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Report of the State Geologist

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Barbour, Erwin H., "Report of the State Geologist" (1903). *Conservation and Survey Division*. 455.
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NEBRASKA
GEOLOGICAL SURVEY

ERWIN H. BARBOUR, STATE GEOLOGIST

VOLUME I

REPORT

OF THE STATE GEOLOGIST



LINCOLN, NEB.
JACOB NORTH & CO., PRINTERS
1903

HISTORICAL INTRODUCTION

A history of the Geological Survey of Nebraska is briefly told, for its inauguration has been so recent that little is to be recorded. Citizens of the state, viewing the commonwealth as one rich in agriculture and poor in mines, have come to the false conclusion that a geological survey of the region is superfluous, if not wasteful. However erroneous such a conviction may be, it has served to check state appropriations for making public in printed reports the resources of which the state can boast. Prior to April, 1901, no legislative appropriations had been made, and the work of the Geological Survey was conducted at private expense. In 1891, the writer was appointed Acting State Geologist by Governor Thayer, and successively reappointed by Governors Crouse and Boyd, and by the legislature of 1893, in which year it was enacted that the head professor of geology at the University of Nebraska should be the geologist for the state, with the title Acting State Geologist. At the same time there were likewise established the offices of acting state botanist, chemist, and entomologist, all of these being purely honorary positions and carrying no salary.

The writer has willingly devoted his vacations and holidays to the state survey as a pure gratuity, his office not even being provided with stationery or postage for a voluminous correspondence, nor with any means of publishing facts and results. Citizens will therefore excuse the tardy appearance of formal reports.

Past conditions were somewhat reversed in 1899, at which time the Regents of the University of Nebraska, in recognition of the importance of a geological survey, provided that \$500 be devoted to this object during the year 1899 and \$250 a year for 1900, 1901, 1902.

ACCOUNT OF THE NEBRASKA GEOLOGICAL SURVEY
TO 1912.

BY ERWIN HINCKLEY BARBOUR.

Although the history of the Nebraska Geological Survey has been briefly reported on at least one former occasion, it was a number of years ago. In the meantime progress has been made, the organization of the Survey has been somewhat changed, and it seems expedient to bring the history to date for future reference. In the early struggle for the establishment of a Geological Survey of the State, apathy, rather than open opposition, had to be overcome, for public interest seemed to be centered upon agricultural pursuits. The idea that agriculture is our sole resource has been carried to such extremes that speakers in public addresses, county editors in their papers, and commercial clubs in circulars and reports have made the plain unqualified statement that "Nebraska has no interests save agricultural interests". One of the most unwarranted and widely distributed of these circulars was published recently by the Commercial Club of a prominent city in the State with the following headlines:

"Nebraska is purely an agricultural state. She has no income from any other source, and no indications or prospects of developing along any other line in the way of mining or minerals. With agriculture as our sole line of industry, are we as a State doing in a general way what we should to bring to bear every known line of energy or activity to secure the best results and interest the greatest number in the agricultural resources of our State."

If the Secretary who worded this sentiment, and if the Chairman of the Commercial Club who subscribed to it, had informed themselves, they would have found that Nebraska does have other interests, and that Agriculture is not its sole dependence.

This circular was written at a time when statistics showed that our non-agricultural interests were nearly as large as our agricultural interests. At that time our mining interests, viz., sand, clay, stone, etc. had reached large proportions. For example, the various industries based on the mining of native pumice alone in this State, as reported to this office, are several millions of dollars annually. It is highly commendable to foster our great staple industry, agriculture, and to exalt it, but on what grounds is any individual, any paper, or any commercial club authorized to minimize and debase the importance of our other industries? Such an action tends to a lopsided in-

stead of a symmetrical development. "The State without a mine" has become a sort of slogan, which unfortunately passes unchallenged, and too often carries with it conviction to those who do not stop to consider what the term "Mining" really comprehends. The effect is bad, for capital and industry, taking repeated assumptions for fact, go elsewhere to develop and enrich those states which do not publish quite so many adverse advertisements. Advertise agriculture by all means, but do not falsely advertise the State of Nebraska as lacking all else.

Americans professedly count class legislation odious, nevertheless, they have for years legislated in favor of one class—the agriculturists. No other class has been legislated for in a like manner. No other class has been thus aided by the Government. One or more costly Experiment Stations are established in every state. Our Legislators have not established Experiment Stations and laboratories for any of the other important industries. Naturally enough our citizens come to think that there is but one industry here and must be excused for saying so in public print. And it may be added that in spite of the fact that non-agricultural industries have received no Government help, the financial returns from these unaided industries in Nebraska promise to exceed in amount those of agriculture.

It is due the writer, that the above explanation be made to account in part for the tardiness of our State in reporting her resources. A serious delay also resulted from the fact that two administrations of the State University requested the writer to refrain from appealing to the Nebraska Legislature for funds for the State Survey on the ground that it might interfere with the appropriations for the University. Accordingly the expenses incident to early field explorations were of necessity borne by private individuals. For a number of years there was not even provision for stationery and postage.

Looking towards the establishment of a State Survey, Governor Thayer appointed the writer Acting State Geologist in 1891 and formal action was taken by the Legislature of 1893 in appointing the Head Professor of Geology in the University of Nebraska, State Geologist.

The first field party was conducted in 1891 by the writer, who not only contributed his time but defrayed the expense of the entire summer's work. In a like manner he bore the expense of the first expedition of 1892. The second of that year, and the

expeditions of several succeeding years, were borne by the Honorable Charles H. Morrill.

In order to carry the State Geological Survey through the pioneer days, the writer has sacrificed some twenty-one hundred dollars of his own money besides forfeiting for twenty years all possible earnings during his vacations.

This might seem unbusinesslike, but for the fact that the undivided energies of instructors are directed to the benefit of others, and not towards the pursuit of wealth.

In 1899, the Regents of the University of Nebraska, recognizing the importance of a State Geological Survey and knowing that no State funds were available for the work, provided that \$500 be devoted to this object during the year 1899. This was scaled down to \$250 for the years 1900, 1901, and 1902. These sums, though small and wholly inadequate to the work involved, were nevertheless very important aids in maintaining the life of the Survey, and rendered possible certain investigations which otherwise probably could not have been conducted. Fortunately for the Survey, the Hon. Charles H. Morrill, for twelve years President of the Board of Regents, who from early days had been interested in geological investigation, became a patron of the University to the amount of about \$1,000 a year devoted to the work of collecting material of all kinds; more particularly, the fossils of the State in which he was especially interested, but including also collections of rocks, clays, limes, soils, native pumice, and other resources.

The first direct State aid was given in 1901 when the Legislature voted \$1,200 for the initial work of the Nebraska Geological Survey. The State Museum at that time occupied the first, second, and third floors of the east end of Nebraska Hall, known also as Science Hall. Unfortunately the building was soon so congested with collections illustrating the resources of the State, that the floors could not carry the load; hence much of the material had to be packed and stored in the basements, attics, and steam tunnels throughout the campus. This practically brought the Morrill Geological Expeditions, which had become an important aid to the State Survey and a feature of the University, to a standstill from 1901 to 1906. In 1906 a portion of one wing of a new Museum was built, and Mr. Morrill again became a patron of the University by annual contribution of \$1,000 for the collection of geological material. By 1910,

however, this building was completely congested, and again Mr. Morrill, against his wishes, discontinued his friendly patronage.

Impressed by the unexpected development of certain resources, and by the necessity of co-operation with the United States Geological Survey, the Legislature of 1911 readily appropriated \$10,000 for the biennium 1911 and 1912. This was allowed in the general appropriation bill signed by the Governor, April 25, 1911, worded:

"For publishing reports for the Geological Survey of Nebraska, and for co-operation with the United States Geological Survey, ten thousand dollars, said money to be expended under the direction of the Board of Regents and the State University."

Accordingly, as a matter of form, the Board of Regents reappointed the writer State Geologist at their meeting May 18, 1911.

The Legislative appropriations for the respective biennia are as follows:

1901-1902\$	1,200
1903-1904\$	2,000
1905-1906\$	2,000
1907-1908\$	2,500
1909-1910\$	2,500
1911-1912\$	10,000

A WORD OF EXPLANATION.

Respecting the typography and appearance of certain reports, prior to 1912, a word should be said in explanation. The director of the State Survey specifies the kind and quality of paper, type, etc., while the State Printing Board advertises and lets all contracts for printing, which, according to law, must go to the lowest bidder. Consequently certain manuscripts fall into unfortunate hands and inferior work is the result. Censure for these errors always falls, not on the printer, but on whoever serves in an editorial capacity. And, while we would not indulge in apologies, we feel disposed to mention certain extenuating circumstances.

While it seems to be the only course to pursue, it is none the less unfortunate that state reports should go to the lowest bidder. For the best is none too good for the people, and the lowest bidder is not infrequently a young and relatively inexperienced village printer with little knowledge of the fitness of things in book-making. Being over-sanguine he is tempted oftentimes to submit bids too low for possible profit, the inevitable result being hurried and inferior workmanship. Fired by hope of gains and reckoning badly on the costs,

he sometimes exceeds the limit of credit and fails, and then peddles his contracts to others. This has happened twice in the past nine years. In one case a printer on the verge of bankruptcy held one of our reports of 150 pages on the press, blocking subsequent reports for a year or more, by virtue of the fact that this state job gave him standing with his creditors. After foreclosure the contract was peddled to three others in succession before it was finally done.

However deeply we may deplore such experiences they seem at times inevitable. Work done under such circumstances cannot come up to standard, and must to a greater or less degree prove disappointing to the reader, the director, and especially to the author who must feel that the quality of his paper is misrepresented by inferior press work.

While there is a penalty clause covering such wanton delay, it is so worded as to be easily evaded and thus rendered inoperative. In justice to the general printing profession these cases may be counted exceptions, for as a rule our printers are well equipped and their intentions good, making all relations with them in an editorial capacity pleasant and profitable.

Under the present organization of the Nebraska Geological Survey, printing contracts are let by the Purchasing Agent of the State University, and there is hope and assurance that better printing, better paper, and greater uniformity may at last be a reality.

PUBLICATIONS OF THE NEBRASKA GEOLOGICAL SURVEY.

A full list of the publications of the Nebraska Geological Survey to July, 1910, may be found in Volume IV, pages 1 to 16. Volumes I, II, and III have been printed. Of Volume IV, five parts have been published. Volume V is written and engraved and ready for the printer. Volume VI is likewise ready, and of Volume VII, five parts are in press. Volumes IV, V, VI, and VII will probably be printed simultaneously. A printed list of such publications of the Nebraska Geological Survey as are now available for distribution will be mailed on application. To institutions and individuals favoring the State Survey with their printed books and reports, our reports are sent postage free; to others they are sent at the price of mailing. To the State Survey, the total cost of mailing separates and volumes is practically prohibitory, amounting to about \$400 in postage

for each thousand. Furthermore, experience shows that when the volumes are postage free, they are viewed as public circulars to be called for indiscriminately and cast aside as lightly as secured.

MANUSCRIPTS AND FIELD NOTES.

The field books of each season are duplicated in typewritten form and properly bound. These are now thirty in number, with numerous geological maps, photographs, and drawings. The following counties have been surveyed topographically by the United States Geological Survey and geologically by the Nebraska Geological Survey: Adams, Butler, Cass, Clay, Douglas, Franklin, Gosper, Hall, Hamilton, Harlan, Howard, Kearney, Lancaster, Merrick, Nuckolls, Phelps, Polk, Sarpy, Saunders, and Webster. In the case of each of these, separate county reports are forthcoming. In addition to the above data there are thousands of miscellaneous notes, among which are many relating to wells, water supply, etc., secured in conjunction with the United States Geological Survey. Unfortunately, the disastrous fire of March 6, 1912 destroyed many of the well records and other data, and will of necessity delay work on forthcoming volumes.

CO-OPERATIVE WORK.

Co-operative arrangements between the Nebraska Geological Survey and the United States Geological Survey were entered into in July, 1911. The local Survey set aside from its funds a sum not to exceed \$3,000 for the biennium, and the Federal Survey a like sum for the furtherance of topographic work. Owing to the exceptional heat of the summer of 1911, levelmen and topographers were not detailed to work in Nebraska until late in the season, when one leveling party consisting of C. P. Gross, levelman, and E. Funsted, rodman, undertook work in Nemaha County. The heat waves rendered telescopic sighting so trying to the eyes that this party was disqualified for further work at the end of a few weeks, and was succeeded by C. P. McKinley, levelman, and D. G. Hull, rodman. Simultaneously with these a topographic party consisting of R. H. Reineck, assistant topographer, and Roy R. Monbeck, rodman, (U. of N. 1911), conducted topographic work in the same region until severe weather closed the season. This co-operative work will be resumed in the spring of 1912 by C. C. Gardner, assistant topographer, and Roy R. Monbeck, rodman.

THE VALUE OF TOPOGRAPHIC WORK OF THE U. S.
GEOLOGICAL SURVEY.

Little or no exact geological work is possible until correct base maps are prepared by competent government topographers. The Government sends experts who work with a maximum of speed at a minimum of cost, and divides expenses equally with the State. Should the State undertake to do this work alone the expense would be prohibitory. Nebraska was the fortieth state to avail itself of the advantages of co-operative work with the Government.

"The benefits to the State from co-operation of this kind are numerous. It gains a complete topographic map of its area, which is of importance to the development of its economic resources and greatly facilitates the study and perfection of all engineering plans and works within it. Among other uses of the topographic maps are the following:

1. As preliminary maps for planning extensive irrigation and drainage projects, showing areas of catchment for water supply, sites for reservoirs, routes for canals, etc.
2. For laying out highways, electric roads, railroads, aqueducts, and sewage systems, thus saving the cost of preliminary surveys.
3. In improving rivers and smaller waterways.
4. In determining and classifying water resources, both surface and underground.
5. In making plans for the disposal of city sewage, garbage, etc.
6. In determining routes, mileage, location of road-building material, and topography in country traversed by public highways.
7. In selecting the best routes for automobiling tours and inter-city runs.
8. As guide maps for prospectors and others in traveling through little known regions.
9. As bases for the compilation of maps showing the extent and character of forest and grazing lands.
10. In classifying lands and in plotting the distribution and nature of the soils.
11. In compiling maps in connection with the survey and sale of lands.
12. In making investigations for the improvement of the plant and animal industries, and in a comprehensive study of physical and

biological conditions in connection with the stocking of interior waters with food fishes and the locating of fish-culture stations,

13. In locating and mapping the boundaries of the life and crop zones, and in mapping the geographic distribution of plants and animals.

14. In plotting the distribution and spread of injurious insects and germs.

15. As base maps for the plotting of information relating to the geology and mineral resources of the country.

16. In maneuvers of the national guard, in the development of military problems, and in the selection of routes for road marches or strategical movements for the troops, particularly of artillery or cavalry.

17. In connection with questions relating to state, county and town boundaries.

18. As a means of promoting an exact knowledge of the country and serving teachers and pupils in geographic studies.

19. As base maps for the graphic representation of all facts relating to population, industries and products or other statistical information.

20. In connection with legislation involving the granting of charters, rights, etc., when a physical knowledge of the country may be desirable or necessary.

In addition as an incident in the making of a topographic map, monuments are established throughout the State, and as their positions are accurately determined by geodetic methods, they serve as datum points for all other government, private, and cadastral surveys. The work includes also the establishment throughout the State of bench marks or permanent monuments which furnish datum elevations for the determination of height in connection with all future public or private engineering works. The magnetic declination is frequently determined, and this work aids local and county surveyors in determining the declination of their compasses, and thus greatly facilitates the search for old property lines."

FIELD WORK, SEASON OF 1911.

The following parties were engaged in active field work during the season of 1911: Jerome B. Burnett, visited every town and city in the State to get commercial data on clay pits, brick and tile production, etc. Later in the season chemical and physical tests of Ne-

braska clays were undertaken by George Borrowman, Adjunct Professor in Chemistry.

A second party, consisting of Edwin G. Davis, Robert A. Graham, and C. Harold Eaton, furnished with team, wagon, two motor cycles, and complete camp outfit, were engaged upon the stratigraphic survey of Adams, Butler, Douglas, Gosper, Hall, Hamilton, Howard, Kearney, Merrick, Phelps, Polk, Sarpy, and Saunders Counties. The two motor cycles proved to be highly efficient aids in field work.

A third party, consisting of the writer and E. F. Schramm, accompanied for two weeks by Dr. J. W. Beede, explored the stone quarries, clay pits, and outcrops of the Carboniferous in Southeastern Nebraska, having in mind the exact correlation of the Carboniferous beds.

A fourth party, under C. P. McKinley, was engaged in co-operative work running control lines in Nemaha County, as mentioned on page 10.

A fifth party, in charge of R. H. Reineck, was engaged in the same region in topographic work as described on page 10.

During the season of 1912, work will be resumed, particularly in Southeastern Nebraska, where levelmen and topographers will begin co-operative work, according to agreement, in April.

THE UNIVERSITY OF NEBRASKA,

Lincoln, March, 1912.