	1.36
July	1,280	270	527	.314	.36
August	750	126	255	.152	.18
September	312	110	158	.094	.10
The year	7,780	83	837	.498	6.73
1923-24					
October	196	107	153	0.091	0.10
November	1,760	213	534	.318	.35
December	8,540	455	2,040	1.21	1.40
January	910	250	529	.315	.36
February	1,880	540	935	.557	.60
March	4,890	455	901	.536	.62
April	2,960	430	943	.561	.63
May	16,900	380	2,510	1.49	1.72
June	9,300	1,000	3,430	2.04	2.28
July	5,940	600	1,470	.875	1.01
August	15,500	380	2,160	1.29	1.49
September	7,780	212	1,190	.708	.79
The year	16,900	107	1,400	.833	11.35

GASCONADE RIVER AT JEROME, MO.

Location.—In sec. 13, T. 37 N., R. 10 W., 500 feet north of St. Louis-San Francisco Railway station at Jerome, Phelps County, half a mile below St. Louis-San Francisco Railway bridge, and half a mile below Little Piney Creek.

Records Available.—April 12, 1903, to July 21, 1906, and January 3, 1923, to September 30, 1924.

Extremes of Discharge.—1923-1924: Maximum stage recorded during period, 15.80 feet May 29, 1924 (discharge, 30,400 second-feet); minimum stage, 1.50 feet October 7-13, 1923 (discharge, 480 second-feet).

High water of January 5, 1897, about 31 feet (determined from records of United States Weather Bureau and relationship between gages).

MONTHLY DISCHARGE OF GASCONADE RIVER AT JEROME, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 2,840 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1923					
January 3-31	2,290	720	1,110	0.391	0.45
February	8,300	1,040	2,520	.887	.92
March	13,500	1,040	4,120	1.45	1.67
April	4,100	1,260	1,980	.697	.78
May	11,600	1,220	2,870	.101	1.16
June	7,700	1,350	3,400	1.20	1.34
July	1,850	810	1,060	.373	.43
August	2,070	544	809	.285	.33
September	720	480	.580	.204	.23
1923-24					
October	765	480	559	0.197	0.23
November	1,850	720	981	.345	.38
December	12,300	945	3,180	1.12	1.29
January	1,650	855	1,130	.398	.46
February	2,510	1,170	1,560	.549	.59
March	5,460	1,080	1,640	.577	.67
April	4,830	990	1,780	.627	.70
May	28,100	900	4,330	1.52	1.75
June	12,300	2,070	5,420	1.91	2.13
July	4,530	1,350	2,360	.831	.96
August	16,300	990	3,330	1.17	1.35
September	10,400	720	1,970	.694	1.77
The year	28,100	480	2,360	.831	11.28

GASCONADE RIVER NEAR RICH FOUNTAIN, MO.

Location.—In SE. 1/4 sec. 16, T. 42 N., R. 8 W., at highway bridge on Belle-Rich Fountain road, just below Brushy Creek and just above Swan Creek, 4 miles east of Rich Fountain, Osage County, and 53 miles above mouth.

Records Available.—October 10, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 17.20 feet May 30, 1924 (discharge, 27,700 second-feet); minimum discharge, 424 second-feet September 29 and 30, 1922.

MONTHLY DISCHARGE OF GASCONADE RIVER NEAR RICH FOUNTAIN, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 3,180 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	1,000	475	593	0.186	0.21
November	765	540	631	.198	.22
December	1,450	605	752	.236	.27
January	2,780	860	1,380	.434	.50
February	9,280	1,150	2,920	.918	.96
March	14,200	1,150	4,920	1.55	1.79
April	4,630	1,560	2,550	.802	.89
May	9,820	1,450	3,330	1.05	1.21
June	8,400	1,560	3,960	1.25	1.40
July	2,000	860	1,190	.374	.43
August	3,140	595	1,120	.352	.39
September	908	540	658	.207	.23
The year	14,200	475	2,000	.629	8.52
1923-24					
October	1,000	508	597	0.188	0.22
November	2,000	860	1,110	.349	.39
December	14,300	1,150	4,110	1.29	1.49
January	2,330	1,050	1,460	.459	.53
February	3,140	1,450	1,970	.619	.67
March	6,260	1,200	1,970	.619	.71
April	6,400	1,200	2,290	.720	.80
May	27,300	1,150	4,800	1.51	1.74
June	18,300	2,900	7,460	2.35	2.62
July	6,400	1,560	3,160	.994	1.15
August	16,100	1,050	3,550	1.12	1.29
September	8,900	800	2,130	.670	.75
The year	27,300	508	2,880	.906	12.36

PINEY CREEK NEAR BIG PINEY, MO.

Location.—In NE. 1/4 sec. 8, T. 34 N., R. 10 W., at Ross highway bridge, 3 miles east of Big Piney, Pulaski County, 14 miles above Spring Creek, 24 miles above Dry Creek, and 30 miles above mouth.

Records Available.—October 13, 1921, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 10.26 feet April 28, 1922 (discharge, 8,950 second-feet); minimum stage, 1.82 feet September 25 and October 4, 1922 (discharge, 96 second-feet).

MONTHLY DISCHARGE OF PINEY CREEK NEAR BIG PINEY, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 560 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	420	96	144	0.257	0.30
November	295	99	149	.266	.30
December	680	132	208	.371	.43
January	3,700	185	594	1.06	1.22
February	6,350	279	924	1.65	1.72
March	5,760	263	1,240	2.21	2.55
April	1,090	311	551	.984	1.10
May	8,660	335	975	1.74	2.01
June	5,220	299	1,230	2.20	2.46
July	950	188	259	.462	.53
August	248	129	167	.298	.34
September	171	114	136	.243	.27
The year	8,660	96	548	.979	13.23
1923-24					
October	171	108	133	0.238	0.27
November	178	132	147	.262	.29
December	1,320	171	515	.920	1.06
January	327	150	210	.375	.43
February	319	178	235	.420	.45
March	1,090	164	306	.546	.63
April	510	164	279	.498	.56
May	3,480	171	520	.929	1.07
June	2,640	248	722	1.29	1.44
July	1,090	210	335	.598	.69
August	1,090	185	435	.777	.90
September	3,700	150	455	.812	.91
The year	3,700	108	358	.639	8.70

LOWER MISSISSIPPI RIVER BASIN—MERAMEC RIVER NEAR STEELVILLE, MO.

Location.—In SW. 1/4 sec. 21, T. 38 N., R. 4 W., at highway bridge on Steelville-Cuba road, 400 feet below St. Louis-San Francisco Railway bridge, half a mile above Whittenberg Creek, 2 miles below Perigee Spring, and 2 1/2 miles north of Steelville, Crawford County.

Records Available.—December 21, 1922, to September 30, 1924. The United States Weather Bureau has records of stage 1 mile upstream since October 1, 1916.

Extremes of Discharge.—1923-1924: Maximum stage recorded, 12.43 feet May 29, 1924 (discharge, 11,900 second-feet); minimum stage, 0.58 foot October 16, 1923 (discharge, 140 second-feet).

MONTHLY DISCHARGE OF MERAMEC RIVER NEAR STEELVILLE, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 830 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
December 21-31	1,410	150	479	0.577	0.24
January	1,330	210	368	.443	.51
February	2,430	210	564	.680	.71
March	7,160	228	1,250	1.51	1.74
April	3,430	308	636	.766	.85
May	5,290	330	917	1.10	1.27
June	9,720	330	1,200	1.45	1.62
July	455	150	244	.294	.34
August	405	150	190	.229	.26
September	355	160	199	.240	.27
1923-24					
October	228	140	169	0.204	0.24
November	228	172	188	.227	.25
December	6,940	185	848	1.02	1.18
January	290	176	218	.263	.30
February	1,320	237	474	.571	.62
March	2,280	248	507	.611	.70
April	4,850	256	708	.853	.95
May	11,200	209	1,330	1.60	1.84
June	4,850	390	1,250	1.51	1.68
July	4,520	365	860	1.04	1.20
August	10,700	240	878	1.06	1.22
September	3,230	206	466	.561	.63
The year	**11,200**	**140**	**659**	**.794**	**10.81**

MERAMEC RIVER NEAR SULLIVAN, MO.

Location.—In N. ½ SW. ¼ sec. 35, T. 40 N., R. 2 W., at Sappington highway bridge, 3½ miles below Brazil Creek, 4½ miles below Thickety Creek and 6 miles southeast of Sullivan, Franklin County. Gage is in Crawford County.

Records Available.—September 9, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 17.25 feet April 9, 1924 (discharge, 15,400 second-feet); minimum stage, 1.58 feet August 14, 1922 (discharge, 273 second-feet).

The flood of August, 1915, reached a stage of about 30.7 feet (determined by levels to somewhat indefinite flood marks).

MONTHLY DISCHARGE OF MERAMEC RIVER NEAR SULLIVAN, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 1,550 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	1,740	317	452	0.292	0.34
November	540	392	443	.286	.32
December	3,720	376	804	.519	.60
January	3,400	500	1,030	.665	.77
February	5,000	630	1,460	.942	.98
March	10,100	630	2,610	1.68	1.94
April	6,400	720	1,450	.935	1.04
May	8,310	675	1,970	1.27	1.46
June	9,870	870	2,090	1.35	1.51
July	1,020	345	507	.327	.38
August	1,080	330	414	.267	.31
September	540	317	368	.237	.26
The year	10,100	317	1,130	.729	9.91
1923-24					
October	540	304	368	0.237	0.27
November	500	360	401	.259	.29
December	7,710	392	1,520	.981	1.13
January	630	392	464	.299	.34
February	1,860	500	816	.526	.57
March	5,100	462	979	.632	.73

MONTHLY DISCHARGE OF MERAMEC RIVER—Continued.

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1923-'24					
April	11,400	585	1,780	1.15	1.28
May	13,100	426	2,180	1.41	1.63
June	5,100	1,080	2,100	1.35	1.51
July	7,350	500	1,400	.903	1.04
August	6,180	426	1,040	.671	.77
September	4,360	345	732	.472	.53
The year	13,100	304	1,150	.742	10.09

MERAMEC RIVER NEAR EUREKA, MO.

Location.—In SE. ¼ sec. 32, T. 44 N., R. 4 E., at Votaw Ford highway bridge on Eureka-Valley Park road, one-fourth mile below Antire Creek, 1½ miles above St. Louis-San Francisco Railway bridge, 2 miles east of Eureka, St. Louis County, 3 miles below Big River, and 35 miles above mouth.

Records Available.—August 26, 1903, to July 21, 1906, and October 6, 1921, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 24.45 feet April 19, 1922 (discharge, 38,600 second-feet); minimum stage, 0.60 foot September 28, 1922 (discharge, 320 second-feet).

The flood of August 22, 1915, reached a stage of 38.8 feet and the flood of February 1, 1916, a stage of 35.6 feet. (Determined by levels to flood marks.)

MONTHLY DISCHARGE OF MERAMEC RIVER NEAR EUREKA, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 3,800 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	4,200	365	791	0.208	0.24
November	920	525	686	.181	.20
December	9,900	525	1,630	.429	.49
January	7,140	1,080	2,240	.589	.68
February	13,600	1,290	3,860	1.02	1.06
March	27,600	1,380	7,760	2.04	2.35
April	14,900	1,470	3,400	.895	1.00
May	18,500	1,290	4,980	1.31	1.51
June	16,500	1,440	4,880	1.28	1.43
July	1,620	740	999	.263	.30
August	10,000	710	1,510	.397	.46
September	1,530	535	798	.210	.23
The year	27,600	365	2,790	.734	9.95
1923-24					
October	1,210	495	675	0.178	0.21
November	1,630	700	939	.247	.28
December	21,500	820	5,380	1.42	1.64
January	3,060	1,040	1,720	.453	.52
February	6,380	1,210	2,610	.687	.74
March	15,800	1,120	3,120	.821	.95
April	18,100	1,210	4,650	1.22	1.36
May	30,600	820	6,240	1.64	1.89
June	22,400	3,680	7,940	2.09	2.33
July	10,100	1,040	3,250	.855	.99
August	7,940	890	2,120	.558	.64
September	6,120	670	1,430	.376	.42
The year	30,600	495	3,340	.879	11.97

MERAMEC SPRING NEAR ST. JAMES, MO.

Location.—In SE. ¼ sec. 1, T. 37 N., R. 6 W., 600 feet below outlet of Spring, 1 mile above mouth of Spring branch, and 6 miles southeast of St. James, Phelps County.

Records Available.—March 1, 1903, to July 21, 1906, and November 11, 1921, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum discharge, 420 second-feet, March 17, 1923; minimum discharge, 73 second-feet November 27-28, 1923.

MONTHLY DISCHARGE OF MERAMEC SPRING NEAR ST. JAMES, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1922-23			
October	140	81	92.7
November	87	79	83.2
December	203	79	100.
January	162	95	112.
February	299	95	138.
March	420	100	205.
April	316	100	145.
May	282	100	148.
June	334	114	168.
July	137	97	112.
August	147	85	98.5
September	114	83	88.9
The year	420	79	124.
1923-24			
October	87	77	79.9
November	87	73	78.3
December	334	79	145.
January	112	86	94.6
February	234	96	133.
March	283	96	128.
April	266	110	145.
May	352	98	154.
June	370	152	233.
July	388	144	225.
August	300	133	169.
September	215	116	132.
The year	388	73	143.

BOURBEUSE RIVER AT UNION, MO.

Location.—In SW. 1/4 sec. 26, T. 43 N., R. 1 W., at highway bridge on St. Clair-Union road, 800 feet above Flat Creek, 1 mile east of Union, Franklin County, 4 miles below Hamilton Creek, 7 miles above Birch Creek, and 13 miles above mouth.

Records Available.—June, 7, 1921, to September 30, 1924. The United States Weather Bureau has records of stage since October 19, 1916.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 14.70 feet April 2, 1922 (discharge, 14,600 second-feet); minimum stage, 0.80 foot October 5 and 6, 1922: minimum discharge, 38 second-feet October 8, 1923.

Maximum stage recorded by United States Weather Bureau, 27.3 feet August 22, 1915. Flood of 1897 reached a stage of 26.0 feet (exact date unknown).

MONTHLY DISCHARGE OF BOURBEUSE RIVER AT UNION, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 767 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	425	40	71.8	0.094	0.11
November	81	50	61.7	.080	.09
December	2,680	50	262.	.342	.39
January	810	82	226.	.295	.34
February	4,440	160	752.	.980	1.02
March	8,280	235	1,620.	2.11	2.43
April	3,140	190	564.	.735	.82
May	990	117	308.	.402	.46
June	6,540	115	706.	.920	1.03
July	175	66	934.	.122	.14
August	760	65	194.	.253	.29
September	110	42	67.4	.088	.10
The year	8,280	40	411.	.536	7.22
1923-24					
October	114	39	53.5	0.070	0.08
November	275	76	109.	.142	.16
December	11,900	102	1,610.	2.10	2.42
January	650	167	284.	.370	.43
February	3,040	371	776.	1.01	1.09
March	6,080	271	842.	1.10	1.27
April	1,300	97	293.	.382	.43
May	13,500	78	1,820.	2.37	2.73
June	6,770	550	2,310.	3.01	3.36
July	2,230	112	485.	.632	.73
August	1,300	71	265.	.346	.40
September	920	45	175.	.228	.25
The year	13,500	39	752.	.980	13.35

CASTOR RIVER AT ZALMA, MO.

Location.—In S. ½ sec. 29, T. 29 N., R. 9 E., at highway bridge in Zalma, Bollinger County, 2 miles below Perkins Creek, 4 miles above Cato Slough, and 7 miles above Headwater Diversion levee of Little River Drainage District.

Records Available.—September 12, 1921, to September 30, 1924. The Little River Drainage District, Cape Girardeau, has records of stage from July 1, 1919, to September 11, 1921.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 374.0 feet Nov. 20, 1921, and February 2, 1923 (discharge, 8,100 second-feet); minimum stage, 351.10 feet August 31, 1924 (discharge, 30 second-feet).

MONTHLY DISCHARGE OF CASTOR RIVER AT ZALMA, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 395 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	119	41	70.1	0.177	0.20
November	237	84	132.	.334	.37
December	2,360	89	269.	.681	.79
January	5,580	179	822.	2.08	2.40
February	7,980	249	1,400.	3.54	3.69
March	6,900	261	1,570.	3.97	4.58
April	5,310	299	1,040.	2.63	2.93
May	7,200	423	2,260.	5.72	6.60
June	1,870	190	612.	1.55	1.73
July	168	51	94.6	.239	.28
August	874	46	188.	.476	.55
September	157	50	93.6	.237	.26
The year	7,980	41	713.	1.81	24.38
1923-24					
October	325	46	156	0.395	0.46
November	299	135	193	.489	.55
December	1,760	130	555	1.41	1.63
January	509	161	267	.676	.78
February	883	248	435	1.10	1.19
March	680	234	410	1.04	1.20
April	680	134	419	1.06	1.18

MONTHLY DISCHARGE OF CASTOR RIVER—Continued.

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1923-24					
May	3,160	109	347	.878	1.01
June	2,360	248	545	1.38	1.54
July	883	114	292	.739	.85
August	862	30	192	.486	.56
September	455	32	100	.253	.28
The year	3,160	30	325	.823	11.23

ST. FRANCIS RIVER NEAR PATTERSON, MO.

Location.—In N. ½ sec. 16, T. 29 N., R. 5 E., at Black's highway bridge, 1½ miles above Clark's Creek, 4 miles below Big Creek and 3 miles east of Patterson, Wayne County.

Records Available.—June 16, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage determined from flood marks, 20.0 feet November 19, 1921 (discharge, 36,600 second-feet); minimum stage recorded, 2.10 feet August 21, 1922 (discharge, 5 second-feet).

MONTHLY DISCHARGE OF ST. FRANCIS RIVER NEAR PATTERSON, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 956 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	131	17	43.5	0.046	0.05
November	1,080	28	260.	.272	.30
December	8,540	58	718.	.751	.87
January	7,200	294	1,520.	1.59	1.83
February	34,000	426	3,560.	3.72	3.87
March	34,600	590	3,620.	3.79	4.37
April	6,240	508	1,590.	1.66	1.85
May	25,800	750	3,780.	3.95	4.55

MONTHLY DISCHARGE OF ST. FRANCIS RIVER—Continued.

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
June	2,600	250	1,160.	1.21	1.35
July	310	76	117.	.122	.14
August	2,040	76	264.	.276	.32
September	1,260	62	226.	.236	.26
The year	34,600	17	1,400.	1.46	19.76
1923-24					
October	1,150	57	204	0.213	0.25
November	830	93	246	.257	.29
December	12,600	129	2,210	2.31	2.66
January	715	335	465	.486	.56
February	5,460	482	1,420	1.49	1.61
March	5,040	394	1,130	1.18	1.36
Apri	2,080	214	644	.674	.75
May	12,300	152	1,050	1.10	1.27
June	11,200	482	1,620	1.69	1.89
July	2,280	156	727	.760	.88
August	4,340	142	632	.661	.76
September	3,920	68	376	.393	.44
The year	12,600	57	892	.933	12.72

LITTLE RIVER DITCH NO. 1 AT KIRK, MO.

Location.—In sec. 27, T. 19 N., R. 10 E., at St. Louis-San Francisco Railway bridge at Kirk, Dunklin County, 9½ miles below ditch No. 63, the nearest lateral, and 20 miles above the Arkansas State line where the ditch empties into Big Lake.

Records Available.—September 13, 1921, to September 30, 1924. The Little River Drainage District, Cape Girardeau, has records of stage since May, 1920.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 256.25 feet April 4, 1922 (discharge, 5,940 second-feet); minimum stage, 244.80 feet October 1-5, 1922 (discharge, 112 second-feet).

MONTHLY DISCHARGE OF LITTLE RIVER DITCH NO. 1 AT KIRK, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1922-23			
October	144	112	126
November	250	122	192
December	480	238	329
January	4,800	420	1,610
February	5,620	1,230	2,910
March	5,360	1,090	2,960
April	4,030	1,160	1,760
May	5,620	1,160	3,580
June	4,100	810	1,540
July	1,090	290	452
August	290	122	204
September	390	122	236
The year	5,620	112	1,320
1923-24			
October	317	133	200
November	670	238	415
December	4,100	600	1,850
January	2,660	1,020	1,380
February	1,380	845	1,040
March	1,160	740	836
April	810	450	582
May	1,120	510	733
June	1,700	480	813
July	2,220	303	854
August	950	225	512
September	225	144	171
The year	4,100	133	784

LITTLE RIVER DITCH NO. 66 AT KIRK, MO.

Location.—In sec. 27, T. 19 N., R. 10 E., at the St. Louis-San Francisco Railway Co.'s bridge at Kirk, Dunklin County, half a mile below Ditch No. 72, half a mile above Ditch No. 73, 8 miles below Ditch No. 64, the most northerly lateral, and 20 miles above outlet into Big Lake at the Arkansas State line.

Records Available.—September 13, 1921, to September 30, 1924. The Little River Drainage District, Cape Girardeau, has records of stage from May, 1920, to September, 1921.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 253.85 feet May 21, 1923 (discharge, 1,580 second-feet); minimum stage, 243.2 feet October 30 to November 17, 1921 (discharge, 1 second-foot).

MONTHLY DISCHARGE OF LITTLE RIVER DITCH NO 66 AT KIRK, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1922-23			
October	7	3	4.06
November	13	3	7.37
December	112	10	68.1
January	1,210	42	363.
February	1,540	221	764.
March	1,190	197	602.
April	920	197	389.
May	1,580	273	951.
June	974	147	454.
July	173	39	71.8
August	59	16	32.2
September	303	16	120.
The year	1,580	3	319.
1923-24			
October	102	28	56.8
November	333	51	124.
December	1,240	173	608.
January	938	197	364.
February	363	173	242.
March	273	132	162.
April	142	67	94.4
May	618	67	155.
June	333	59	118.
July	132	28	47.8
August	63	8	26.9
September	8	8	8.
The year	1,240	8	168.

LITTLE RIVER DITCH NO. 81 AT KIRK, MO.

Location.—In sec. 27, T. 19 N., R. 10 E., at the St. Louis-San Francisco Railway bridge at Kirk, Dunklin County, 1 mile below the nearest lateral entering above, and 20 miles above the outlet into Big Lake at the Arkansas State line.

Records Available.—September 13, 1921, to September 30, 1924. The Little River Drainage District, Cape Girardeau, has records of stage since May, 1920.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 254.05 feet April 4-5, 1922 (discharge, 2,390 second-feet); minimum discharge, 20 second-feet August 11-20, 1922.

MONTHLY DISCHARGE OF LITTLE RIVER DITCH NO. 81 AT KIRK, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1922-23			
October	42	26	35.3
November	123	36	61.
December	257	67	158.
January	1,980	166	640.
February	2,370	500	1,290.
March	2,250	424	1,320.
April	1,980	424	748.
May	2,340	424	1,320.
June	1,050	292	604.
July	424	140	201.
August	180	50	114.
September	208	50	127.
The year	2,370	26	552.
1923-24			
October	274	68	120.
November	583	118	263.
December	1,920	343	946.
January	1,290	379	626.
February	564	397	455.
March	526	308	360.
April	379	184	247.
May	826	224	341.
June	545	125	263.
July	1,260	98	323.
August	224	80	147.
September	80	57	65.9
The year	1,920	57	348.

SPRING RIVER NEAR WACO, MO.

Location.—On line between secs. 7 and 18, T. 29 N., R. 33 W., at highway bridge on Joplin-Waco road, 700 feet below Brier Branch, 1 mile below Blackberry Creek, 1½ miles above Kansas City Southern railway bridge, 1½ miles east of Waco, Jasper County, and 2½ miles below North Fork.

Records Available.—April 25 to September 30, 1924.

Extremes of Discharge.—Maximum stage recorded during period, 20.12 feet May 29 (discharge, 18,200 second-feet); minimum stage, 1.70 feet May 19 (discharge, 134 second-feet).

MONTHLY DISCHARGE OF SPRING RIVER NEAR WACO, MO., FOR THE YEAR ENDING SEPT. 30, 1924.

(Drainage area, 1,160 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
May	17,600	145	2,530	2.18	2.51
June	15,900	690	3,310	2.85	3.18
July	10,500	360	1,590	1.37	1.58
August	9,460	360	1,650	1.42	1.64
September	2,390	205	436	.376	.42

SHOAL CREEK NEAR JOPLIN, MO.

Location.—In S. ½ sec. 28, T. 27 N., R. 33 W., at Grand Falls hydro-electric plant of Empire District Electric Co., in Newton County, 2 miles below Silver Creek, 2½ miles below Spring Creek, and 4 miles south of Joplin, Jasper County.

Records Available.—April 1 to September 30, 1924.

Extremes of Discharge.—Maximum daily discharge during period, 6,250 second-feet; minimum discharge, 13 second-feet during numerous short periods when plant was shut down and water stored.

MONTHLY DISCHARGE OF SHOAL CREEK NEAR JOPLIN, MO., FOR THE YEAR ENDING SEPT. 30, 1924.

(Drainage area, 458 square miles).

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
April.....	3,060	191	1,680	3.67	4.10
May.....	6,550	262	970	2.12	2.43
June.....	1,960	409	817	1.78	1.99
July.....	6,250	196	697	1.52	1.75
August.....	3,760	337	714	1.56	1.80
September.....	752	231	345	.753	.84

WHITE RIVER AT BEAVER, ARK.

Location.—In sec. 20, T. 21 N., R. 26 W., at Missouri & North Arkansas Railroad bridge, a quarter of a mile east of depot at Beaver, Carroll County, 2 miles above Leatherwood Creek, and 5 miles below Cedar Creek.

Records Available.—July 17, 1909, to December 31, 1910, and May 16 to September 30, 1924.

Extremes of Discharge.—1923-1924: Maximum stage recorded, 18.35 feet May 1, 1924 (discharge, 23,500 second-feet); minimum stage, 2.15 feet August 25 and September 1, 1923 (discharge, 45 second-feet).

MONTHLY DISCHARGE OF WHITE RIVER AT BEAVER, ARK., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 1,270 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1923					
May 16-31....	21,500	2,350	6,950	5.47	3.25
June.....	3,640	448	1,300	1.02	1.14
July.....	980	98	269	.212	.24
August.....	147	45	695	.055	.06
September.....	840	46	203	.160	.18

MONTHLY DISCHARGE OF WHITE RIVER—Continued.

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1923-24					
October	358	108	188	0.148	0.17
November	4,630	335	1,140	.898	1.00
December	11,200	1,060	3,210	2.53	2.92
January	2,240	335	744	.586	.68
February	2,040	510	1,050	.827	.89
March	3,770	405	1,230	.969	1.12
April	13,400	405	1,950	1.54	1.72
May	21,500	430	2,670	2.10	2.42
June	3,900	358	1,390	1.09	1.22
July	2,240	183	495	.390	.45
August	5,530	115	738	.581	.67
September	772	90	255	.201	.22
The year	21,500	90	1,260	.992	13.48

JAMES RIVER AT GALENA, MO.

Location.—In NW. ¼ sec. 7, T. 24 N., R. 23 W., at highway bridge in Galena, Stone County, a quarter of a mile above Missouri Pacific Railway bridge, half a mile above Railey Creek, 8 miles below Crane Creek, and 40 miles above mouth.

Records Available.—October 28, 1921, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 13.50 feet July 12, 1924 (discharge, 18,400 second-feet); minimum stage, 0.74 foot October 17, 1922 (discharge, 77 second-feet).

MONTHLY DISCHARGE OF JAMES RIVER AT GALENA, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	129	78	90.2	0.090	0.10
November	171	78	113.	.113	.13
December	332	90	148.	.148	.17
January	1,920	120	461.	.461	.53
February	4,780	510	1,430.	1.43	1.49
March	8,140	462	2,150.	2.15	2.48
April	2,220	396	751.	.751	.84
May	2,430	374	1,090.	1.09	1.26
June	4,780	635	2,110.	2.11	2.35
July	2,320	242	579.	.579	.67
August	276	112	158.	.158	.18
September	184	104	124.	.124	.14
The year	8,140	78	767.	.767	10.34
1923-24					
October	202	97	148	0.148	0.17
November	2,010	269	735	.735	.82
Decem er	6,980	410	1,570	1.57	1.81
January	930	350	525	.525	.61
February	1,050	530	695	.695	.75
March	3,470	370	710	.710	.82
April	1,610	316	659	.659	.74
May	9,100	300	1,540	1.54	1.78
June	6,980	930	2,680	2.68	2.99
July	6,980	505	1,890	1.89	2.18
August	13,800	580	2,520	2.52	2.90
September	5,740	316	930	.930	1.04
The year	13,800	97	1,220	1.22	16.61

CURRENT RIVER NEAR EMINENCE, MO.

Location.—In SE. ¼ NW. ¼ sec. 15, T. 29 N., R. 3 W., at foot of Coot Mountain, 1 mile below Jack's Fork, 3 miles above Blair Creek, 6 miles below Big Creek, and 8 miles northeast of Eminence, Shannon County.

Records Available.—August 24, 1921, to September 30, 1924.

Extremes of Discharge.—Maximum stage recorded, 14.20 feet November 19, 1921 (discharge not determined); minimum stage, 1.16 feet September 16, 1924 (discharge, 540 second-feet).

MONTHLY DISCHARGE OF CURRENT RIVER NEAR EMINENCE, MO., FOR THE YEAR ENDING SEPT. 30, 1924.

[Drainage area, 1,230 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
October	935	582	649	0.528	0.61
November	750	605	640	.520	.58
December	2,650	655	1,520	1.24	1.43
January	1,080	655	762	.620	.72
February	1,050	685	858	.698	.75
March	3,170	655	1,060	.862	.99
April	1,560	685	959	.780	.87
May	6,200	605	1,170	.951	1.10
June	6,920	1,080	2,140	1.74	1.94
July	1,640	785	1,090	.886	1.02
August	1,320	655	861	.700	.81
September	3,810	540	873	.710	.79
The year	6,920	540	1,050	.854	11.61

CURRENT RIVER AT VAN BUREN, MO.

Location.—In NE. ¼ NW. ¼, sec. 25, T. 27 N., R. 1 W., at highway bridge in Van Buren, Carter County, half a mile below Davis Creek, 3 miles below Henpeck Creek, 3 miles above Carlos Creek, 4 miles above Big Spring, and 5 miles below Mill Creek.

Records Available.—June 18, 1921, to September 30, 1924.

The Missouri Engineering Experiment Station has records at the same site from August 25, 1912, to July 30, 1921.[1]

Extremes of Discharge.—1921-1924: Maximum stage recorded, 10.25 feet Nov. 20, 1921 (discharge, 22,100 second-feet); minimum discharge, 712 second-feet September 16, 1924.

[1]See Missouri Univ. Eng. Exp. Sta. Bull., Sec. 22, Vol. 21, No. 35.

MONTHLY DISCHARGE OF CURRENT RIVER AT VAN BUREN, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

[Drainage area, 1,640 square miles.]

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	1,120	810	851	0.519	0.60
November	980	810	891	.543	.61
December	4,480	810	1,140	.695	.80
January	5,970	1,120	2,300	1.40	1.61
February	21,400	1,250	4,180	2.55	2.66
March	15,800	1,250	4,150	2.53	2.92
April	2,280	1,550	1,900	1.16	1.29
May	15,400	1,900	4,240	2 59	2.99
June	9,220	1.780	3,720	2.27	2.53
July	1,720	1,160	1,340	.817	.94
August	1,250	930	1,040	.634	.73
September	1,080	870	953	.581	.65
The year	21,400	810	2,230	1.36	18.33
1923-24					
October	870	810	860	0.524	0.60
November	930	870	872	.532	.59
December	4,920	870	1,840	1.12	1.29
January	1,450	870	1,000	.610	.70
February	1,250	870	1,110	.677	.73
March	2,860	930	1,220	.744	.86
April	2,420	870	1,210	.738	.82
May	8,120	870	1,500	.915	1.06
June	7,600	1,250	2,460	1.50	1.67
July	1,900	990	1,340	.817	.94
August	1,500	780	1,050	.640	.74
September	3,000	712	938	.572	.64
The year	8,120	712	1,280	.780	10.64

CURRENT RIVER AT DONIPHAN, MO.

Location.—In N. ½ sec. 27, T. 23 N., R. 2 E., at highway bridge three-quarters of a mile west of Doniphan, Ripley County, 2 miles above Briar Creek, and 12 miles below Buffalo Creek.

Records Available.—June 14, 1921, to September 30, 1924. The U. S. Engineer Office, Memphis, Tenn., has records of stage from August, 1918, to June, 1921.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 13.00 feet February 3, 1923 (discharge not determined); minimum stage, 0.48 foot September 17, 1924; minimum discharge, 1,240 second-feet December 25-26, 1922.

MONTHLY DISCHARGE OF CURRENT RIVER AT DONIPHAN, MO., FOR THE YEAR ENDING SEPT. 30, 1924.

(Drainage area, 2,030 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
October	1,960	1,640	1,710	0.842	0.97
November	1,800	1,640	1,690	.833	.93
December	5,270	1,720	2,720	1.34	1.54
January	2,210	1,720	1,860	.916	1.06
February	2,300	1,720	2,040	1.00	1.08
March	3,800	1,800	2,150	1.06	1.22
April	3,520	1,800	2,170	1.07	1.19
May	8,300	1,720	2,390	1.18	1.36
June	7,400	2,350	3,640	1.79	2.00
July	3,260	1,960	2,300	1.13	1.30
August	2,250	1,710	1,880	.926	1.07
September	2,660	1,490	1,680	.828	.92
The year	8,300	1,490	2,180	1.07	14.64

JACK'S FORK AT EMINENCE, MO.

Location.—In W. ½ sec. 26, T. 29 N., R. 4 W., at highway bridge half a mile north of Eminence, Shannon County, 1 mile below Mahan's Creek, 6 miles below Alley Spring branch, and 8 miles above mouth.

Records Available.—October 18, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 10.00 feet February 1, 1923 (discharge, 12,200 second-feet); minimum stage, 0.90 foot September 16, 1924 (discharge, 128 second-feet).

MONTHLY DISCHARGE OF JACK S FORK AT EMINENCE, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

(Drainage area, 376 square miles.)

Month.	Discharge in second-feet.				Run-off in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	
1922-23					
October	199	132	153	0.407	0.47
November	199	143	166	.441	.49
December	1,860	143	261	.694	.80
January	3,200	234	601	1.60	1.84
February	10,900	438	1,470	3.91	4.07
March	6,600	438	1,260	3.35	3.86
April	770	438	527	1.40	1.56
May	6,430	555	1,180	3.14	3.62
June	4,590	350	987	2.62	2.92
July	370	227	284	.755	.87
August	310	173	209	.556	.64
September	272	155	180	.479	.53
The year	10,900	132	600	1.60	21.67
1923-24					
October	241	150	169	0.449	0.52
November	213	152	169	.449	.50
December	1,360	185	511	1.36	1.57
January	310	179	219	.582	.67
February	350	210	242	.644	.69
March	555	170	266	.707	.82
April	415	161	226	.601	.67
May	1,930	147	358	.952	1.10
June	2,610	272	606	1.61	1.80
July	350	206	276	.734	.85
August	505	161	239	.636	.73
September	220	131	150	.399	.45
The year	2,610	131	286	.761	10.37

BIG SPRING NEAR CHICOPEE, MO.

Location.—In sec. 6, T. 26 N., R. 1 E., 1,000 feet above mouth of the spring branch, 4,000 feet below St. Louis-San Francisco Railway bridge over Current River, and 3½ miles southeast of Chicopee, Carter County.

Records Available.—January 8 to June 30, 1922, and April 1, 1923, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum discharge, 840 second-feet May 27, 1923; minimum discharge, 318 second-feet September 15-18, 1924.

MONTHLY DISCHARGE OF BIG SPRING NEAR CHICOPEE, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1923			
April	534	424	493
May	840	424	499
June	472	388	413
July	472	384	416
August	380	344	364
September	358	344	347
1923-24			
October	344	330	342
November	330	330	330
December	404	318	355
January	365	330	338
February	358	330	349
March	388	330	351
April	388	330	351
May	412	344	371
June	472	330	401
July	404	358	381
August	358	330	346
September	344	318	329
The year	472	318	354

ELEVEN POINT RIVER NEAR BARDLEY, MO.

Location.—In NW. ¼ sec. 20, T. 23 N., R. 2 W., at highway bridge on Alton-Doniphan road, 7 miles southwest of Bardley, Oregon County, 7 miles above Fredericks Creek, 12 miles above Arkansas State line, and 20 miles below Greer Spring branch.

Records Available.—October 22, 1921, to September 30, 1924.

Extremes of Discharge.—1922-1924: Maximum stage recorded, 10.64 feet March 16, 1923 (discharge not determined); minimum stage, 1.42 feet December 20, 21, 25, and 26, 1922; minimum discharge, 315 second-feet September 30, 1924.

MONTHLY DISCHARGE OF ELEVEN POINT RIVER NEAR BARDLEY, MO., FOR THE YEAR ENDING SEPT. 30, 1924.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
October	425	385	399
November	405	332	363
December	800	332	509
January	505	368	410
February	650	385	464
March	550	368	426
April	700	350	409
May	1,040	368	554
June	1,290	600	755
July	700	485	558
August	1,550	405	556
September	425	315	362
The year	1,550	315	481

GREER SPRING AT GREER, MO.

Location.—In SE. ¼ SW. ¼, sec. 36, T. 25 N., R. 4 W., 250 feet below Greer Spring Milling Co.'s dam, 500 feet below second spring, 850 feet below first spring at mouth of cave, 1 mile north of Greer, Oregon County, and 1¼ miles above mouth of the spring branch.

Records Available.—August 10 to December 30, 1904, and November 18, 1921, to September 30, 1924.

Extremes of Discharge.—1921-1924: Maximum stage recorded, 1.68 feet April 11, 1922 (discharge, 835 second-feet); minimum stage, 0.88 foot December 23-26, 1922 (discharge, 204 second-feet).

MONTHLY DISCHARGE OF GREER SPRING AT GREER, MO., FOR THE YEARS ENDING SEPT. 30, 1923 AND 1924.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1922-23			
October	282	270	273
November	282	259	270
December	270	204	236
January	522	248	352
February	655	353	521
March	655	353	500
April	503	353	444
May	636	336	466
June	579	465	507
July	446	285	356
August	370	302	333
September	336	285	300
The year	655	204	380
1923-24			
October	285	240	264
November	270	225	239
December	344	225	291
January	302	232	250
February	248	225	244
March	240	210	224
April	240	210	226
May	560	270	316
June	579	353	441
July	465	353	387
August	353	285	328
September	285	225	253
The year	579	210	289

PUBLICATIONS OF THE BUREAU OF GEOLOGY AND MINES.

The following is a complete list of the publications issued by the present Bureau of Geology and Mines and former Geological Surveys. The reports of the second series are given first, since most of these are still available for distribution. A majority of those listed under the headings of Former Surveys are exhausted. The volumes available are distributed free upon receipt of transportation charges.

By a recent postal ruling, books may be sent by parcel post. By knowing the weight of the volume given in this list the exact postage can therefore be determined at any postoffice. The Biennial Reports are sent at a uniform charge of 10 cents. All publications sent to foreign countries go at the rate of two ounces for one cent.

The reports may be obtained upon application to H. A. Buehler, State Geologist, Rolla, Missouri.

Vol. No. 2nd series.		Weight (ounces)
I.	*Geology of Miller County, by E. R. Buckley, A. F. Smith and S. H. Ball, xvi + 207 pp., XVIII pls., including geologic map, 56 figs. 1913..... Describes the topography, general geology, and mineral resources of Miller County, Mo.	33
II.	*The Quarrying Industry of Missouri, by E. R. Buckley and H. A. Buehler, xv + 371 pp., LIX pls., including geologic map of Missouri. 1904.... Discusses properties, geology, distribution and laboratory tests of Missouri granites, rhyolites, limestones and sandstones and describes the quarries from which they are obtained.	56
III.	*The Geology of Moniteau County, by F. B. Van Horn, ix + 104 pp., XIII pls., including geologic map, 25 figs. 1905..... Describes the topography, general geology and mineral resources of Moniteau County, Mo.	24
IV.	Geology of the Granby Area, by E. R. Buckley and H. A. Buehler, viii + 120 pp., XLII pls., including general geologic, topographic and outcrop, 3 figs. 1906..... Describes the general geology, occurrence of lead and zinc ores of the Granby Area in Newton County, Mo., and discusses the genesis of the ores of southwestern Missouri.	34
V.	*Public Roads, their improvement and maintenance, by E. R. Buckley, xiii + 124 pp., XXX pls. 1907..... Contains specifications for building roads, directions for their construction, improvement and upkeep, a chapter on road materials, etc.	29
VI.	*The Lime and Cement Resources of Missouri, by H. A. Buehler, xvi + 255 pp., XXXVI pls., including a geologic map of Missouri, showing location of lime and cement plants. 1907..... Discusses properties, manufacture and production of lime and cement, the distribution of lime and cement resources by counties, including analyses and a chapter on the geological formations of Missouri and their composition.	45

*Edition exhausted.

Vol. No. 2nd series.		Weight (ounces)
VII.	The Geology of Morgan County, by C. F. Marbut, xiv + 97 pp., XIX pls., including a geologic map of Morgan County, 19 figs. 1908..... Describes the topography, general geology and mineral resources of Morgan County, Mo.	25
VIII.	*The Geology of Pike County, by R. R. Rowley, xiv + 122 pp., XX pls., 13 figs., geologic map of Pike County. 1908..... Describes the topography, general geology, mineral resources and paleontology of Pike County, Mo.	27
IX.	Geology of the Disseminated Lead Deposits of St. Francois and Washington counties, by E. R. Buckley, 2 pts.; pt. 1. xvi + 259 pp., pls. I-XXXIX, 10 figs.; pt. 2, pls. XL-CXXI, including a general geologic map of southeastern Missouri. 1909..... Discusses location, history, production, physiography, general geological history, structure, mines, ores, genesis of the ores of southeastern Missouri, with a chapter on barite and galena in the Potosi formation.	84
X.	*The Iron Ores of Missouri, by G. W. Crane, xvi + 434 pp., XLVII pls., 29 figs., and geologic map of Missouri showing the location of the iron deposits. 1912..... Discusses the history, development, production, types and distribution of Missouri iron ores and general geology and physiography of the ore-bearing district.	64
XI.	*The Coal Deposits of Missouri, by Henry Hinds, xi + 503 pp., XXIIII pls. 97 figs., and maps of the Clinton, Calhoun, Lexington, Bevier, Huntsville and Richmond quadrangles and geological map of Missouri. 1912..... Describes briefly the Pennsylvanian series in Missouri and discusses in detail the mode of occurrence, coal industry, the distribution by counties, analysis, and tests of Missouri coal.	59
XII.	The Geology of the Rolla Quadrangle, by Wallace Lee, xii + 111 pp., X pls., 17 figs., topography and geologic maps of the Rolla Quadrangle, 1913..... Describes the topography, physiographic history, general geology and mineral resources of the Rolla Quadrangle in Phelps and Dent counties, Mo.	23
XIII.	The Stratigraphy of the Pennsylvania Series in Missouri, by Henry Hinds and F. C. Greene, with a chapter on Invertebrate paleontology by G. H. Girty, 500 + pp., XXXII pls., 5 figs. 1915.....	50
XIV.	The Geology of Jackson County, by W. E. McCourt assisted by M. Albertson and J. W. Bennett. 158 pp., XIX pls., including geologic maps and cross sections. 1917..... Describes topography, general geology and mineral resources of county and includes brief discussion of history and settlement.	30
XV.	The Sand and Gravel Resources of Missouri, by C. L. Dake. 250 pp., XLVII pls., including a large number of maps. 1918..... Discusses nature and uses of sand and gravel, types found in Missouri and the Geology of Missouri sands and gravels. A large number of screen tests and analyses are contained in the report.	45
XVI.	The Occurrence of Oil and Gas in Missouri, by Malcolm E. Wilson. 1922. Discusses the oil and gas possibilities of Missouri.....	45
XVII.	The Devonian of Missouri, by E. B. Branson, J. S. Williams, V. O. Tansey and G. A. Stewart, X + 279 pp., A-H + 71 pls., 10 figs. 1922..... Describes the distribution of the Devonian formations in Missouri and gives detailed descriptions and synonomy of the paleontology. Of interest chiefly to geologists.	58
XVIII.	Structural Reconnaissance of the Mississippi Valley Area from Old Monroe, Missouri, to Nauvoo, Illinois, by Frank Krey, 86 pp., 18 pls. 1924. This report (in co-operation with the Illinois Geological Survey) gives detailed descriptions of structural conditions in the area as a guide to oil prospecting.	15

*The Oil and Gas Possibilities of the Belton Area, by Malcolm E. Wilson. Describes geology and geologic structure in southwest Jackson and northwest Cass counties. A pamphlet containing 39 pp., III pls., including geologic structure map. 1918.

Mineral Resources of Missouri, by H. A. Buehler. A pamphlet of 36 pp., about one-half being illustrations. Brief paragraphs on the distribution of the mineral resources of the state.

Biennial Reports.

These reports describe the work of the Bureau and contain a chapter on the mineral production of the state with statistics for the previous two years. Starting with the report to the 52nd General Assembly they also contain an account of the investigation of the water resources of the state with records of stream flow.

	Postage.
Biennial Report of the State Geologist to the 42nd General Assembly, by E. R. Buckley, 83 + 3 pp., VIII pls. 1903	10c
Biennial Report of the State Geologist to the 43rd General Assembly, by E. R. Buckley, 56 pp., III pls. 1905	10c
Biennial Report of the State Geologist to the 44th General Assembly, by E. R. Buckley, 57 pp. 1907	10c
Biennial Report of the State Geologist to the 45th General Assembly, by H. A. Buehler, 59 pp. 1909	10c
Biennial Report of the State Geologist to the 46th General Assembly, by H. A. Buehler, 68 pp., VI pls. 1911	10c
Biennial Report of the State Geologist to the 47th General Assembly, by H. A. Buehler, 54 pp., III pls. 1913	10c
Biennial Report of the State Geologist to the 48th General Assembly, by H. A. Buehler, 62 pp., IV pls. 1915	10c
Biennial Report of the State Geologist to the 49th General Assembly, by H. A. Buehler, 75 pp., I pl. 1917	10c
Biennial Report of the State Geologist to the 50th General Assembly, by H. A. Buehler, 117 pp., IV pls. 1919	10c
Biennial Report of the State Geologist to the 51st General Assembly, by H. A. Buehler, 87 pp., IV pls. 1921	10c
Biennial Report of the State Geologist to the 52nd General Assembly, by H. A. Buehler, 133 pp., V pls., 1 map. 1923	10c
Biennial Report of the State Geologist to the 53rd General Assembly, by H. A. Buehler. 143 pp.. IV pls. 1925	10c

Maps.

Base Map of Missouri, compiled in co-operation with the United States Geological Survey. Shows elevations of towns. Unmounted	15c
Geological Map of Missouri, 1922	25c
Joplin District township maps; scale, 4 inches to the mile, T. 27 to 29, R. 32 to 34, inclusive, each, 1922	10c
*Lawrence County Topographic Map, 1922	20c
Ste. Genevieve County Topographic Map, 1922	25c
Ste. Genevieve County Geological Map, 1922	25c

Former Surveys.

The following is a list of publications of this Bureau up to the publication of volume 13, 1st series. In this list the publications of the Survey are arranged in the order in which they were transmitted for publication. *Editions exhausted.

1. **Report of a Geological Reconnoissance* of that part of the State of Missouri adjacent to the Osage River, made to William H. Morell, chief engineer of the State, by order of the Board of Internal Improvement, by Henry King, M. D. Geologist. (Senate Journal, Appendix, 1st Session, 11th General Assembly, pages 506-535.) Jefferson City, 1840.
2. **First and Second Annual Reports* of the Geological Survey of Missouri, by G. C. Swallow, State Geologist, 448 pages, 17 plates, 18 sections, 26 figures and 5 maps, 8 vo. cloth, Jefferson City, December, 1855.
3. **Third Report of Progress* of the Geological Survey of Missouri, by G. C. Swallow, 3 pages, Jefferson City, December, 1856.
4. **Fourth Report of Progress* of the Geological Survey of Missouri, by G. C. Swallow, 8 pages. Jefferson City, December, 1858.
5. **Fifth Report of Progress* of the Geological Survey of Missouri, by G. C. Swallow, 13 pages. Jefferson City, December, 1860.
6. **Geological Report of the Southwestern Branch of the Pacific Railroad, State of Missouri*, by G. C. Swallow, xvii + 93 pp., 2 pls., fold map. St. Louis. 1859.
7. **Annual Report of the State Geologist* of the State of Missouri, by Albert D. Hager, 23 pages. Jefferson City, December, 1870.
8. **Report of Geological Survey* of the State of Missouri, 1855-1871, by G. C. Broadhead, F. B. Meek and B. F. Shumard, 327 pages, 29 illustrations and 9 maps, 8 vo., cloth. Jefferson City, March, 1873.

9. **Preliminary Report on the Iron Ores and Coal Fields* from the field work of 1872, by R. Pumpelly, A. Schmidt, G. C. Broadhead and W. B. Poter, 671 pages, 190 illustrations and an atlas with 14 large sheets, 8 vo., cloth. Jefferson City, April, 1873.
10. **Report of the Geological Survey* of the State of Missouri, including field work of 1873-1874, by G. C. Broadhead, 794 pages, 91 illustrations and an atlas of 15 sheets, 8 vo. cloth. Jefferson City, August, 1874.
11. **Industrial Report on Lead, Zinc and Iron*, together with notes on Shannon county and its copper deposits, by Chas. P. Williams, Ph. D., Acting State Geologist, 199 pages and 11 illustrations, 8 vo., cloth. Jefferson City, December, 1876.
12. **Bulletin No. 1.* By Arthur Winslow, G. E. Ladd, A. E. Woodward and G. Hambach, 85 pages and 2 sketch maps. Jefferson City, April, 1890.
13. **Bulletin No. —.* A Bibliography of the Geology of Missouri, by F. A. Samson, 76 pages, 810 titles. Jefferson City, December, 1890.
14. **Bulletin No. 2.* By G. E. Ladd and A. E. Woodward, 101 pages, 4 plates, 3 sections and 2 sketch maps. Jefferson City, December, 1890.
15. **Biennial Report of the State Geologist*, transmitted to the 36th General Assembly, Arthur Winslow, State Geologist, 53 pages, 2 diagrams. Jefferson City, January, 1891.
16. **Bulletin No. 4.* A description of some Lower Carboniferous Crinoids from Missouri, by S. A. Miller, 40 pages and 5 plates. Jefferson City, February, 1891.
17. **Bulletin No. 5.* By Erasmus Haworth and G. E. Ladd, 86 pages, 5 plates and 5 figures. Jefferson City, July, 1891.
18. **A Preliminary Report on the Coal Deposits of Missouri*, by Arthur Winslow, 226 pages, 131 illustrations and 1 map, 8 vo, cloth. Jefferson City, November, 1891.
19. **Vol. II. A Report of the Iron Ores of Missouri*, by F. L. Nason, 366 pages, 8 plates, 62 illustrations and 1 map, 8vo, cloth. Jefferson City, December, 1892.
20. **Vol. III. A Report on the Mineral Waters of Missouri*, by Paul Schweitzer, including notes of A. E. Woodward, 256 pages, 23 plates, II figures and 1 map, 8vo, cloth. Jefferson City, December, 1892.
21. **Biennial Report of the State Geologist*, transmitted to the 37th General Assembly, Arthur Winslow, State Geologist, 37 pages, 3 diagrams. Jefferson City, January, 1893.
22. **Vol. IV. Paleontology of Missouri (Part I)*, by C. R. Keyes, 271 pages, 32 plates and 9 figures, 8vo, cloth. Jefferson City, June, 1894.
23. **Vol. V. Paleontology of Missouri (Part II)*, by C. R. Keyes, 266 pages, 24 plates and 2 figures, 8vo, cloth. Jefferson City, June, 1894.
24. **Vol. VI. Lead and Zinc Deposits (Part I)*, by Arthur Winslow, 287 pages, 12 plates and 71 figures, 8vo, cloth. Jefferson City, July, 1894.
25. **Vol. VII. Lead and Zinc Deposits (Part II)*, by Arthur Winslow, 383 pages, 29 plates and 268 figures, 8vo, cloth. Jefferson City, July, 1894.
26. **Vol. VIII. Annual Report with Accompanying Papers*, by C. R. Keyes, 395 pages, 30 plates, 16 figures and 1 map, 8vo, cloth. Jefferson City, December, 1894.
27. **Biennial Report of the State Geologist*, transmitted to the 38th General Assembly, C. R. Keyes, State Geologist, 60 pages. Jefferson City, January, 1895.
28. **Vol. IX. Reports on Areal Geology (Sheets 1-4)*, by C. R. Keyes, A. Winslow, C. H. Gordon, Erasmus Haworth and F. L. Nason, 430 pages, 22 plates, 53 figures, 3 folio plates and 4 maps, 8vo, cloth. Jefferson City, April, 1896.
29. **Vol. X. Surface Features of Missouri and Bibliography*, by C. R. Keyes, C. F. Marbut and J. E. Todd, 533 pages, 22 plates and 24 figures, 8vo, cloth. Jefferson City, June, 1896.
30. **Vol. XI. Clay Deposits*, by H. A. Wheeler, E. M., 622 pages, 39 plates, 15 figures and 2 maps, 8vo, cloth. Jefferson City, November, 1896.
31. **Biennial Report of the State Geologist*, transmitted to the 39th General Assembly, C. R. Keyes, State Geologist, 63 pages, 7 plates and 2 figures. Jefferson City, December, 1896.
32. **Vol. XII. Areal Geology (Sheets 5-10)*, E. M. Shepard, C. F. Marbut and G. C. Broadhead, edited by C. F. Marbut, 656 pages, 13 plates, 39 figures and 6 maps, 8vo, cloth. Jefferson City, December, 1898.
33. **Biennial Report of the State Geologist*, transmitted to the 40th General Assembly, by John A. Gallaher, State Geologist, 68 pages. Jefferson City, December, 1898.
34. **New Year Announcement of the Bureau of Geology and Mines*, by J. A. Gallaher, State Geologist, 27 pages. Jefferson City, January, 1900.
35. **Vol. XII. Preliminary Report on the Structural and Economic Geology of Missouri*, by John A. Gallaher, State Geologist, 260 pages, 65 plates, 9 sections and 6 figures, 8vo, cloth. Jefferson City, September, 1900. (Weight, 46 ounces.)
36. **Biennial Report of the State Geologist*, transmitted to the 41st General Assembly, by Leo Gallaher, Act. State Geologist, 55 pages. Jefferson City, January, 1901.

FINANCIAL STATEMENT FOR 1923 AND 1924*—SUPPORT FUND.

1923.

H. A. Buehler	$5,395.43
W. F. Pond	2,867.14
J. M. Thiel	2,782.51
R. E. Murphy	300.00
R. H. Hall	344.41
J. S. Williams	1,184.11
C. O. Reinoehl	1,921.36
H. W. Mundt	1,785.00
J. I. McCaw	1,080.00
Office	2,379.84
C. L. Dake	1,479.13
J. Bridge	1,302.24
W. A. Tarr	657.64
Mound City Engraving Co	184.58
W. D. Turner	666.40
E, M. Shepard	107.60
R, B. Rutlege	582.26
H. S. McQueen	1,339.52
G. L. Knight	705.99
E. T. Campbell	522.24
G. G. Harris	283.36
B. D. Jones	400.00
Hugh Stephens Printing Co	1,466.74
A. Hoen & Co	795.50
M G. Mehl	473.12
Henry Heil Chemical Co. (supplies)	18.00
Long Motor Co	147.90
Bemis Bag Co. (cloth bags)	124.35
E. B Branson	141.11
J. G. Parker	300.00
Perry Love	158.00
Total	$31,895.48

1924.

H. A. Buehler	$6,090.25
W. F. Pond	3,064.73
J. M. Thiel	1,645.57
J. S. Williams	1,172.65
C. O. Reinoehl	2,165.66
H. W. Mundt	1,850.00
J. I. McCaw	1,150.00
Office	2,181.50
C. L. Dake	1,375.15
J. Bridge	903.27
W. A. Tarr	56.54
Mound City Engraving Co	330.34
E. M. Shepard	54.03
R. B. Rutledge	1,684.65
H. S. McQueen	2,201.81
B. D. Jones	1,166.67
R. F. Flint	747.96
Hugh Stephens Printing Co	2,657.56
E. E. Hawkins	620.00
Underwood Typewriter Co	88.29
Wm. Ainsworth & Sons	59.00
St. Louis Paper Can Co	40.08
A. A. Smith (postage)	221.88
I. A. Keyte	199.98

Frank Krey	450 00
Missouri School of Mines	69.49
Total	$32,247 06

FINANCIAL STATEMENT FOR 1923 AND 1924*—WATER POWER FUND.

1923.

H. C. Beckman	$2,763.10
V. L. Austin	685.02
W. S. Frame	1,083.82
H. E. Zoller	145.00
E. L. Williams	192.24
W. R. Denison	60.00
Gage Readers	1,955.20
Total	$6,884.38

1924.

H. C. Beckman	$4,099.16
V. L. Austin	1,690.62
W. S. Frame	1,482.51
Gage Readers	2,332.65
F. W. Hughes	1,423.48
Long Garage	440.50
Total	$11,468.92

FINANCIAL STATEMENT FOR 1923 AND 1924*—TOPOGRAPHIC FUND.

1923.

F. L. Whaley and party	$3,215.70
J. M. Rawls and party	2,064.24
C. L. Sadler and party	2,802.29
J. B. Leavitt and party	2,499.06
W. R. Broaddus and party	1,461.92
I. F. Hazelwood	321.40
E. L. McNair	804.04
A. L. McCrae	15.74
J. L. Saunders and party	2,902.08
Total	$16.086.47

1924.

F. L. Whaley and party	$2,039.41
J. M. Rawls and party	1,574.54
C. L. Sadler and party	1,944.66
J. B. Leavitt and party	3,935.76
W. R. Broaddus	678.21
C. R. Fisher and party	3,580.66
C. E. Bardsley	1,247.94
E. C. Metzeroth	899.97
Total	$15,901.15

*Figures for December, 1924, include only salaries of permanent staff.