# REPORT

OF THE

# GEOLOGICAL SURVEY OF OHIO.

## VOLUME I.

## GEOLOGY AND PALÆONTOLOGY.



## PART II. PALÆONTOLOGY.

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| F. B. MEEK, . . . . . | PALÆONTOLOGIST. |

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# PREFACE.

THE present volume contains the first part of the Palæontological Report of the Geological Survey of Ohio, and the first illustrated memoir ever published on the fossils of the State. Ohio, with its great breadth of surface and diversity of geological structure, is one of the richest fields for the palæontologist known, and during the last forty years its Silurian, Devonian and Carboniferous strata have furnished a very large number of well marked fossils, most of which have gone to enrich the cabinets of other States and countries. The exposures of the Lower Silurian rocks about Cincinnati deserve special mention, from the variety and beauty of the organic remains which they yield. This locality has now a world-wide fame, and it has supplied suites of beautifully preserved fossils which form the pride of many cabinets in Europe as well as in our own country. The Corniferous limestone and the Waverly group have also contributed a large number of fossil mollusks, crustaceans and corals to the collections made in our State by resident or foreign geologists.

The Devonian and Carboniferous rocks have proved to be rich in fossil fishes, and the latter in Batrachians and plants. Collections of all these have been made by the writer, which in variety and interest are not surpassed by those derived from the Palæozoic formations of any country.

Among the fossils obtained by others in former years from these different formations, many proved to be new to science, and a large number of them have been described by Profs. Hall, Winchell and Meek. The descriptions of these species are, however, widely scattered through the various media for the publication of scientific material, and are accessible to but few of our citizens. In many instances, too, the descriptions were published without figures, so that it has been almost impossible for our students of geology to determine accurately the names and the relations of the fossils they have collected. As fossils constitute the most reliable data for the identification of strata, the difficulty which has been experienced in obtaining accurate information about those found in this State has not only retarded the progress of geological knowledge among our people, but has occasioned much difference of opin-

ion and prolonged discussion among geologists in regard to the equivalence of our rocks. When the present Geological Survey was organized, it therefore became one of the most important duties of the Corps to make systematic collections of the fossils of the different formations; to read from them the lessons they might teach, and to publish such figures and descriptions as would enable our teachers and students to identify them, and apply them to their legitimate uses. The first part of this duty has been done. A sufficient number of fossils has been gathered from all the fossiliferous rocks to enable us to make out satisfactorily the geological structure of the State, and to settle all the questions that have been raised in regard to the relations of our strata to those that have been studied and named in other States and countries. They have thus rendered us indispensable assistance in the acquisition of the information conveyed in our geological reports.

The second part of the task assigned us, is in part performed by the publication of the present volume. In order to give the greatest possible accuracy and value to the review of our palæontology, which was expected as one of the results of the Geological Survey, it was necessary to invoke the aid of several specialists. The different classes of fossils collected by the members of the Geological Corps, and such as, gathered in former years, were accessible to us, were committed for study to persons who had given special attention to one or another of the different departments of palæontology. The *invertebrate* fossils were assigned to Mr. F. B. Meek, one of our most learned and accurate scientists, who, in addition to other labors by which he had gained a well deserved reputation, had for several years been acting as palæontologist to the Illinois Geological Survey, and had thus become critically familiar with the invertebrates of the Palæozoic formations of the Mississippi Valley. The greater part of the matter contained in the palæontological portion of the present volume has been supplied by Mr. Meek, and forms the first installment of his report upon the materials placed in his hands.

Prof. James Hall, the distinguished palæontologist of New York, who had characterized and named a large number of fossils from this State, also consented to contribute to our reports descriptions and figures of such Ohio fossils as he had already described, or held waiting examination in the rich stores of his magnificent collection. The matter to be furnished by Prof. Hall is promised for our next volume on Palæontology.

The *Amphibian* remains–of which nearly twenty species, all new to science, had been obtained from the Coal Measures before the organization of the present Survey–were committed to Prof. Edward D. Cope, who stands in the front rank of living comparative anatomists. His report on these interesting fossils is nearly ready, and will form

part of our second volume. As it will more than double the number of genera and species known in the Batrachian fauna of the Coal Measures, it cannot fail to prove an important contribution to science.

The description of the *fossil fishes* and *fossil plants* was assumed by the writer, who had for many years made them objects of special study, and who had in his collections nearly everything of interest in these departments which had been obtained in the State during the last quarter of a century. A partial report on this material is made in the present volume. The discussion of the remainder will be reserved for future publication.

In the law providing for a Geological Survey of Ohio, the Geological Corps was required, first, to make the survey, and when that should be completed, to embody the results in a Final Report, but it has been thought by the Geological Board wiser not to wait the completion of the field work before publishing in permanent form any portion of the results. As a consequence, this volume is given to the public, while as yet much of the matter which is to form future volumes remains to be accumulated. If it had been possible to gather and prepare all the material to be used, before the publication of any part of it, it would have been easy to arrange it in such a way that all the facts related to each other should be grouped together; but this is not now entirely practicable. An effort has been made, however, to give as great system to our report as could be done under the circumstances. In the Geological portion of this volume, after a general review of the Physical Geography and Geological Structure of the State had been given, a more detailed description of the Silurian and Devonian Systems was presented; while the discussion of the Carboniferous and Drift formations was postponed. So far as possible a parallel course has been followed in the accompanying report, Figures and descriptions are now given of only the Silurian and Devonian invertebrates; the Carboniferous mollusks, crinoids and corals remaining for publication hereafter. In the arrangement of the descriptions of the vertebrate fossils and fossil plants, such an arrangement was scarcely practicable, inasmuch as most of these are derived from the Carboniferous System; and if no Carboniferous fossils were admitted into this volume, our materials would be very unequally divided. An arrangement *by subjects* has therefore been adopted, so far as relates to these fossils, and one which will perhaps be equally acceptable. In this volume the fossil fishes are reviewed collectively, and while some material in this department will remain to be included in another volume, no general discussion of the zoological relations and geological distribution of our fossil fishes will be attempted there. On the other hand, the interesting group of amphibians found in our Coal Measures are altogether reserved for another volume, where they will be described

in detail, and will supply figures for perhaps ten plates. The description of the fossil plants will also be mainly deferred. A few species of unusual interest–for which drawings and descriptions have been prepared for many years–are published in this volume, to give variety to its contents, and to divide more equally the materials in hand. But most of the matter prepared in this department will be reserved until it can form part of a general review of our fossil plants, similar in scope to the synopsis of our fossil fishes now published. In that report the plants of our different formations will be described in order, beginning with those of the Lower Silurian; and the progress of plant life will, as far as practicable, be traced through the successive geological ages.

The State of Ohio, with its 88 counties and 39,964 square miles, presents so wide a field for geological exploration, that the time of the Geological Corps has been mainly occupied in the study of the general and local geological structure and economic geology. A large number of fossils have, however, been collected in the prosecution of our work, and in a few instances they have been made objects of special search; but the accumulation of good material in any department of palæontology is generally a matter of time and patient waiting for the results of mining, quarrying, etc., and it is only to be rapidly obtained by a large outlay of money. As we have not felt justified in the expenditure of much time or money for making collections of fossils beyond what were required for geological purposes, we should now be able to present to the public but little new and interesting palæontological matter if we had not been permitted to avail ourselves of the fruits of other labors than our own. Fortunately for the interest and value of our reports, during the long interval which has elapsed since the suspension of the former Geological Survey, the collectors of Ohio fossils have not been idle; and though much of the material which would be most fitly presented to the public through the medium of the Geological Survey has been lost, scattered or described elsewhere, at the beginning of our Survey we found such an amount of new material in the hands of private parties as would in itself, if properly illustrated, greatly embellish and enrich our Report. Through the courtesy of the holders of this material, most of it has been made available for our use, and this, with the collections made by the Geological Corps, forms an array of new matter which we venture to hope will be of interest to the public.

In the preceding notes reference is made only to the fossils of the bedded rocks; but there are some other organic remains found in the State, which, though much more modern, still belong to a former age, and are the legitimate and by no means the least interesting objects of investigation by the palæontologist. In the superficial

deposits many interesting mammalian remains have been brought to light in the prosecution of public works–railroads, canals, etc.–and more especially in the excavations for the drainage of swamps and peat marshes. Of these, the most striking are the bones, teeth and tusks of the Elephant and Mastodon. In nearly every county of the State relics of these huge mammals have been exhumed, and in some instances nearly the entire bony structure has been found. In most cases, however, the bones have been broken up and scattered, and nothing like a complete skeleton has in any case been preserved. Most of these remains were met with in former years, but even since the organization of the Geological Survey, some important discoveries of this kind have been made. As before, however, ignorance or carelessness has prevented the preservation of material which, if it could have been saved from violence or decomposition, would have been of the greatest scientific value. An earnest effort has been made to secure all possible facts and specimens which could serve to illustrate the occupation of our territory by these great animals, and whatever information we may be able to gather on this subject, will be recorded in the future publications of the Survey.

I should also refer here to the discovery of the bones of the giant Beaver *(Castoroides Ohioensis),* which was first described by Col. J. W. Foster in the Second Annual Report of the former Geological Corps (1838). Some other remains of this remarkable animal have since been found, and it is proposed to present, in a future report, all the facts that can be gathered in regard to it, with figures of such portions of its structure as are now extant.

Fragments of the bones of the large wild hog *(Dicotyles compressus)*–which once inhabited Ohio, but is now entirely extinct–have in several instances been found in our own and adjoining States. A most important discovery of this kind has recently been made at Columbus; and, thanks to the intelligent care of Mr. J. H. Klippart, who took great pains to preserve them, nearly complete skeletons of twelve individuals of this species of peccary have been secured for study and description. As only a small portion of the bony structure of this animal was before known, the discovery to which I have referred will add very much to our knowledge of it, and will furnish some interesting material to our palæontological reports.

Acknowledgments are elsewhere made of our obligations to some of those who have contributed to the attractiveness and value of our reports, but it is eminently proper that I should here repeat the names of Messrs. C. B. Dyer, U. P. James, S. A. Miller, S. T. Carley, David H. Shaffer and Dr. Miller, of Cincinnati; Rev. H. Hertzer, now of Louisville, Ky.; J. K. O'Neall, Esq., of Lebanon, Ohio; Dr. A. H. Agard and L. P. Wheelock, of Sandusky; Jay Terrell, Esq., of Elyria, and Prof. George N.

Allen, of Oberlin; all of whom have generously given us the use of the materials in their bands, the fruits of many years of patient and assiduous collection.

The fossil fishes, amphibians and plants which will be described in this and other volumes of our Report, were mostly obtained by the writer before the commencement of the Geological Survey, and the originals of the descriptions published by Prof. Cope and myself now form part of the collections of the School of Mines of Columbia College, New York. So far as practicable, specimens of the species described will be placed in the cabinet of the Ohio Agricultural and Mechanical College and in the Museum of the Smithsonian Institution. Where the specimens are unique, they will be found in the cabinet of the School of Mines. All the material gathered by the Geological Corps becomes, by special act of the Legislature, the property of the Ohio Agricultural and Mechanical College, and may be referred to in the cabinet of that institution.

I may be permitted to express here a regret that no fire-proof repository has been provided by the State of Ohio for the specimens collected on the Geological Survey, as the destruction by fire of material not so protected seems to be only a question of time. The *type* specimens–such as have served as the basis of chemical, geological and palæontological description–have a special, and, in some instances, an inestimable value. Their loss is frequently a public calamity, and a large part of the confusion which exists in the records of natural science is due to the destruction of such standards of reference. The best specimens obtained in any State should, if possible, be fixed in some safe and accessible repository at the State Capital, or in some institution of learning that can provide accommodations for them, where they will not be exposed to theft or fire, and where they may be at all times readily accessible to those who desire to consult them. Such specimens are not merely objects of curiosity, but they constitute a kind of library in which knowledge of the greatest scientific importance is recorded. They differ from books, however, in this, that many of them are *unique copies*, and when lost, can never be replaced. In this respect they are more like legal documents and public archives, and should be preserved with the same care. The importance of these considerations has been recognized in several of the States of our Union–as in New York, Illinois, etc.–where special provision has been made in the construction of public buildings for the reception and display of the collections of the Geological Surveys, and for the safe preservation of the type specimens described in the Reports.

The illustrations which accompany the descriptive matter of this volume will generally commend themselves by the accuracy and beauty of their execution, and it is

but just that the artists who have so ably seconded the efforts of the palæontologists, should receive honorable mention in this connection.

The drawings of the crustaceans, mollusks and crinoids, of which figures are now published, were for the most part made by Mr. W. H. Holmes.

The fossil plants and the Carboniferous fishes were drawn by Mr. T. Y. Gardner, and form part of the series of plates prepared by the writer before the beginning of the Survey, and which have been supplied without cost to the State.

The plates of Devonian fishes were drawn by Mr. G. K. Gilbert, for two years an assistant on the Survey of Ohio, and now Chief Geologist of the Government Surveys in Colorado, Arizona and New Mexico, under Lieut. G. M. Wheeler, U. S. A.

The engraving of our plates has been mostly done on stone by Messrs. T. Sinclair & Son, of Philadelphia, who are making a specialty of palæontological illustrations. By securing the services of trained and skillful lithographers, they have done our work in a style and with a degree of promptness that deserve special commendation. I should also say that the courtesy of Mr. Sinclair, and his cordial co-operation in our efforts to secure accurate and tasteful copies of our drawings, have contributed much to the results attained.

J. S. NEWBERRY.

COLUMBUS, OHIO, *January 1st*, 1873.