
ADMINISTRATIVE REPORT



TWENTY-FIFTH ANNUAL REPORT OF THE STATE GEOLOGIST

IOWA GEOLOGICAL SURVEY,
DES MOINES, DECEMBER 31, 1916

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

GENTLEMEN: The plans of the Iowa Geological Survey which were approved by the Board for the field season of 1916 have been carried forward successfully, and reports of the investigations are now being prepared for publication.

The State Geologist directed the work of the Survey, with the hearty co-operation of the Assistant State Geologist and the other members of the geological corps to whom special problems were assigned.

In the Administrative Report for 1915, reference was made to some detailed studies of the glacial deposits of the state which were being made by the Director and which gave promise of having considerable significance in connection with the interpretation of the complex history of the Pleistocene period. Among these studies was the problem of the origin of gumbotil which had been found on each of the three oldest drifts of the state. It can now be stated that both field and laboratory evidence indicate clearly that the gumbotils on Nebraskan, Kansan, and Illinoian drifts are the result chiefly of the chemical weathering of glacial till.

The Nebraskan gumbotil has been found in widely separated localities in Iowa. Among the many counties in which it has been studied are Decatur, Clarke, Warren, Madison, Union, Ringgold, Taylor, Adams, Adair, Cass, Montgomery, Page, Shelby, Crawford, Carroll, Tama, Humboldt, and Johnson counties. The topographic positions of the separate outcrops indicate that the Nebraskan gumbotil was formed on an extensive plain with slight relief. The maximum thickness of the Nebraskan gumbotil thus far studied is about 13 feet.

The Kansan gumbotil has the same relations to the underlying Kansan till as the Nebraskan gumbotil has to the underlying Nebraskan till. The Kansan gumbotil has a maximum thickness of more than 20 feet and is limited to tabular divides and other remnants of a gumbotil plain, which, before it was affected by erosion, was as extensive, apparently, as the original Kansan drift plain. This gumbotil occupies a definite topographic position, and where it is exposed in railroad cuts it is seen to lie horizontally in the cut and not to conform to the surface slopes which have been developed by erosion. The Kansan gumbotil has been seen at scores of places in southern Iowa and at many places in other parts of the state; in fact, the Kansan gumbotil has been studied in every county of three tiers of counties in southern Iowa as well as in many of the counties which are farther north. Moreover, within the Iowan drift area the Kansan gumbotil has been found beneath Iowan till at numerous places. It will be of interest to state that the Kansan gumbotil is now known at a sufficient number of places in Iowa to permit the restoration of the Kansan gumbotil plain as it was in Iowa before erosion began.

The relations of the Illinoian gumbotil to the underlying Illinoian drift are similar to the relations of Nebraskan and Kansan gumbotils to their respective drifts.

A comprehensive paper entitled "The Origin of Gumbotil" is now being prepared for publication by the State Geologist and Dr. J. N. Pearce of the department of Chemistry of the State University of Iowa. Another paper, which will be published in Volume XXVII of the Reports of the Survey, calls attention to the fact that there are several large granite boulders in the Kansan drift in southern Iowa. The view which prevailed some years ago among some geologists to the effect that large granite boulders are limited to the Iowan drift is incorrect.

Again, a paper is being prepared with regard to the gravels and related materials in the region about Afton Junction and Thayer in Union county. These gravels are so well known to students of Pleistocene geology, and their Aftonian age has been so generally accepted, that one may well hesitate to state that a restudy of these famous exposures and other exposures in the

same region has revealed evidence which seems to justify further discussion of the origin and relationship of these gravels, and to warrant question being raised with regard to former interpretations.

Ever since the year 1895, when Dr. T. C. Chamberlin made reference in Geikie's Great Ice Age to the interesting characteristics of these gravels, and interpreted them to be kamelike deposits closely associated with the drift upon which the gravels lie and overlain by a later drift sheet, many glacial geologists of America and of Europe have visited the locality. Some have come merely to see the type sections of the two oldest drifts, now known as the Nebraskan drift and the Kansan drift, separated by the gravels which years ago were named the Aftonian interglacial gravels; others have come to study carefully the characteristics of the drifts and gravels and their inter-relationships. The most important contributions dealing with these gravels and related deposits have been made by Chamberlin, Bain, and Calvin.

The purpose of the paper which is being prepared is to show that the gravels of Union county, which for so many years have been called the Aftonian interglacial gravels, do not constitute a distinctive stratigraphic horizon separating the Nebraskan drift from the Kansan drift, which is the generally accepted interpretation, but that these gravels are lenses and irregularly shaped masses of gravels within a single drift, the Kansan, or, if in two drifts, the Nebraskan and the Kansan, it is not possible by means of the gravels to differentiate the two drifts.

It will be shown, also, in this paper that, although the gravels in the vicinity of Afton Junction and Thayer cannot be used to establish the presence of two drifts, there is other evidence in the region which makes it clear that the two oldest drift sheets are present, and that they are separated in age by a very long interglacial epoch. At several places near the village of Afton and also west of Osceola about twenty miles east of Afton there are fine outcrops of Nebraskan gumbotil, below which is Nebraskan drift, and above which is Kansan drift. Moreover, in Dodge township, Union county, there is a splendid section of peat lying on Nebraskan drift and overlain by Kansan drift. This peat

bed was described years ago by Savage. The gumbotil and the peat are now the significant evidence of Aftonian time.

If the interpretations here outlined are correct, the Aftonian gravels of Union county have lost much of their former significance, and the type sections, particularly the Grand river section, can no longer be referred to as sections in which it is possible to study the two oldest drift sheets separated by Aftonian gravels.

The Assistant State Geologist, Dr. James H. Lees, did special work in several of the counties of the state, particularly in Adams, Crawford, and Greene counties. In addition, he rendered valuable service in editing Volume XXVI of the Reports of the Survey, and in again taking charge of the exhibit of some of the mineral products of Iowa at the State Fair. He has, moreover, by correspondence and by personal visit, furnished information to persons interested in the development of one or more phases of the geology of our state.

Besides the Director and the Assistant State Geologist, the corps employed in the regular work of the Survey during 1916 has been much the same as in previous years. Prof. John L. Tilton and Prof. Bohumil Shimek did work in areal geology; Dr. S. W. Beyer and assistants continued their investigations on the clay resources of the state; Prof. W. H. Norton continued to collect data regarding underground waters; Prof. A. O. Thomas and Dr. F. M. Van Tuyl continued their studies on the Devonian and Mississippian systems of rocks, respectively. Mr. W. H. Schoewe made a detailed study of extinct Lake Calvin, and Mr. A. J. Williams carried forward some studies on evidences of glaciation in the Driftless area of Iowa; Prof. A. W. Hixson did some work on the content and quality of the volatile, combustible matter of Iowa coals.

The Survey in 1916 continued to co-operate with the United States Geological Survey in the work of stream gaging and discharge measurements of the important streams of the state, in the collecting of mineral statistics, and in the preparation of topographic maps.

Dr. John L. Tilton has submitted his manuscript on the geology of Clarke and Cass counties, and has revised and re-written parts of the manuscript of the late Dr. James Gow on the geology

of Adair county. In addition, Doctor Tilton has been studying in detail the Missouri stage of the Pennsylvanian of Iowa. Among the most important results thus far achieved in this study is the mapping of a fault in southwestern Iowa, to which he has given the name Thurman-Wilson fault. A complete description of the fault is given in his report of the geology of Cass county in Volume XXVII of the Reports of the Survey. The location of this fault has, as pointed out by Doctor Tilton, important economic bearings. It is now clear for the first time why Nodaway coal found in the southern part of southwestern Iowa is not found also in the northern part of southwestern Iowa, except in a small area close to Thurman, Fremont county. It was thought formerly that the fault at Thurman changed into an anticline near Stennett, and if so there ought to be Nodaway coal north of the anticline. It is now evident that it would be unwise to prospect for the Nodaway coal seam north of the fault line. Doctor Tilton shows, also, the effect of the fault on the present distribution of the coal in the Des Moines stage of the Pennsylvanian series.

Dr. W. H. Norton has completed his investigations on the brecciated limestones of the Wapsipinicon stage of the Devonian of Iowa; his report will be published in Volume XXVII of the Reports of the Survey. Doctor Norton has studied for several years these most interesting rocks, and hence his discussion of their characteristics and probable origin will be read with profit by all students of the problem of brecciation in rocks.

Prof. A. O. Thomas has continued his studies of the paleontology of the state. His investigations have had to do chiefly with the life of the Silurian and the Devonian. In connection with the Silurian he has been studying the abundant coral remains found in the Niagaran rocks near Monticello, in Jones county. At no other place in the world, with the exception of the Island of Gotland in the Baltic Sea, are corals so well developed as at that one small area of Iowa. Associated with the corals, Professor Thomas has discovered recently some specimens of the rare crinoid, *Herpetocrinus*. This is the first known occurrence of this genus from the Silurian of the state. In connection with his studies of the Iowa Devonian, Professor Thomas

is preparing a paper on the echinoderms. The paper will bring together the scattered literature on the crinoids and other echinoderms heretofore described, and will describe nearly twice as many new species as had been described previously. Moreover, the sea-urchin remains to be described in the paper are the most abundant and most striking of the sea-urchins from the Devonian of the world.

The discovery of remains of Pleistocene mammals continues to be reported from time to time from various parts of the state. During the year, mammalian fossils have been found near Denison, in the bed of Iowa river at Marshalltown, near Harvey, in a sand and gravel pit in the northwest part of Mason City, in the bed of Skunk river about eight miles west of Keota, and elsewhere. These remains consist chiefly of the teeth and limb bones of the mammoth and mastodon.

Mr. W. H. Schoewe has been doing detailed field work in order to map the shore lines and other features of Lake Calvin, an extinct glacial lake. Reference to this lake was made by J. A. Udden in his report on the "Geology of Muscatine County," published in Volume IX of the Reports of the Survey. Mr. Schoewe has found that this lake when in existence covered parts of Muscatine, Cedar, Johnson, Washington, and Louisa counties. It covered an area of about 325 square miles and in places it had a depth of probably 100 feet. The outlet of the lake was at Columbus Junction. The report of Mr. Schoewe will be awaited with great interest.

It is not surprising that interest continues with regard to whether oil and gas will be found in commercial quantities in Iowa. Those persons who wish to know the attitude of the Survey on this subject should consult the administrative reports in Volumes XXIII and XXV of the Reports of the Survey. During recent years there has been considerable drilling for oil in Iowa, thus far with no success. With regard to natural gas, it may be of interest to state again that small amounts of gas have been found in sand pockets in the drift; in fact, gas in the drift is apparently somewhat widespread. Among the many counties in Iowa in which gas has been found in drift in wells being drilled for water are the following: Boone, Decatur, Emmet, Fremont,

Guthrie, Hamilton, Harrison, Johnson, Louisa, Polk, Scott, and Taylor counties.

Two bulletins of Natural History are nearing completion, one by Dr. Bert H. Bailey on the Hawks and Owls of Iowa, and the other by Dr. Dayton Stoner on the Rodents of the State. The view which is prevalent among citizens of the state is that hawks and owls and related birds of prey are detrimental to the agricultural and other interests of the state and that, therefore, all of them, without discrimination, should be destroyed. It is by no means generally understood that these birds of prey are the chief destroyers of rodents and insects, many of which are harmful to crop production. The agriculturist should know that with few exceptions hawks and owls are not his foes but his friends, and he should see to it that every effort is made to preserve rather than destroy them. With regard to the rodents, it may be stated that they are the most numerous and the most widely distributed of all the orders of mammals, and since all of them are either herbivorous or omnivorous in diet they are of considerable importance to the agriculturist. Some of them are harmful and some of them are helpful in relation to crop production. It is necessary, therefore, that the farmer and gardener be able to discriminate between those rodents which are his friends and those which are his foes.

During the year 1916 the Survey co-operated, as in former years, with the United States Geological Survey in the preparation of statistics of mineral production in Iowa. The value of the output for the year 1916 was \$29,158,908, which is the highest figure of record for the state, and exceeds the value of the output for 1915 by \$2,095,958. Year by year for several years the value of the mineral output of Iowa has increased. During the three years previous to 1916 the values of the outputs were as follows: in 1913, \$25,612,345; in 1914, \$26,301,865; and in 1915, \$27,062,950; a decade ago, in 1907, the value of the output was only \$17,627,925.

Coal continues to be the chief mineral produced in Iowa; clay and clay products ranks second; cement ranks third, and gypsum fourth. In 1916 these four products had a value of \$27,466,541, which is more than 94 per cent of the total value of all

the mineral products. In 1916 the value at the mine of the output of coal was \$13,530,383; in 1915 the value was somewhat more, \$13,577,608. The total tonnage of coal mined in 1916 was 7,260,800, compared with a tonnage of 7,614,143 in 1915. The five leading coal producing counties in 1916, in order of tonnage, were Monroe, Polk, Appanoose, Lucas and Dallas counties; then followed Marion, Wapello, and Jasper counties. The average number of men employed in coal mining in Iowa in 1916 was 14,443.

The value of clay and clay products in 1916 was \$7,375,716, a figure which has never been exceeded in the history of the clay industry in the state. The values of the clay products in the three chief clay producing counties were as follows: Cerro Gordo county, \$1,943,530, Webster county, \$1,332,411, and Polk county \$971,911. Iowa's production in drainage tile alone in 1916 had a value of \$3,986,163; in 1915 the value was \$3,802,579.

In 1916 the three cement plants of Iowa, two of which are at Mason City, the third at Des Moines, produced cement to the value of \$5,063,647, which is the record value for the state. A fourth plant, located at Gilmore City, Pocahontas county, will soon begin to operate. Additional cement plants should be erected in Iowa during the next few years in order that the demands of a cement age may be adequately met. When Iowa begins permanent road construction, immense amounts of cement will be required for this purpose alone. It is indeed fortunate that within the borders of Iowa there are almost unlimited supplies of materials which can be used in making a high grade Portland cement.

The value of sand and gravel in 1916 was \$980,272, of stone and lime, \$610,534, and of mineral waters, \$14,404.

Iowa continues to be an important producer of gypsum. At present the entire output of the state comes from Webster county, but it is hoped that before many years the gypsum deposits at Centerville may be developed also. The report of Dr. Frank A. Wilder on the gypsum deposits of the state is not yet ready for publication. When completed it will prove to be of great value to all persons interested in the gypsum industry.

It is of interest to state that in 1916 the Missouri Iron Company began to ship ore from Iron Hill, which is about two and one-half miles northeast of Waukon, Allamakee county. The general characters of this ore, the method of treatment, and other features, are described fully in Volume XXV, pages 33 to 92, of the Reports of the Iowa Geological Survey.

I take pleasure in submitting to you the following papers, and recommend that they be published as Volume XXVII, which is the Twenty-Fifth Annual Report of the Iowa Geological Survey:

Mineral Production in Iowa in 1916, by George F. Kay.

The Geology of Ringgold County, by Melvin F. Arey.

The Geology of Taylor County, by Melvin F. Arey.

The Geology of Clarke County, by John L. Tilton.

The Geology of Cass County, by John L. Tilton.

The Geology of Adair County, by James E. Gow and John L. Tilton.

Some Large Boulders of the Kansan Drift of Southern Iowa, by George F. Kay.

The Wapsipinicon Breccias of Iowa, by William H. Norton.

Respectfully submitted,

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State Geologist.

