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History of Geology in Iowa for the Last Twenty-Five Years

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HISTORY OF GEOLOGY IN IOWA FOR THE LAST TWENTY-FIVE YEARS.

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This is so broad and full a subject that the necessary limitation of time and space will compel its treatment in a somewhat bald and meager manner. It is fitting that there should be given at the outset a brief statement of what had been accomplished previous to 1886-7. In 1839 Dr. D. D. Owen organized a corps of observers with whom he made a reconnaissance of portions of Iowa, Wisconsin and Illinois, the results of which were published in 1840 as a part of the senate documents. Several years later he revisited the state and the fruits of his survey were published by authority of Congress in 1852 under the title of a Report of a Geological Survey of Wisconsin, Iowa and Minnesota. These pioneer reports, so far as they pertained to Iowa, have been of marked value from a scientific standpoint, because they called attention to the things and places of special interest in a state where geology was in the main somewhat tame and obscure and apparently unimportant in an economic sense. The difficulties that had to be overcome at the time were extreme and one wonders that results of such extent and value were achieved under the attendant trying circumstances.

In 1855, 1856 and 1857 Professor James Hall was employed as State Geologist. His report was published in two parts and contained chapters on Physical Geography by J. D. Whitney, General Geology and Geology of Iowa by Hall, Geology of the Des Moines Valley and Certain Counties of Southeastern Iowa by A. H. Worthen, Central and Northern Counties of the Eastern Half of the State, and Chemistry and Economical Geology by J. D. Whitney, constituting Part I, and Chapter VIII on Palaeontology by Hall which formed Part II. The impetus given to the interest in the geology of Iowa by this report resulted in the inauguration of a new survey in 1866, which however was discontinued with the publication of two volumes in 1870. Prof. C. A. White was the State Geologist and O. H. St. John was the assistant. The work was necessarily preliminary to a large extent, but covered the entire state as never before.

In 1886, just on the threshold of the quarter century, the geological history of which we are to review briefly, T. C. Chamberlin and R. D. Salisbury made a report on the Driftless Area of the Upper Mississippi which appeared in the Sixth Annual Report of the U. S. Geological Survey. This area is located largely in Wisconsin, but a relatively small portion of it extends across the Mississippi into Minnesota and Iowa and therefore Iowa geology shares amply in the benefits of this most interesting and able report.

In 1890 the Eleventh Annual Report of the Director of the U. S. Geological Survey contained a paper on the Pleistocene History of Northeastern Iowa by W. J. McGee. Undoubtedly this was the most extensive and important contribution pertaining wholly to Iowa geology that had been made since the publication of White's Reports. Considering the area covered it was very complete and thorough in its details. Its philosophical method of treatment

gave it unusual prominence and this paper speedily became an important factor in quickening the interest in geology, not only among students of the subject, but in the general public to a considerable extent.

Between 1870 and 1892 numerous individuals prompted by personal interest in the general subject, or in some of the many problems it presented, carried on investigations in various directions and along various lines, the results of which appeared from time to time in articles published in periodicals devoted to general science or to geology more specifically and in papers read before various scientific associations. Another advantage, more direct perhaps, showed itself in the increased efficiency of teachers of the subject in the high schools and colleges of the state. A third benefit of the activity of these earnest workers in geology has maifested itself in so broadening and deepening in the general public an appreciation of the need of an exhaustive geological survey of the state that the legislature of 1892 authorized the establishment of such a survey on such a basis that it has been uninterruptedly maintained up to the present time with good prospects that it will continue until the state has reaped the fullest benefits not only from the geological sandpoint, but from the biological as well.

In accordance with the provisions of the legislature a Geological Board was organized, consisting of the Governor, Horace Boies; the Auditor of State, J. A. Lyons; the Presidents of the State University and of the Agricultural College, Drs. Charles A. Schaeffer and W. M. Beardshear, respectively; and the president of the Iowa Academy of Science, Prof. C. C. Nutting. They at once elected Professor Samuel Calvin, State Geologist; Charles R. Keyes, Assistant State Geologist and G. E. Patrick, Chemist. Special and temporary assistants were selected by Prof. Calvin and Miss Nellie E. Newman was made secretary, a position she has held ever since, a fact which strongly testifies to her faithfulness and efficiency. Field work was begun very promptly. As to the character of that season's work, I quote from Calvin in his first report. "Owing to the lateness of the season when work could be begun, it was deemed best to devote the short time before winter would put an end to field work, to make preliminary reconnoissances for the purpose of settling certain general questions respecting the general geology of the state. At the same time the general purpose of the survey--the determination of the location and extent of geological deposits of economic value—has been kept in view and a large amount of valuable information has already been collected."

Before entering upon a necessarily brief consideration of the real value of the work of the Survey, I wish to make a further quotation from Calvin's first report, which, if borne in mind by those who have been somewhat impatient with the slowness with which the economic phases of the Survey have been developed, will serve as a proper explanation of any seeming failures in that direction, especially, if it be remembered that the appropriations have never been large and that this work has been done by men who are largely employed in other matters.

"The work of the Survey is now fairly begun. The questions of greatest economic interest to the people of the state cannot all be fully settled at once. Time will be necessary in order to cover the entire ground. The results along each line will be made ready for publication as rapidly as circumstances permit, though only when the Survey is completed will the material resources be fully

presented. It must also be borne in mind that the determination of the economic problems which must ever be kept in view as the end sought after in this Survey is an impossibility without the preliminary determination of questions relating to the genesis and order of succession of the geological strata."

The Survey has been under the general direction and control of Professor Calvin throughout the twenty years since its establishment, until his death a little more than a year ago, with the exception of about two years beginning in 1904 and running into 1906, when upon the resignation of Prof. Calvin, Prof. Frank A. Wilder, Calvin's assistant at the University, was chosen State Geologist. Calvin's object in giving up the leadership in the Survey was to secure the needed leisure for the preparation of monographs on the stratigraphy and palaeontology of the state, but which were never completed since Prof. Wilder's plans were changed and he removed from the state and Calvin resumed the headship of the Survey.

The heavy loss sustained by the state and the scientific public at large through the death of Prof. Calvin was greatly augmented by the failure of the completion of these subjects by one whose peculiar fitness for such work lay in his natural qualifications as well as in a most intimate and complete knowledge of them growing out of almost a lifetime's interest in and observation upon them.

In accordance with the plans formed at the outset, the county was made the unit in getting at a full and accurate acquaintance with the various aspects of the geology of the state and special assistants have been employed upon detail county work and their reports have been published from time to time until at the present only fourteen counties remain to be reported upon and the field work in at least half of those has been done wholly or in part. In addition to the county work, special subjects of economic importance have been assigned to those within or outside the state who have been recognized as experts in those subjects. Twenty volumes in all have been issued, some of which have been devoted almost wholly to the reports on counties, none of which have been void of economic interest. A mere enumeration of the various subjects considered in the other volumes would be of little value at this time, yet my subject demands that they should have some consideration at our hands. The first volume contains a 250 page index of the Bibliography of Iowa Geology up to the time of its preparation, 1892, and an annotated catalogue of the minerals of the state by Keyes. The same writer devotes 130 pages to the geological formations of the state as they were then understood. A careful comparison of their character, extent and location as then given, with a similar account that might be given now would readily show how much has been accomplished in the intervening years in this single direction. Other papers on special topics were by Calvin, Beyer, Bain and Houser. The second volume, by Keyes, was devoted wholly to Coal, under such heads as Origin of Coal, Carboniferous Basin of the Mississippi Valley, General Geology of the Coal Region, Lithology of the Coal Measures, Stratigraphy of the Coal Measures, the Coal Beds, Composition of Iowa Coals, Waste in Coal Mining, and Extent of Coal Industry. Coming so early in the history of the Survey and covering so clearly and fully one of the most important industries of the state, this volume has been one of the most profitable and satisfactory of the entire series and yet the development of the subject in the succeeding years gave ample excuse for a fuller and

more complete treatment of the same subject in Volume XIX under the titles: Coal Deposits of Iowa by Henry Hinds; Fuel Values of Iowa Coals by Frank A. Wilder; Analyses of Iowa Coals, James H. Lees and A. W. Hixson; History of Coal Mining in Iowa, Lees; Coal Statistics, Beyer; General Section of the Des Moines Stage of Iowa, Lees; The Carboniferous Section of S. W. Iowa, Geo. L. Smith; and the Bibliography of Iowa Coal, Lees. The same volume very properly also contained papers on Peat and Peat Deposits in Iowa by Beyer, and the Flora of Northern Iowa Peat Bogs by Pammel. These two volumes and extended details in the county reports of counties within the coal producing area constitute a very generous scientific and practical presentation of this most interesting and important subject.

The third volume, 1893, presented a variety of topics, several of which were of immediate economic value while several were chiefly of scientific interest. They were as follows: Work and Scope of the Geological Survey, Keyes; Gypsum Deposits of Iowa, Keyes; Clay Industries of Western Iowa, Lonsdale; Certain Building Stones, Beyer; Thickness of the Palaeozoic Formations in Northeastern Iowa, Norton; Carboniferous and Devonian Outliers in Iowa, Norton; Glacial markings in Southwestern Iowa, Fultz; Cretaceous Rocks of the Sioux river, Bain; the Zinc Industry, Leonard. These topics were treated necessarily in a preliminary way and have received fuller consideration in later volumes in most instances, but they served to get before the public promptly much valuable information and quickened and increased the interest in further investigation.

Volume VI., dealt with Lead and Zinc Deposits in Iowa, Leonard; Sioux Quartzites and Certain Associated Rocks, Beyer; Artesian Wells of Iowa; Norton; Relations of the Wisconsin & Kansan Drift Sheets in Central Iowa and Related Phenomena, Bain.

Volume VIII., contains, besides County Reports, an article by Bain on Properties and Tests of Iowa Building Stones.

Volume IX., is devoted to County Reports, but also includes an account of the Artesian Wells of the Belle Plain Area by H. R. Mosnat.

In Volume X., Stuart Weller discusses the Fossil Fauna of the Kinderhook Beds of Burlington. The rest of the volume is given to County Reports.

Besides the County Reports, Volume XIII., has a very valuable report on the Lithographic Stone of Mitchell County by A. B. Hoen.

Volume XIV., is given up to the interests of the Clay Industry in a series of six articles as follows: Technology of Clay, Beyer and Williams; Chemistry of Clays, Weems; Selection and Installation of Power Plants, G. W. Bissell; Geology of Clays, Beyer and Williams; Tests of Clay Products, Marston; Directory of Clay Workers, Beyer and Williams.

Volume XV., is devoted mainly to county reports, but it also presents a very practical report on Cement and Cement Materials in Iowa by E. C. Eckel and H. F. Bain.

Volume XVII., considers economic subjects only. They are: Quarry Products of Iowa, Beyer, William and Bissel; Analyses of Iowa Coals, Limestones, Chalks, Clays, Shales and Marls, Tests of Iowa Building Stones, by Marston.

Volume XVIII., is unique in the series and one of the most notable. It is of purely scientific interest and is wholly given to the consideration of Devonian Fishes of Iowa by Dr. Charles R. Eastman. It is a well nigh exhaustive mono-

graph made possible by the wealth and variety of material afforded largely by the Devonian limestone near North Liberty, Johnson County, Iowa, though other localities contribute some excellent material.

Volumes not specifically mentioned above are given to county reports almost wholly. While space will not admit of referring in detail to the contents of each of these reports, it is proper to characterize them collectively as being rich in data respecting the various geological features to be observed in the counties under consideration whether of merely local or of general interest, and which can be made use of in the preparation of volumes on the stratigraphy, physiography, palaeontology, and other subjects involving the state as a unit. Whenever a county contains some particular phase of geology presented in an unusually favorable manner or degree, such a county has been assigned to someone particularly well qualified along that line, even though that feature may already have been handled in a monograph in some previous volume. Thus the subject gets a later consideration and at the hands of a second investigator. A few instances in illustration may be given. Leonard's monograph on lead and zinc in Volume VI. is well supplemented in the Dubuque County report in Vol. X., by Calvin and Bain. Wilder's report on Webster County contains a very valuable monograph on Gypsum and the Gypsum Industry, while the loess has received much attention in various reports. Shimek in his report on Harrison and Monona counties finds opportunity to give the public the benefits of his latest studies upon that most interesting formation. Similar remarks apply to his treatment of the Aftonian Stage in the same report. The temptation is strong to multiply instances. In fact, every subject of the geological interest in the state has been given special consideration time and again. I can not forbear to mention the Pleistocene series in a paragraph by itself, however.

Calvin in Volume XII., of the Survey says, "The work of our geologists, in co-operation with members of the U. S. Geological Survey, has made Iowa classic ground for the study of problems relating to the drift. The succession of events which took place during that most interesting and most unique of all the divisions of geological time, the Glacial Epoch, is more clearly recorded in Iowa than anywhere else on this continent." The history of geology in Iowa in the past twenty-five years shows a remarkable advance in the solution of the problem of the drift. Keyes, in his article on the Geological Formation of Iowa in the first volume of the Survey published twenty years ago, says the drift is made up in Iowa of two sheets, the upper and the lower till. Now, if we concede a place in the list to the Iowan, a condition I make only because of the doubt thrown upon it by Leverett within the past few years, there are five glacial and four interglacial stages definitely displayed and established within the bounds of the state. Involved with these are the loesses, gumbo, or the Loveland, as Shimek is pleased to term it, the Buchanan gravels and several other more or less differentiated deposits nearly all of which have been placed beyond doubt as to identity, relations, etc. An annual report of the mineral production of Iowa was begun in Volume VIII. This has been in charge of Prof. Beyer in all the succeeding volumes and has proven a valuable feature of the reports. The annual administrative reports of the State Geologist often contain noteworthy discussions of subjects that have an important practical

bearing on various questions that arise in the public mind. A good illustration may be found in Volume XI. on pp. 17-21 and in Volume VII., pp. 23-27, wherein Calvin plainly and positively sets forth what geology teaches relative to the possible findings of gold, petroleum, gas, etc., in paying quantities in Iowa, discussions which ought to be periodically published in the newspapers of Iowa until they are fully appreciated by the public, and here I cannot refrain from quoting his final paragraph on the subject in Volume XII., since it discloses so clearly the real character and spirit of the man. "Letters received at this office, asking for information and advice relative to boring for oil or gas, have been more numerous the past year than ever before. In every case the writers have been informed as to the exact facts and left to exercise their own judgment concerning the propriety of proceeding with the contemplated enterprise. In the matter of developing our natural resources the people of Iowa are entitled to the best information that geological science can give; and the present knowledge of the geological structure of the state makes it possible over the greater part of our area, to predict the outcome of drilling for water or for other products, with a high degree of accuracy. It is difficult, however, to get men—even the most intelligent of men—to appreciate the significance of some of the simplest of geological facts, when it happens that the men are not themselves geologists, nevertheless the world is moving toward a brighter, higher and grander intelligence; and those whose mission it is to teach can afford to exercise patience, to labor and wait."

At the risk of being commonplace and tedious I have given considerable detail to the published volumes of the Survey, because in a very large degree the geological history of Iowa in the past twenty years, at least, is to be found in these twenty volumes, volumes which will ever stand as a worthy monument to the energy, scholarship and eminent ability of the great souled man who planned the work and himself did no small part of it and who chose and directed as his assistants men who, in the midst of other heavy tasks, gladly gave themselves to the furtherance of the plans of their great leader, who for forty years was so identified with Iowa Geology that the one can scarcely be thought of apart from the other.

Earlier in this paper I have spoken of the work done by many who pursued their investigations from personal interest in the subject at a time when there was no help afforded them by the state, or the general government. Similar work has been kept up during the last twenty years, even though their services in many instances were required in furthering the work of the survey. Thus there is a very considerable store of valuable papers scattered through the various periodicals, bulletins and reports that publish such papers, the mere mention of the titles of which would occupy more time than I would be justified in using here. These papers constitute a most valuable supplement to the work of the Survey and I wish to append to this paper as properly belonging to my theme an index of such bibliography. I have alluded to some county field work not yet published. It is proper to say that no inconsiderable amount of work has been done on several special subjects which will be completed and published in the near future. Norton has been collecting data respecting all deep wells that have been put down since the sixth volume of the Survey was published that some time will be given the public in a form that will benefit the general public interested in securing copious supplies of wholesome water.

It may also be added that a few years ago the U. S. Geological Survey, Division of Hydrology, made a survey of the State as to its underground waters. I understand that the report will be issued some time during the present year. Norton had this work in immediate charge.

Topographic surveys have been conducted in certain parts of the state by the Topographic Division of the U. S. Survey and more than forty rectangles have been completed and maps have been published which are available for use in the schools and elsewhere at a moderate expense. Naturally the rectangles have been located where the topographic features are most pronounced, but in time the whole area of the state will have been covered by this work.

Another important phase of the geological history of Iowa during the last quarter century is the advance made in the work offered in physiography and geology in its high schools and colleges. Without attempting to enter into the details, I wish to call attention to the importance of what has been done. Twenty-five years ago physical geography was taught quite generally in the high schools and in the larger high schools geology appeared in the courses of study offered. But the physical geography of those days devoted much time to topics that had no connection with geology even in its broadest sense. Today physiography is practically the underlying basis of about all that is offered in the place of the old physical geography and it also is largely the basis on which commercial geography is built up, a branch of geography that has been developed almost wholly in the past quarter century. Physiography involves about every practical detail of dynamical geology and much of descriptive geology. The more obvious principles of physiography are often given under the head of Nature Study even in the grades in many schools, thus creating an interest in subjects that, when generally understood, will hasten the coming of that "brighter, higher and grander intelligence" forseen by Calvin.

Not only has the scope and application of physiography been greatly enlarged and improved, but it is taught today in every high school of any pretensions in the state. Then, too, the equipment in way of specimens, maps, charts, pictures, lantern slides, etc., has been multiplied and the method of handling the subject has become modern in the best sense of the word, insuring a clear comprehension of the subject and a practical application of the facts and principles involved. And here, I may speak of another phase of the work of the Survey in furnishing all high schools that desired it an illustrative collection of the minerals, rocks and fossils of the state, and also a large wall map of Iowa showing every detail of the formations as they were understood at the time of its publication. The geological column of the state accompanies the map, leaving little to be desired that could be graphically presented. The published volumes of the Survey also became a part of the reference library of each high school, so that the latest knowledge of each county's geology becomes promptly available in each school.

The advance in the courses and equipments of the university and colleges of the state has been even greater than in the high schools, as would have been expected, since they are the fountain heads, whence the advance in the secondary schools has been derived. Since we can not particularize in every case, it would be invidious to particularize in any case. Suffice it to say, therefore, that the

opportunities for the diffusion among the youth of the state of a knowledge of the geology of the state as well as of general geology are unexcelled anywhere.

It appears from a hasty review of what has been done in Iowa geology during the past quarter century that an advance has been made that has involved a critical investigation of every phase of the subject both in the way of the industrial interests and of pure science which, after all, in its ultimate results, is certain to prove of economic value as well and these investigations have been made with such efficiency by those who have given their time and effort to them that Iowa has great reason to be proud of the work and the workers. To be sure, much remains to be done. The very results secured have opened up new problems in some cases and it is undoubtedly true that when these new problems have been solved, they in turn will uncover yet others. It is difficult, if not impossible, to reach the ultimate in any direction.