
ADMINISTRATIVE REPORT

TWENTY-SECOND ANNUAL

Report of the State Geologist

IOWA GEOLOGICAL SURVEY,
DES MOINES, DECEMBER 31, 1913.

To Governor George W. Clarke and Members of the Geological Board:

GENTLEMEN:—I have the honor to report that during the year 1913 the Iowa Geological Survey successfully carried forward the investigations which were approved by you at the beginning of the field season. In accordance with the well established policy of the Survey each investigator was assigned the kind of work for which he was best fitted by training and experience. The work of the Survey for the year 1913 may be summarized as follows:

AREAL GEOLOGY.

Detailed areal work and geological mapping was carried forward in Audubon and Shelby counties by Bohumil Shimek, who had already done considerable work in this part of the state. As an aid in the interpretation of the Pleistocene geology of Audubon and Shelby counties, Professor Shimek made a detailed study of numerous deep cuts which, fortunately, had but recently been made, just north of Audubon and Shelby counties, between Coon Rapids and Manilla, by the Chicago, Milwaukee and St. Paul Railway Company.

The Director of the Survey continued his studies of the geology of Lucas county and also did some work in Union county. The Assistant State Geologist continued his work on the geology of Crawford county and also on the physiographic features of the Missouri slope of western Iowa.

The field work in Floyd county was completed by A. O. Thomas, in Clarke county by J. L. Tilton, in Cass county by J. E. Gow, and in Calhoun and Greene counties by T. H. Macbride. Reports on these counties are now being prepared for publication.

ROAD AND CONCRETE MATERIALS.

For several years S. W. Beyer, H. F. Wright and assistants have been making a detailed investigation of the road and concrete materials of the state. The field work and the laboratory tests were completed during the year, the latter having been made at the Experiment Station of Iowa State College. The manuscript is ready for publication. A preliminary report was prepared for the members of the last General Assembly. The complete report will constitute a large part of Volume XXIV of the publications of the Survey.

The information contained in this report will be of great value to the people of the state. There never was a time when the people were more interested than they now are in the subject of good roads. Only recently, for the first time, has a Highway Commission been created in this state. There is reason to believe that under the wise direction and supervision of efficient engineers the roads of Iowa will soon compare favorably with the best roads of the other states of the country. Road improvement and road building depend largely upon the availability of sand and gravel; clay, limestone, sandstone, glacial boulders, and the manufactured products of clay and limestone. It is gratifying to know that the investigations of Doctor Beyer and his assistants have shown that the majority of the counties of Iowa are amply supplied with materials suitable for one or more types of road that are believed to be practical under existing conditions.

INDUSTRIAL WATERS.

During the summer of 1913 George A. Gabriel continued the investigations of the previous year on the surface waters of Iowa, to ascertain with definiteness their industrial applicability. The publication of the conclusions of these investigations will be of great value to many corporations and communities which have recently awakened to a realization of the great waste resulting from the use of unsuitable waters.

ARTESIAN WATERS.

Volume XXI of the Survey reports, on the Underground Waters of Iowa, was published last year. This report is proving to be of inestimable value to the people of Iowa in connection with the problem of water supply for domestic and other pur-

poses. It has been most favorably reviewed in the geological journals of America and Europe. Since the publication of this volume the Survey has continued to keep records of the deep wells that have been sunk within the state, and from time to time it will publish information additional to that given in the published report. Professor Norton continues to be in charge of this work.

PLEISTOCENE PROBLEMS.

J. E. Carman of the University of Cincinnati has completed a detailed investigation of the drift sheets of northwestern Iowa. His work has made it possible to prepare a more accurate map than the present one of the soils and other surface features of this part of the state. Professor Carman's report will soon be ready for publication.

STRATIGRAPHIC GEOLOGY.

Many of the problems of geology are not limited to a single state but embrace several adjoining states. In the investigation of such problems it is of great advantage from every standpoint to have close coöperation among the various geological surveys concerned. At the present time several of the state surveys, including those of Oklahoma, Kentucky, Ohio, Illinois, Missouri and Iowa, are interested in a thorough study of the Mississippian rocks which occur in these states. During the summer of 1913 the surveys of Illinois, Missouri and Iowa employed Professor Stuart Weller of the University of Chicago, who has been for many years a student of the stratigraphy and paleontology of the Mississippian series, to act in an advisory capacity in the study of the Mississippian rocks of their respective states. Under the supervision of Professor Weller field work in Iowa was done by Francis M. Van Tuyl, who made detailed sections of the rocks in the southeastern part of the state and collected numerous fossils which will be of great service in correlating the Mississippian rocks of Iowa with those of adjacent states.

A. O. Thomas began a detailed investigation of the stratigraphy and paleontology of the Devonian rocks of the state.

THE STREAMS OF THE STATE.

In connection with the study of the flow, floods and water-power of the streams of the state gaging stations have been established for some time on the Des Moines, Cedar, Wapsipinicon

and Iowa rivers. During the summer of 1913 additional stations were established on some of the above streams, and also on Upper Iowa, Maquoketa, Turkey and Skunk rivers. At these stations gage readings are systematically being made. Discharge measurements also are being made at low and high water stages of the streams. The work is being done by the Iowa Geological Survey in coöperation with the Water Resources Branch of the United States Geological Survey, each survey bearing half the expense.

COOPERATIVE TOPOGRAPHIC MAPPING.

The Iowa Geological Survey continued to coöperate with the United States Geological Survey in making topographic maps of areas selected by the Director of the Iowa Survey. The Iowa Geological Survey spent \$1,750 in this work, and the United States Geological Survey spent an equal amount for field work. As in former years the Iowa Survey paid half the expenses of the field whereas the United States Geological Survey paid half the expenses of the field and all other costs connected with drawing, engraving and publishing the maps.

The field work was done under the supervision of R. B. Marshall, Chief Geographer of the United States Geological Survey, on the Boone, Attica, Chariton and New Virginia sheets. The drafting of the Ames topographic map was completed and the map was transmitted for engraving.

The topographic maps of Iowa already issued are proving to be of great value, and it is strongly recommended that the next legislature be urged to appropriate to the Survey a much larger amount than is now available for this important work. The state of Illinois is spending \$10,000 a year for topographic work, in which state the United States Geological Survey spends an equal amount. In Ohio about \$45,000 a year is being expended, in Minnesota \$20,000 yearly, and in Missouri \$12,000. The Iowa Geological Survey should have at least \$10,000 a year for topographic mapping. If this amount were duplicated, as it probably would be, by the United States Geological Survey it would be possible to complete the topographic map of the state in a much shorter time than can be done with our present small appropriation.

The development of the state in connection with a highway system, drainage projects, steam and interurban railways and in many other ways demands the preparation of topographic maps as rapidly as possible. Further delay will but add to the great financial loss that the state has already suffered through a lack of such maps. At the last meeting of the Iowa Engineering Society, and also at a recent meeting of the Iowa Academy of Science, resolutions were adopted urging that efforts be made to secure for the Iowa Geological Survey increased appropriations for this important work.

ANALYSES OF IOWA COALS.

The Survey has already published much valuable information about the coals of the state. It now has ready to be published an additional report that will be of great value to all persons who are interested in the coal industry of Iowa. The report has been prepared by A. W. Hixson. It consists of proximate and ultimate analyses of sixteen representative coals of Iowa, accompanied by a thorough discussion of these analyses. The investigation has shown that Iowa coals have a low heat value on account of their high sulphur and moisture content; that the high sulphur content, moreover, renders the coals unsuitable for the manufacture of coal or water gas, and causes them to be destructive to grates and fire boxes. The coals weather somewhat rapidly, which is an unfavorable feature in connection with long storage of the coals. The characters of Iowa coals with regard to the manufacture of producer gas and coke, the probable effect of washing the coals, and many other features are interestingly discussed. It is stated that the Iowa coals compare favorably with those of northern Illinois and Missouri. In the closing pages of the report is a discussion of the purchase of coal under specification. Professor Hixson's report will be published as a part of Volume XXIV of the Survey.

THE CLAY PLANTS OF THE STATE.

During the summer of 1913 A. P. Potts of Iowa State College collected samples of clay from the various plants of the state which are using the shales of the Des Moines stage. In the laboratory, Professor Potts will subject these clays to detailed tests in order to secure information which may be of value to the industrial users of clays.

MINERAL STATISTICS.

Early in 1913 the Iowa Geological Survey in coöperation with the United States Geological Survey compiled the statistics of mineral production in Iowa for the year 1912. The value of the output was \$22,910,066, which is higher than any previous figure of record. The year 1910 previously held the record, the value of the output for that year having been \$22,744,572, which output exceeded that for 1911 by \$1,790,955. Coal was in 1912, as in previous years, the leading mineral product. Its value at the mines was \$13,152,088, which was fifty-seven per cent of the total value of the mineral industry of the state. The five leading coal producing counties in order of rank were Monroe, Polk, Appanoose, Mahaska and Dallas. These same counties held similar rank in 1911. The average price of coal at the mine was \$1.80 a ton, which is the highest average price on record in Iowa. The average number of men employed in coal mining was 16,370.

The value of clay and clay products was \$4,524,492, which exceeded the figure for 1911 but was less than that for 1910 when the record value of \$5,335,036 was reached. Of the total value drain tile contributed \$2,293,084 and common brick \$1,017,097. In the production of clay and clay products, Webster county with ten producers ranked first, Cerro Gordo county with seven producers, second, Polk county with eleven producers, third, and Woodbury county with three producers, fourth. These four counties contributed sixty per cent of the total value of the clay industry.

The value of cement sold in 1912 reached the figure of \$2,790,396. This was an increase of nearly fifty per cent over the value of 1911, which was \$1,881,253. With three modern plants of large capacity, and with an abundance of excellent raw material available, larger and larger productions of cement may be expected.

The figures for stone and lime and for sand and gravel were larger for 1912 than for any previous year. The value of the stone and lime was \$998,236 and of the sand and gravel \$563,409. A large part of the stone was used for concrete and railroad ballast. Lee county produced more than one-third of the total

output. This was due to a considerable extent, to the large amount of limestone used by the Mississippi Power Company in the construction of the Keokuk dam.

The value of the gypsum output was less in 1912 than in 1911. Decreases were also shown in the values of mineral waters and sand lime brick.

Some months ago the mineral statistics for 1911 and 1912 were published and distributed to the mineral producers of the state. These statistics will be published also in Volume XXIV of the Survey.

THE CENTERVILLE GYPSUM DEPOSIT.

A brief reference was made to the Centerville gypsum deposit in Volume XXI of the reports of the Survey. Recently, a somewhat detailed account of the deposit was written by the Director of the Iowa Geological Survey for publication by the United States Geological Survey.*

The discovery of a deposit of gypsum in the Mississippian rocks of southern Iowa is of scientific interest. Whether or not this gypsum will prove to be of economic importance has yet to be determined. The evidence indicates that the deposit may be extensive and the gypsum is of good quality. The presence of anhydrite decreases the value of the deposit for making wall plaster and related products. The relation of the anhydrite to the gypsum and the relative amounts of the two minerals will have an important bearing on the commercial value of the deposit. However, anhydrite is considered by some manufacturers of Portland cement to be practically as serviceable as gypsum.

The fact that the deposit is more than five hundred feet below the surface and the presence of large amounts of artesian water are factors unfavorable to the mining of the gypsum. On the other hand, the deposit is well located with regard to fuel and transportation, and it is fair to assume that if gypsum products were made in this part of the state a good market for such products could soon be developed.

PUBLICATIONS OF THE SURVEY.

During the year 1913 the Iowa Geological Survey published and distributed to the people of the state a Bibliography of

*Kay, George F., A New Gypsum Deposit in Iowa: Bull. U. S. Geol. Survey, No. 580-E.

Iowa Geology and Mining and a bulletin on the Weed Flora of Iowa. The former which is Volume XXII of the Survey is a complete bibliography of all that has been written with regard to the geology of the state. The author of the volume was Dr. Charles Keyes, a former Assistant State Geologist of the Survey. Preceding the bibliography proper are chapters on Geographic Exploration of Iowa-Land, Geologic Reconnaissance in Iowa, Historical Sketch of Mining in Iowa, and Systematic Geologic Surveying in Iowa. In these chapters some exceedingly interesting facts are presented. The discussion of geographic exploration covers a period of three centuries. Reference is made to the influence that early trade routes had upon settlement and the establishment of commercial enterprises. In the chapter on geological reconnaissance it is pointed out that some of the earliest geological work in America was done within the limits of our own state. The chapter on the history of mining in Iowa brings out the fact that the first discovery of lead and zinc in America was in the Dubuque region; that mineral coal was used by the Iowa Indians before the advent of Europeans in the region; and that coal was mined here one hundred and fifty years previous to its discovery in Pennsylvania. The first practical experiment in the conservation of our mineral resources was tried out seventy-five years ago in Iowa by the Federal Government, and proved a dismal failure. At one time the Dubuque region produced nine-tenths of the lead of the United States, and one-tenth of the world's supply. This bibliography will serve the very useful purpose of making available and accessible the extensive and widely scattered literature of the geology of the state.

The Weed Flora of Iowa is a bulletin of 900 pages and constitutes Bulletin No. 4 of the publications of the Iowa Geological Survey. The need of such a volume had long been felt by all who are familiar with the enormous damage caused to the crops of Iowa by weeds. A conservative estimate places the injury at \$25,000,000 annually. The publication of concise information with regard to weeds, such as is given in this bulletin, should do much to decrease this great loss. If the unexcelled resources of our soil could be conserved by the extermination of weeds the farmers would be greatly benefited in a financial way.

Each kind of weed is described in detail, its geographical distribution within the state is shown on a small state map, and methods of extermination are given. Excellent illustrations of the weeds described will be of great assistance to those who are not familiar with the different weeds but who wish to identify them.

Among the most interesting chapters are those dealing with the general characters of seeds, the scattering of weeds, weed migration, the injuriousness of weeds, and weeds for medicinal purposes. A chapter on weed laws gives a summary of the laws of various states in the Mississippi valley.

This bulletin, which will be of great service to the agricultural and related interests of the state, was prepared by Dr. L. H. Pammel and collaborators.

OFFICE WORK.

The Des Moines office has been in charge of James H. Lees, Assistant State Geologist, and Miss Nellie Newman, the Secretary. Mr. Lees cannot be commended too highly for his thorough and painstaking work in connection with the preparation and publication of the reports that have been issued during the year.

From the office have gone out hundreds of letters giving reliable information with regard to the geological features of the different sections of the state. In response to the continued demand for the publications of the Survey many volumes of our reports have been distributed during the year, not only to the citizens of Iowa, but to many persons in other parts of the country who are interested in the possibilities for investment within the state.

Herewith I submit the following papers with the recommendation that they be published as Volume XXIV, which is the Twenty-second Annual Report of the Iowa Geological Survey:

The Road and Concrete Materials of Iowa, by S. W. Beyer and H. F. Wright.

Analyses of Iowa Coals, by A. W. Hixson.

Mineral Production in Iowa for 1911 and 1912, by George F. Kay.

Respectfully submitted,

GEORGE F. KAY.