

ANNUAL REPORT

OF

PROF. GEO. H. COOK, STATE GEOLOGIST,

TO

HIS EXCELLENCY JOEL PARKER,

PRESIDENT OF THE BOARD OF MANAGERS

OF THE

GEOLOGICAL SURVEY OF NEW JERSEY,

FOR THE YEAR 1865.

TRENTON, N. J.:

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1866.

STATE OF NEW JERSEY, }
EXECUTIVE DEPARTMENT, January 10th, 1866. }

- *To the Senate and General Assembly:*

By the act of the Legislature authorizing the completion of the Geological Survey of the State, which was approved March 30th, 1864, it becomes my duty to submit to the Legislature the annual report of the State Geologist upon the progress of the work, together with the expenses attending it. The report is herewith submitted.

The act appointed a Board of Managers, consisting of the Governor of the State as President, and two persons from each Congressional District as members, who, with the State Geologist, have the management of the survey, and direct the publication of its results.

Board of Managers:

His Excellency JOEL PARKER, (President).

Gen. DAVID POTTER, of Cumberland.

Hon. ANDREW K. HAY, of Camden.

Hon. WILLIAM PARRY, of Burlington.

JOHN A. ROEBLING, Esq., of Mercer.

ISAAC B. CORNELL, Esq., of Somerset.

HENRY AITKIN, Esq., of Union.

Hon. ANDREW B. COBB, of Morris.

ABRAHAM S. HEWITT, Esq., of Passaic.

WILLIAM M. FORCE, Esq., of Essex.

Hon. JACOB R. WORTENDYKE, of Hudson.

The Board has held regular meetings, at which the progress of the work has been shown, and the plans for its continuance presented. The accounts have all been audited by a committee of the Board.

At the last meeting the Geologist was directed to proceed with the publication of the map and report upon the marl district of the State, and some of the results of the survey will soon be ready for distribution.

JOEL PARKER.

*To His Excellency Joel Parker, President of the Board of Managers
of the Geological Survey of New Jersey :*

Sir: I have the honor herewith to submit my report upon the operations of the State Geological Survey for the present year.

Your obedient servant,

GEO. H. COOK,
State Geologist.

New Brunswick, N. J., Dec. 26, 1865.

REPORT.

The work upon the geological survey has been steadily prosecuted through the entire year. Mr. John C. Smock, Assistant Geologist, was engaged in the chemical and mineralogical examination of rocks, minerals, and other useful substances during the last winter. With the opening of spring, he began the survey of the trap ridges in the red sandstone district, and continued it through the month of June. Since that time he has been engaged in the marl district, verifying the work of the survey of 1854-5-6, and carrying it out with greater minuteness of detail. Professor David Murray was occupied for some time last winter and spring in collecting and arranging all the geographical positions which had been previously determined in the State. During the summer, he connected the eastern end of the New York and New Jersey State line with the United States Coast Survey, and determined its latitude and longitude. He has also made considerable progress in triangulating, for the correction of the State geological map, and finished a few computations. Mr. Paul Cook was engaged with Professor Murray in his work. G. M. Hopkins, Civil Engineer, has made a careful survey and plotted upon a large scale, about eighty square miles of territory in Morris county. This includes the largest iron mines of that county. He was assisted in the field by Mr. Edward H. Latch, and in mapping by Mr. S. B. Linton. Mr. Hopkins has also compiled from various sources, and drawn a map of the greensand marl district in the counties of Monmouth, Ocean, Burlington, Camden, Gloucester and Salem. Dr. Chas. C. Abbott has spent some time in continuing his catalogue of the vertebræ animals of New Jersey. From the United States Coast Survey, through J. E. Hilgard, Esq., Assistant in charge of the office, there has been furnished descriptions of all triangulation stations they have occupied in the northern half of the State; together with diagrams of the several locations. My own time has been partly taken up with the work mentioned above, and partly in studying out the geology of districts which must next be surveyed in detail.

The results of the survey during the past year are as follows:

1. A geological map and sections of the cretaceous formation, including the greensand marl beds. It also includes the fire and potter's clay beds. The different strata are traced upon the map, as they appear upon the surface; and they are shown in thickness, dip and relative position in the different sections. The map is upon a scale of two miles to an inch, and includes an area of about two thousand square miles. The descriptive matter to accompany this map is collected, a large number of chemical analyses are completed, and the whole work so far advanced that it is expected the final report will be ready for publication in the course of the winter.

2. A topographical survey and map of part of the iron-ore district of Morris county has been completed. This map has been drawn upon a scale of six inches to one mile. It covers about eighty square miles, and upwards of sixty different iron mines are located upon it. The heights of hills along the veins of iron-ore have been found by leveling, and the hills are defined by level contour lines drawn along their surface for every twenty feet of rise. The fields of cultivated land are also shown and the woods. There is still needed to complete the map, a magnetic survey of the direction and extent of the veins of iron ore that are now worked. If means will allow, the contour lines may be surveyed and drawn over the whole map. Sections and plans of some of the principal iron mines are also to be drawn. There is still other field work in geology to be done upon the district embraced by this map before it will be ready for publication.

3. A partial report, with map and sections of the Green Pond Mountain rocks is in preparation. These rocks have heretofore been the subject of much study and speculation. They form a long and narrow range of mountain ridges of conglomerate, sandstone and shale, bounded on both sides by the gneiss rocks of the Highlands. They contain but few fossils or other marks for determining their age or position in the geological series. The sections which have been made show that they lie directly, but unconformably, upon the gneiss. Fossils of the Trenton Age are found at a few localities, lying in a synclinal valley of these rocks, and probably upon them. From these facts it may fairly be concluded that the rocks in question are among the lowest in the series of sedimentary or fossiliferous formations. Full and detailed sections of heights and of rock structure will be prepared before publication.

4. A very large collection of heights above the level of the sea, of places in various parts of the State, has been obtained from our own observations, and from the various railroad and canal surveys. These will be used in constructing geological maps and sections. They will also be useful in illustrating the physical geography of the State, and in furnishing information relating to the location of roads, railroads, canals, and works for water power and for drainage. The sources from which these heights have been ascertained are given in the tables. There are one thousand of these, including the heights of mountains, mountain gaps, canal levels, railway summits and sta-

tions, bridges, streams, &c., all of which can be easily identified. It is designed to extend this as far as possible in the further progress of the survey.

5. The true latitude of the monument at the east end of the State line between New Jersey and New York, has been determined by making it a triangulation point, and connecting it with well known stations of the United States Coast Survey. This line was originally marked by stone monuments set in the ground at the end of every mile. The line was run in the summer of 1774. Since that time some of the posts have been lost, and of others it is asserted that they have been moved. As it becomes important in describing and locating iron mines and other valuable property along the boundary, it is necessary to have the line itself reliably defined. It is as a beginning of this work that the geographical position of the starting point on the Hudson has been again ascertained, and if means will allow, the whole line will be resurveyed.

The point agreed upon by the Commissioners who settled the boundary between the two States for the east end of the line, was on the west bank of the Hudson river, in latitude 41° north. The latitude was determined from astronomical observations by the eminent astronomer David Rittenhouse. It is about a mile below Sneden's Landing, and is marked upon a heavy block of stone, which lies upon the bank of the river, just at high-water mark. It is undoubtedly in the place where it was originally set. Our calculations make it to be in latitude $40^{\circ} 59' 47''.78$, and in longitude $73^{\circ} 53' 51''.25$. This varies from the determination of Mr. Rittenhouse by $12''.22$, or about 1,237 feet. This result does not, however, discredit the accuracy of Mr. Rittenhouse's work. Similar discrepancies between the results of astronomical observations, and geodetic surveys have been frequently observed both in our own and in foreign countries: and they are too well known to be attributed to errors of observation or measurement, though the cause is not fully understood.

6. In reviewing the triangulation of the northern part of the State, which was done in 1854-5-6, the following geographical positions and distances have been satisfactorily determined, using the United States Coast Survey line between Springfield and Mount Rose as the base:

LATITUDES, LONGITUDES, AZIMUTHS AND DISTANCES.

STATIONS.	LATITUDES.	LONGITUDES.	AZIMUTH.	TO STATION.	DISTANCE IN METRES.	DISTANCE IN FEET.	DISTANCE IN MILES.
Springfield.	40° 41' 19".44	74° 21' 03".44	41° 07' 46".1	Mount Rosc.	47,366 7	155,410 15	20.43
Mount Rosc.	40° 22' 00".56	74° 43' 06".14	220° 53' 27".8	Springfield.	47,366 7		
Mine Mount.	40° 43' 17".45	74° 38' 23".33	279° 43' 16".07	Springfield.	21,523 18	69,061 35	13.25
Mine Mount.			99° 54' 34".25	Back Azimuth.	40,642 05	133,346 57	25.25
Walnut Grove.	40° 50' 24".08	74° 34' 21".85	14° 16' 36".03	Mount Rosc.	25,120 34	82,419 83	15.609
Walnut Grove.			194° 13' 55".91	Back Azimuth.	13,561 32	44,494 69	8.302
Boonton.	40° 55' 06".73	74° 14' 04".47	311° 53' 53".54	Springfield.	23,859 12	84,843 77	16.06
Boonton.			132° 03' 33".55	Back Azimuth.	16,880 88	55,386 16	10.48
			9° 53' 00".24	Mine Mount.			
			189° 56' 22".07	Back Azimuth.			
			350° 33' 02".65	Springfield.			
			107° 40' 59".53	Back Azimuth.			
			58° 57' 48".55	Walnut Grove.			
			238° 51' 5".44	Back Azimuth.			

7. The geographical positions determined by the United States Coast Survey, within the bounds of New Jersey, have been copied out from the various reports in which they have been published, and are arranged for use in constructing maps.

The descriptions and marks of the different stations occupied by the Coast Survey in the northern half of the State, have been copied out from the records of the office and sent to us.

The officers of the United States Coast Survey have rendered material aid to the Geological Survey by the free use of their theodolites, and by their prompt and hearty response to all applications for information relating to their work or records.

8. The catalogue of vertebrate animals of the State, has been continued by Dr. Charles C. Abbott, of Trenton.

EXPENSES.

At the annual meeting in December, 1864, the Survey had been in operation only nine months, and the accounts then audited amounted to-----

-----	\$1,198 64
The bills for the remaining three months of the year were audited by your committee, Messrs. Hewitt and Aitkin, and amounted to-----	1,076 08

Making, for the first year, a total of-----	\$2,274 72
Which is less than half the \$5,000 appropriated.	

The expenses this year are as follows:

For the quarter ending June 30-----	\$1,173 49
" " " September 30-----	2,221 84

These have been audited by the committee and paid by the State Treasurer.

The bills for the quarter ending December 31, amount to-----	1,063 29
	<u>\$4,458 62</u>

The act of the Legislature of 1864, for completing the Geological Survey of the State (Laws of New Jersey, chap. 337, p. 591), required the "survey to be completed within a period not to exceed four years, and at an expense not to exceed the sum of twenty thousand dollars, aside from the cost of publication." It is intended to keep the expenses of the work within the appropriation, and to complete the survey in the time set.

PLAN OF PURSUING THE WORK STILL TO BE DONE.

In the further prosecution of the survey it is proposed to finish the work in sections, like that of the cretaceous formation which is now presented. The red sandstone formation which lies directly northwest of the cretaceous will be finished in the course of the year; and following that, the large district which lies to the southeast of the

cretaceous, and includes all the southern part of the State, will be completed. The northwestern portion of the State, comprising that which is most intricate in its geological structure will be the last done.

The great natural advantages of our State, in its nearness to the best markets of the country, in the remarkable adaption of its soil to the most productive agriculture in its great mineral wealth, in its immense water power, and in its mild and healthy climate are beginning to be appreciated. At no time during the history of the State has population increased so rapidly, industrial enterprise been so extensive and successful as now, nor has the value of property ever before increased so fast. Everything that can be done to develop our resources, and make them more fully known, helps forward these interests of the State. The Geological Survey which is devoted to these objects, has met the hearty approval and co-operation of our citizens. The names of those who in their public or private capacities have contributed aid and information to the work would make too long a list for this report; it would be invidious to single out from among them, and I must therefore, in general, express to those friends the thanks of my assistants and myself; as I know I do also of the board of managers, and of yourself their president, for the many favors received.

GEO. H. COOK, *State Geologist.* --