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JOHN R. PROCTER, DIRECTOR.

REPORT

ON THE

PROGRESS OF THE SURVEY

FROM JANUARY, 1888, TO JANUARY, 1890,

By JOHN R. PROCTER.

FRANKFORT, KY.:

CAPITAL OFFICE, E. POLK JOHNSON, PUBLIC PRINTER AND BINDER
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REPORT OF STATE GEOLOGIST.

To His Excellency, S. B. BUCKNER, Governor of the Commonwealth of Kentucky :

SIR: I have the honor to make the following report on the progress of the Geological Survey of the State for the two years ending December 31, 1889 :

In my last biennial report I gave a review of the work of the Survey from the time it came under my direction, in 1880, to the close of the year 1887; and also called attention to some of the results obtained by the Survey. As this report has been published in the "Public Documents" (1887-88) where it can be seen by persons who wish information on the work of the Survey, I will not dwell upon work done previous to the year 1888.

The scope of the work can be better understood by dividing it under the following heads :

(1) Topographic Work: The surveying in the field and platting of maps of the counties of the State on a scale of two miles to the inch; the completion of an accurate map of the entire State.

(2) The Geological Work: Putting the geology on the maps; obtaining information respecting the extent, thickness, and quality of the various strata of coals, iron ores, clays, etc.; making careful measurements of coal for publication; averaging samples for analysis; testing, to determine coking properties of coals; studying relations to available transportation routes; and also relations to resources in adjacent States; a study of kinds, quality and distribution of timbers; to publish accurate geological maps, and carefully prepared and accurate reports to accompany these maps.

To make also survey of counties to promote agricultural

development; to analyze the soils and subsoils, and underclays of the various geologic horizons; and to color the geology on the maps to enable the agriculturist to make practical use of results obtained. To study, and report on, natural fertilizers, such as marls, phosphatic rocks, etc. To study the structures with reference to the stores of petroleum, salt water and gas.

(3) Chemical Work: This is intimately connected with the field work in geology. Analyses are made from samples carefully collected by officers of the Survey, of coals, ores, clays, marls, mineral waters, soils, rocks, and other substances.

(4) Collection for State Cabinet: The collecting specimens of coals, ores, building stones, etc., of the State, and arrangement in a manner best calculated to give reliable information and enable persons to study intelligently the resources of the State.

(5) The Office Work of the Survey: Preparation of reports for publication and reading proofs of same; drawing sections and preparing illustrations; drawing maps and coloring geology on same; conduct of the large correspondence of the Survey.

The work for the past two years will be discussed under the several divisions as above given.

(1) TOPOGRAPHIC WORK.

This department has been for a number of years in charge of Mr. J. B. Hoeing, an educated engineer, who has had large experience in topography.

He has, during the past few years, been ably assisted by Mr. Fred. H. Bagby. The work of this department consists in (1) surveying the various counties of the State, and publishing a map of each county, on a scale of two miles to the inch; and, (2) the completion of an accurate map of the entire State.

A most important work during the past two years, has been the compilation and publication of a much needed map of the State, on a scale of ten miles to the inch. This has been published as a county map, and the same map, showing the Geol-

ogy of the State more in detail than has hitherto been shown, has just left the press. This map is a great improvement on all previous maps of the State. It is the only map of the State showing correctly the mountain structure along the south-eastern border of the State.

The Survey is also engaged in making a map of the State on a scale of 1,300,000 (the nearest decimal scale to five miles to the inch). This is large enough to show prominent features in topography and subdivisions in geology. The turnpikes and more important public roads will also be shown. Only accurate work is put on this map, and, with the means at the disposition of the Survey, progress has necessarily been slow.

As the county maps are completed on a scale of two miles to the inch, they are reduced and transferred to this map. Such surveys for railway lines as can be obtained are copied, and by this means, much additional data can be utilized.

During the summer and autumn of 1888, Mr. Bagby, assisted by Mr. L. M. Sellier, Mr. C. B. Blakey, Mr. Clement Nunn, and Mr. John L. Grayot, completed the field work in the counties of Lyon, Livingston and Webster, and during the winter the maps of these were drawn and made ready for the Geologist.

In the spring of 1889, a party was sent, in charge of Mr. Bagby, to make a survey of the South Fork of the Cumberland river, northward from the State line. This was necessary in order to complete the maps of Pulaski, and Wayne and Whitley counties.

After completion of this work, a party was organized for work in Western Kentucky, under direction of Mr. Bagby, consisting of L. M. Sellier, J. M. Major, Edward Bull, Hugh Frazer and Lindsey Blainey. Breckinridge and Meade counties were surveyed, and the maps of those counties are now being drawn in the Frankfort office of the Survey.

The topographic and geological map of Whitley, and that part of Pulaski county located south of Cumberland river, has recently been completed and published. Proofs have been received of the maps of Lyon, Livingston, Caldwell and Crittenden counties, and these maps will be published so soon as the geology can be put on the sheets. A very instructive map, showing mountain passes, was published during the year 1889.

The maps of the State and those of the various counties already published are much in demand, and it is important that this work be pushed to completion.

Reliable maps are of inestimable value, and their importance is steadily increasing. Such a map is indispensable to a correct delineation of the geology, and is valuable to the agricultural, commercial, mining, manufacturing, and more especially to the educational interests of a community.

It was well said by a wise ruler: "To govern a country well, it is necessary to know it well."

(2) GEOLOGICAL WORK.

It was required by the last act appropriating money for the continuation of the Survey, that work should be prosecuted first in such counties as had received less attention from the Geological Survey. This requirement has been strictly observed in the conduct of the field work during the years 1888-9. The region between the Tug and Levisa Forks of the Chatterawha or Big Sandy river, from Wolf Creek southward to the State line, comprising about 800 square miles, came within the above requirements, as it had not been touched, either by the present Survey or by the former, under the direction of Dr. D. D. Owen. In the summer of 1888, Mr. C. M. Brown, who had been connected with the Geological Survey of Ohio, and who had knowledge of the stratigraphy of much of the Appalachian coal field, began work in this region, in connection with Prof. A. R. Crandall, who has immediate charge of work in the eastern coal field. Explorations during 1888 were mainly confined to the area drained by the waters of John's Creek. Prof. Crandall has continued his study of this region, during the year 1889, whenever he could be spared from work in other sections. He had the services of Mr. I. J. Proffitt, who had rendered valuable assistance in opening and tracing coals on the head waters of the Kentucky river in former years. Mr. Proffitt was engaged in opening and facing up coals, so that they could be measured and sampled for analysis by officers of the Survey. His work was performed in a most satisfactory manner. As a result of

the investigations of the past two years in the above-mentioned region, several coals have been identified and traced, so that their position and extent is known, and the existence of the main coking seam, previously described as a valuable coking coal, and named the "Elkhorn Bed," has been proven over a wide area as a valuable coal of workable thickness. Several iron ores of much promise have been studied, one well suited to the manufacture of steel by the Basic process. Two or three weeks' field work will be necessary between Levisa and Russell Forks before the complete report on this region can be made ready for publication. Prof. Crandall also completed field work in Whitley and southern part of Pulaski county, which had been commenced in 1887. The geological map of that section has been published, and the report, with plates and sections, is now ready for the printer.

Prof. Crandall has been assisted in his work in the eastern coal field by Mr. G. M. Sullivan. In 1888 Mr. Sullivan was engaged on the upper waters of Straight creek and on the head waters of the south fork of the Kentucky river. During the year 1889 Mr. Sullivan was engaged with Prof. Crandall in a study of the economic geology of Jackson and a portion of Rockcastle counties. The report, map and sections covering this region are now being prepared in the office. A preliminary report on the "Resources of the North Cumberland Valley" was published some years since, and ran through several editions. The publication of the completed report on this region has been delayed. Mr. Thruston, who was Prof. Crandall's assistant in the work, accepted a more remunerative service elsewhere, and other causes operated to prevent the earlier publication. Most of the matter, including numerous sections, is now in hand, and it is expected to print this report early in the spring of 1890. The analyses of coals collected have already been published in the chemical reports. As the mountains between the Pine and the Cumberland are the highest in the State, attaining an elevation of 4,000 feet above sea level, on the head waters of the Cumberland, it would be of value to construct a map of this region showing the mountain structure. The data collected by the U. S. Survey, the various railway and land surveys, and the State Geological Survey, with a few weeks field

service of a competent topographer making corrections on map, will enable the Survey to publish an interesting and valuable map of this region on the uniform scale of two miles to the inch. Only a few counties in the eastern coal field remain unexplored and it is believed that, if the amount appropriated for the continuation of the Survey be not decreased, data for reports on the entire region can be collected during the years 1890 and 1891.

In the western coal field the Survey has now ready for the geologist, maps of Butler, Ohio, Muhlenberg, Hopkins, Webster, and Hancock, and some data on the remaining counties. Enough topography is ready to keep one more geologist busy in that field until the maps of the few counties not yet surveyed can be completed. It would be in the interest of economy if two topographic parties could be set to work in Western Kentucky during the spring and summer of 1890—one in the coal field and one in the counties included in the subcarboniferous limestone formations surrounding the coal field. I was disappointed in my efforts to secure the services of a competent geologist to do economic geology in this field during the past year. Such work can be pushed forward more rapidly than similar work in the eastern field, since, with the examinations already made, this field is better known, and the transportation facilities make all parts of the region easily accessible.

Mr. E. O. Ulrich, who, because of his connection with the Geological Survey of Illinois, had acquired a knowledge of the rocks below the carboniferous, was put at work in Caldwell county in 1888, and he continued in that region during the year 1889, completing the field geology of Caldwell and Crittenden counties. He is now engaged in preparing his report on those counties for publication.

Prof. R. H. Loughridge, who had finished the geology of the counties west of the Tennessee river, completed, during the year 1889, the geology of Livingston county, and is now engaged in preparing it for publication. It is hoped to continue this work over the counties of Lyon and Trigg during the present year. In the forthcoming reports on the counties above-named, situated between the western coal field and

the Tennessee river, especial attention will be given to the large deposits of superior limonite or "brown" iron ores. These are similar to the ores on which the prosperity of Decatur and Sheffield is based. Furnaces in these counties will have, in addition to the local ores, the similar ores of Alabama and Tennessee brought *down* stream, and in the direction of the market. They will also be convenient to the Missouri ores, carried up the Ohio river to the furnaces in the upper Ohio. The report on the Geology of Clinton County, by Prof. R. H. Loughridge, is in the hands of the printer. The geological map of this county has already been published.

In addition to the regular work in the counties above referred to, it was necessary to have special work done before the geological map of the State could be published, viz: The tracing of the outlines of the Trenton rocks of the lower silurian; the tracing of the division between the upper and lower members of the subcarboniferous; the exposures of the Devonian black shale in the counties of Pulaski, Casey, Russell, Wayne, Allen, and Monroe, and the extent and outline of the alluvial bottom lands along the valley of the Ohio river.

In my last biennial report, in speaking of natural gas, I said: "The recent discoveries in adjoining States of this cheap and valuable source of power, have led to hopes of finding valuable stores by boring into the rocks of this State. These efforts have been reasonably successful, and, at the same time, have been the means of greatly increasing the knowledge of the rock formation beneath the surface of the State. Enough has been learned to establish the fact that there are reliable gas horizons in the State, and, at the same time, to enable the Survey to advise against the putting down wells in unpromising localities. The results of the borings made in the State are being collected by the Survey, and it is hoped to have enough data collected to justify the early publication of a report on this subject." Wishing to give the people of this State the benefit of the best known authority on the natural gas and petroleum, the Survey secured the services of Prof. Edward Orton, State Geologist of Ohio, who has for the past few years made a special study of these subjects. Prof. Orton could spare from his other duties only two or three summer months. He carried forward his

investigations during the summers of 1888 and 1889, extending his observations from Meade county westward to the Tennessee river, and southward to the region drained by the head waters of the Green and Barren rivers. The results of his observations have been embodied in a report which, when published, will be one of the most valuable contributions to the literature of natural gas and petroleum thus far published. If the means at the disposal of the Survey will admit, it is expected to have the benefit of Prof. Orton's services until he can extend his observations for gas and petroleum over the entire State. This need not require a great amount of field work, as a mass of valuable data is already accumulated in the possession of the Survey. It is confidently expected that large stores of natural gas and petroleum will reward judicious exploration. During the past autumn I visited Grayson county and indicated locations for three wells, where the conditions are most favorable for the obtaining of gas under high pressure.

(3) CHEMICAL WORK.

The distinguished chemist, Dr. Robert Peter, has been at the head of this department since the first organization of the Survey, under the direction of Dr. D. D. Owen. In the spring of 1888 his seventh chemical report since the organization of the present Survey was published, and the eighth chemical report of the new series is now going through the press. The two last reports are especially valuable, because of the large number of analyses therein contained, of coals from hitherto unexplored sections of the State. The four chemical reports ending 1881 contain analyses of 154 coals from developed mines and 96 from undeveloped, and the four chemical reports ending with the one now in press contain 40 analyses of coals from developed and 377 of coals from undeveloped mines. The last report will contain analyses of the brown ore (limonite) being developed on the north slope of Pine Mountain.

A most desirable and well-appointed room has been provided for the use of the Chemical Department of the Survey, in the building recently erected for the Agricultural Experimental

Station, at Lexington, through the kindness of the able Director of that Station, Mr. M. A. Scovell. It is believed that a proper co-operation between the Survey and this Station will increase the usefulness of both, and prove beneficial to the agricultural interests of the State.

(4) THE STATE CABINET.

Valuable additions have been made to the State Cabinet during the past two years, and the collection has been classified and labeled by Mr. Moritz Fischer, who has charge of this department of the Survey. The admirable arrangement of this collection is evidence of Mr. Fischer's industry and ability. Besides his work in the Cabinet and the Library of the Survey, he has made frequent excursions in various parts of the State for the purposes of collecting, and to aid in the geological work.

It would be wise economy if the State would provide for the permanent protection and care of this collection. It has only a temporary lodgment in the large unfinished room in the new wing of the public building. Such a cabinet would soon be rendered of little value by careless handling, or misplacement of labels. This collection of coals, ores, woods, building stones, clays, fossils, Indian relics, photographs, maps, etc., etc., has been the work of years of the members of the Survey, and could not be duplicated without the expenditure of many thousands of dollars. Its usefulness becomes more apparent as the development of the State progresses.

(5) THE OFFICE WORK OF THE SURVEY.

As the survey approaches completion, this part of the work becomes more laborious and increases in importance. The constantly increasing interest, as the great value of the resources of the State becomes better known and appreciated, adds each year to the volume and value of the correspondence of the Survey. Mr. E. A. Fellmer, the Secretary of the Survey, has rendered most valuable assistance by the faithful and efficient manner in which he has discharged his duties. The correspondence is but a small part of the office work. Many inquiries are of a

nature requiring the collecting of special information before proper replies can be made.

By far the hardest task is the effort to meet the demands from all parts of the State for work and information, and yet keep the expenditures within the limits of the appropriation. Since I have had charge of the direction of the Survey, the total amount available for field and office work of the Survey—topographic, geological, chemical, and the collection and care of the Cabinet—has amounted to less than \$10,000 per annum. An examination of the maps and reports already published, and the material in hand, will convince anyone that the work has been prosecuted with due regard to economy.

The results already obtained are of a value to the State beyond comparison with the amount expended. In my last report (January, 1888,) I said: "I have attempted to tell briefly of the early settlement of Kentucky, and the marvelous prosperity of the pioneer State, and how and why great lines of railway, connecting the seaboard with the West, passed by the North and to the South, carrying industrial development and commercial prosperity beyond our borders. But these conditions exist no longer, Kentucky lies athwart and midway between the East and the West, and between the North and the South, and now great lines of railway traverse the entire length and breadth of the State, while others are being pushed to rapid completion; and from every section comes the information of an industrial awakening, such as the State has never before experienced.

"It is a noteworthy fact, that now railways are being constructed along the routes traversed by our pioneer fathers—down the Ohio river, and others through the great mountain gaps and along the 'Wilderness Road,' and movements inaugurated within the past year, backed by ample capital and intelligence, will continue until Kentucky is placed in the front rank as a manufacturing State, as she has been in the past as an agricultural State."

The tide has turned; the wished for era of prosperity has arrived. The restless sons of Kentucky no longer seek wider fields for enterprise beyond our State. The accumulated earnings of our citizens are no longer sent to swell the wealth of

the north-west, but find ready and profitable investment in pushing forward the industrial development within our own borders.

This great central State, blessed beyond measure with the varied elements of wealth, has an assured prosperity beyond the most sanguine hopes of her devoted sons.

Respectfully yours,

JOHN R. PROCTER,

State Geologist.