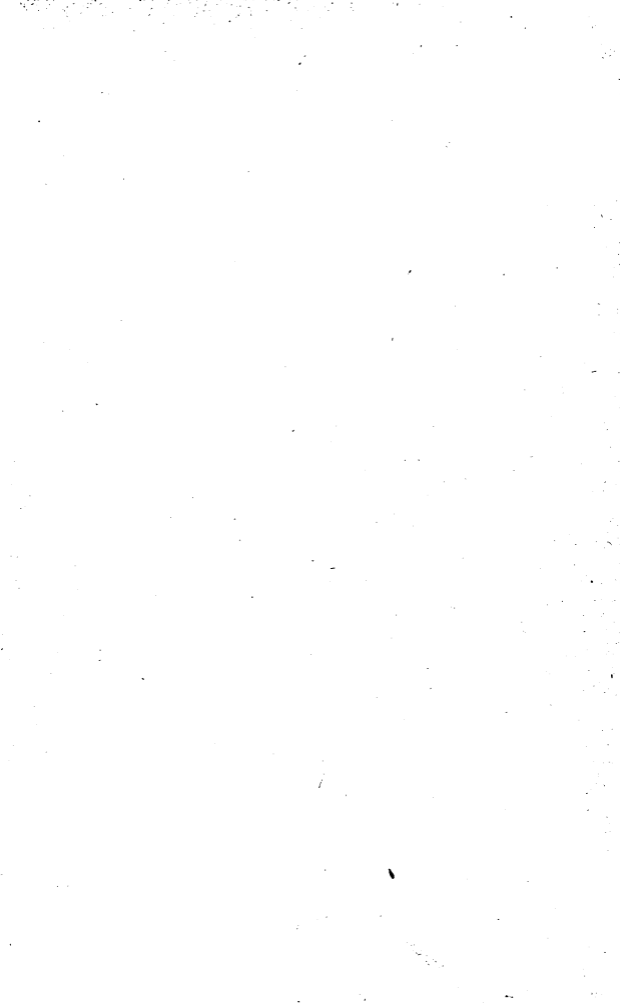

ADMINISTRATIVE REPORTS.

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THIRD ANNUAL

Report of the State Geologist.

IOWA GEOLOGICAL SURVEY, }
DES MOINES, December 31, 1894. }

To Governor Frank D. Jackson and Members of the Geological Board:

GENTLEMEN:—I have the honor to submit, in accordance with law, an account of the work done by the Iowa Geological Survey during the past year. The work of 1894, was to a large extent, simply a continuation of that begun in 1893. So far as possible, investigations entered upon by persons employed on the survey during the preceding year were continued in 1894, but owing to the limited means at the disposal of the Survey it became necessary early in the season to suspend all work that could be temporarily laid aside without serious loss. It is very gratifying, however, to be able to report that notwithstanding the rather narrow means available for its prosecution, the work of the Survey has been pushed with vigor along certain lines, and substantial results have been attained.

In addition to the attention necessarily given to administration, to correspondence, and to answering inquiries of all imaginable kinds, my own work has included the finishing of the report on Allamakee county, which report is now ready, with suitable illustrations, for the printer; the investigation of the composition and origin of Iowa chalk, and the preparation

of a report which was contributed to Volume III; the preparation of newspaper articles giving information of immediate interest to certain localities; and the contribution of papers to scientific periodicals and learned associations.

My work in the field included the investigation of Delaware county, with a view to making a complete report on its geological structure, and geological products of economic importance. Progress was made with the field work of Buchanan, Fayette, Howard, Winneshiek and Dubuque counties. Jones county was nearly completed last year, but it seemed best to defer further work on it until some of the problems in counties adjacent can be investigated. It is often the case that the geology of any given county cannot be clearly elucidated in all its relations and details without following the different formations into the counties adjoining. While many of the investigations so made are not available in writing up the report on the county under immediate consideration, they all have the effect of simplifying and expediting the work when the several counties thus partially studied are taken up in detail.

I have also given a considerable share of time to work on the collections, particularly on those representing the paleontology of the several formations in northeastern Iowa. Paleontology furnishes the key to the correct identification of the several beds as we pass from one rock exposure to another; for in a drift-covered region like Iowa exposures are not continuous, and the geologist must avail himself of the only known reliable means for recognizing at separated localities strata of the same geological horizon. The thickness of deposits of commercial importance, and their geological extent, can often only be determined by the most careful attention to paleontological data. A large series of specimens has been identified and prepared for display in the cases of the museum.

The work of Dr. Charles R. Keyes on the coal, gypsum and other economic products of Iowa, as well as on certain counties of the state, is set forth in detail in his administrative report, herewith submitted.

Since the resignation of Dr. Keyes in order that he might assume the duties of State Geologist of Missouri, Mr. H. F. Bain

has been appointed chief assistant. Mr. Bain has rendered very efficient service in connection with all work assigned him, and for a full statement of what he has personally accomplished during the year attention is respectfully directed to his administrative report, which is here appended.

Prof. G. E. Patrick began an investigation of the soils of the state, analyses being made of the best and the poorest soil in each of the sections covered by his investigations, the effort being to determine whether it was possible to discover from the chemical properties what was the controlling factor in determining the difference in the value of the soil. A considerable number of these analyses had been made, and were pointing to important results when the work had to be suspended. Prof. Patrick has also made analyses of coals and of the ores of iron, lead and zinc. The calorimeter tests of the coals, which it was hoped might be taken up this year, it has been necessary to postpone. The coal samples have, however, been preserved, and will be available for such work at any time in the future.

Mr. E. H. Lonsdale has had the clays in charge. Half of the field work was completed the previous season, and the remainder was done during the past year. A report on the clay industries of the state is now being prepared by him, and is well advanced towards completion.

Mr. A. C. Spencer continued the work on building materials, begun the previous year, intending to make a complete study of the limes and cements of the state. This work was continued up to the last of May, a considerable amount of valuable information being accumulated, when the necessities of the decreased appropriation forced the discontinuance of the work.

Mr. A. G. Leonard continued his work on the zinc and lead deposits of northeastern Iowa, completing in May the field work. He has submitted his report which is now being prepared for the printer. In order to make this report most valuable it will be necessary to have a map of the region to accompany it. It is hoped that such a map may be made during the early part of the coming season.

Mr. C. H. Gordon has completed and handed in his manuscript of the Geology of Van Buren county, and also a paper on

Buried River Channels in southeastern Iowa. The paper on Van Buren county will constitute a part of this volume. That on Buried River Channels appears in the second annual, Volume III.

Prof. Wm. H. Norton has made a study of the deep wells of northeastern Iowa, with special reference to determining the thickness and extent of the various geological formations. Much valuable information was obtained and the results of his work are incorporated in a report which forms one of the chapters of Volume III. Professor Norton has also finished the field work on Linn county, and his full report on this work has been submitted and is being prepared for the printer.

Prof. S. W. Beyer spent a number of weeks during the summer in field work, devoting attention to the geology of Boone county, and to geological problems in the northwestern part of the state.

Owing to the press of other work Mr. Beyer found himself unable to devote that amount of time to the subject of artesian waters which seemed desirable in order to allow the early completion of the volume. During the year, therefore, this work has been placed in the hands of Professor Norton, who had already paid considerable attention to this subject. For the present Mr. Beyer will devote what time he may be able to give to survey work to areal geology. His report on Boone county will probably be completed within the next year.

Mr. A. J. Jones finished some previously incompletd work in Van Buren county and Professor A. G. B. Wilson rendered valuable assistance on the field work of Delaware county.

Mr. F. C. Tate continued in charge of the drafting up to October 1st, and Miss Nellie E. Newman continued her work as secretary up to October 15th.

Since the date last mentioned the working force of the Survey has been practically limited to the chief geologist, the assistant geologist and the chemist.

Necessarily the first work following the organization of a State Survey must be preliminary and in the nature of a general reconnoissance of the whole field. A considerable amount of the work of the past seasons was of this preliminary nature.

A knowledge of the general characteristics, subdivisions and geographic distribution of the geological formations is indispensable to good areal work, so that the work in one region may be checked and correlated properly with that in every other. This work is now largely accomplished and the Survey is ready to take up areal investigations and push them as rapidly as the means available will permit.

There are differences of opinion among working geologists as to what the areal unit for purposes of detailed investigation should be. The subdivision of the state into counties is wholly artificial, and hence the county boundaries have no relation whatever to the distribution of geological formations. Nevertheless it seems to me best in prosecuting a State Survey to adopt the county as the areal unit. The boundaries of counties are definitely located and generally known. The county is one of the organic units of civil government. Its inhabitants are bound together by common purposes, and have a common pride in its resources and in whatever promotes its welfare. Definite information regarding the resources of his county as such, has more interest to the ordinary intelligent citizen, thoroughly loyal to his own locality as he usually is, than a report on an area embracing probably parts of several counties, though that area lend itself more naturally to scientific investigation because limited by natural geographic features or distinguished by some peculiarities of geologic structure. The adoption of the county as the areal unit, will not add anything to the amount of field work to be done. Its only disadvantage, so far as I can see, lies in the fact that it will increase slightly the volume of the reports, because each county must be written up fully and independently. The advantages of the plan are so many as to far outweigh any slight disadvantages. The present citizens, as well as prospective settlers and investors, think not of naturally defined areas, but of counties in which they become interested; and they will turn to the geological report of the several counties under consideration for information concerning their resources. Under each county, therefore, the information should be the fullest and most trustworthy possible; discussing the geological structure, the supply of building

stones, limes and cements, the character and quantity of clays and the uses to which they are adapted, the nature and origin of the soils, the water supply, both in superficial and underground streams, the mineral products such as coal, lead, zinc, iron, gypsum, and the like, the supply of road materials; in short, whatever may be necessary to give parties interested a clear conception of the future industries that the county will probably support.

The completion of the work by counties will be the end to which the energies of the Survey will be chiefly directed in the future. Reports on a few of these regions appear in Volume III, and Volume IV, the manuscript for which is herewith submitted, is wholly devoted to county geology. A special report on the clays of Iowa is about ready to be submitted for your approval, but the special reports on building stones, limes and some other subjects can be written more economically when work on the several counties is finished.

During the year the publication of the work on coal, prepared by Dr. C. R. Keyes, and constituting Volume II of the Survey reports, has been completed, and partially distributed as the law requires. The second annual report, Volume III, is about ready for distribution; the manuscript and illustrations for the third annual report, Volume IV, are herewith submitted.

In submitting this report containing the reports on the geology of several counties, there are a few general considerations to which it might perhaps be well to call attention.

Iowa, as is well known, is a drift covered region. It has been but little disturbed by orographic movements, and the principal changes which have taken place in the strata since deposition are due to erosion. These geological conditions control the methods applicable to mapping it. Owing to the thick mantle of drift it is often impossible to map with any acceptable degree of accuracy, the minor divisions of the geological formations.

Often the division lines between two contiguous formations can only be drawn approximately, and in a straight rather than curved line such as actually exists. This will explain an

appearance on the maps which might easily be mistaken for fault lines. When the conditions present have permitted the tracing of the actual contact line it has been done and is shown on the maps. When the line is only approximate the fact may be readily recognized from the manner in which it is drawn.

In tracing the eastern limit of the coal measures it has not always been possible to mark the exact division line between the productive and the unproductive portions of the Carboniferous. In such case the areas mapped as coal measures indicate only those in which coal is known to occur, or in which the indications are sufficient to warrant prospecting with the drill. It must be remembered that within these areas smaller areas over which the coal measures have been removed by erosion are not unlikely to occur. Since, however, the data do not exist by which they can not be mapped, and never will all exist until the coal field is exhausted, they can not be separated. It is also true that there are probably numerous small outliers as yet undiscovered lying beneath the drift. Some of these may in time prove productive.

It is gratifying to be able to state that the work of the Survey continues to demonstrate that the Iowa coal measures are far richer than they have been believed to be, and it is not improbable that when the peculiar conditions of their deposition and preservation are fully understood, we may have the same degree of certainty in regard to the presence or absence of coal in a particular region which now obtains in other fields.

In drawing and printing these maps the Survey has been able to effect a saving of fully 40 per cent in the usual cost of such work. They were carefully drawn, and the lettering put in from type rather than by hand. In this way the cost of the original drawing was greatly reduced, and a map prepared with sufficient detail to allow it to be reproduced directly by photolithographing, doing away with the necessity of an engraving on stone, and effecting very considerable reduction in cost. It is believed that the results obtained are fully up to the standard required for such work.

The original base map used in the field has been in a majority of cases taken from some county atlas, and was usually on a

scale of two inches to the mile. This has been corrected and revised, both from the county records and the field notes of the geologist in charge. On it has been marked the exact location of each known outcrop, with references to note book and page where the outcrop is described in full. From this foundation the base map used was drawn on a scale of $\frac{3}{4}$ inch to the mile, which in reproducing was further reduced to $\frac{1}{2}$ inch to the mile. Upon this smaller map the colors representing the different formations were laid down.

In the color scheme that adopted by the International Congress of Geologists has been followed in general, though modifications have been introduced. When the minor divisions of a formation are sufficiently well shown to be mapped separately they are shown by the pattern lines. Where these minor divisions cannot be separated, a solid color representing the major division is used. In this way each county map has represented on it all the detail which the conditions there allow, and yet the several counties show a general agreement.

In those counties where the paleontological work has not as yet been carried on so as to separate the divisions of the different formations on that basis, the lithological and stratigraphical units of the county have been mapped as such, it being intended to introduce as much detail of this character on the maps as will admit of such expression, and as appears to be of probable usefulness in that connection. Additional details are given in the text accompanying each report.

It is believed that the plan adopted embraces that degree of flexibility which is advisable and which will meet the conditions of the various regions as the work of the Survey advances.

Respectfully,

SAMUEL CALVIN,
State Geologist.

REPORT OF DR. CHARLES R. KEYES.

IOWA GEOLOGICAL SURVEY. }
DES MOINES, December 31, 1894. }

SIR:—I have the honor of transmitting to you an account of the work conducted by me during the past year.

During the first weeks of 1894 all efforts were directed to getting through the press the report on the Coal Deposits of Iowa, which forms Volume II of the series issued by the Survey. At the same time, and until after the field season had opened, the work of editing Volume III and of supervising the printing of the first half, occupied considerable time. The necessary field work to finish up the report on two counties was also accomplished. The work on the gypsum deposits begun two years ago, was completed and the report written. Mr. Lonsdale finished up the topographical map of the region commenced some time previously by Mr. Hess. The reports on personal work completed during the year are:

1. "Coal Deposits of Iowa," forming Volume II. It is a description of the salient geological features of the coal region, with particular reference to the coal-bearing strata, the nature of coal horizons, and a detailed account of the coal beds as exhibited in the different parts of the Iowa field.

2. "Administrative Report of the Assistant State Geologist for 1894."

3. "Work and Scope of the Geological Survey," is an account of what has been done by the Survey since its organization. It was prepared primarily for the use of the legislators and the newspapers of the state.

4. "Glacial Scorings in Iowa." Heretofore only a few isolated evidences of ice scratches were known. Recently a number of new localities, showing fine glaciation, were discovered, and special attention is here called to them.

5. "Economic Geology of Lee County," which contains a report on the natural resources of the district. It is accompanied by a colored geological map of the area, on a scale of one-half inch to the mile, and a number of suitable illustrations.

6. "Economic Geology of Des Moines County," a report on the geology and natural resources of Des Moines county, similar to the report on Lee county.

7. The inquiry in regard to the Sioux quartzite, begun last year, was continued. Mr. Beyer also spent some time in the region, and the results of his work will probably be ready in time for insertion in the current annual report.

The work on Building Stones was reviewed and considerable information obtained.

Respectfully,

CHARLES R. KEYES,
Assistant State Geologist.

To PROF. SAMUEL CALVIN, State Geologist.

REPORT OF MR. H. F. BAIN.

IOWA GEOLOGICAL SURVEY,
DES MOINES, December 31, 1894. }

SIR:—I submit herewith a statement of the work done by me during the year just past.

The greater portion of the months of January and February was spent in the office assisting in the revision of the manuscript and the reading of the proof of Volume II and the first portion of Volume III, which were at that time going through the press. Time was found in the first of the two months mentioned to take a trip down the Des Moines river through Marion, Mahaska and Wapello counties for the purpose of connecting the work done by Messrs. Keyes and Gordon.

March 6th I left Des Moines for Plymouth county to investigate reported discoveries of valuable lignite which were at that time attracting attention. While in the region I did additional work on the Cretaceous of the Sioux valley the results in part appearing in Volume III of the Survey reports.

In the early part of April I took up the work in Keokuk county, extending it later into Mahaska and Washington counties, and continuing the work until September 1st. The month of September was spent in Woodbury and neighboring counties. At the first of October I was called to Des Moines and placed in charge of the office where I have since been.

During the year I have completed the following work:

- (1) Geology of Mahaska county.
- (2) Geology of Washington county.
- (3) Geology of Keokuk county.

These reports are now copied and ready for illustrating and final revision. In addition I have in preparation:

(1) Geology of Woodbury county.

(2) Report on the Methods of Coal Mining in Iowa as Influenced by Geological Structure.

It is expected that the former of these papers will be practically completed at some time during this winter and the second will be pushed as rapidly as circumstances permit. I have also spent some time, and expect to spend more, in an investigation of the mining problems of Polk county in view of a joint report on the geology of the county by Dr. Keyes and myself.

In addition to the above work several short articles have been furnished for newspapers and geological journals and a considerable amount of manuscript revised.

H. FOSTER BAIN,

Assistant Geologist.

TO PROFESSOR SAMUEL CALVIN, State Geologist.

REPORT OF PROF. G. E. PATRICK.

IOWA AGRICULTURAL COLLEGE, }
AMES, IOWA, December 31, 1894. }

DEAR SIR:—I have the honor of presenting to you the following report of the work done by the chemical division of the Survey during the year ending December 31, 1894.

The samples analyzed during the year are as described below. All except the soil samples were sent me from the office of the Survey, at Des Moines; the soil samples were sent me direct by persons collecting them.

SAMPLE NUMBER.	DESCRIPTION.
261	Cerussite (lead carbonate) Buena Vista, Clayton county.
262	Smithsonite (zinc carbonate) Durango, Dubuque county.
263	Smithsonite (zinc carbonate) McGovern mine, Dubuque county.
264	Galena (lead sulphide) Lansing, Allamakee county.
265	Galena (lead sulphide) Kerrick mine, Dubuque county.
266	Smithsonite (zinc carbonate) Treub & Southwell mine, Dubuque.
267	Clay (blue) Mason City, Cerro Gordo county.
268	Clay (dark gray) Indianola, Warren county.
269	Clay (buff) Indianola, Warren county.
270	Clay (yellow) Spencer, Clay county.
271	Clay, Red Oak, Montgomery county.
272	Clay (alluvial) Bridgewater.
273	Clay (loess) Guthrie Center, Guthrie county.
274	Galena (lead sulphide) Bear Creek, Allamakee county.
275	Iron ore (limonite) Iron Hill, Allamakee county.
276	Smithsonite (zinc carbonate) Mineral Creek, Allamakee county.
277	Lead carbonate and sulphide, Mineral Creek, Allamakee county.
278	Iron Ore (haematite) Waukon, Allamakee county.
279	Iron Ore (limonite) Waukon, Allamakee county.
280	Clay, Crills Mill, Plymouth county.
281	Gypsum, Iowa Plaster Co., Quarry No. 1, Fort Dodge, Webster county.
282	Gypsum (white selected), Iowa Plaster Co., Fort Dodge, Webster Co.

- 283 Gypsum, Iowa Plaster Co., Quarry No. 3, Fort Dodge, Webster county.
 283 B Gypsum, Iowa Plaster Co., Quarry No. 3, Fort Dodge, Webster county.
 284 Gypsum, Iowa Plaster Co., Quarry No. 3, Fort Dodge, Webster county.
 285 Cone-in-cone, Duncombe Mill, Fort Dodge, Webster county.
 286 Cone-in-cone, Madrid, Boone county.

Soils not numbered:

- 2 samples from J. O. Overholt, Havelock, Pocahontas county.
 2 samples from H. A. Saunders, Grand Junction, Greene county.
 2 samples from John Klein, Keota, Keokuk county.
 2 samples from L. Skeels, Wallingford, Emmet county.
 2 samples from C. D. Miller, Denison, Crawford county.
 2 samples from J. F. Grawe, Waverly, Bremer county.
 2 samples from George Gadbois, Salix, Woodbury county.
 2 samples from James Sullivan, Stuart, Guthrie county.
 2 samples from Fred Divelbess, Logan, Harrison county.

Reports upon the analysis of all the above described samples have been made to the Assistant State Geologist, and will doubtless appear in the scientific papers of this or subsequent volumes.

SOIL INVESTIGATIONS.

A few remarks under this head seem called for. In my last annual report, dated December 29, 1893, I stated that fifty-eight samples of soil had been collected from twenty-six different counties of the state, and that their chemical examination was just being begun. This work, executed under my constant guidance and supervision, had been under way only a few months—until the latter part of April, 1894—when it was suddenly called to a halt, for lack of funds, and has not been resumed since.

It is a great pity this work had to be suspended, when only fairly begun, for it promised results of general interest and value. The objects in view were, first, to ascertain the composition of the soil in the various parts of the state, by complete quantitative analysis; second, to ascertain the proportions of the various plant-food elements existing in a condition of ready availability to plants (so far as this can be done by chemical means) in the soil of the various parts of the state; and third, to ascertain, if possible, the special causes of infertility of soils in particular localities, and to prescribe remedies therefor

wherever they might be indicated. Toward the first of these objects a good start has been made, and in the direction of the third I had gone so far as to receive, from farmers, a few samples of infertile soils for examination, when the entire work was suspended.

It is to be hoped that this work will be resumed in the near future. The farmers of the state are much interested in it, as I have good reason to believe; it promises results of real value as well as of general and scientific interest, and unless continued the beginning already made will be of comparatively little value.

Thanks are due and are hereby expressed, to the farmers who kindly gave their services in collecting the soil samples. Following are the names of those who have sent samples since the date of my last annual report:

Mr. J. H. Gerholdt, Cedar Falls, Black Hawk county.

Mr. John B. Ennis, Ottumwa, Wapello county.

Mr. T. J. Boyland, Manchester, Delaware county.

Mr. E. S. Brown, Hoskins, Woodbury county.

Mr. W. J. Thompson, Jamaica, Guthrie county.

Respectfully submitted,

G. E. PATRICK,
Chemist.

To PROFESSOR SAMUEL CALVIN, State Geologist.

