New York State Museum Bulletin

Published by The University of the State of New York

No. 267 ALBANY, N. Y. April 1926

New York State Museum

TWENTY-FIRST REPORT OF THE DIRECTOR OF THE STATE MUSEUM AND SCIENCE DEPARTMENT

INCLUDING THE SEVENTY-EIGHTH REPORT OF THE STATE MUSEUM, THE FORTY-FOURTH REPORT OF THE STATE GEOLOGIST AND THE REPORT OF THE STATE PALEONTOLOGIST FOR 1925

ALBANY
THE UNIVERSITY OF THE STATE OF NEW YORK
1926

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THE UNIVERSITY OF THE STATE OF NEW YORK

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With years when terms expire

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The University of the State of New York

The State Museum, January 14, 1926

The Honorable Frank P. Graves
President of the University

SIR: I beg to submit herewith the report of the Director of the State Museum for the year 1925.

Very respectfully

JACOB VAN DELOO
Acting Director

John M. Clarke

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IN MEMORIAM

JOHN MASON CLARKE

1857–1925

On May 29, 1925, after a brief illness, our former Director, Dr John Mason Clarke, passed away in the 69th year of his life. Doctor Clarke came of old American stock, with the best of traditions. He was born in Canandaigua, N. Y., on April 15, 1857, among the Devonian rocks which had a strong influence in shaping his later career as a scientist. His father, Noah Turner Clarke, was for 50 years teacher and principal in the academy at Canandaigua, and it was from his father that he obtained his first geology in school, as well as his classical training.

Doctor Clarke went to Amherst in 1873, where he studied under that inspiring teacher, B. K. Emerson. After his graduation from Amherst in 1877, he taught for 2 years in the Canandaigua Academy and then returned to Amherst as assistant to Emerson in 1879–80. He taught in the Utica Free Academy during the school year 1880-81. For the following year, through the efforts of Emerson, he was given an appointment at Smith College as teacher of geology and mineralogy—a position which he held until the end of the college year 1883 when he was given leave of absence to study for the doctorate at Göttingen, under Professor von Koenen. He returned to Smith College in the fall of 1884, and in the spring of 1885

became lecturer in geology, zoology and German at the Massachusetts Agricultural College. The following few months of unemployment were spent at Canandaigua, where he continued his work on the Upper Devonian.

Doctor Clarke's connection with the Geological Survey of New York began January 2, 1886, when he started work under James Hall. He gradually rose in position, and upon the death of Doctor Hall in 1898, succeeded him as State Paleontologist. In 1904, when Doctor Merrill retired, Doctor Clarke also became State Geologist and Director of the State Museum and Science Division of the Education Department; and he held these three titles until his death. In nearly 40 years of service he produced more than 200 scientific papers that won for him a place among the leading scientists of the world; and in the past 15 years, with the support of his scientific staff, he built up a Natural History Museum noted for its unusual character, originality and educational value.

Several memorials to Doctor Clarke have already appeared and a very full account of his life and works has been written for the Bulletin of the Geological Society of America by Professor Charles Schuchert of Yale University. It is the intention here, therefore, to touch upon Doctor Clarke more especially in his capacity of Director, State Geologist and State Paleontologist.

It was always Doctor Clarke's conviction that a museum which is not changing and growing is a dead museum. As Director he expanded the museum and moved it into the Education Building where there was more adequate space for exhibition. He was very successful in securing able assistants through whose work has grown up an entirely new archeological exhibit, a fine zoological exhibit, an enlarged mineralogical exhibit, an entirely new geological exhibit and a much enlarged paleontological exhibit with many restorations. Doctor Clarke was also unusually successful in obtaining gifts of materials or of large sums of money for creating exhibits. Notable among these important additions to the Museum, without great expense to the State, are the Indian groups with the accompanying decorated panels and lunettes, the gift of the late Mrs F. F. Thompson; a valuable collection of western Indian basket work, also the gift of Mrs Thompson; a large and very fine collection of bird eggs and a collection of starfish, presented by Benjamin W. Arnold; the Louis Agassiz Fuertes paintings of the birds of New York, donated by Mrs Russell Sage; the Thompson-Seton wash drawings of birds; the Peck memorial mushroom group; the Temple Hill mastodon, the gift of the late Emerson McMillin; and the fossil

sponge restoration group given by Mrs Higgins in memory of her husband, Governor Higgins.

Doctor Clarke's ambition, as the crowning achievement of his directorship, was the expansion of the Museum still further through securing a new museum building which would be a museum of art and history as well as of science. Much time and effort were expended in an attempt to secure the Roosevelt Memorial for a State Museum; and even when he met with failure he continued with his plans and undoubtedly would have seen the realization of his hopes were it not for his sudden and untimely death.

Doctor Clarke was interested in the various branches of science and was ready to give his support to all of them fully as much as to his own special field. As Director of the Museum he was ever industrious in securing means for the publication of large works on natural science, particularly those which would appeal to and draw the interest of the public. In this category belong the well-known Birds of New York by E. H. Eaton, in two large quarto volumes, with separate editions of the 106 colored plates, and the Wild Flowers of New York by H. D. House, also in two large quarto volumes, with a separate edition of the 264 colored plates.

In his capacity as Director, Doctor Clarke was also interested in and took steps for the preservation of natural monuments of the State. It is due to his efforts that we have the Clark Reservation at Jamesville; the Chittenango Falls Park at Cazenovia; Lester Park near Saratoga, and Stark's Knob monument at Schuylerville, under the supervision of the State Museum; and the John Boyd Thacher Park in the Indian Ladder region of the Helderbergs, under state control—all natural monuments and all obtained as gifts. Doctor Clarke even went outside the State in his efforts to preserve natural monuments and to protect wild life.

As State Geologist Doctor Clarke furthered the geological mapping of the State with the result that about two-thirds of the State has been mapped by geological experts at very small cost, many of the maps having been made by college professors during summer vacations. The New York State Survey has probably employed more college professors than any other state survey; and they have likewise been employed in the working out of the glacial geology of the State and also the economic geology—notably in connection with the salt, iron, oil and gas interests. Doctor Clarke is probably the only State Geologist who has favored equally both economic and purely scientific work. In this regard he fully maintained the traditional attitude of the New York State Survey which he inherited from Dr James Hall.

Paleontology was Doctor Clarke's special field as it had been Hall's. The surroundings in which he was born drew his attention in his early years to the Devonian formations, and he finally became the first authority in America on the Devonian. His most important work in this field was done in the last volumes of the Paleontology of New York, by Hall and Clarke—those describing the Trilobites of the Devonian and the Brachiopods. It is also due to his efforts that the Devonian rocks of New York have been, in a most refined manner, divided into their different beds and mapped in detail. Much of this work was carried out by his boyhood and life-long friend, the late D. Dana Luther, who was also one of Hall's field men. In later years Doctor Clarke found a wonderful field of geological activity in the Devonian of the Gaspé coast of Canada.

In the last decade of his life he was more inclined to look for the general, philosophic aspect of science, as shown by his work on Dependent Life, and to be retrospective in biographical and other literary work. The Life of James Hall, which is really a history of the geology of America during Hall's life, is the outstanding work of that kind. He also became interested in ceramics, particularly of New York, in the culture of the Pennsylvania Dutch of the earlier years and in other lines which amounted to hobbies, but which he treated in a scientific manner and about which he published treatises. He therefore possessed more scientific interests than most modern scholars, and as a result his publications of books and pamphlets not only were large in number but also embraced a great variety of subjects.[1]

Doctor Clarke had an unusually brilliant, well-trained mind. He worked hard and quickly and at the same time with such an ease of manner that he turned out a large amount of work apparently without effort; and he had likewise the ability to carry on several lines of work at the same time without confusion. Besides his keen, philosophical mind he was gifted with a strong artistic sense and a love of nature, evidences of which are seen in his writings and all through his life. He had many lovable qualities and was a man of such wide interests that he could be a most charming companion and friend. Strong in his likes and dislikes, he was at the same time a man of deeper sympathies than those who met him casually could realize, especially toward those who might be considered

[1] A complete list of Doctor Clarke's publications may be found with Professor Schuchert's memorial of Doctor Clarke in the first number of the Bulletin of the Geological Society of America for 1926.

among the weak; and it was this which sometimes led him into being imposed upon. He was a friend to young people and many a young scientist has him to thank for a helping hand.

Honors came naturally to crown a lifetime of successful work, even up to the very end. The Thompson Gold Medal of the National Academy of Sciences was received shortly before his last illness, and death alone, according to letters from Professor Barrois, prevented his election to fellowship in the French Academy. He was elected to membership in numerous scientific and historical societies in this country, Canada, England, Germany, France and Russia; he was made a member of the National Academy of Sciences in 1909; elected vice president of the Geological Society of America in the same year, and president in 1916; made first president of the Paleontological Society in 1909; awarded the Prix de Léonide Spindiaroff by the International Geological Congress in 1910 for his geologic work in Gaspé; awarded a gold medal by the Permanent Wild Life Protection Fund in 1920, the Hayden gold medal of the Philadelphia Academy of Natural Sciences in 1908, and the Thompson Gold Medal of the National Academy of Sciences in 1925. He received an honorary Ph. D. degree from the University of Marburg in 1898, that of D. Sc. from Colgate University in 1909, University of Chicago in 1916 and Princeton University in 1919, that of LL. D. from Amherst College in 1902 and from Johns Hopkins University in 1915.

THE MUSEUM

General. The work of this department, both research and museum, has been continued along established lines, with such changes as new conditions or circumstances required.

New material and new exhibits have been added to the Museum. Notable among them is a display of live animals in Zoology Hall, including a number of snakes of various species, several salamanders and turtles. Facilities of the Museum are inadequate for extensive exhibition of live animals. Two new exhibits have been added to Paleontology Hall. The paleobotanical restoration of the Gilboa Fossil Trees, one of the largest and most striking restorations attempted here or elsewhere, was opened to the public on February 12, 1925, after 2 years of laborious and ingenious work. This group and a new case entitled: "What is a Geological Formation?" are described in a paper on New Museum Exhibits which follows in this report. The case, "What is a Geological Formation?" was designed as a companion to the "What is a Fossil?" case which was installed in the Museum some time ago and which has proved to be exceedingly successful. Lack of space remains the most outstanding obstacle to the progress of Museum exhibitions and therefore will be a grave hindrance to the Museum in its policy of introducing educational exhibition cases to give to the numerous unscientific visitors an adequate background for a better understanding and appreciation of the various exhibits.

Unexhibited collections. The Museum continues to be hampered by the fact that important collections, through lack of space, remain stored away in various places in the Education Building where they are inaccessible to visitors or students. This is particularly true of the entire collections of the recent Mollusca of New York and elsewhere. Students of the Mollusca have come to the Museum with the express purpose of studying parts of this collection, and the Zoologist has been forced to refuse their requests. Collection after collection of paleontological and stratigraphical material has been packed away in boxes, which makes the material practically inaccessible or involves a laborious amount of work to obtain perhaps a few specimens for exchange or for study by our staff or outside scientists. A museum should be able to keep all collections obtained in tiers of drawers arranged systematically so that they are immediately accessible.

Parks. The State parks under the custody of the New York State Museum were cited in the preceding report but no definition of

them was given. It has been thought advisable to list them, giving a description of their nature and size and the conditions under which they were acquired.

Chittenango Falls Park. Located 4 miles below Cazenovia, Madison county. Contains a gorge and waterfall over 100 feet high. Interesting cliffs of Devonian and Silurian rock formations. Abundant flora with rare ferns. Interesting alike for its scientific and scenic features. Recreational facilities are being provided and plans have been drawn for a new state highway to pass through the gorge, thus making available in the best possible way the scenic beauties of the place. Area 22 acres. Acquired by gift in 1922 from the Chittenango Falls Park Association.

Clark Reservation. Located in the town of De Witt about 6 miles from Syracuse. This is a glacial park consisting of 115 acres and was the gift of Mrs Frederick Ferris Thompson. The origin of its main features is due to the great glacial streams which passed along the ice front during the retreat of the continental glacier. The park contains a number of abandoned cataracts and plunge basins, the largest of which fully equals in size those at Niagara Falls. A lake having an area of 7 acres occupies one of the plunge basins. The park is visited by many thousands annually.

Lester Park or "Cryptozoon Ledge." Located in the town of Greenfield, 3 miles west of Saratoga Springs. The area is 3 acres and the park is crossed by a highway at its most interesting spot. The main feature is the "Cryptozoon Ledge," a broad, flat glaciated platform of Cambrian limestone filled with crowded remains of some of the earliest marine plants, known as Cryptozoons. The Cryptozoons grew in large, round, concentric masses and appear like gigantic cabbage heads. The planing action of glacial ice and later weathering have resulted in making this exhibit truly unique. The park, which was acquired solely for the purpose of preserving this remarkable ledge, is the gift of Willard Lester of Saratoga Springs.

Stark's Knob. This reservation of 4 acres is at the north end of the Saratoga battlefield 2 miles above Schuylerville and close to the state highway. The knob is the remains of a volcanic plug or neck and the only one known in the State. Previous to its acquisition some quarrying operations had been in progress. The knob also possesses a historic interest. It was here that General John Stark mounted his battery and effectively obstructed attempts of the defeated Burgoyne to withdraw his forces northward through the narrow valleys of the Hudson and the Battenkill. Stark's Knob is the gift of the late Emerson McMillin.

Squaw Island. This is a small island opposite Sucker brook near the north end of Canandaigua lake, Ontario county. Squaw island is so called on account of the tradition that during Sullivan's raid in 1779, the Seneca women from the Indian village at the foot of the lake took refuge there. The island is interesting geologically because of the formation of "water biscuits" found abundantly on the beaches and lake bottom adjacent to the island. The "water biscuits" are oval in shape and their origin is due to the waters charged with lime and carbonic acid gas from Sucker brook, coming in contact with living algae. Absorption of the carbonic acid gas by the algae results in the deposition of the lime on the object where the algae are growing, and as the process is repeated the "water biscuit" is gradually built, consisting of a network of algae with concentric layers of lime. Custody of the island was taken over by the State Museum in 1918, and through the generosity of the late Mrs Frederick F. Thompson of Canandaigua, a tablet explanatory of its geological and historical interest has been erected.

Publications. During the past year the following publications have been issued:

Bulletin 256 The Susquehanna River in New York and Evolution of Western New York Drainage; by Herman L. Fairchild

Bulletin 257 Key to Gall Midges; by Ephraim P. Felt

Bulletin 258 The Utica and Lorraine Formations of New York. Part I. Stratigraphy; by Rudolf Ruedemann

Bulletin 259 Geology of the Gouverneur Quadrangle; by H. P. Cushing

Bulletin 260 Twentieth Report of the Director of the State Museum and Science Department (1924)

Bulletin 261 Geology of the Ausable Quadrangle; by James F. Kemp and Harold L. Alling

Bulletin 262 The Utica and Lorraine Formations of New York, Part II. Systematic Paleontology; by Rudolf Ruedemann

Bulletin 263 Albany Molding Sands of the Hudson Valley; by Charles M. Nevin

Bulletin 264 Studies in New York Spiders (Genera: Ceratinella and Ceraticelus); by C. R. Crosby and Sherman C. Bishop

Bulletin 265 Some Silurian (Ontarian) Faunas of New York; by Rudolf Ruedemann

Bulletin 266 Report of the State Botanist for 1924

Lectures. The Museum has continued its policy of giving a series of free public lectures which are untechnical and on subjects of general and popular interest.

Field work. Professor R. J. Colony of Columbia University has continued his work on the Schunemunk quadrangle, and Dr Robert Balk, also of Columbia University, has been doing geological mapping on the Newcomb quadrangle.

The results of the field investigations in oil and gas by Professor Henry Leighton and Professor R. E. Somers, both of the University of Pittsburgh, and the investigations of Charles M. Nevin of Cornell University on molding sands, are included in the report of the Assistant State Geologist. The work of mapping the four quadrangles of the capital district was continued this past summer by the Assistant State Paleontologist, and smaller collecting trips were made by both the Assistant State Paleontologist and the Paleobotanist.

Field expeditions and gifts have materially increased the collections in the divisions of zoology and entomology. The results of the field work on New York mammals in 1925 by Dr Francis Harper, secretary of the Boston Society of Natural History, are given in the report of the Zoologist. Considerable additions have been made to the botanical collections through contributions and collections by the State Botanist and others.

Legislative support and loss of staff. In spite of the fact that the Museum fills a great educational need of the public and that the people from within the State and tourists in large numbers have made generous use of the advantages offered, the State Museum still lacks adequate legislative support. The salaries paid to the staff of the Museum are inadequate and therefore expert members of the Museum staff are constantly leaving their positions in search of something that will guarantee a reasonable return for their services. We have in the last few years lost an Assistant State Geologist, the Assistant in Economic Geology, Mineralogist, and Archeologist. The position in economic geology has never been filled. Our former Mineralogist left for a position with the American Museum paying more than twice the salary he was receiving with the State Museum, and at the same time our Museum could offer him an increase of only $100 a year if he stayed. Twice the Museum has tried to fill the position, and we are now without a Mineralogist because only an untrained man just out of college would accept such an inadequate salary. We have also lost the position of scientific technician. The State Entomologist and State Botanist have both for years had a crying need for an assistant but they have been forced to do without or to use temporary and unskilled help at intervals. This makes an added burden for men who are already most inadequately paid for the services required

by their position. Just recently the Museum has likewise lost a trained mechanic, the lack of whose services considerably hampers the department. At the time of writing there is no prospect of filling the position at the salary provided.

The Director of the State Museum died on May 29, 1925. The requisites of the position are so out of proportion to the compensation that the position still remains vacant, although about 8 months have passed since his death. All this certainly shows either indifference or a lack of comprehension of the value of scientific service to the State.

STAFF OF THE DEPARTMENT OF SCIENCE

The members of the staff, permanent and temporary, of the Department as at present constituted, are:

ADMINISTRATION

John M. Clarke[1], Director
Jacob Van Deloo, Clerk and Secretary of the Museum
Anna M. Tolhurst, Director's Stenographer

GEOLOGY AND PALEONTOLOGY

John M. Clarke,[1] State Geologist and State Paleontologist
Rudolf Ruedemann, Assistant State Paleontologist; Curator of Paleontology
Chris A. Hartnagel, Assistant State Geologist; Curator of Geology
William L. Bryant, Honorary Curator of Fossil Fishes
Winifred Goldring, Paleobotanist
Edwin J. Stein, Draftsman
Marie F. Tetrault, Stenographer
Charles P. Heidenrich, General Mechanical Assistant
Marion E. Bollman, Clerk
John L. Casey, Custodian of Museum Collections
William Rausch, Cabinetmaker
Ernest S. Teetsel, Laborer
James S. Skinner, Laborer

Temporary Experts

Areal Geology

Dr Robert Balk, Columbia University
Dr R. J. Colony, Columbia University

[1] Died May 29, 1925.

Economic Geology

Professor Henry Leighton, University of Pittsburgh
Professor R. E. Somers, University of Pittsburgh
Mr Charles M. Nevin, Cornell University

Paleontology

S. K. Roy, University of Illinois
J. J. Wirz, Rochester

BOTANY

Homer D. House, State Botanist

Temporary Expert

Clair A. Brown, Syracuse University

ENTOMOLOGY

Ephraim P. Felt, State Entomologist
Douglas B. Young,[2] Assistant State Entomologist
Elma Rose Atamian, Stenographer
Anna J. De Meur, Clerk

ZOOLOGY

Sherman C. Bishop, Zoologist
Benjamin W. Arnold, Honorary Curator of Ornithology
Walter J. Schoonmaker, Technical Assistant
Arthur Paladin, Taxidermist

Temporary Expert

Francis Harper, Boston Society of Natural History

ARCHEOLOGY

Noah T. Clarke, Archeologist
Harry C. Wardell, Technical Assistant

ACCESSIONS

Paleontology and Paleobotany

By Donation

Frank Bulman, South Kensington, London
Preparation of Dictyonema flabelliforme, Shineton shale, Cherme's Dingle, near Wrekin, Shropshire, England
Dr S. L. Powers, chief geologist, Amerada Petroleum Corp., Tulsa, Okla.
Slab with Climacograptus colonies. Athens shale, Catawba Valley, Virginia

[2]Died April 5, 1926.

Frederick H. Allen, New York City
Large specimen of Cryptozoon undulatum. Theresa Limestone, Saratoga, N. Y.
G. Arthur Cooper, Hamilton, N. Y.
Twenty specimens of two new species of Crinoids, from Hamilton shale, Hamilton, N. Y.
Dr F. W. Sardeson, Minneapolis, Minn.
Fifteen specimens, Plectambonites sericius (Soby), Tecorah shale, St Paul, Minn.
Fourteen specimens, P. minnesotensis (Sard.), Galena limestone, St Paul, Minn.
G. S. Bixby, Plattsburg, N. Y.
Two hundred miscellaneous specimens of fossils and minerals from various localities
R. W. Gausmann, division engineer with New York City Board of Water Supply, Grand Gorge, N. Y.
Fossil stump of seed fern, Upper Devonian, Gilboa
New York City Board of Water Supply
Various fossil plant specimens, Gilboa, N. Y.
Luther E. Dennis, superintendent with Hugh Nawn Construction Co., Gilboa, N. Y.
Two specimens of a new species of fossil tree, Upper Devonian beds, Gilboa

By Purchase

E. Reinhard, Buffalo, N. Y.
Sixteen specimens of Bertie Waterlime fossils, at Buffalo, N. Y.

Geology and Mineralogy

By Donation

Whitehead Brothers Company, Rochester, N. Y.
Molding sand exhibit showing various grades of sand. The exhibit includes upper and lower halves of mold together with rough and finished castings.
Professor W. G. Foye, Middletown, Conn.
Minerals from Connecticut: thulite, Haddam; uraninite crystals, Portland; green tourmaline on quartz, Collins Hill, Portland; iolite, Hungry Hill, Guilford; beryl, Collins Hill, Portland
Mrs W. J. Bennett, Lake Mahopac
Epidote in quartz
Edwin C. Dinturff, Syracuse, N. Y.
A suite of dike rocks from Syracuse, Ithaca, Kentucky, South Africa and Arkansas. Also a specimen of selenite from Fayetteville, N. Y.
W. W. Jones, Albany
Argentite from "Annie Mine," Black Hawk, Col.
A. G. Betts, Kinderhook
Celestite, Schoharie, N. Y.
Bernard O'Brien, Herkimer
Quartz from "box-vein," Lyonsdale
Richard Welcying, Schenectady, N. Y.
Specimen of native copper found in drift at Schenectady
New York Trap Rock Corporation, Verplanck, N. Y.
Close fold in Precambrian limestone from quarry at Verplanck, N. Y.
E. W. Leavenworth, Carlisle, N. Y.
Clay concretion in limestone found near Carlisle

By Purchase

E. S. Law, Charlemont, Mass.
Large specimen containing many crystals of ankerite; one large specimen actinolite

Historical Objects

By Donation

Fred Woodruff, Warwick
Cast iron plow having one wooden handle. On one side of the beam is this inscription: "St. John Malver & Co."; on the other: "Kerr No. 1."

Peter C. Brooks, Cornwall
Dog power. A wooden tread power with iron fly wheel. A churn with top and the sweep used with the power were also received.

Entomology

Additions to species of mosquitoes or Culicidae by exchange, from Eric Hearle of the Entomological Laboratory, Vernon, B. C., and by gift from Dr William Matheson of Cornell University:

Excellent series of birch leaf miner, Fenella pumila Klug., and elm leaf miner, Kaliofenusa ulmi Sund., by collection.

Large series of spruce leaf miner, Olethreutes abietana Fern. Reared from infested material.

Number of other desirable additions to the collections through field work, contribution and exchange.

Zoology

By Donation

Reptiles and Batrachians

Leslie Karner, De Freestville
Garter snake, De Freestville

Paul McNamee, Loudonville
Hog-nosed snake, Loudonville

James J. Corrigan, Albany
Two pond turtles, near Saratoga

S. W. Frost, Arendtsville, Pa.
Fence swift, Arendtsville, Pa.

Jay H. Weber, Leonia, N. J.
Hog-nosed snake, Jones Beach, Long Island

G. P. Englehardt, Brooklyn
Newt, Syosset, Long Island
Cricket frog, twelve specimens, Long Island

Alf Dampf, Mexico City
Three salamanders, Mexico City

L. M. Klauber, San Diego, Calif.
Two red diamond rattlesnakes
Three Boyle's king snakes
Two Pacific rattlesnakes
Two pallid rattlesnakes
Two California king snakes

C. S. Brimley, Raleigh, N. C.
Numerous specimens of salamanders

Richard Brown, Port Allegany, Pa.
Many salamanders

Claire Brown, Albany, N. Y.
Musk turtle, Burden's lake, Rensselaer county.

Dr W. Klinglehoffer, Germany
Salamanders

M. K. Brady, Washington, D. C.
Salamanders and lizards

Birds

Dr Addison Miller, East Schodack
American egret, East Schodack

Fish

Carl Miller, Albany
Pickerel, Bacchus pond, Rensselaer county
State Conservation Commission, Albany
Frost fish
White fish
William L. Rathky, Albany
Bowfin, Lake Champlain

Mammals

Dr H. D. House, Albany
Star-nosed mole, Rafts pond, Albany
Leslie Karner, De Freestville
Brewer's mole, De Freestville
John L. Casey, Albany
Big brown bat, Albany
Arthur Kilfoil, Rensselaer
Woodchuck, Nassau
Sarah E. Veeder, Lyons
Horns of Roman ox (pairs)
Two African antelopes (pairs)
Geraldine Fitzgerald, Whitehall
Skull of woodchuck, Whitehall
D. B. Young, Albany
Brewer's mole, near Newport
H. P. Crisp, Albany
Red squirrel, Nassau
Edward J. MacCormack, Rensselaer
Two skunks, Tassawassa lake

Spiders

Fanny T. Hartman, Rockledge, Fla.
Thirty specimens
Mrs Mary Matiske, Albany
One specimen
E. J. Anderson, Cold Spring Harbor, L. I.
One specimen
C. R. Crosby, Ithaca
Specimens from Coxsackie, several vials
R. Hancock, Birmingham, England.
Six specimens aquatic species
Dr H. D. House, Albany
Several vials
D. B. Young, Albany
Several vials
C. A. Hartnagel, Slingerlands
Several vials
Winifred Goldring, Slingerlands
Several vials
Jacob Van Deloo, Albany
Several vials

By Collection

Reptiles and Batrachians

Dr S. C. Bishop
Garter snake, Avalanche lake, Essex county
Newt, Chapel pond, Essex county
Wood frog, Thacher Park, Albany county
Three dusky salamanders, Thacher Park, Albany county
Three timber rattlesnakes, Honeoye lake
W. J. Schoonmaker
Newt, Syosset, L. I.
Musk turtle, Burden's lake, Rensselaer county

Fish

W. J. Schoonmaker
Pickerel, Burden's lake, Rensselaer county

Mammals

Dr S. C. Bishop
Racoon, Stamford
W. J. Schoonmaker
Four deer mice, Galway
Deer mouse, Rensselaer
Three House mice, Rensselaer
Short-tailed shrew, Rensselaer
Woodchuck, De Freestville
Two cottontail rabbit skulls, East Nassau
Two skunks, Tassawassa lake
Dr Francis Harper
Large collection

Spiders

Dr S. C. Bishop
Collections from Voorheesville; Bolton Landing, Lake George; Dunwoodie; New Salem; McLean; Clarksville; Intervale; Chapel pond, Essex county, and Adirondack Lodge
W. J. Schoonmaker
Several vials from Rensselaer county

By Exchange

Reptiles and Batrachians

L. S. Frierson jr, Gayle, La.
Four blue-tailed skinks
Five striped lizards
Snapping turtle
Spotted chicken snake
Copperhead snake
Holbrook's king snake

By Purchase

Paul A. Webb, Meadville, Pa.
Two mudpuppies, Meadville, Pa.
Fifteen mudpuppies, French creek, near Saegertown, Pa.

Botany

By Donation

The Dr J. V. Haberer Collection
Ten thousand specimens
The Martha C. Carter Collection
Four hundred specimens
W. C. Ferguson, Hempstead
One hundred specimens
C. A. Brown, Albany
Eighty-five specimens
Mrs O. P. Phelps, Gansevoort
Ten specimens
Mrs Franc F. Pugsley, Pittsford
Seven specimens

By Exchange

Gray Herbarium, Cambridge, Mass.
One hundred one specimens
Elam Bartholomew, Stockton, Kans.
Two hundred specimens

Other specimens have been contributed by a number of correspondents. Collections by the State Botanist and his temporary assistant have added 1280 specimens to the herbarium.

ADDITIONAL RECORDS OF PLEISTOCENE MAMMALS

Since the publication in 1922 of New York State Museum Bulletin 241–42 on The Mastodons, Mammoths and Other Pleistocene Mammals of New York State, by C. A. Hartnagel and Sherman C. Bishop, the following additional records have come to the attention of the authors.

Fulton County

1 1853. Rangifer sp. Caribou. "In the collections of the Portland Society of Natural History, at Portland, Maine, is a horn of a caribou, rather recently presented, together with other objects, by daughters of the late Maj. Charles Harrod Boyd. The specimen bears these data: "Carabou horn from swamp six feet below surface — E. Bartlett — Rockwood — Fairytown — N. Y.— 1853."

"The antler, which is from the right side of the head, is attached to the parietal bone and bears but one branch which leaves the main shaft 4½ inches above the burr. The tips of both the main shaft and the branch are broken off. The chord of the main shaft from the burr measures 23½ inches and has a diameter of 1¼ inches just above the branch; the branch measured from the front of the main shaft along its lower surface has a length of 8 inches and is nearly uniform in diameter for its entire remaining length."

The above account is taken from an article by Arthur H. Norton, Museum of Natural History, Portland, Maine, published in Journal of Mammalogy, May 1924, p. 132–33. Rockwood has an elevation of 1044 feet and is in the town of Ephratah.

Madison County

2 1842 (before). *Woodstock*. "In the yellow-colored clay which underlies the swamp back of the village of Woodstock in Madison county, the soil of which is muck or peat, the tooth of an elephant, the Elephas ....., was found in digging a ditch. Attention to this discovery was directed by Mr Gerrit Smith and the Rev. Mr Schofield of Peterboro, from whom fragments were received, the tooth having separated into parts by exposure to the air and rough usage. This is the only fossil which was seen, forming a part of the quaternary era, during the survey of the district. A part of the tooth is in the State Collection." Lardner Vanuxem, Natural History of New York, Geology, Part III, 1842, p. 220. Among the Museum collections are a number of unlabeled fragments of mammoth teeth but none of the mastodon. It seems likely therefore from this fact and from the brief account given by Vanuxem that the tooth found was that of the mammoth.

Steuben County

3 1853 (before). *Mitchellville.* Mastodon or Mammoth. In the History of the Settlement of Steuben County, New York, by Guy H. McMaster, published 1853, is the statement (page 8) that "the tooth of a mammoth was once found under the bed of one of our central mill-ponds." On page 11 of the same publication is a note which reads:

The mastodon's tooth alluded to above was dug from a bed of blue clay near the steam saw-mill of Mr George Mitchell, in the Gulf road between Bath and Wheeler. It is eight or ten inches in length. A large bone was disinterred at the same place which crumbled on exposure to the air. Further examination will doubtless disclose other grinders of this huge beast and perhaps a pair of those broad tusks, curving outwardly at the points, somewhat like scythes, which adorn the heads of its brethren found elsewhere, and with which one good able bodied fellow, sweeping his head to and fro in wrath, might mow down an army of antagonists like meadow grass.

The bed of clay in which the tooth was found is of unusual depth and tenacity, and it is guessed that the animal of which the said bone was an appurtenance while rambling through the gulf, indiscreetly bounced into the mire and was unable to disengage his ponderous feet. It is further surmised that the bears may have pulled his skull around after death but that the frame of his body remains where he mired.

The writers are indebted to the Honorable Reuben B. Oldfield of Bath, N. Y., for calling attention to the published account in McMaster's history. What became of the tooth is not definitely known. In a letter Mr Oldfield states that "it might have been in the high school building which burned about that time." As the published account refers to the find as "the tooth of a mammoth" and also as "the mastodon's tooth," it is impossible to decide to which animal the tooth belonged. In view of the conditions where the tooth was found and the other finds recorded from Steuben county the chances are that the tooth belonged to the mastodon.

Orange County

4 1925. *Monroe.* Mastodon. Three well-preserved teeth and a few bone fragments were discovered October 16, 1925, by workmen engaged in cleaning out a spring on the property of the Orange and Rockland Electric Company of Monroe, N. Y. The attention of R. W. Smith, president of the company, having been directed to the find, steps were immediately taken to make a careful survey of the ground in the immediate vicinity in the hope of securing addi-

tional remains. Excavations were confined to a rather limited area by the character of the ground but in the course of a few days a large tusk was exposed which had a length of about 6½ feet and a diameter at the base of about 8 inches. The tusk was in such a friable condition that expert handling was required to remove it intact. When fully exposed it was photographed in position in the ground. It was then given a protective coat of plaster of Paris and sent to the American Museum, New York City.

The exact position of the spring may be located on a United States Geological Survey map, Schunemunk quadrangle, by continuing a line due east from Oxford Depot, on the Erie Railroad, until it intersects the first stream which flows northward into Moodna creek. In other words, the spring lies 1 mile east of Oxford Depot, 1 mile south of Bull Mine and about 1½ miles north and a little west of Monroe. A photograph of the teeth and a brief account of the discovery of the remains was given in the New York Herald Tribune for Friday, October 23, 1925, p. 14.

New York County

5 1925. Mastodon. Remains of a mastodon were unearthed in late April 1925 by contractors excavating for the foundations of an apartment house north of Dyckman street near Seaman avenue, New York City. An account of the discovery was given by H. F. Osborn and Charles C. Mook in the New York Herald Tribune and reprinted with several photographs and maps, in the Literary Digest for May 9, 1925, p. 25. The following account is taken from that of Osborn and Mook:

The remains consist of both sides of the lower jaw, fairly well preserved, but with the articular processes missing, and some fragments of limb bones, including part of the humerus, or upper arm bone. Several teeth, which had been excavated with the bones, were missing, having been taken away by bystanders. Two of these teeth have since been brought to the Museum, and it is hoped that more will appear. The teeth now included in the specimen are the third milk molar of the left side, and the first molar and a fragment of the second molar of the right side.

Erie County

6 1925. Bison. The discovery on December 31, 1925, of bison remains in the city of Buffalo has revived interest in the controversy regarding the origin of the city's name. Evidence of the former occurrence of the bison in western New York is to be found in the records of remains from Jamestown near the outlet of Chautauqua

lake and in the refuse pits on the sites of Indian encampments or villages on Cattaraugus creek and at Irving, but so far as our records show, this is the first discovery of remains within the actual limits of the city itself.

These remains are probably not to be regarded as fossil but they are interesting in the evidence that they provide for the historical basis of the name of the city and creek.

The facts on which the following account of the discovery is based have been supplied by William P. Alexander of the Buffalo Society of Natural Sciences, in whose care the bones have been placed. The bones were unearthed by workmen employed by the city in the construction of a sewer trench on the Old Terrace, now one of the busy thoroughfares of the city. The attention of the society was directed to the find by G. O. Curtis of Buffalo who recognized the possible importance of the discovery and delivered a number of the bones to the museum. Mr Alexander immediately visited the site of the excavations and made a careful survey of the deposits. The trench had been refilled at the exact point where the bones were found but 20 feet eastward the section showed that the trench had been cut through a layer of dry, yellow stratified sand, a deposit built up as part of the delta of Little Buffalo creek. Assistant City Engineer John H. Feigel, who was present when the fragments were thrown out, is responsible for the statement that the bones were buried to a depth of about 8 feet.

A list of the bones recovered follows: parts of three crania; five single jaw bones with teeth; one tibia; one metacarpal; two metatarsals. Other bones in the north side of the trench were noticed by the workmen who failed to recognize the importance of the discovery and refilled the trench.

SOME PROBLEMS IN THE SCHUNEMUNK AREA

By R. J. Colony

One of the prominent structural zones in the Schunemunk quadrangle runs from the northeastern part of the area through the entire length of the quadrangle in a southwesterly direction, continuing through the adjacent region to the southwest. In this zone are included Snake hill, slightly southwest of the city of Newburgh, and a series of prominent isolated hills lying just west of Schunemunk mountain and closely adjoining it. The largest and most northerly of these is Woodcock hill, about 1 mile south of Salisbury Mills and just west of the northern end of Schunemunk, and the most southerly one is a much smaller hill about one mile east of Oxford Depot, which may be called, for convenience, Oxford Depot hill. Directly north of Oxford Depot hill is Bull Mine hill; northeast of Bull Mine hill and between it and Woodcock hill there are three other small hills; the most southerly of these is called Galloway hill, the most northerly is called Round Top and the third has no name. The structural zone along which these hills are distributed is more or less offset in places by crossfaults, particularly in the southern part of the quadrangle, just south of Oxford Depot hill; here the zone has been shifted to the west, and the structural conditions become more complex. This zone, as the writer has previously mentioned,[1] bifurcates at the north end of Schunemunk mountain and runs along the base of the mountain on both east and west sides, separating it from the Precambrian crystalline complex on the east and from the series of isolated hills just mentioned, on the west. All of these isolated hills, including Snake hill, are detached faulted portions of the main mass of Precambrian crystallines that occupies the southern and eastern portion of the quadrangle. Schunemunk mountain is also cut off on the south by structural breaks that are so badly obscured by a heavy cover of drift that their distribution and relations have not yet been exactly determined. It seems certain, however, that Schunemunk mountain, which is composed of more or less thinly bedded, flaggy Devonian graywacke (Bellvale flags) conformably overlain by a coarse conglomerate (Schunemunk conglomerate) that occupies the highest parts of the mountain, is a down-faulted block that is itself structurally complex, owing its position in part to folding and thrust faulting of Appalachian age and in

[1] Colony, R. J. Field work in the Schunemunk Region during 1924. Annual Report, Director of New York State Museum, 1924.

part to the later block-faulting that occurred during Triassic time, and owing its development as a physiographic feature to post Triassic differential erosion that etched out the older and softer Cambro-Ordovician sediments surrounding the more resistant and geologically younger rocks of which the down-dropped block is composed.

Snake hill and the other isolated hills on the west side of Schunemunk mountain are all remnants of the great overthrust crystalline mass from the east. They are all in fault-contact with the Hudson River slates along a curved and warped thrust-plane that dips in a southeasterly direction at angles varying from 35 to 60 degrees and that rises toward the southwest, so that the thrust contact between the gneiss and the Hudson River slates lies at a higher elevation on Bull Mine hill than it does on Woodcock and Snake hills to the northeast.

The western slopes of these detached hills of gneiss are very abrupt, whereas the eastern slopes are in general less steep, extending to level meadows that in the aggregate form the narrow valley between the hills of gneiss on the west and Schunemunk mountain on the east.

Involved with these gneiss hills on the east and underlying the meadows of the valley are Cambro-Ordovician and later sediments in complicated structural relationships, in general much obscured by heavy cover. This valley lies along a fault zone that is a product of dynamic conditions during Triassic time, so that the detached hills of gneiss were cut off from the main crystalline mass by normal faults that intersected the older thrust faults of Appalachian age, and they were separated and offset from one another by oblique faults that probably were closely related to the general Triassic disturbance and possibly represent the closing stages of that movement.

It is therefore evident that within the very restricted area beginning with Snake hill in the northeastern part of the quadrangle and extending southwesterly and embracing Schunemunk mountain and the narrow zone on either side of it there is a structurally complex belt, made up of formations extending from the Precambrian crystallines to Upper Devonian, that have been subjected to at least three, and possibly four, periods of profound deformation, provided it is conceded that the rocks of the area have passed through the Taconic movement as well.

Several thousand feet of sedimentary beds are represented, including the Wappinger limestone, the Hudson River slates, the

Shawangunk conglomerate, High Falls shale, the Helderbergian series, the Highland Mills beds and related formations, among which are representatives of the Coeymans, New Scotland, Port Ewen, Oriskany, Esopus and Schoharie formations; and very considerable thicknesses (300 feet?) of the Cornwall shales, Bellvale flags (3000 feet?) and Schunemunk conglomerate (700 feet?).

These sediments, folded during the Appalachian revolution and forming the extreme northern tip of the great syncline that extends southwesterly into New Jersey, were later very badly broken and displaced during Triassic block-faulting. As a result of this later movement the folded sediments now comprising Schunemunk mountain and its immediately adjacent narrow valley on either side were crowded by down-dropping into the narrow space between the massive crystallines on the east and the overthrust but broken margin of them on the west that was itself badly broken and dislocated by the same Triassic movement. Thus the strata forming Schunemunk mountain, originally synclinal, have been so badly crowded that on the eastern side and especially at the base of the mountain, they are vertical in attitude, exhibiting many crush-zones, excessive jointing, and slickensided and striated surfaces; that is, they show evidence of much intraformational crowding and movement. Toward the top of the mountain the dips become flatter but they are still steep. The north end of the mountain is split longitudinally by a fault that seems to die out towards the south, but this is not yet definitely established. At any rate, there is a swamp on the top of the mountain that lies between steep escarpments on either side of it, and the base of the conglomerate on the eastern side of this break is 200 feet higher in elevation than on the western side.

The severe dynamic conditions imposed on this narrow belt have been responsible for the development of minor areas especially complex that have proved puzzling to previous workers in this district, and have been the object of special attention during the brief periods of field work both in 1924 and this year. These areas are as follows: (1) north of the north end of Schunemunk, the so-called "Idlewild Syncline;" (2) the valley on the east side of Schunemunk, including the Highland Mills section; (3) the valley on the west side of Schunemunk, including the detached hills of crystalline rock, the relations here being extremely complex; (4) the region southwest of Monroe, between the main mass of the crystallines and the western limit of the quadrangle.

In all of these minor areas small remnants of the broken synclinal mass are involved with overthrusts of Appalachian age in

such a manner as to suggest that the original Appalachian folding was not productive of simple synclinal structures, but that there was connected with it some complex thrust faulting as well. It was to these areas that attention was more particularly directed; additional work will be necessary before the structural problems connected with them can be satisfactorily solved.

REPORT ON THE FIELD WORK DONE FOR THE NEW YORK STATE GEOLOGICAL SURVEY IN GEOLOGICAL MAPPING OF THE NEWCOMB QUADRANGLE, ESSEX COUNTY, N. Y.

By Robert Balk

The writer was engaged in geological mapping of the Newcomb quadrangle from July 1 to September 30, 1925. Field work was carried on without interruption during the whole time. The northern half of the quadrangle, which is situated in the Adirondack mountains, southwest of Mount Marcy, has been covered almost completely. The middle part of the southern half has not yet been studied.

Formations

Four general formations of rocks were mapped. They are:

1*a* Series of Precambrian crystalline rocks. A sedimentary series, usually called Grenville series, consisting of impure marble and containing crystals of yellow quartz and red garnet, black graphite and green diopside, and tourmaline of various colors. In places the marble is found associated with amphibolites and quartzites. The latter show sometimes slight development of pyrite, chalcopyrite and hematite in veinlets.

b An intrusive series of anorthosite, gabbro and a basic granite-syenite, (nordmarkite).

2 Basic dikes, younger than the first group, of unknown but possibly of Precambrian age.

3 Quaternary glacial (till) and postglacial deposits (fluvio-glacial sands).

4 Recent stream deposits and small accumulations of peat.

Distribution

The distribution of the rocks is as follows:

In its most northeastern corner the mapped area touches the great massif of anorthosite which constitutes the central part and the highest peaks of the Adirondack mountains. About 2 square miles are made up of this characteristic rock. Southwestward the large intrusive is fringed by a more basic, "rim-facies," that is, a rock richer in dark minerals (hornblende, augite, garnet), which has previously been described by many authorities. Farther southward or southwestward the general distribution of the Precambrian rocks suggests a systematic arrangement as the igneous rocks both

decrease in mass and grow more acidic and as, on the other hand, the Grenville sediments increase in mass. In other words, the igneous rocks immediately southwest of the massif of anorthosite are comparatively basic representatives (gabbro, syenitic granites, rich in plagioclase, augite and hornblende). They constitute almost the entire northern half of the sheet, with the exception of three tracks of marble—at Newcomb, Goodenow river valley and Chain Lakes—which represent perhaps huge inclusions.

Still farther to the south and southwest the gabbros decrease and within the basic granites more acidic phases and indistinctly bounded bands of a proper granite appear. Southward from the latitude of Cedar river the series of sedimentary rock becomes very conspicuous and equals in mass the intrusives which *in turn* grow still more acidic. A reddish-pink, medium-grained granite is particularly well developed.

The quaternary rocks—especially till—cover a considerable area of the sheet, although most of the morainic material has been removed from the higher mountain slopes, except some large boulders. The drift, however, covers much of the valley grounds as a continuous sheet. The Hudson, Goodenow, Cedar, Indian and Boreas rivers in postglacial time cut their beds into these soft deposits. They frequently reach the hard rock floor and show remnants of their former higher level in the form of cross-bedded sands along their courses, several feet higher than the present level.

Special attention was to be directed to the primary structures of the Precambrian rocks, which were originated during the time of the intrusion. It was found that the basic rim-facies of the anorthosite exhibits an interesting linear flow-structure pitching southwest off the intrusive body. The following series of basic granites, etc. is characterized by a platy foliation. This gneissic texture strikes E SE—W, NW, and dips, next to the anorthosite, to the southwest and south. Farther southward the dip-angle becomes steeper and is vertical along an approximate line from Goodenow river to Polaris mountain. Still farther south the foliation is found slanting increasingly to the north. The intrusive rocks bordering the anorthosite, therefore, appear as a large wedge-shaped series, the southern margin of which lies almost horizontal and is intricately involved and interbedded with the older sediments which apparently underlie the whole magmatic complex. This result seems to corroborate to some extent previous conclusions of Doctors Daly and Bowen, reached from a merely theoretical standpoint.

PALEONTOLOGY AND PALEOBOTANY

REPORT BY RUDOLF RUEDEMANN, *Assistant State Paleontologist*

Three bulletins on the geology and paleontology of the State were completed during the year and published in May and June. They are:

Bulletin 258 The Utica and Lorraine Formations of New York. Stratigraphy—175p. 9 figs.

Bulletin 263 Idem. Systematic Paleontology. Part 1. 171p. 75 figs., 13 pls.

Bulletin 265 Some Silurian (Ontarian) Faunas of New York. 134p., 41 figs., 24 pls.

Part II of the fauna of the Utica and Lorraine formations of New York has also been completed during the year, both as to text and drawings, and is ready for the printer. It is the last part of the monograph of the Utica and Lorraine formations of New York and comprises the mollusca, crustacea and merostomata; among the crustaceans, a form that may represent the earliest of the barnacles, and among the merostomes, six new eurypterids from the Utica shale, where before only one form was known. Eurypterids of Ordovician age have hitherto been described only from the rocks of the State of New York, in Memoir 14 of the State Museum. These additional species are therefore of exceptional scientific interest.

The entire fauna of the Utica and Lorraine formations listed and described in the two bulletins comprises 312 species and varieties. Of these, ninety-five are new to science and another third had not before been recorded from the State, tripling the previously known fauna of the Utica and Lorraine formations. Striking differences in the facies of the Utica and Lorraine faunas that are brought out by the list to be published in the last installment of the monograph are described in a separate paper in this report. They indicate wide differences in the physical conditions surrounding the deposition of the Utica and Lorraine sediments.

Smaller papers have been published elsewhere; one on Fundamental Lines of North American Geologic Structure in the Twentieth Report of the Director, and others in the Pan-American Geologist and Science.

The field work consisted in mapping on the four quadrangles of the capital district and smaller collecting trips.

The Paleobotanist has given most of her time to Museum work. She supervised the completion of the Gilboa forest group, which

involving various new features of Museum work, such as restoration of whole trees with extremely delicate foliage, combination of actual geologic rock structures with an imaginary scene of an extinct forest, brought up many problems, both scientific and structural, that required much study. A description of the group, with a photograph, is given in a paper on New Museum Exhibits which follows in the report.

Miss Goldring is also engaged on the study of new crinoid and plant material that has come in during the year. Two papers dealing with this material are included in this report, and also a paper describing the recent Museum exhibits on which she has been engaged.

INDUSTRIAL GEOLOGY

REPORT BY C. A. HARTNAGEL, *Assistant State Geologist*

The value of the mineral production of New York State for 1924 amounted to more than $96,000,000. This is the largest annual value ever reported and represents nearly a threefold increase during the past 20 years. In order to present in a concise manner the mine and quarry products, together with quantities and values, the following table has been prepared:

Mineral Production of New York in 1924

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement	Barrels	7 435 875	$13 460 594
Natural cement	Barrels	.....	*a*
Building brick	Thousands	1 052 761	14 118 452
Pottery	.....	.....	8 421 523
Other clay products	.....	.....	3 678 564
Carbon dioxide	Pounds	.....	*a*
Crude clay	Short tons	5 948	31 238
Diatomaceous earth	Short tons	199	12 995
Emery	Short tons	1 610	11 426
Feldspar and quartz	Short tons	17 686	120 739
Garnet	Short tons	7 428	623 472
Gypsum	Short tons	1 474 491	14 329 246
Iron ore	Long tons	303 386	1 448 616
Marl	Short tons	.....	*a*
Millstones	.....	.....	18 215
Metallic paint	Short tons	14 522	63 955
Mineral waters *b*	Gallons	6 789 182	811 465
Natural gas	1000 cubic feet	6 196 000	3 632 000
Natural-gas gasoline	Gallons	476 753	49 639
Peat	Short tons	508	7 438
Petroleum	Barrels	1 440 000	5 245 000
Pyrite	Long tons	7 593	16 705
Salt	Barrels	14 091 486	6 739 597
Molding sand	Short tons	607 089	1 040 735
Other sand and gravel	Short tons	12 790 451	7 542 458
Sand-lime brick	Thousands	16 529	220 851
Slate	.....	.....	962 276
Granite	Short tons	68 360	211 766
Limestone *c*	Short tons	6 969 060	9 461 774
Marble	Short tons	64 220	532 358
Sandstone	Short tons	303 000	1 529 590
Trap *d*	Short tons	.....	238 125
Talc	Short tons	78 340	1 162 488
Zinc ore	Short tons	40 350	606 320
Other materials	.....	.....	45 872
Total value	.....	.....	$96 395 492

a Included under other materials.
b Quantity and value partly estimated.
c Includes value of lime, but not value of limestone for cement making. Tonnage does not include amount used in lime making.
d Includes value of miscellaneous stone.

Molding Sands

During the year there has been issued a report on the molding sands of the Hudson river district written by Professor C. M. Nevin of Cornell University. This report is of much value to the molding sand industry since it contains not only information relating to origin and location and method of deposition of many beds of molding sands, but also laboratory tests adding much to our knowledge of the character and uses to which molding sand may be put. Standardization of grades of sand is one of the ends toward which the molding sand investigations are being aimed.

The production of molding sand in New York State at present amounts to over 600,000 tons annually. Most of this product is from the Hudson river district. The rapid depletion of the present developed molding sand beds of the Hudson river district has made it desirable to continue field operations with a view to the future expansion of molding sand areas and the possible discoveries of areas containing sands of a coarser type than those found in the Hudson river district, for which there is a ready market.

With this end in view Professor Nevin spent the month of July 1925 in the field, making a reconnaissance of prospective new territory. During this month thirty-five samples of sand were collected for examination and testing and more than 2000 miles were covered in making the investigations.

From Saratoga Springs north to Glens Falls, Professor Nevin reports a number of undeveloped areas of molding sand of commercial size. This territory lies north of the present development in the Hudson river district, and future operations for production of sands of the Albany type will be extended to this region.

Examination of the territory directly north of Glens Falls along Lake George and Lake Champlain did not indicate the presence of new areas of molding sand of commercial importance. Although surface materials were abundant they were in general too sandy and open.

In southwestern New York along the Allegheny river are extensive deposits, from which some shipments are already being made. As a result of the field work other untouched areas have been located, some of these located on Indian Reservation but unfortunately not available for exploration. There are also a number of other areas in western New York containing molding sand, which may reasonably be expected to be developed within the next few years.

The core sands in the region west of Rome were also included in the field studies. The district has already produced a considerable

amount of core sand, but Professor Nevin reports in addition large undeveloped deposits, some of which have a thickness of 50 feet. The sand, though of a rather fine grain for certain types of core work, contains but one-half of one per cent of lime—a feature which makes it highly desirable.

The sand dunes at the east end of Lake Ontario at Selkirk were also investigated, the sand of these dunes resembling the famous Michigan City core sand of very similar origin. Beach sands of a coarser type are adjacent to the sand dunes, making possible the production of at least two grades of sand. It is estimated that the sand dunes alone contain about 5,000,000 tons of molding sand, with shipping facilities possible by lake barges.

Natural Gas

The field work on the natural gas district of western New York, started in 1924, has been continued, Professor Henry Leighton of the University of Pittsburgh spending a month in the field during the past summer. The results of office and field studies are to be incorporated in a bulletin.

Professor Leighton's work was concerned in part with securing data in order to make possible a map showing underground relations of the gas-bearing strata. In Chautauqua county the position of the Medina sandstone as referred to sea level was plotted and results relating to structure have been plotted on maps. New developments in recent years have made available a number of well logs, which will be of much help in interpreting underground relations and depths of the gas-bearing rocks.

Among the new gas fields developed within the past year or two is one along Hunters creek about 4 miles northeast of Holland, Erie county. In September 1925 there were twelve producing wells and four drilling. A pipe line will conduct the gas to East Aurora. Some further studies were also made in the Pavilion field. Attempts to extend the field by drilling have not met with any degree of success.

In the Dansville region the gas field has been extended somewhat and a deep test that will probably go to the Trenton limestone is under way. The gas fields of Allegany county were also given some attention, and a number of well logs were obtained and the positions of the wells plotted on the map.

In Oswego county near the city of Fulton a good producing gas well has been brought in during the year. Other wells are being drilled in the county in hopes of finding additional producers.

Petroleum

Field studies on the petroleum areas of New York State, which were undertaken a few years ago, were completed during the summer of 1925, a month's field work having been carried on by Professor R. E. Somers of the University of Pittsburgh.

The oil fields of New York have now been producing for a period of 45 years. They comprise an area of 50,000 acres located in the counties of Cattaraugus, Allegany, and Steuben. Altogether there are some 15,000 producing oil wells in these counties. Although there has been no noteworthy expansion of the oil-producing areas during the past 25 years and no new sands of importance have been discovered, the productiveness of the field has nearly doubled since 1912, in which year but 782,661 barrels of petroleum were produced. The 1924 production amounted to 1,440,000 barrels which represents the largest output in a period of more than 30 years. The large increase in production is for the most part due to methods of flooding which have been introduced in the New York and Pennsylvania fields in recent years and which have attracted widespread interest throughout the country. With these flooding methods of increasing the production of oil, the field and laboratory investigations have been chiefly concerned.

Professor Somers' work included: (1) The collection of late production data. The figures of recent years are of extreme value in showing the increase in oil output due to the flooding method of exploitation. (2) Collection of late geological information, special attention being given to correlation and naming of the oil sands. (3) Collection of samples of water from various stages in the process of flooding. The water samples are to be analyzed in order to determine what changes if any take place in the composition of the water as it passes through the sand. (4) Samples of sand at five-foot intervals were collected from several wells. A study of these samples are to be made to show nature and variation of the sand.

ENTOMOLOGY

REPORT BY EPHRAIM P. FELT, *State Entomologist*

The unusually cool summer of 1925 was probably responsible in considerable measure for the abnormal behavior of insect life. There were comparatively few serious outbreaks and these were mostly by species which ordinarily escape notice.

Cottony maple scale, Pulvinaria amygdali Ckll. This all but unknown species in New York State caused a great deal

of apprehension and was responsible for a considerable loss in the peach orchards from Lockport eastward to Owego. This scale insect is very closely related to the cottony maple scale, Pulvinaria vitis Linn., a species which occasionally becomes extremely abundant in the southern part of the State, especially on soft maple. Both of these insects secrete a large amount of honeydew and this falling upon the foliage or the fruit of the infested trees affords a suitable medium for the development of a sooty fungus, the latter blackening the smeared surfaces and in the case of the peach materially reducing the value of the crop. In a few instances most of the fruit from individual orchards was sold to canneries instead of being disposed of in the open market. The Entomologist visited the infested area twice, making a preliminary examination on the first trip and later going over the territory more carefully with associates and attending a conference for the purpose of determining the best procedure in infested orchards during the late fall and the following spring. It was decided to advise spraying with a lime sulphur wash at winter strength in the fall or spring as a safe and possibly satisfactory method of preventing serious injury another season, this to be supplemented by spraying at the time the young were crawling with a lime sulphur wash, 1 to 40, to which 10 pounds of air-slaked lime were to be added for each 100 gallons, this latter having given the most satisfactory results in checking the development of young scales and the secretion of honeydew the past season. This outbreak as indicated above is unprecedented for New York State and the occurrence of parasites in some of the orchards and other considerations justifies a hope that there may not be severe injury another season.

European corn borer, Pyrausta nubilalis Hubn. The western area infested by this somewhat well-known insect has been considerably increased during the past year and the borer has become more abundant in certain sections, especially in the Silver Creek area. There is somewhat greater damage in this section than in 1924, although the injury is not serious and generally speaking there has not been a material increase in the numbers of the insect in New York State.

Very disquieting reports came in connection with the work of this pest in southwestern Ontario in particular, and owing to the potential importance of the borer, the Entomologist attended the European Corn Borer Tour and Conference in Ohio, Michigan and Ontario, Canada, September 29th to October 1st, for the purpose of making personal comparisons between conditions in the

Canadian area in particular and the infested sections of New York State. There has been a much greater increase in the infestation in Ohio corn fields east of Toledo than has been recorded for New York State. The most serious conditions were observed in the eastern part of Essex and the western part of Kent counties, Ontario, Canada. There is an area of about 400 square miles which is very badly infested, one section comprising some 10 square miles being most severely affected. We were informed that in this latter area, owing to the serious infestation of 1924, there had been during the past season a reduction in the acreage of about 75 per cent. It was stated that 100 per cent stalk infestation prevails throughout the 400 square miles and that in the case of corn planted about May 15th, there were thirty-five to forty-five borers to a stalk, while in the plantings from June 4th to 6th the average was approximately twelve borers to a stalk and in fields planted later, June 15th, some five or six borers to a stalk. It was noted that relatively fair fields of corn, making some allowance for conditions, were to be found throughout this section and occasionally at least rather near very seriously infested fields, this alone indicating that the time of planting or other local factors may have an important effect upon the degree of infestation. A number of the early planted fields in this area were practically total losses, most of the stalks being so badly riddled by the pests that they could be readily crushed between the thumb and the fingers and the few malformed ears being practically worthless. This extremely serious condition followed a year of unusual abundance of corn borer and a consequent 50 to 75 per cent reduction in the corn acreage, this latter serving to increase the infestation. Furthermore, it is stated that the middlewest practice of breaking off the ears and leaving the stalks in the field is largely followed in this area. These conditions lead us to hope that the agricultural methods in New York State are such as to make impossible the extreme damage of the past season in certain sections of Ontario. The European corn borer behaves so differently in various sections of the country and from season to season as to justify close observation of the entire situation for some years to come.

Destructive leaf feeders. The apple tent caterpillar, Malacosoma americana Fabr., was somewhat abundant in sections of Rensselaer and Columbia counties, and particularly in the eastern part and also in the southeastern portion of the State. The fall canker worm, Alsophila pometaria Harris, was also extremely abundant in southern Westchester county. Both insects

are somewhat perennial nuisances and are easily controlled by the judicious application of poisons or the adoption of other repressive measures.

Ten-lined inch worm, Erannis tiliaria Harris. The outbreak of the past season was forecast by the appearance in October 1924 of millions of light brown moths at the lights of many cities and villages in the State. The insects attracted general attention then and were the basis for the prediction of extended injury the following spring. The forecast was amply justified by the stripping of basswood, oak and maple over wide areas in the Adirondacks, the Catskills and the eastern section of the state, particularly, by the bright yellow, black-lined measuring worms an inch or more in length. The somewhat close restriction of these pests to the soft maples of swamps or the oaks and other trees on elevations was quite marked, the latter especially so in the eastern part of Rensselaer county. The report of wingless females being found in numbers in late fall suggests a continuation in restricted areas of the defoliation of the past season, though very probably stripping will be less general since there was no such flight of moths in 1925 as was observed the preceding year.

Elm leaf beetle, Galerucella luteola Mull. This insect continues to be somewhat of a pest on shade trees, serious injury, however, being much more restricted than in earlier years and very frequently limited to a few trees near some especially good winter shelter, such as a belfry, an open shed or an old building, shelters presumably offering many attractive crannies for the overwintering beetles.

Apple and thorn skeletonizer, Hemerophila pariana Clerck. This recent introduction appears to have passed its maximum and is probably being controlled to a very considerable extent by natural enemies or responding to unfavorable climatic conditions. It is possible that the cool summer was unfavorable for the development of the insect. It certainly is true that there has been no such extensive feeding and defoliation as was characteristic of 1923 and 1924. Even unsprayed trees escaped for the most part with very little damage.

Gipsy Moth, Porthetria dispar Linn. The Entomologist has continued to cooperate with the gipsy moth office of the New York State Conservation Commission, assisting and advising in relation to the temporary weather stations, the latter having been located during the past season at Hampton, Salem, North Petersburg, Austerlitz and Pine Plains, and also East Charlemont, Mass.

The balloon schedules of earlier years were followed closely and these stations were visited several times. The general results indicated by returned tags agree closely with those of 1923 and 1924, there being a very general easterly drift and relatively little in a westerly direction.

The Entomologist has also examined a number of the recent infestations in the barrier zone and in addition one just north of the New York State line, namely at Lacolle, province of Quebec. The infestations are cleaned up very thoroughly and promptly after discovery and all except the larger have been practically exterminated. These conditions justify the maintenance of the barrier zone, since it is proving an effective method of preventing further westward spread.

Birch leaf skeletonizer, Bucculatrix canadensisella Chamb. This small insect is sometimes extremely abundant and in 1924 showed a marked difference in the degree of infestation between the western slopes of the Berkshires and some areas on the eastern slopes where practically all the birch foliage was destroyed. A few records of injury by this insect were received during the past season but none of any moment.

Birch leaf miner, Fenusa pumila Klug. The Entomologist was fortunate in observing thousands of the adults of this recently introduced leaf miner upon gray birches at Stephentown on May 27th. The following day they were seen in much smaller numbers at Karner and by June 10th they had mostly disappeared from an area which compared closely in seasonal development with the Stephentown section. Field observations were continued at irregular intervals throughout the season and data obtained which indicate but two generations in 1925, although the time limits appear to be ample and observations in 1924 indicated some breeding until well into the fall. This insect appears to be extending its range. Its work was observed rather commonly a little south of Newburgh and also in the Woodstock-Tannersville area of the Catskills. A number of birches near the main line of the New York Central Railroad near Fox Ridge and Port Byron showed from the train in early September what appeared to be the characteristic work of this insect.

An unusual outbreak by forest leaf feeders, the red-humped oak caterpillar, Symmerista albifrons Abb. & Sm., and the maple trumpet skeletonizer, Epinotia aceriella Clem., on the sugar maples of Cortland county was brought to our attention through Dr G. G. Atwood, chief of the bureau of plant industry,

Department of Farms and Markets. The great abundance of the latter insect was particularly noteworthy. The feeding by both occurred so late in the season that no material damage resulted.

There was an unusual abundance of small leaf-mining caterpillars working in spruce and hemlock needles. They enter at the base and fasten the affected needles together with frass-filled masses of webbing. The Colorado blue spruce suffered in several localities through the work of one of these insects, Olethreutes abietana Fern. More than 200 moths were reared from one small flat spray with major dimensions of 9 by 12 inches. A related species, Epinotia nanana Treit., attacked the needles of the Norway spruce in a similar manner and a third species, Recurvaria piceaella Kearf., was also reared from affected spruce. All three of these species are practically unknown as pests in the eastern United States. A fourth species should be mentioned in this connection, namely Argyresthia freyella Walsm., the silvery gray cocoons of which were numerous upon the leaflets of red cedar, Juniperus virginiana. The caterpillar or larva of this last is also a leaf miner.

Lunate onion fly, Eumerus strigatus Fall. Because of the considerable interest of the federal authorities in ascertaining the status of this insect in the United States in relation to the possibilities of preventing further introductions through the importation of bulbs, the Entomologist made a systematic examination of iris beds in various parts of the State and succeeded in collecting adults at Saratoga, Amsterdam, Schenectady, Albany, Greenville and Athens in the eastern part of the State and at Geneva in the central portion, indicating a wide distribution and probably the establishment of the species in most, if not all these localities. Such collecting as was possible at Rochester, East Aurora and Fredonia in the western section of the State failed to establish the presence of the insect, though this by no means indicates the absence of the species. The special attention given to this insect resulted in increased interest in other pests of the iris and consequently a number of other species affecting this popular flower were submitted for identification during the summer.

White pine weevil, Pissodes strobi Peck. This common pest of the white pine kills the leaders of thousands of small trees annually and in certain sections is very abundant and injurious to recently set trees. The city of Troy has a large number of young pines on the slopes surrounding the Tomhannock reservoir northeast of the city and at the request of the division of forests and

lands, State Conservation Commission, the Entomologist made several examinations of the infested area and advised the city authorities as to the best methods of handling the somewhat serious situation. A very large proportion of the infested shoots were cut and burned before the weevils escaped, a procedure which is bound to reduce the infestation greatly.

Spiny witch-hazel gall, Hamamelistes spinosus Shimer. This has an interesting alternation of food plants since it produces a spiny, budlike gall upon the witch-hazel, the aphids issuing from these galls migrating to the leaves of various birches and occasionally becoming so extremely abundant as seriously to curl or deform much of the foliage. There were several outbreaks of this insect on ornamental birches reported from the southern section of the State and observations in the eastern portion of Rensselaer county showed this plant louse to be extremely numerous upon native birches. Furthermore, the infested trees were frequented in considerable numbers by Syrphid or flower flies and other enemies of plant lice, indicating that natural checks would soon reduce the infestation greatly.

Birch psyllid, Psyllia striata Patch. The above record in relation to birch aphids should be supplemented by data relative to this comparatively unknown jumping plant louse, a species easily recognized by the long woolly strands adhering to the body and drifting with the wind as series of curved, spreading, wool-like fibers. This insect was extremely abundant on birches at Karner.

American holly leaf miner, Phytomyza ilicis Curtis. Observations the past season showed a general and somewhat severe infestation by this insect at Westbury, Long Island. A very considerable proportion of the holly leaves had the entire upper surface mined and discolored, this being particularly evident on the sunny portions of the shrubs. The lower and more sheltered leaves showed only a few of the characteristic serpentine mines. This locality is near the northern limit for the species.

Elm lace-bug, Corythucha ulmi Osborn & Drake. A rather severe infestation by this insect, heretofore unknown in New York State and recorded from only one New England locality, was observed on a small group of elms at Brainard, town of Nassau, the foliage being so badly affected that it was well browned toward the end of the summer. Investigations later showed the tiny lace-bugs to be wintering in large numbers among the leaves and débris at the base of the trees. Consequently judicious burning would be a rather easy method of greatly reducing such an infestation.

Croton bugs, Ectobia germanica Linn. These insects, sometimes spoken of as cockroaches, are well-known pests of city dwellings. One of the Hudson valley cities experienced considerable difficulty with these insects after they had become established in a dump and multiplied to such a great extent as to be veritable nuisances in the neighborhood. It is easy to outline effective control measures. The difficulty is to suggest methods which will not involve too great expenditures.

Insects and Health

The relation of insects to health is a subject brought to the attention of the Entomologist in many ways and is a relationship which is becoming more apparent as knowledge along this line increases. Recognizing the importance of popular information on this phase of economic work, the Entomologist has prepared a bulletin discussing briefly the essential relations between insects and the dissemination of disease, a phase of entomology of as much importance to the dwellers of the cities and villages as to residents of the country.

Winds and the Dissemination of Insects

The studies of recent years along this line have been continued and there is now in hand to be published elsewhere an extended discussion of the part winds play in the dissemination of insects. The Entomologist has assembled data from all sections of the world and has attempted to interpret this in the light of information recently acquired through aviation and other studies of air currents. He has found numerous records indicating widespread aerial movements, presumably drifting rather than purposive flight, evidenced in part at least by the data in relation to southern and southwestern insects being found upon high mountains and more recently by the collecting of an aphid, Dilachnus piceae Panz., and a flower fly, Syrphus ribesii Linn., on the snowy surface of North-East Land, Spitzbergen Islands, north latitude 80°, under conditions which indicate that "hundreds of thousands and even millions" of these insects had been blown in a broad belt over the island, probably originating on the Kola Peninsula, a distance of over 800 miles in a straight line.

The data assembled raise a serious question as to there being a real or purposive migration among insects comparable to that known to be true of birds and may lead to a very considerable modification in our methods of recording distribution in the future.

As an outcome of earlier work with balloons mentioned above,

the Entomologist has outlined methods for the use of these in connection with investigation of air currents conducted by the Bureau of Plant Industry, United States Department of Agriculture, balloons being released the past summer from a series of stations from Texas north to the Great Lakes. Work was also started by the Bureau of Entomology, United States Department of Agriculture, at a station located at Tallulah, La., a number of balloons being liberated in the early fall at the time cotton moths were taking flight, in an effort to duplicate the presumed northward drift of these insects. Enough data were secured to show a general northward drift, though to date there is no record of one of these balloons covering the same distance as the cotton moth, something not surprising when the extremely small number of balloons, relatively speaking, is compared with the millions of moths which must participate in these movements.

Nomenclature

The Entomologist, owing to the very large number of genera and species of insects, is compelled to use a great many scientific names and is consequently more interested in the rules in relation to these than is the zoologist working in other animal groups. An examination of the some 140,000 generic names of animals shows that a very considerable proportion have been formulated more for the purpose of avoiding duplication throughout the entire series rather than of developing a systematic and suggestive diversity. The result has been a large number of names characteristic to a very slight degree of the groups they represent, in many instances differing from each other very slightly and in some cases being extremely long. Furthermore, because of present rules prohibiting duplications throughout this entire series, it is extremely difficult to find reasonably characteristic short terms for new genera now being proposed at the rate of about 1500 annually. These considerations led the Entomologist, in cooperation with Dr S. C. Bishop, State Zoologist, to propose a system of four letter prefixes, these latter using so far as possible characteristic initial letters of the major groups, the third and fourth letters, assigned alphabetically in a well-recognized sequence for differentiation between the families. In order to avoid a marked break with the present system, it is recommended that the prefix be written as a part of the generic name as we now know it, the latter also capitalized. It is believed that serious defects exist in a system which permits such unwieldy names as Brachygnathosuchus, Pseudaugochloropsis and

Pseudoheptaphlebomyia, such similar terms as Agroeca, Agroecia and Agroecus, and such meaningless designations as numerous anagrams, all serious and unnecessary defects in a branch of science standing for accuracy and presumably welcoming the cooperation of students. Names are simply designations and it is held that they should be so formed as to aid to the greatest possible extent in their ready placing and identification and that with the fewest possible objectionable features.

Collections

The transfer to the State Entomologist of the custody of the Erastus Corning magnificent collection of butterflies, title to remain with the Albany Historical and Art Society, was one of the last acts of our late Director, Dr John M. Clarke. This action resulted in bringing a notable collection under expert care and the housing of it with those of earlier local collectors, namely, the W. W. Hill collection of Lepidoptera, comprising some 10,000 specimens and representing over 3000 species, and the J. A. Lintner collection. These three, with the constantly increasing state collections, represent an assemblage of material of great value to all future entomological workers.

During the year there has been an exchange of certain species of mosquitoes or Culicidae with Eric Hearle of the Entomological Laboratory, Vernon, B. C., and as a result the Museum has acquired a number of very desirable additions. The New York State collection of Culicidae, carefully studied and revised by Dr William Matheson of Cornell University, was returned during the year with a number of valuable additions. The extensive series of parasitic flies belonging to the Tachinidae has been carefully studied by Luther S. West, a graduate student at Cornell University, and is to be returned in the near future.

The arrangement and determination of the insects in the collection has continued whenever opportunity offered and some progress along this line may be reported. The Anthomyid flies, best known because among them may be found such important pests as the cabbage root maggot, P h o r b i a b r a s s i c a e Bouche, and the onion fly, P h o r b i a c e p a r u m Meig., have been rearranged by Mr Young. He has also given considerable time to the dance flies or Empidae which are now in fairly satisfactory condition. The Oscinidae or Chloropidae, better known as frit flies or grass stem flies, have been largely rearranged and some progress has been made in the classification of the Phoridae or hump-backed flies, minute, difficult species.

There have been a number of desirable additions to the collections through field work, contributions and exchange as in previous years. It was possible this season to collect in the field an excellent series of the birch leaf miner, Fenusa pumila Klug., and also of the elm leaf miner, Kaliofenusa ulmi Sund. A large series of the spruce leaf miner, Olethreutes abietana Fern., was reared from infested material.

The accessions during 1925 and many of those in 1924 hitherto not placed have been cared for and a number of identifications of beetles or Coleoptera and flies or Diptera have been made in the course of this work. It has also been necessary in connection with the increase in the size of the collection to repin and rearrange a number of boxes which had become badly overcrowded.

Attention was called last year to the need for another assistant in entomology and this has not decreased with the passage of time. Experience in other museums has shown that systematic or taxonomic work is very commonly in arrears, although well classified collections are necessary for the best work. There is in the New York State Collection of insects a large amount of unclassified material which can not possibly be arranged with the present staff, since numerous interruptions due to the necessities of identifying miscellaneous sendings from correspondents and other hindrances greatly delay systematic work upon the various groups. The Division is failing to meet its opportunities along a number of lines on account of insufficient assistance.

Publications

A folder entitled School Guide to Insects and Books About Insects, was issued early in the year and appears to have been of material service in many localities, if one may judge from the demand for copies. The Key to Gall Midges, A Résumé of Studies i-vii, Itonididae, dated February last, brings to a conclusion an extended monographic study of the gall midges of America, a small and comparatively neglected group comprising a large number of extremely interesting forms and including such important pests as the wheat midge, Contarinia mosellana Gehin, and the Hessian fly, Phytophaga destructor Say.

The Entomologist has prepared during the year a number of popular notices regarding various injurious insects. One of the most important entitled Insects and Human Welfare, was published in the Scientific Monthly for December.

Office Matters

The demands from schools, both teachers and pupils, for information regarding the insects of the State are increasing and have resulted in the exhaustion of practically all the available literature especially suited to their needs. It is obvious that such calls indicate a somewhat general interest in insect life and seekers for this knowledge should be encouraged in every possible way.

Lectures

The Entomologist has lectured on insects and disease before the senior class of the Albany Medical College, in a postgraduate course in infections, diseases and public health conducted by the State Department of Health, and before the staff of the division of laboratories and research, State Department of Health. He has also given a number of other lectures or talks on insects before various organizations in different parts of the State.

General

The work of the office has been materially aided as in the past year by the identification of a number of insects through the courtesy of Dr L. O. Howard, chief of the bureau of entomology, United States Department of Agriculture, and his associates. There has been effective and close cooperation with the State Department of Farms and Markets, particularly the bureau of plant industry, the State Conservation Commission, especially the gipsy moth office, the State Department of Health, the State College of Agriculture at Cornell University, the State Experiment Station at Geneva, various county farm bureaus and other public welfare organizations. A number of correspondents have donated specimens and rendered valuable service by transmitting data respecting different insects and by assisting in other ways.

ZOOLOGY

REPORT BY SHERMAN C. BISHOP, *Zoologist*

The routine work of the Zoologist and his assistants may be briefly summarized under the following heads:

Care of Collections

The great majority of zoological specimens are essentially perishable in character and require constant attention. They collect dust and dirt and must be cleaned. Specimens in alcohol or other liquid

preservatives must be examined at frequent intervals to prevent loss by evaporation. Bird and mammal skins and mounted specimens on exhibit and in the study collections are subject to the attack of museum pests, beetles, moths and other insects and must be fumigated.

Replacement of Specimens

Specimens long exposed to light, dust and constant changes in temperature deteriorate and must be replaced from time to time. This is especially true of the skins of birds and mammals whose color and patterns fade. Colors of naked skins, horns, beaks and claws may be restored by painting but feathers and fur offer greater difficulties.

Collection, Preservation and Classification of Specimens

The collection of suitable materials requires active field work on the part of the Zoologist. The preservation of the materials thus brought together is partly accomplished in the field and partly in the Museum's workrooms and requires considerable technical skill on the part of the assistant to the Zoologist. It is greatly to the credit of the assistant that all materials intrusted to his care have received intelligent and prompt treatment.

The Zoologist is responsible for the proper identification of the zoological materials added to the Museum's collections by field work, purchase and exchange but he can not be expected to have an intimate knowledge of all the individuals composing the various groups. If he is to accomplish anything of value he must confine his efforts to a few subjects. The division is undermanned. Specialists in ichthyology and mammalogy should be added to the staff if the Museum is to study and report on these groups. There is a constant demand for information relative to the history, habits and economic importance of various fishes, mammals and other animals and the Museum should be in a position to answer these inquiries. Some of these questions can not be answered because they have reference to subjects which have never been investigated and can not be until some adequate provision is made at the Museum.

Field Work

Field work during the past year has been carried on in various parts of the State and in northwestern Pennsylvania. In July 2 weeks were spent in Essex county, part of the time in the vicinity of Keene Valley and the remainder at Adirondack Lodge. Ex-

tensive collections of arachnids, reptiles and amphibians were added to the Museum's series. In August a short excursion was made to Honeoye lake where a fine series of the timber rattlesnake, Crotalus horridus was secured. In early September western New York and northwestern Pennsylvania were visited for the purpose of studying the life history and breeding habits of the Hellbender, Cryptobranchus, the largest salamander in the western hemisphere. Shorter trips were made in the vicinity of Albany, continuing investigations on the local fauna which have been carried on during the past few years.

The State Museum was fortunate in having on its staff of experts during the past summer Dr Francis Harper, secretary of the Boston Society of Natural History. Doctor Harper collected and studied the smaller mammals in various parts of the State and has added a series of study skins and skulls to the Museum collection. A more detailed account of the summer's work is appended to this report.

Classification and Arrangement of Specimens

The Museum's extensive collection of myriapods has been studied and completely revised by Professor J. W. Bailey of Mississippi College. This collection is the most complete in existence for the area covered, New York State.

New Groups and Exhibits

Several new groups now in course of construction have been designed to show something of the life history and breeding habits of several common reptiles and amphibians. The work of reconstructing the animals and their eggs is in charge of F. H. Stoll of Brooklyn, N. Y., an accomplished technician in wax, glass and plaster. The materials on which the studies are based have been furnished in most part by the Division of Zoology.

Without the special equipment of a zoological garden it is impossible to exhibit many kinds of living animals, but it has been found possible to place in Zoology Hall a number of reptiles and amphibians whose interesting habits have attracted the attention of a large number of visitors. The specimens exhibited include several species of snakes, turtles, lizards and salamanders.

In response to the growing interest manifested by the public in native birds, the Division of Zoology has installed a temporary exhibit showing the common winter birds of the capital district grouped according to the habitat in which the various species may

be found. The exhibit has been prepared by H. H. Cleaves, ornithologist and lecturer on wild life subjects, whose services have been secured during the absence of the taxidermist, Arthur Paladin.

Correspondence

Specimens of all kinds are being received at the State Museum from teachers, pupils in the public schools, museum workers and others interested in natural history. Identifying and reporting on these specimens often involve considerable study and correspondence but is regarded as one of the proper functions of the division.

Investigations

The Zoologist has continued his investigations on the life histories and habits of the New York reptiles and amphibians and has nearly completed the section dealing with the salamanders. The large collections of spiders and other arachnids which have been brought together during the past 10 years are being studied and have furnished material for several reports, some of which have been published as bulletins of the State Museum.

Publications

During the past year the following papers have been published:

Studies in New York Spiders: Genera Ceratinella and Ceraticelus; with C. R. Crosby

The Life of the Red Salamander

Singing Spiders

Two New Spiders from the Blue Ridge Mountains of North Carolina; with C. R. Crosby

An Egret and Little Blue Heron in Rensselaer County, New York

In Press:

The Spiders of New York: A Distributional List; with C. R. Crosby

The Phalangida of New York: A Distributional List; with C. R. Crosby

Notes on the Spiders of the Southeastern States with Descriptions of New Species

A Genus and Two New Species of Spiders Collected by Buto quercicus Holbrook

Records of Some Amphibians and Reptiles from Kentucky

Zonitoides arboreus (Say) in Mammoth Cave, Kentucky

Science and Scientific Names; with E. P. Felt

Prepared:

Notes on the habits and Development of Necturus maculosus (Raf.)

Suggestions

If the proper exhibition of materials pertaining to zoology is regarded as an important function of the State Museum, an effort should be made to secure the services of a competent preparator. It is not to be expected that any one preparator will be qualified to cope with all of the many intricate problems which arise but he should be able to handle a considerable number of them.

NEW YORK MAMMALS

By Francis Harper

In view of the decided need of increasing our knowledge of the distribution, habits, life histories and economic status of New York mammals, and also of making additions to the study collection of mammal skins in the State Museum, the writer was authorized to engage in field work for these purposes during the past summer.

In early July a small collection was made in the Hudson Highlands, a region whose fauna has been made known principally by the late Dr Edgar A. Mearns. A mammal of particular interest in this part of the State is a form of the red-backed mouse (genus Evotomys). Since there has been some question as to the exact species or subspecies represented by the single specimen that Doctor Mearns was able to secure, a special effort was made to collect additional specimens. By concentrating on certain sphagnous areas that occur in the most elevated portions of the Highlands, I was able to obtain three samples of Evotomys, which will doubtless be sufficient for finally determining the identity of the local form.

The distribution of the Allegany cave rat (Neotoma pennsylvanica) in this State is apparently limited to the Hudson Highlands, where it has been recorded from only a few localities. During the present season a specimen was trapped on Schunemunk mountain, and several other new locality records were secured.

From the middle of July to the latter part of August, field work was carried on in the Adirondacks, principally in the following localities: Indian lake in Hamilton county, and Chapel pond and

Adirondack Lodge in Essex county. Opportunities were sought for studying mammalian life in environments that have been affected to the least possible extent by civilization. One result of such studies may be the gaining of a more definite idea of the composition and interrelations of the Adirondack fauna during past centuries, before the white man's vastly disturbing influence upon nature began to be felt there. In view of the important distributional relations between plants and animals, much attention was given to the vegetation of the various ecological areas or habitats, from the treeless summit of Mount MacIntyre to the marshes and watercourses of the valleys. The altitudinal distribution of the various mammals was another matter given particular attention, since there are large gaps to be filled in our knowledge thereof. Information concerning the weights of mammals, though desirable and useful, is very meager or even totally lacking, in the case of many species; therefore the weight of nearly every specimen taken during the season was noted to the fraction of a gram. Female specimens were dissected for information regarding the season, number and development of embryos. Some photographs of mammals were secured by flashlight and a considerable number of other photographs were taken to illustrate the vegetation and topography in various habitats.

About fifteen species of mammals, represented by seventy-four specimens, were collected in the Adirondacks, and information of value was obtained concerning others. Those collected include the following: masked shrew (Sorex personatus personatus), big-tailed shrew (Sorex dispar), eastern short-tailed shrew (Blarina brevicauda talpoides), New York weasel (Mustela noveboracensis noveboracensis), northeastern mink (Mustela vison vison), northeastern chipmunk (Tamias striatus lysteri), red squirrel (Sciurus hudsonicus), Canadian white-footed mouse (Peromyscus maniculatus gracilis), bog lemming (Synaptomys sp.) eastern red-backed mouse (Evotomys gapperi gapperi), eastern meadow mouse (Microtus pennsylvanicus pennsylvanicus), house rat (Rattus norvegicus), northern woodland jumping mouse (Napaeozapus insignis insignis), southern snowshoe rabbit (Lepus americanus virginianus), and probably one or two others whose status has not yet been fully determined. Sorex dispar and Synaptomys are among the rarest of New York mammals in collections.

Close to the summit of Mount MacIntyre, which has an elevation of 5112 feet, three species, Sorex personatus personatus, Peromyscus maniculatus gracilis, and Evotomys gapperi gapperi, were obtained, and signs of another, Lepus americanus virginianus, were abundant. On the lower but likewise treeless summit of Mount Wright, which rises to 4585 feet, a Microtus sp. was collected.

Among the most interesting spots investigated were the ice caverns and talus slopes near Chapel pond and at Indian Pass. These localities yielded Sorex personatus personatus, Sorex dispar, and perhaps still another member of the same genus, in addition to several more ordinary species.

BOTANY

Report by Homer D. House, *State Botanist*

Scientific Investigations

The investigative work of the State Botanist during 1925 has been directed chiefly to a study of the flora of certain local areas, particularly in the vicinity of Newcomb, Essex county. Collections and field studies have also been made in other sections of the State. A detailed account of these investigations will be presented elsewhere. A large number of fungi, both parasitic and saprophytic, collected chiefly during 1925 are being studied in collaboration with Dr John Dearness and will be reported upon later. The mycological studies on the collections of 1924 have been completed and will be presented in the State Botanist's formal report.

Contributions to the State Herbarium

The following list indicates the chief sources of additions to the state herbarium by contribution and exchange during the past year:

Martha C. Carter (estate), Oneida	400
Elam Bartholomew, Stockton, Kans. (exchange)	200
Gray Herbarium, Cambridge, Mass. (exchange)	101
W. C. Ferguson, Hempstead	100
C. A. Brown, Albany	85
Mrs. O. P. Phelps, Gansevoort	10
Mrs Franc F. Pugsley, Pittsford	7

Other specimens have also been contributed by a number of correspondents. The most noteworthy contribution, not mentioned above is the Dr J. V. Haberer collection. This collection numbers upward of 10,000 specimens and constitutes a most valuable addition to the herbarium of the State Museum. Only a portion of the

collection has been received prior to January 1, 1926 and a more detailed account of the material will be deferred until a later report. It is eminently proper, however at this time to offer a brief sketch of his life and botanical activities.

The Dr J. V. Haberer Collection. Along with the Charles S. Sheldon collection, received in 1915, this ranks as the most notable gift to the herbarium of the State Museum. Dr Joseph Valentine Haberer was born at Utica in 1855, and died at Utica on December 7, 1925, only a few days after he had conveyed his herbarium to the Museum. His education was received in the public schools of Utica and the College of Physicians and Surgeons of Columbia University. In his chosen profession he ranked high and enjoyed a successful practice in Utica and its vicinity throughout his life.

In botanical circles he was widely known as one of the best of amateur botanists and a discriminating collector. His interest in plant life was enthusiastic, continuous and perhaps often to the neglect of his professional duties. In 1866 he was instrumental in the organization of the Asa Gray Botanical Club of Utica and was long its president. Asa Gray was born near Utica and spent part of his early life there so that the name of the organization was particularly appropriate. The society flourished for many years but local interest in botany declined and the society no longer has an active membership. Doctor Haberer's collections were made almost exclusively in central New York. He explored carefully all of the region of southern Herkimer county, most of Oneida county and made repeated excursions into the southern Adirondack region of Hamilton and northern Herkimer counties. His cottage on the shore of Oneida lake near South Bay where he spent most of his summer months was his base for botanical exploration of the entire Oneida lake region. He usually collected in quantity and as a consequence has contributed many valuable specimens to the herbaria of Harvard University, the National Herbarium at Washington, the New York Botanical Garden and the New York State Museum. Students of the difficult plant groups such as Viola, Crataegus, Carex, Botrychium, etc., have made abundant record of his critical field observations and extensive collections. Several species and varieties of plants have been named in his honor, the best known being a variety of the Ternate Botrychium (Botrychium obliquum var. Habereri) named by the late Benjamin D. Gilbert, a well-known authority on ferns. Doctor Haberer is survived by three sons, all of Utica. His wife died in 1913 and his only daughter, Mary Isabella, in 1910.

The Martha C. Carter Collection. The herbarium of Miss Martha Celette Carter, donated to the Museum in 1925 by her sister, contains about 400 specimens, nearly all of which were collected in the vicinity of her home, Oneida, and around Oneida lake. Miss Carter was born at Oneida on July 25, 1869 and died there on September 6, 1924. After attending the Oneida schools Miss Carter studied botany under the late Dr L. M. Underwood at Syracuse University, from which institution she was graduated with honor in 1892. Later she studied china painting and in this art as well as in water colors and oil achieved a statewide reputation. An ardent lover of flowers and outdoor life, she derived from her association with Doctor Underwood the necessary scientific attitude which resulted in the formation of a most noteworthy herbarium of the local flora, a collection which forms a valuable addition to the collections of the State Museum.

Additions to the State Herbarium. The total number of specimens added to the collections from all sources during the year 1925 is 2183, classified as follows:

Collections by the State Botanist	
Ferns and flowering plants	595
Fungi, mosses and lichens	685
Exchanges and contributions	903

The collections by the State Botanist and his temporary assistant were made in the counties of Albany, Columbia, Essex, Fulton, Hamilton, Herkimer, Madison, Oneida, Oswego, Otsego, Saratoga, and Warren.

Identifications

The State Botanist has been called upon during the year to identify 520 specimens of plants, including many edible and poisonous mushrooms, and plant disease fungi. These identifications were requested by 142 persons, mostly by letter, some of them, however, by personal visits to the office.

Lectures

During 1925 the State Botanist has delivered seven lectures before various organizations upon the subjects of plant life and wild flowers.

ARCHEOLOGY

After more than 18 years of service, Arthur C. Parker, former Archeologist, severed his connection with the State Museum on January 1, 1925, to assume the duties of director of the Municipal Museum at Rochester, N. Y. Since March 1, 1925, the work has been carried on by the present Archeologist.

A great deal of time has been spent in putting in order older collections and miscellaneous specimens. The archeological series of negatives has been brought together and systematically arranged in the office files, and the same attention has been given to photographs, maps and drawings. The entire subject catalog has been revised and listed under new and simple headings to avoid duplication. The ethnological storage room has been thoroughly renovated and provision has been made for temporary storage room for collections not yet cataloged.

Field Inspections

Field inspections have been made at various sites during the year. Among these are the farm of Mary H. Stanley near Chittenango Falls, where indications of only temporary camp quarters were found; the Charles Dockstatter farm and the adjoining Floyd Gates farm near Jamesville, which examination showed to be once the site of Iroquois occupation of the early historic period; sites in the vicinity of Cazenovia, Pompey and Manlius have also been examined.

During road grading operations on the Dutchtown road, seven Indian graves were unearthed on Sand Hill, a historic Mohawk site 1¼ miles northwest of Fort Plain and about a half mile due north of the site of Old Fort Plain. The Archeologist was not notified in time to prevent tampering with the graves, with consequent scattering and destruction of materials. Perfect Iroquois clay pottery vessels were reported smashed, and amateur collectors obtained traders' brass kettles, a few beads and a human effigy carved in bone. The burial site was directly in front of the Klock farmhouse, on the east side of the road. The front lawn, over a distance of 100 feet, was honeycombed with trenches; but the only article of interest found, except a few fragmentary human bones at a depth of 3½ to 4 feet, was the base of an early graphite crucible encrusted on the bottom and sides with a heavy layer of fused brass. This

was found at a depth of 40 inches in front of the north end of the farmhouse.

The Otstungo prehistoric site (number 38, Montgomery County, of Parker's Archeologic History of New York) was visited by the archeologist and Douglas Ayres jr of Fort Plain, and two days were spent in an attempt to locate the hitherto undetermined burial spot in connection with this ancient village. Results were negative or only slightly favorable and further investigations will be needed to locate the burial ground. Some of the public-spirited citizens of Fort Plain have urged that this prehistoric Mohawk village, which is one of the best examples of natural fortifications in the State, be preserved. This admirable undertaking has the indorsement of the archeologic division, with the hope that the site will in time be added to the group of state reservations now existing.

The New York State Archeological Association

This association came into existence in March 1916, when the Lewis H. Morgan chapter was organized at Rochester. This chapter today has a membership of 375, with Alvin H. Dewey president; Walter H. Casseber, secretary; Edwin G. Foster, treasurer. The association is successfully achieving the purposes for which it was formed, in recording the results of its work; preserving and protecting the ancient sites of aboriginal occupation within the State; encouraging the scientific collecting and cataloging of Indian artifacts and accomplishing much more in arousing and holding the interest of its members in the study of New York archeology and ethnology.

A Long Island chapter was organized at Southold in August of this year with eleven members, enthusiastic students of the archeology of the eastern end of Long Island, who had been working for years without coordination. Much work has been accomplished during the past few months at "Old Southold township" and a number of burials have been excavated, one of which revealed a very remarkable series of ceremonials, and another a very unusual group of aboriginal domestic utensils. The chapter has already been presented with a very desirable plot of ground by one of its members and it is hoped that a museum will be built there in the near future. The New York State Museum, through the division of archeology, is ready to cooperate in any possible way in the formation of new chapters.

Rev. Dr William M. Beauchamp

1830–1925

In the passing of William M. Beauchamp on December 13, 1925, the city of Syracuse has lost its "grand old man," for he was the oldest Episcopal clergyman in the central New York Diocese; Onondaga county lost its foremost historian; the State of New York has lost its dean of archeology, for Doctor Beauchamp was a venerable and highly respected authority on this science.

Doctor Beauchamp was born at Coldenham, N. Y., on March 25, 1830. As a young man he became interested in the study of archeology and ethnology and devoted most of his life to research in these sciences. The citizens of the State have been greatly enriched by the knowledge and data gathered by Doctor Beauchamp and preserved for them in the many bulletins which he wrote for the State Museum. He was honored with many distinctions, but none seems more fitting than the one bestowed on him by the Onondaga nation when he was adopted as a member of the Eel clan and called "The Beautiful, or Perfect, Rainbow."

FAUNAL FACIES DIFFERENCES OF THE UTICA AND LORRAINE SHALES

By Rudolf Ruedemann

In part I of the monograph of the Utica and Lorraine formations of New York (New York State Museum Bulletin 258, 1924) the writer fully discussed the origin of the black shales of the Cincinnatian (*ibid.* p. 73) and arrived at the conclusion that the black graptolite shales of New York State were deposited in the deeper water of basins; in the case of the Schaghticoke, Deep Kill and Normanskill, shales in narrow basins running in the direction of the Appalachian geosyncline; in that of the Utica shale in local depressions southwest and west of Adirondackia, of a more widely extending epicontinental sea. The fauna of the typical graptolite shales of the Lower Ordovician was described as containing only a few pelagic forms besides the graptolites, that of the Utica and associated shales (Canajoharie, Atwater and Deer River shales) as containing larger faunas, corresponding to the more calcareous composition of the shales. These faunas were also recognized as greatly depauperated when compared with those of the contemporaneous sandstones and gray shales of the upper Schenectady beds in the east, and the Cobourg limestone in the north in the case of the Utica shale; and of the Trenton limestones with their luxuriant life in the case of the contemporaneous Canajoharie shale.

The completion of a faunal table for the third and last instalment of the monograph of the Utica and Lorraine formations has brought to the writer's notice some striking differences in composition between the faunas of the black shales and the gray shales and associated sandstone of the Upper Ordovician which throw an important light on the character of the two facies represented by these shales. It is the purpose of this paper to point out these differences in the biota of the shales and their bearing on the problem of the graptolite shales.

The following list shows the number of species of each class found in the black shales and in the gray Lorraine shales and interbedded (more or less calcareous) sandstones.

CLASS	NUMBER OF SPECIES		PERCENTAGE OF FAUNA	
	Utica etc. black shale	Lorraine gray shale	Utica etc. black shale	Lorraine gray shale
Plants	5	1	4.6	.5
Sponges	11	...	10	.....
Corals	...	1	....	.....
Graptolites	23	8	21	3.8
Crinoids	...	4	....	.....
Worms	9	4	8.3	2.0
Star fishes	1	...	....	.....
Bryozoans	4	32	3.7	15.3
Brachiopods	12	33	11.1	15.8
Pelecypods	5	63	4.6	30.1
Gastropods	4	30	3.7	14.4
Cephalopods	13	6	12	2.4
Trilobites	7	11	7.4	5.3
Ostracods	4	13	3.7	6.2
Cirripedes	1	2	....	.....
Phyllocarids	2	...	....	.....
Merostomes	6	1	5.5	.5
Total	108	209		

The black shale at Six Mile creek near Rome, which furnished the famous material of Triarthrus eatoni and of Cryptolithus tesselatus retaining the appendages, has hitherto been considered as of Utica age, but has been proved by the writer in Bulletin 258 to belong with the Frankfort shale. The biologic aspect of the fauna of this shale is, however, typically that of the other black shales and its fauna is therefore here counted with the black Utica shale. It is doubtless a local continuation, in the center of the sinking basin, of Utica conditions into Frankfort (Lorraine) time.

The table brings out the following essential differences in the fauna of the black and gray shales respectively. The former is characterized by the preponderance of seaweeds (5, 4.6 per cent), sponges (11, 10 per cent), graptolites (23, 21 per cent), worms (9, 8.3 per cent), cephalopods (13, 12 per cent), and merostomes (6, 5.5 per cent) in absolute numbers and in relative percentage over the other biota of the assemblage and the corresponding numbers of the Lorraine beds. While these groups are not at all or only scantily represented in the gray Larrania shales, the latter contain large absolute numbers of species and relatively large percentages

of bryozoans (32, 15.3 per cent), brachiopods (33, 15.8 per cent), pelecypods (63, 30.1 per cent) and gastropods (30, 14.4 per cent).

A more detailed comparison of the fossil associations of the black Utica and gray Lorraine shales brings out the following facts:

The seaweeds of the Utica shale while rarely preserved distinctly enough to invite description, are nevertheless so omnipresent in macerated small patches that they undoubtedly constituted the principal source of the organic matter of the black shale (N. Y. State Mus. Bul. 258, p. 76, 84).

The sponges which were found in the Utica shale are all primitive Hexactinellida, like the sponges that have been found in the black Canadian shales at Little Metis, Quebec, and in Europe. They occur at certain horizons in great abundance, as in the upper Utica shale at Holland Patent.

The graptolites are everywhere present in the black shales and frequently in myriads to the exclusion of everything else, as Climacograptus typicalis at various horizons of the upper Utica. The few species observed in the Lorraine gray shales and associated sandstones are never of profuse occurrence and as a rule are scattered and rare finds.

Corals and crinoids are absent altogether in the black shales.

The worms with nine species constitute 8.3 per cent of the fauna. Undoubtedly there were many more forms which on account of their lack of hard parts escaped fossilization.

There were four species of bryozoans observed in the black shales as compared with thirty-two in the gray shales and alternating sandstones. Two of these are varieties of Spatiopora lineata Ulrich and occur only attached to cephalopod shells of the two others, one, Prasopora cf. contigua Ulrich, has been found only in one individual, and only the fourth, Hemiphragma bassleri, has been obtained in large zoaria but is also of very rare occurrence. The bryozoans are therefore by no means a regular constituent of the black shale fauna.

The brachiopods are not regular constituents of the black shale fauna either. It is true that there are twelve species recorded from the black shale as compared with thirty-three from the gray shale and sandstone, but these are nearly all minute forms with phosphatic-chitinous shells, namely, two forms of Leptobolus, two of Lingula, one of Trematis, one of Schizocrania, one of Schizambon and one Orbiculoidea. The remainder are a small Dalmanella found in the Utica shale near the top, a small Platystrophia, one example, a unique large example of Orthorhynchula linneyi

(James) and the small Camarotoechia (?) humilis of the Frankfort shale. This brachiopod biota contrasts strongly with that of the Lorraine gray shales and alternating sandstones with their multitudes of Dalmanellas, and other orthids; of Plectambonites and gigantic Rafinesquinas. The brachiopod fauna of the black shale has for the most part the appearance of having been attached to seaweeds or other floating objects and Schizambon minutus has been found only attached to patches of eurypterid skin.

The contrast between the pelecypod component of the two faunas is especially striking; there having been found but five species in the black shale against sixty-three in the gray shales and sandstones. The lamellibranchs of the Utica are of rare occurrence and very small forms, the only exception being Cuneamya subquadrangularis, which reached a length of about an inch but was found in only one example. Against this impoverished biota stand the multitudes of large Modiodesmas, Modiolopses, Pterineas, Byssonychias and Orthodesmas of the Lorraine beds.

The gastropods have likewise only an extremely depauperated representation in the black shales, the biota consisting of a minute Strophostylus, a small Holopea found in only one individual and two Conularias that are of doubtful reference to that class of mollusks. Against this stand thirty species in the Lorraine gray shales and sandstones with many large and abundant individuals and a great variety of genera.

The cephalopods, on the other hand, in contrast to all other mollusks, find their largest representation in the black shale, with thirteen species out of a fauna of 108 species against six species out of one of 209 species for the Lorraine beds. They constitute therefore 6 per cent of the Utica fauna and but 2.4 per cent of the Lorraine fauna. The Utica biota of cephalopods consists mostly of straight orthoceratites (Geisonoceras, Endoceras, Cycloceras), small Trocholites and the rare species Oncoceras pupaeforme. Small individuals of Geisonoceras are found sometimes in great abundance, but also larger individuals occur as the Geisonoceras amplicameratum of the upper Utica which was figured in the third instalment of the monograph and which attained a length of 2 feet. In one case the shattered conch of a large Endoceras was found in the Utica shale. In contrast to this larger biota of smaller cephalopods stands the smaller number of Lorraine forms which, however, consist of much larger species of Endoceras and Actinoceras.

The trilobites with seven species in the black shale against eleven in the Lorraine shales apparently are as well represented in the former as in the latter. It is to be considered, however, that one of these eight is Cryptolithus bellulus found in the black Frankfort shale at Six Mile creek; two others are species of Triarthrus; one is the Ogygites latimarginatus of the Collingwood; one Homotelus stegops, a Lorraine form, appearing in the top beds of the Utica; two others Proëtus beecheri and Odontopleura crosota, were found as very rare fossils in the black shale of Frankfort age at Six Mile creek near Rome. In the Utica shale itself only species of Triarthrus occur and it should be noted that with the exception of the Ogygites of the Collingwood shale and the Homotelus of the top of the Utica all species consist of small forms indicating unfavorable conditions. Against this stand the common Homotelus stegops of the Lorraine, a large Isotelus and two species of Calymmene and two of Odontopleura in the Lorraine shales. It should also be noted that a Triarthrus (T. huguensis Foerste) and Cryptolithus bellulus continue into the black shale intercalations of the lower Lorraine (Whetstone Gulf) beds and are extremely common there in places (N. Y. State Mus. Bul. 258, plate facing p. 112). The trilobite biota of the black shale is a very restricted one, though represented by an abundance of individuals in some horizons.

The ostracods are represented in the black shales only by a few primitive forms that are not very abundant in individuals.

Of supposed cirripedes the Utica shale has furnished the remarkable Eobalanus informans Rued. attached to the cephalopod shells and suggesting an early barnacle, while in the Lorraine shales the detached plates of Lepidocoleus are frequently observed.

The phyllocarids of the black shale consist of a swarm of the small Ceratiocaris timida Rued. found in the paragastric cavity of a sponge (see part III of the Utica and Lorraine Formations) and a group of telson spines found in the shale at Six Mile creek near Rome. No remains have as yet been observed in the gray Lorraine shales.

The merostomes have afforded six species represented by fairly complete individuals in the Utica shale, but only a single telson spine in the Lorraine shale. In one case (figured in part III, *op. cit.*) two individuals (Eurypterus rusti, Pterygotus walcotti) were found rolled into a round mass suggestive of the

alga Discophycus of the Utica shale. It is very probable that we have here before us cast skins that settled at the bottom and drifted about there. It is notable that also the black shales of the Normanskill beds and of the Schenectady beds in the Ordovician and the thin black shale laminations intercalated between the sandstones of the Silurian Shawangunk grit have afforded large assemblages of eurypterids (Mem. 14, N. Y. State Mus.).

It clearly follows from this analysis that the black shales of the Utica and Lorraine formations are characterized by a very distinct fauna that contrasts with that of the gray shales and alternating sandstones of the Lorraine as much as does the Cobourg limestone of equal age with the upper Utica. A comparison of the fauna of the black Canajoharie shale with that of the equivalent Trenton limestone would bring out still greater differences and the thinner intercalations of black shale in the Schenectady and Snake Hill beds show similar assemblages to those of the Utica and Canajoharie shales.

The fauna of the Canajoharie shale as described by the writer in The Lower Siluric Shales of the Mohawk Valley (N. Y. State Mus. Bul. 162, 1912, p. 15 ff., see especially p. 23) consists of graptolites, sponges, small brachiopods, mainly with phosphatic-chitinous shells (Leptobolus, Lingula, Schizocrania) besides small specimens of Dalmanella and Rafinesquina; small lamellibranchs referable to Pterinea, Prolobella, Ctenodonta and Whiteavesia; a few small gastropods (Clathrospira, Liospira), small Orthoceras-conchs, among trilobites mainly Triarthrus becki and small Calymmenes, cirripede plates (Lepidocoleus, Turrilepas) and ostracods of the genera Primitiella and Ulrichia.

The aspect of the black shale faunas in the Mohawk valley remained therefore entirely the same from the Canajoharie shale of Trenton age to Lorraine time. These faunas therefore constitute a very distinct facies pointing to a definite condition in their habitat. Let us see now what this may have been as derived from the nature of the faunules.

We have already in part 1 of the monograph of the Utica and Lorraine formations (N. Y. State Mus. Bul. 258, p. 77 ff.) fully set forth the differences between the typical graptolite shales of the Appalachian troughs (Schaghticoke, Deep Kill, Normanskill shales) and the black graptolite shales of the Mohawk valley. While the former are as a rule but relatively thin intercalations of black shales in grit and limestone beds, and great masses of gray, red and green shales, the black graptolite shales of the Canajoharie, Utica,

Deer River, Atwater and Lower Lorraine (Whetstone Gulf and Frankfort beds) are uninterrupted successions of black shales, reaching a thickness of 700 feet in the Utica shale and over 1200 feet in the Canajoharie shale.

Further it was shown that there is an important difference found in the composition of the shales, the typical graptolite shales of the Appalachian troughs being purely argillaceous, while those of the Mohawk valley possess a strong admixture of calcareous matter.

The most important difference, however, is to be seen in the faunal assemblages of the two groups of graptolite shales. The typical graptolite shales of the first group have furnished a large graptolite fauna in many successive zones, but utterly lack other fossils. In all the thousands of feet of the combined Schaghticoke, Deep Kill and Normanskill shale but nine fossils, other than graptolites and the eurypterids of Catskill, have been found by me and all, almost without exception, only as extremely rare fossils. These fossils are:

Graptospongia pusilla Rued. a sponge of the Normanskill shale
Paterula amii Rued.
Schizotreta papilliformis Rued.
Leptobolus walcotti Rued.
Lingula quebecensis Billings
Eunoa accola Clarke
Serpulites interrogans Rued.
Caryocaris wrightii Gurley
C. curvilatus Gurley

The eurypterids found in the Normanskill shale at Catskill (N. Y. State Mus. Mem. 14, p. 413 ff.) are:

Eurypterus chadwicki C. & R.
Eusarcus linguatus C. & R.
Dolichopterus breviceps C. & R.
Stylonurus modestus C. & R.
Pterygotus ? (Eusarcus) nasutus C. & R.
P. normanskillensis C. & R.

These eurypterids occur intermingled with the graptolites. It will be seen that the nongraptolitic biota, extremely meager as it is, still represents important elements of the much larger one of the black graptolite shales of the Mohawk valley, namely, the sponges, phosphatic-chitinous inarticulate brachiopod shells, all very minute with the exception of the gigantic Lingula quebecensis and Eunoa accola, Clarke (probably a Discinocaris comparable to the British D. gigantea), the worms, phyllocarids[1] and eurypterids.

[1]The phyllocarids (Caryocaris) are found in great numbers on some bedding planes, not only here but also especially in British Columbia, Nevada and Quebec and are the same species in all these regions.

The writer has considered (N. Y. State Mus. Bul. 258, p. 82) these common nongraptolitic elements of the faunas of the calcareous and noncalcareous black shales as the nektonic, planktonic and pseudoplanktonic portion, the latter attached to seaweeds that drifted into the basins or grew along their margins; and has arrived at the conclusion that while the typical graptolite shales of the Appalachian region were deposited in the dead grounds of the deeper littoral zone (*ibid.* p. 81) of narrow troughs, carried there by the undertow of storms, the black graptolite shales of the Mohawk valley with their larger nongraptolitic faunas, more or less calcareous admixture and thick continuous deposition do not indicate conditions so utterly uncongenial to bottom life though still unfavorable. "This condition is principally due to the influx of the black mud, for in the transitional beds (Dolgeville beds) richly fossiliferous limestone beds alternate with fairly barren black shale bands." We inferred (*ibid.* p. 83) that the Canajoharie and Utica shales were deposited in seas of broader expanse, the Utica sea especially having extended far to the west. They had their shore lines in the east and northeast where the Schenectady beds exhibit many signs of shallow origin, while toward the north and northwest the Utica shale is replaced by the Cobourg limestone. While the black mud of the Canajoharie shale, which is replaced rapidly westward by the Trenton limestone, may be also due to the action of the undertow, the wide westward extension of the Utica shale was considered (p. 84) as calling for a further agency of wider geographic influence than the undertow and this was found in the presence of marine currents in the epicontinental Utica sea. Local thick accumulations of black Utica shale, as that around Utica, amounting to 700 feet of shale, suggest local sinking basins or depressions southwest of Adirondackia. In these basins conditions of more severe stagnancy may have developed at times, as suggested by the complete barrenness of some beds and the presence of iron pyrites.

While the extremely meager fauna of the typical argillaceous graptolite shales of the Appalachian troughs was considered as entirely foreign to the bottom grounds where the shale was deposited and as wholly derived from the higher levels of the water, the much larger biota of the Utica and associated shales, amounting to 108 forms in our list, were in Bulletin 258 considered as partly composed of foreign elements and partly of an impoverished bottom fauna of small pelecypods, gastropods, cephalopods, trilobites etc.

Our analysis of this larger fauna here carried out has shown, however, that this fauna is entirely different from that of the shore

formations, represented by the gray shales, sandstones and limestones. The sessile benthos as represented by the corals, crinoids and bryozoans is either entirely absent or, as in the case of the bryozoans, mainly represented by forms attached to shells of other vagile species. The sponges are an exception and their occurrence in closely crowded, well-preserved and fairly well spaced colonies indicate their former sessility on the bottom and their preservation *in situ*. The small types of phosphatic brachiopods, of pelecypods, gastropods and cephalopods, all with relatively thin shells, as well as the trilobites, may have belonged partly to the vagile benthos and partly been nektonic, planktonic, or pseudoplanktonic, living on and between floating seaweeds. The prevailing forms of trilobites, the species of Triarthrus and Cryptolithus, were undoubtedly bottom dwellers and mud grovellers. The phyllocarids found hiding in the paragastral cavity of a sponge were clearly also members of the vagile benthos and the eurypterids belonged partly to the vagile benthos and were partly pelagic. There is hence no doubt that the graptolite shales of the Utica type, in contrast to the typical graptolite shales of the Appalachian region, were deposited in depths that allowed specially adapted life, consisting of hexactinellid sponges; worms; a few bryozoans; small brachiopods with phosphatic, nonarticulating valves; small, often thin-shelled pelecypods; gastropods and cephalopods; small, mostly mud grovelling trilobites; primitive, minute ostracods; some phyllocarids and eurypterids.

The nature of this fauna supports the view attained before by the writer from the lithologic, stratigraphic and paleogeographic evidence, that the Utica shale and similar graptolite shales were deposited in the deeper reaches of more widely expanding epicontinental seas where there was plentiful influx of mud but still sufficient oxygen to allow a depauperated microfauna to exist, while in the typical graptolite shales no bottom life seems to be preserved.

At the same time that these conclusions with the exception of the analysis of the Utica-fauna were published, there appeared a most important contribution to the discussion of the problem of the graptolite shales by one of the pioneers of British graptolithology, T. E. Marr under the title The Stockdale Shales of the Lake District (Quart. Jour. Geol. Soc. v. 81 pt. 2, p. 113–33, July 4, 1925). This paper attacks the problem mainly from the side of the lithogenesis and stratigraphy of the rocks.

The great series of Silurian graptolite shales consists throughout of fine-grained material. The normal and principal deposits of the

period are green beds; besides these are found black to gray graptolite-bearing mudstones, blue nongraptolitic beds and red beds. This is a combination that we have typically in the Normanskill shale, with the addition, however, in the latter, of coarse grit beds and the Rysedorph hill conglomerate. Dr R. H. Rastall, who examined the different Stockdale shales, found that the mechanical basis of all these shales is the same, that the prevailing green muds are due to chloritic products derived from rocks of igneous and metamorphic character which furnished the material. The blue graptolite-shales contain 6 per cent to 11 per cent of carbon as coloring matter; the blue muds owe their color to the presence of iron carbonate, to the absence of free carbon and to the paucity of iron sulphide; the red beds are colored by iron oxide.

The vertical sequence is of great importance. It was found that the dark graptolitic muds predominate below, then follow the blue, thirdly the green, and lastly the red muds.

"The beautiful state of preservation of the delicate graptolites, is belong the graptolites, which by Lapworth and Ruedemann are were those of quietness of the floor; and this view is borne out by the preservation of the extremely thin tests of the Cephalopoda and the organisms referred to the Phyllocarida belonging to the genera Aptychopsis, Peltocaris and Discinocaris."

The fauna is divided into the plankton, in a general sense, or the organisms living near the surface and the benthos. To the former belong the graptolites, which by Lapworth and Ruedemann are considered as largely pseudo-planktonic and partly truly planktonic, the Phyllocarida and Cephalopoda and the problematical Dawsonia (also a constituent of the New York fauna). "The actual or presumed benthonic creatures of the Stockdale shales are distinguished by their dwarf size" and in the case of dark graptolite-bearing muds normal benthonic forms are practically absent. H. A. Nicholson and Marr had already shown in 1888 (The Stockdale Shale, Quart. Jour. Geol. Soc. v. 44, p. 654–732) that the Stockdale shale becomes coarser upward and especially eastward, suggesting an approach of the land margins toward the area under consideration in the latter part of the period, and during the same period lying in an easterly direction.

"As the quiet conditions which marked the deposition of the sediments can not be regarded as due to their formation in abysmal depths, embayments from the main ocean suggest themselves at once." Miss G. L. Elles D. Sc., has plotted upon a map of Europe the places of occurrences of the Stockdale shales or their equiva-

lents, and we copy here this interesting sketch map. It shows two deep gulfs extending from the Atlantic ocean across Great Britain into Scandinavia and middle Europe (see text figure 1). The shore lines are marked by a fringe of coastal deposits which are not shown on the map.

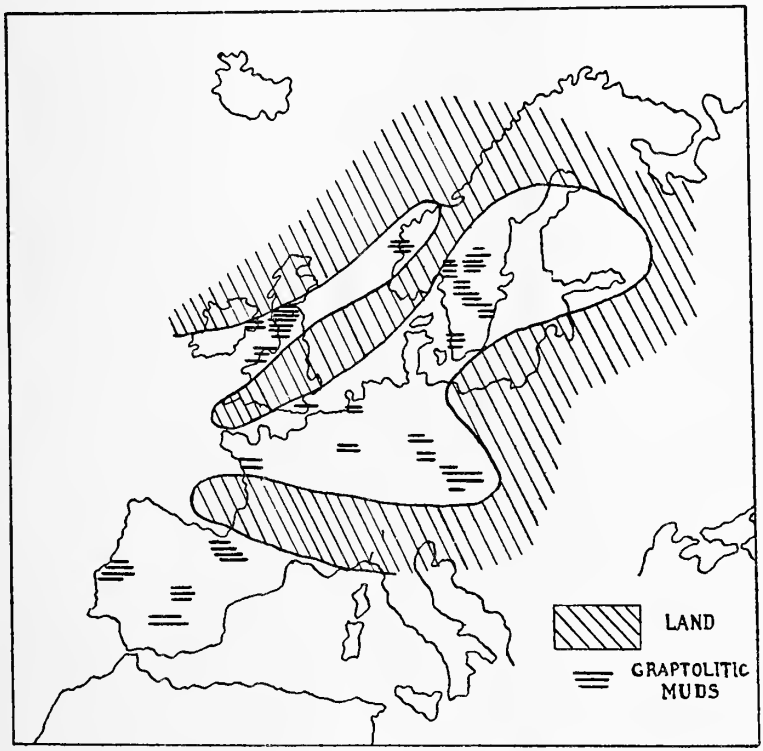


Figure 1 Sketch map showing localities in Europe and the British Isles where the Stockdale shales or their equivalents were deposited. (After J. E. Marr)

"In the quiet waters of such gulfs the fine sediments of the Stockdale shales and their equivalents might well be formed and the floating vegetation collected." The frequent and sudden appearance and disappearance of this algae material, regarded as the coloring matter of the black graptolite shales, is considered a matter of great importance. It is to some extent rhythmical and the most reasonable explanation, in Doctor Marr's view, is that it was due to change in direction of the sea currents which at times carried the weeds into the embayments, and at other times failed to do so.

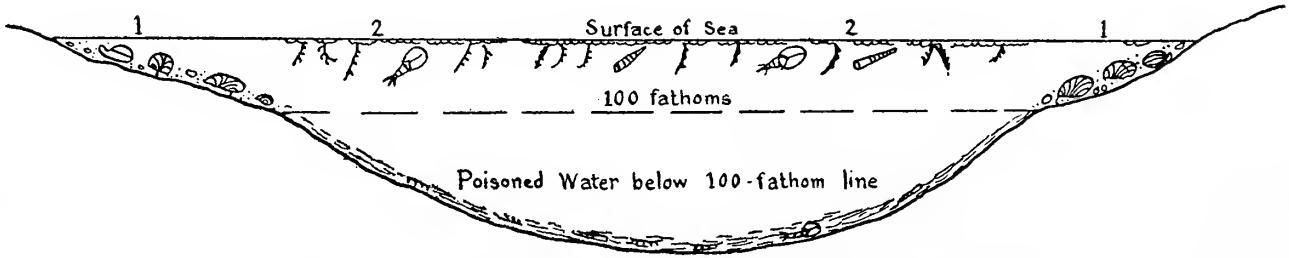


Figure 2 Diagram representing the conditions which prevailed during the deposition of dark graptolitic muds. (After J. E. Marr)

1 equals littoral deposits containing large and abundant benthonic forms. 2 equals algae, with pseudo-planktonic graptolites, also planktonic Cephalopods and Phyllocarida. Below lifeless sea bottom with black muds, wherein dead planktonic and pseudo-planktonic organisms, which have sunk from the surface waters, are entombed.

"The dwarf benthonic fauna is most important in the blue beds and parts of the red beds, very sparse in the green beds, and practically absent from the dark graptolitic beds. The general paucity of the benthonic fauna and the dwarf nature of the animals is not due to the muddy habitat, for there are similar muddy sediments in deposits of many ages containing abundance of benthonic life. The explanation is found in the view that conditions of stagnation arose in the deeper and quieter parts of the embayments causing the lower waters to be charged with deleterious substances" which for convenience are spoken of as poison. During the accumulation of the dark graptolitic muds this was fatal to benthonic life, it was only moderately harmful when the blue muds were laid down. The bottom conditions of the Black sea, already frequently referred to in connection with the black shales, are cited and the fact is emphasized that bacteria flourishing on the decomposing organic matter that is dropping into the depths from the plankton of the surface waters produce sulphuretted hydrogen which poisons the lower waters. The analogy, however, is not pushed to such an extent that landlocked water straits are inferred for the deposition of the Stockdale shales, but it is rather suspected that in that "age of algae" these plants played a more important part in geologic operations than at the present day.

An excellent diagram, here copied in text figure 2, illustrates the conditions as seen by Marr. It shows the coastal belt with its abundant benthonic fauna, the plankton and nekton of the surface waters (consisting of graptolites, phyllocarids and cephalopods), and the dead grounds below the 100 fathoms line (simply taken over by comparison with the conditions prevalent in the Black sea) where the black graptolite muds form.

It is finally shown that "the graptolitic muds are more fully developed in the more open tracts of the middle and southern gulf than in the narrower northern one. In Bohemia and other places of the middle gulf, the dark graptolitic muds were deposited in a succession almost unbroken (being interrupted only by the formation of thin green streaks) from the beginning of Valentian to the end of Wenlock times, and in a modified degree during Lower Ludlow times also. In other words, the narrow gulf of the north seems to have been to some extent inimical to the formation of the dark graptolitic muds, which are there largely replaced by the blue, green and red muds. To these latter alone, the narrow gulflike conditions appear to have been important."

We find the conditions so well described by Marr completely

duplicated in the graptolitic shales of New York. The narrow "Levis trough" in which the Schaghticoke shale, Deep Kill shale of early Ordovician or Canadian and the Normanskill shale of middle Ordovician age were deposited, contains, like the northern gulf of Great Britain, a great mass of green, bluish gray and red shales and of grits with rather sparsely interbedded black graptolite shales.

Figure 3 Lower Canadian (Bretonian) epicontinental seas. (After Ulrich)

The most recent paleogeographic chart of Canadian time in North America, here copied from Ulrich (Cambrian and Silurian, Geol. Survey of Maryland, 1919), brings out distinctly this narrow channel of the northeastern portion of the continent, which later in Normanskill time extended much farther south.

On the other hand, the Canajoharie and Utica graptolite shales of Trenton and post-Trenton time extended far to the north and south in the case of the Canajoharie shales and far to the west and northwest in the case of the Utica shale. The chart of the Utica sea, here copied from Ulrich (which included also the northern Colling-

Figure 4 Early Cincinnatian (Utica) epicontinental seas. (After Ulrich)

wood invasion), gives the conception of that sea attained by recent work. The paleogeography of the Utica sea in New York with its shore line in the east and deposition of limestone in the northwest, is copied here from Bulletin 258 of the State Museum.

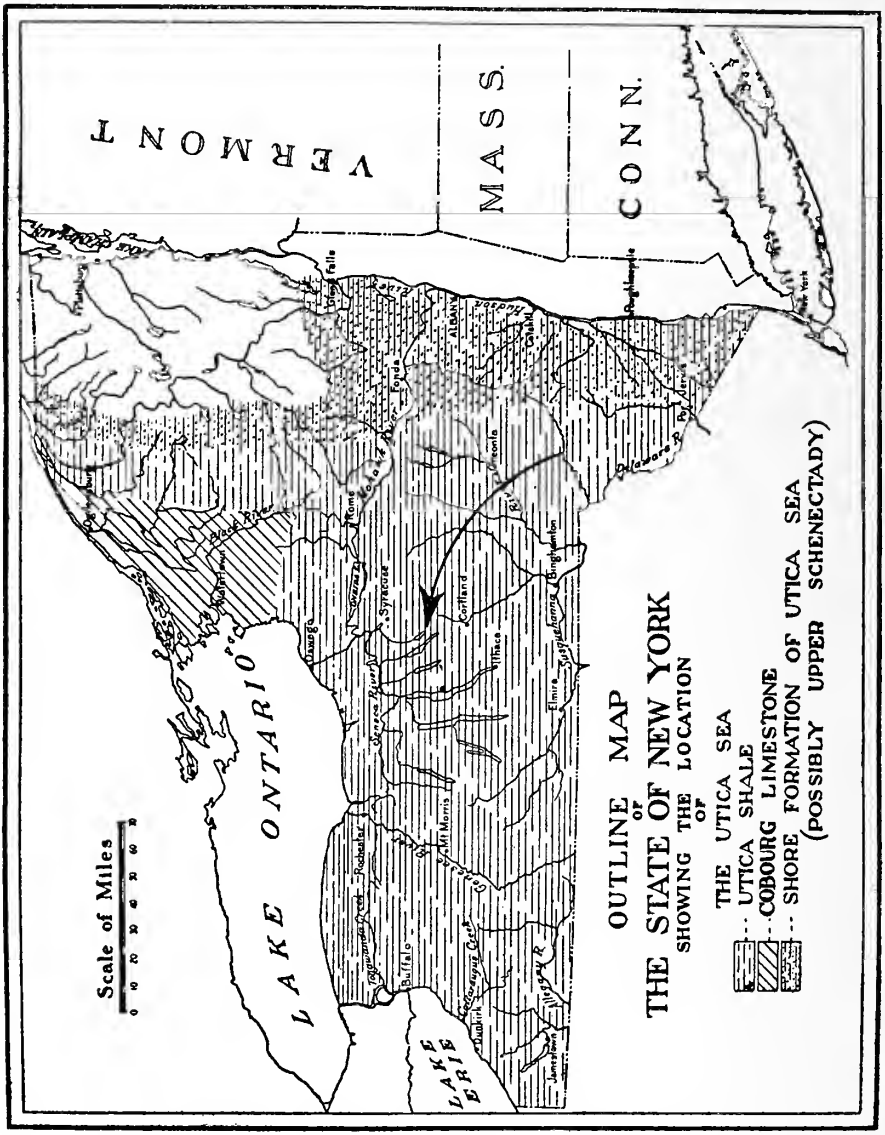
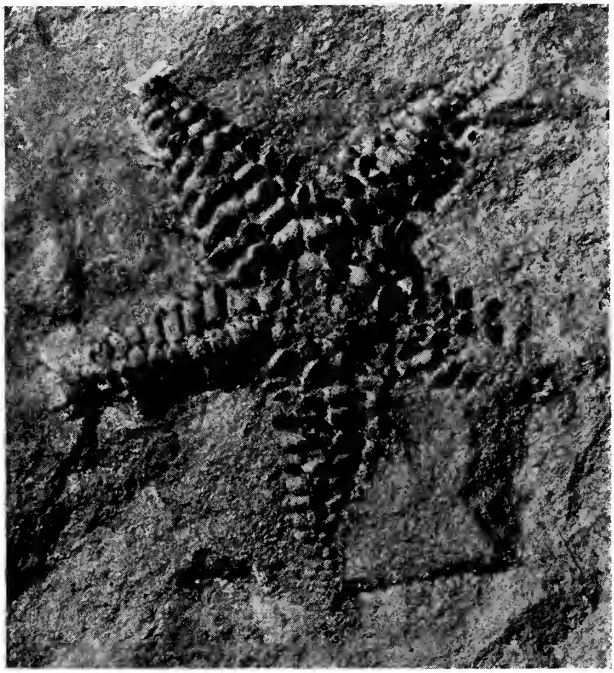


Figure 5

The Canajoharie and Utica shales by their composition of uninterrupted black graptolite shales in successive zones and with their great thickness duplicate the conditions of the graptolite shales in the middle and southern gulfs of Europe, such as are typically shown in the Silurian shales of Bohemia.

We are greatly pleased to find that Professor Marr's final conclusions, reached after a lifelong study of the graptolite shales of Great Britain and of Europe in general, fully agree with ours elaborated in a series of papers in regard to the Canajoharie shale (N. Y. State Mus. Bul. 162) the Schaghticoke, Deep Kill and Normanskill shales (N. Y. State Mus. Bul. 169 and 227–28) and the Utica shale (N. Y. State Mus. Bul. 258). We also hope that this incontrovertible evidence from two continents will conclusively answer the claims of our friend, Professor A. W. Grabau, and his pupil that the graptolite beds are delta deposits and resting on the top of anticlines as in the diagram lately reproduced in the Stratigraphy of China (1923–24, p. 60). On the contrary, we feel, on seeing the graptolite shales of Europe represented as deposited in the deeper reaches of long persisting embayments extending northeast in the direction of the later Caledonian folding (especially so in the case of the northern embayment), that the assertion made in the monograph of the graptolites of New York (N. Y. State Mus. Mem. 11, p. 65) that the graptolite shales were largely deposited in geosynclines, may after all not have been so wrong as letters from some of our correspondents and certain notes in the literature would have it.



Devonaster eucharis (Hall) var. goldringae nov. Holotype x2. Photograph of mold reversed.

A DEVONIAN STARFISH FROM GASPÉ

By Rudolf Ruedemann

The late Dr John M. Clarke had in the splendid fauna which he secured in the Gaspé region of Quebec, Canada, and described so well in the Early Devonic of New York and Eastern North America (N. Y. State Mus. Mem. 9, 1908), only a single echinoderm, a poorly preserved specimen described as Melocrinus micmac. It aroused therefore his greatest interest when Winifred Goldring in 1922 brought a well-preserved specimen of a starfish from the Middle Devonian (*fide* Clarke) sandstone of the neighborhood of the Fourth Lake brook section near Fourth Lake, Gaspé county. He turned the specimen over to me for study and intended to publish a note regarding it.

Unfortunately only the abactinal (dorsal) side is preserved in the specimen. It would therefore be unwarranted to describe this form as a new species, if it were such, but a comparison with Devonaster eucharis (Hall) of our Hamilton shale which was suggested at first sight, brings out the fact that it quite probably would not prove to be a new species, even if the actinal side were preserved, but appears as only a variety of Devonaster eucharis as indicated by the abactinal side.

The specimen is not more than half the size of mature individuals of the New York form (measuring 12 mm. from the apex to the tip of an arm), but compared with individuals of its own size the radials are found to be relatively larger, especially broader (rectangular instead of squarish in top view as in D. eucharis), numbering about 14 in the middle column, while the typical D. eucharis of the same size has about 18. There are no accessory plates seen on the arms and the surface of the radials and supramarginals is smooth or nearly so instead of being pustulose as in typical D. eucharis. We propose to distinguish this well-marked geographical variety as Devonaster eucharis var. goldringae.

Restoration of the Fossil Forests of Gilboa

NEW MUSEUM EXHIBITS

By Winifred Goldring

The Fossil Forests of Gilboa

The restoration group, shown in the accompanying plate, was formally opened to the public on February 11, 1925. This piece of work was executed by the artist and sculptor, Henri Marchand, and his two sons, Georges and Paul, under the supervision of the writer.

The restoration of the Gilboa tree and a full description of the material collected may be found in a paper by the writer, The Upper Devonian Forest of Seed Ferns in Eastern New York, published in New York State Museum Bulletin 251 (18th Report of the Director of the State Museum). The first material was found at Gilboa in 1869 when a freshet in the valley of the Schoharie creek exposed in the bedrock standing stumps of fossil trees. These fossil trees were described by Sir William Dawson of Montreal, but there was not enough material found at the time to enable him to place the trees accurately. Loose stumps from a higher horizon were reported in 1897 when Professor Charles S. Prosser, then connected with the New York State Survey, was working in the Gilboa area. All further efforts to relocate the Schoharie forest or to find some additional evidence of its extent were fruitless until the summer of 1920. Since 1920 the city of New York has been doing construction work on a dam at Gilboa; and through the courtesy of the Board of Water Supply and the various engineers connected with the work, together with zealous collecting by members of the Museum staff and others, much new material has been obtained, including seeds, foliage, roots etc.

It was not, however, until June 1922 that the writer had at hand material enough to enable her to identify these trees correctly and to attempt a restoration. The trees were found to belong to the Pteridosperms, or seed-bearing ferns, and are the earliest geological record (Upper Devonian or late Middle Devonian) of the seed-bearing habit. To these trees was given the name Eospermatopteris, from the Greek, meaning dawn of the seed fern (*eos*-dawn; *sperma*-seed; *pteris*-fern). Fossil tree stumps were found at three different horizons, the second 60 feet above the first, the third 100 feet above this. There were then three successive forests of trees which were ultimately destroyed by the sea and buried. The Gilboa forests grew along the low shores of the western Catskill mountain region,

facing the interior sea which at that period covered all of central and western New York. They grew in marshes which were easily covered by the rise of the tides and their bulbous bases with the long straplike roots anchored them in the soft black muds.

The restoration shows in the foreground an idealized reproduction of the rock section at Gilboa. The three fossil tree horizons are shown, and here the actual fossil stumps are used. In the middle foreground is a representation of the Schoharie creek with a side stream joining it at the left in a series of falls, as is seen in reality in one of its tributaries, the Manorkill. The background is a visualization of the forest as it might have appeared growing along a swampy shoreline in Devonian times. In front of the painting, at either side, are actual life-sized restorations of these seed ferns. Among the fern trees are occasional Protolepidodendrons, (lycopod types) similar to the "Naples tree," a restoration of which has stood for many years in the Museum.

"What is a Fossil?"

It has been the policy of the State Museum to make its exhibits intelligible and interesting to the general public, and this has been especially a problem in the Hall of Invertebrate Paleontology. With this in mind, restoration groups and explanatory cases are being introduced among the fossil exhibits. Of this latter kind are the two cases explaining "What is a fossil?", planned to give the unscientific visitor a background which will allow him to study the fossil exhibits with more understanding.

A label with a full, but simplified, definition of a fossil is placed at the top of one case. This case shows examples of all the different ways in which a fossil may be preserved. Likewise in this case is a series of specimens showing various stages in fossilization from loose shells on a sea beach or river bank through loosely consolidated to completely cemented fossil-bearing rocks. Examples of the effect of partial and complete weathering on fossil-bearing rocks are also shown. Clay concretions, often mistaken for fossils because of their odd shapes, likewise have their place here, as well as pseudofossils which are of inorganic nature—either stains from decaying vegetable matter or branching mineral incrustations often mistaken by the uninitiated for fossil mosses or ferns.

The second case has various illustrations of the preservation of organisms according to their original composition. Here are shown the effect of conditions of preservation upon the original form, also

fragmentary preservation and the distortion of fossils by movements of the rock beds in which they are preserved. In this case belongs also the explanation of types, models, restorations, "squeezes" of various kinds, thin sections, natural and polished sections which are so often seen in fossil exhibit cases and not always comprehended.

Very full explanatory labels accompany all the examples; but for those who wish to spend less time there are subheadings with the specimens which with the full title label permit them to gain something from these cases with a quick survey.

The results obtained from these two cases have been very gratifying. They have attracted wide attention not only from the general public but also from scientific visitors.

"What is a Geological Formation?"

This exhibit was planned as a companion to the "What is a Fossil?" exhibit and serves a similar purpose. It has been placed near the entrance to the Hall of Invertebrate Paleontology at the beginning of the series of synoptic cases, and has already attracted considerable attention.

The case was designed to give a better understanding of the meaning of a geologic formation. On top of the case is a title label giving a comprehensive and understandable definition of a geological formation, and in the case is a large, very full explanatory label. Six geologic maps of the State are shown. One map gives the surface distribution of the rocks of all the different ages. Each of the other five maps shows one of the important divisions: the present outcrop of the rocks of that age; the former extent of the rocks, which erosion has decreased; and the extension of these rocks southward under the younger beds. Five cross sections made through different parts of the State show the under surface conditions: the relations of the beds of the different ages, their general slope and thickness. A geologic column is used to show in more detail the succession from the oldest to the youngest beds in the eastern and western areas.

A plate of drawings of a few characteristic fossils has been made for each age. The visitor is referred to the synoptic cases where are displayed the actual fossil specimens of these and other species, and also outcrop maps of the various formations and maps showing the configuration of North America at each stage.

Colored photographs of typical exposures of the rocks of the different formations add to the attractiveness and instructive value of this case. These photographs are colored in oil so that there is no danger of fading. The museum draughtsman, E. J. Stein, has made a specialty of this oil coloring, and it will be possible for any museum to obtain photographs if desired.

Eospermatopteris. Underside of base showing radiating strap-like roots. Slab 5 feet, 7 inches

NEW UPPER DEVONIAN PLANT MATERIAL

By Winifred Goldring

Eospermatopteris (seed fern) Material

Base with roots. After the earlier notices with regard to Eospermatopteris, the Upper Devonian seed fern, were published, some doubt was expressed as to the trees having grown in the place where they were found (Gilboa, Schoharie county), because stump after stump was taken from the quarry with no roots attached, although slabs of rock were found with detached roots, nor was it quite understood how the roots were attached. In the spring of 1923, while collecting at Gilboa, the writer by the merest chance came upon a large slab near the top of one of the dumps showing the underside of a tree base with long, radiating, straplike roots attached along the margin. The specimen was obtained under difficulties and set up in concrete to form a Museum exhibit, through the kindness of Henri Marchand who was then working on the Gilboa restoration group. The slab, as exhibited, measures 5 feet, 7 inches by 6 feet, 4 inches. The base of the stump is about 14 inches in diameter, and the radiating roots, from one-half inch or less to about an inch in width, extend without termination as far as the rock is preserved. From a study of this and other specimens it appears that the roots were undivided. Much larger specimens were found in the quarry, after this specimen was obtained, with roots at least 9 feet long, but it was impracticable to get them out. The specimen shown is in sandstone, but other specimens were found on the dumps sometime later showing the impression of the root base in the shale bed beneath the sandstone, often with the radiating roots well shown. The shale bed which nowhere is of great thickness, as pointed out in the fuller paper on these trees (N. Y. State Mus. Bul. 251), represents the muds in which the trees grew.

A photograph of the slab showing the tree base with its roots, as it is now exhibited in the Museum, is shown on the accompanying plate.

Petiolar scars. Hitherto specimens of stumps and trunks found at Gilboa have lacked the bark or, where the outer surface was shown, it was on the lower parts of stumps where no markings were distinguishable. This past summer three specimens were brought in by a local collector, R. Veenfliet jr, of Schoharie, N. Y., showing large, rounded scars, spirally arranged on a bit of the outer surface of a trunk, or scattered. With these scars in two

specimens is shown a portion of outer cortex with anastomosing, strengthening strands of schlerenchyma, as in the outer cortex of Eospermatopteris. After much study and comparison with other forms the conclusion has been reached that these spirally arranged markings are the scars marking the place of attachment of petioles of the large fronds of the tree fern, Eospermatopteris. The scars probably came from a young tree or from the upper portion of a larger trunk, for it is doubtful that the scars would be so distinct on the lower part of the older trunks, and they would, without question, have been more stretched apart as the result of elongation and increase in girth.

The two accompanying photographic plates show well the character and arrangement of the scars. One photograph shows also a piece of a Protolepidodendron branch. The occurrence of this species has already been recorded. It has been found sparsely in the beds containing the tree fern material and, while it has not yet been worked out, appears to be a different species than P. primaevum (Rogers) — our well-known "Naples tree."

Lepidophyte Material

Rootlike organ. This specimen, figured in the accompanying photographic plate, was found loose along the edge of one of the big dumps at Gilboa and is the only specimen of the kind that has so far been obtained. It has every appearance of being part of a rootlike organ of a lepidophyte (lycopod-like plant). The root systems of plants of the Lepidodendron, Bothrodendron and Sigillaria groups were alike in that there was no tap root but the trunk passed down into regularly forked and spreading arms or rootlike organs (Stigmariae), bearing spirally disposed, long and slender rootlets. We have already recorded the occurrence of Protolepidodendron remains in the Upper Devonian beds at Gilboa and very recent collecting has brought to light a new species of apparent Sigillarian nature. This rootlike organ probably belongs to one or the other of these two lepidophytes.

Sigillaria (?) gilboensis sp. nov. This new species was added to our collection in the late fall of 1925 through the courtesy of Luther Dennis, superintendent with the Hugh Nawn Contracting Company. Only four specimens have been found, so far as is known, and three of these are in the possession of the State Museum. The best preserved specimen is shown in the accompanying photographic plate; the other two specimens are too poor for photographing and

Eospermatopteris. Specimen showing petiolar scars. Natural size.

Eospermatopteris. Specimen showing petiolar scars and some cortical tissue. About two-thirds natural size.

Lepidophyte. Root-like organ or stigmaria, probably of Protolepidodendron or Sigillaria. Natural size.

Sigillaria (?) gilboensis sp. nov. Portion of trunk with long grasslike leaves. About one-fourth natural size.

of little value for study. In the type specimen the trunk is 3 inches in diameter and a little more than 2 feet is preserved. The leaves are long and grasslike; they may reach a width of one quarter of an inch, but most of them measure less than this. None of the leaves has been found preserved to the full length, but specimens without terminations have been found 8, 9 and 11 inches long. In one of the other specimens the trunk likewise has a diameter of 3 inches; the diameter of the third trunk is between 4 and 5 inches.

As a general rule, leaves of lepidophytes were persistent for a comparatively short time on trunks, but they were more persistent in Sigillaria than in Lepidodendron, comparatively thick branches being found with attached leaves in the case of the former. It is possible that our specimen is a large branch rather than a trunk. It is also very likely that the leaves in this older form were persistent on the trunk for a longer time than in later species, just as in our "Naples tree," Protolepidodendron primaevum (Rogers), of the Upper Devonian the leaves were found to be persistent well down on the trunk. We have in this Gilboa form a new species which has been referred with a query to the genus Sigillaria until more material is available for study. It is possible that a new genus may have to be created for this form.

NEW SPECIES OF HAMILTON CRINOIDS

By Winifred Goldring

This crinoid material is part of that collected by G. Arthur Cooper in the Colgate University quarry in working out a problem for his master's thesis. The beds from which these specimens were collected are of Hamilton age, considered Ludlowville by Mr Cooper.

At first glance, without knowing the beds from which the specimens came, one might believe that one was dealing with an Ithaca-Chemung fauna, especially as regards the inadunate forms. It is quite evident that the Ithaca-Chemung type of crinoid fauna had already crept into these Hamilton beds. Two new species are represented. One has been found occurring in fair abundance, and to this the name Charientocrinus (?) cooperi has been given in honor of the collector; the other has been called Poteriocrinus (?) colgatensis. Of the two other species collected, one is a young specimen and has been identified with Gennaeocrinus carinatus Wood; the other is referred to Botryocrinus nycteus (Hall).

I am indebted to Mr Cooper for the opportunity of studying this material and for permission to retain the types and duplicate material for the State Museum.

Charientocrinus (?) **cooperi** sp. nov.

Plate 1, figures 1–3; text figure 1

This species belongs in the characteristic family Glossocrinidae with species of the genera Glossocrinus, Liparocrinus, Catactocrinus and Charientocrinus. C. cooperi bears a strong resemblance in general to the genotype, Catactocrinus leptodactylus Goldring; but the latter has arms that do not bifurcate, a different arrangement of the pinnules and the stem is not so cirriferous, especially in the proximal portion. The strongest affinities, so far as the present material shows, is with Charientocrinus ithacensis Goldring. The anal area in no specimen is well shown. For the time being the species is referred with a query to the genus Charientocrinus.

The dorsal cup in a typical specimen is about 3 mm high, with small, low infrabasals. The cup is ornamented with conspicuous folds or ridges. The posterior side is shown in one specimen, but not very clearly. The structure of the cup in this area is apparently that of Poteriocrinus, Decadocrinus etc., as is seen in all the genera referred to the family Glossocrinidae, and this species likewise has

the type of anal tube (Figure 1B) characteristic of the genera of this family. The latter is long and slender, in no place preserved for its full length. In one of the smaller specimens, the anal tube has a width of 2.6 mm in the proximal portion; only 16 mm of the tube is preserved and it tapers very little. The specimen from which the measurement of the dorsal cup was taken shows parts of the anal tube, which measures 2.8 mm in width more than half way from the proximal end, and even extends a little beyond the tips of the arms. The tube is shown in several specimens to be composed of rows of narrow plates, but only two specimens give any indication of the median, dorsal, armlike series of plates so characteristic of the genus.

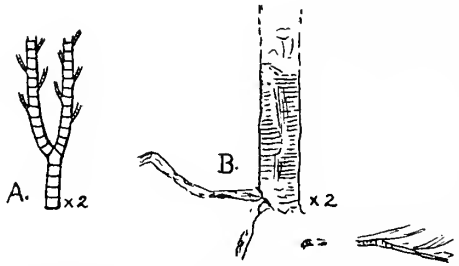


Figure 1 Charientocrinus (?) cooperi sp. nov. A. Proximal portion of an arm showing the arrangement of the pinnules, x2; B. Proximal portion of anal tube, x2.

There are five primibrachs, the fifth axillary, giving rise to two arms to the ray, ten to the crown. The arms are very long (over 51 mm) and slender, compared with the height of the dorsal cup, and bear very long, slender pinnules. The pinnules are borne alternately on each side on every second brachial, thus giving a space of four brachials between the pinnules on each side (figure 1A). The brachials are quadrangular and short, eight occurring in a space of 4.3 mm in the proximal portion.

The column is slender, pentagonal, not preserved for any great length, but bearing on the nodals, so far as preserved, very long slender cirri. The column is composed of alternating thin and thick columnals; the cirri-bearing columnals, the nodals, are close together.

This species differs from C. ithacensis in the fewer primibrachs, the arms not branching above the primibrachs, the more conspicuous folds on the plates of the dorsal cup and in the more cirriferous column.

Horizon and locality. Hamilton beds, Campus quarry, Colgate University, Hamilton, N. Y.

Poteriocrinus (?) colgatensis sp nov.

Plate 2, figures 1–6

This is a very characteristic species, but as the arm characters are missing it is referred with a query to the genus Poteriocrinus. It is so characteristic, however, that there could be no difficulty in identifying it. It is a large species with a heavy, pentagonal, cirriferous stem. The length of the crown is not known, but one specimen measures 65 mm from the base of the calyx to the distal portion of the anal tube, which is not fully preserved.

There are five large infrabasals measuring 2.7 mm in height. The total height of the cup is 9.8 mm. The cup must have been as broad or broader than high, but no measurements can be taken because of the flattened condition of the specimens. The plates of the anal area have the same arrangement as in the Poteriocrinus group. The radianal and anal x are both comparatively large, and so are the first tube plates. The anal tube is long and broad and composed of numerous rows of narrow plates. In one specimen it is preserved for a length of some 55 mm. The anal tube is at least 12 mm broad in its distal portion and 13.5 mm broad a short distance above the calyx.

The arms are not preserved more than one or two brachials above the primaxil in any specimen. There are four primibrachs, the fourth axillary. The first primibrach is much larger than the others; the proximal face measures 5.3 mm and occupies practically the entire upper face of the radial; the distal face measures 2.8 mm. It has a height of 3 mm. The primaxil has a height of 3 mm; the other primibrachs are about 2 mm high and 2.3 mm wide. The brachials following the primaxil are shorter and not so wide.

The calyx plates are ornamented with radiating ridges and depressions at the corners of the plates. There is a spine 2.8 mm long on each primaxil and several about 3 mm long on the distal part of the anal tube.

The column is heavy and pentagonal, composed of nodes and internodes and bearing at the nodes two or three comparatively long, heavy cirri. The cirriferous nodes are quite close together, and the cirri are borne close to the calyx.

Horizon and locality. Hamilton beds, Campus quarry, Colgate University, Hamilton, N. Y.

EXPLANATION OF PLATES

Plate 1

Charientocrinus (?) cooperi sp. nov.

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Figure 1 Specimen showing well the character of arms and column.

Figure 2 Counterpart of the same. The calyx is more distinct here.

Figure 3 Plasticene squeeze of specimen shown in figure 2.

Plate 2

Poteriocrinus (?) colgatensis sp. nov.

Page 91.

Figure 1 Cast of part of a crown. The spines of the anal tube and primaxil are well shown; also the character of the column.

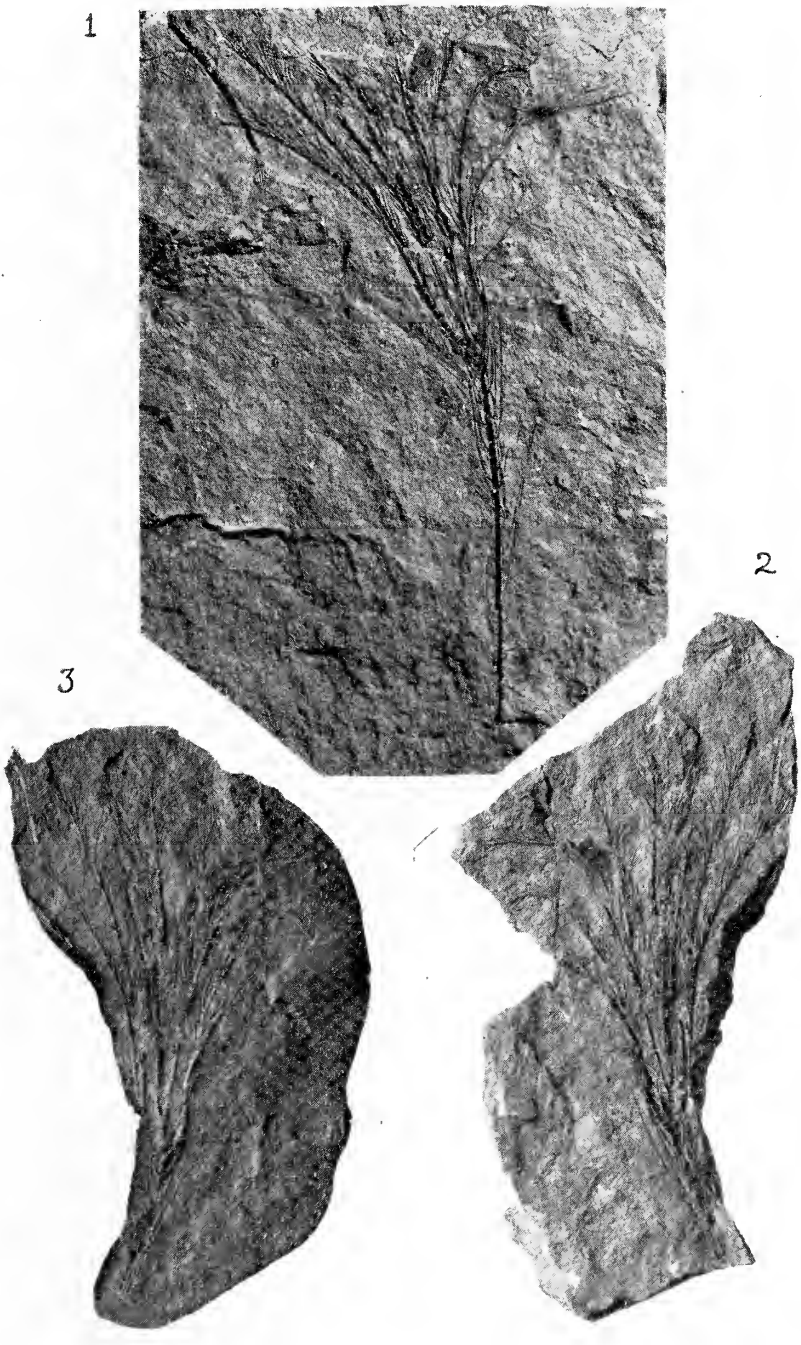
Figure 2 Plasticene squeeze of the dorsal cup and primibrachs of the same specimen. The ridges on the plates of the dorsal cup are quite distinct.

Figure 3 Cast of portion of dorsal cup of another specimen. Note the length of the spine on the primaxil.

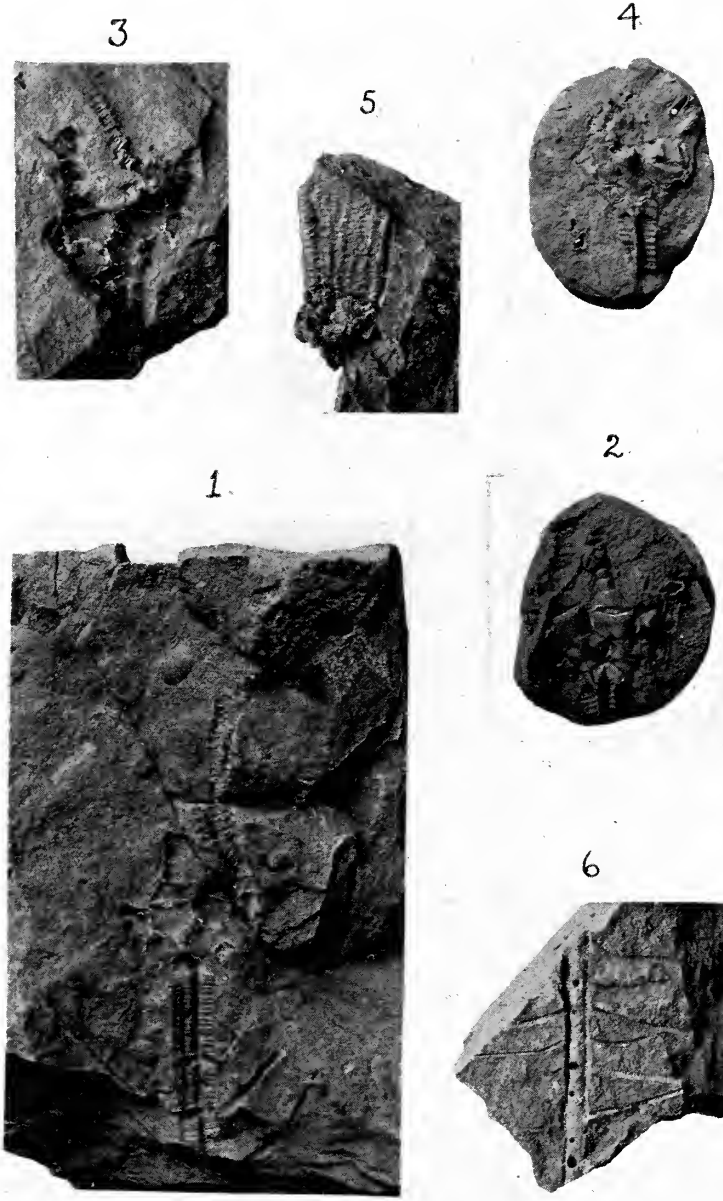
Figure 4 Plasticene squeeze of another specimen showing the anal area (at left).

Figure 5 Internal cast of calyx and proximal portion of anal tube.

Figure 6 Portion of a column with cirri.



J. A. Glenn & E. J. Stein photo.



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New York State Museum

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Museum annual reports 1847–1917. Of the report for 1918 only volumes 2 and 3 were published. *All in print to* 1894, 50c *a volume*, 75c *in cloth;* 1894–*date, sold in sets only;* 75c *each for octavo volumes; price of quarto volumes on application.*

These reports are made up of the reports of the Director, Geologist, Paleontologist, Botanist and Entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Director's annual reports 1904–date.

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1908. (Bul. 133) 234p. 39pl. map. 40c.
1909. (Bul. 140) 230p. 41pl. 2 maps, 4 charts. *Out of print*
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1916. (Bul. 196) 308p. il. 50pl. maps. 55c.
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1918. (Bul. 219, 220) 309p. il. 43pl. 75c.
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1920–21. (Bul. 239–240) 209p. il. maps. *Out of print.*
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1923. (Bul. 253) 136p. il. 7pl. 50c.
1924. (Bul. 260) 148 p. il. June 1925, 50c.

These reports cover the reports of the State Geologist and of the State Paleontologist, Bound also with the museum reports of which they form a part.

Geologist's annual reports 1881–date. Rep'ts 1, 3–13, 17–date, 8vo.; 2, 14–16, 4to.

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899–1903. The two departments were reunited in 1904, and are now reported in the Director's report.

The annual reports of the original Natural History Survey, 1837–41, are out of print.

Reports 1–4, 1881–84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	*Price*	*Report*	*Price*	*Report*	*Price*
12 (1892)	*Out of print*	17	$1.00	21	$.40
14	1.00	18	.75	22	.40
15, 2v.	2.50	19	[.50]	23	.45
16	1.50	20	.50	[*See* Director's annual reports]	

Paleontologist's annual reports 1899–date.

See first note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with the Director's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882–date.

Reports 3–20 bound also with museum reports 40–46, 48–58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4, 17 are out of print. Other reports with prices are:

Report	*Price*	*Report*	*Price*	*Report*	*Price*
1	*Out of print*	14 (Bul. 23)	$.20	26 (Bul. 147)	$.35
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6	.15	18 (" 64)	.20	29 (" 175)	.45
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8	.25	20 (" 97)	.40	31 (" 186)	.35
9	.25	21 (" 104)	.25	32 (" 198)	.40
10	.35	22 (" 110)	.25	33 (" 202)	.35
11	.25	23 (" 124)	.75	34 (" 231–232)	.20
12	.25	24 (" 134)	.35	35 (" 247–248)	.40
13	*Out of print*	25 (" 141)	.35		

Reports 2, 8–12 may also be obtained bound in cloth at 25c each in addition to the price given above.

Botanist's annual reports 1867–date.

Bound also with museum reports 21–71 of which they form a part; the first Botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports for 1871–74, 1876, 1888–99 are out of print. Report for 1900 may be had for 50c. Since 1901 these reports have been issued as bulletins.

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), in volume 4 of the 56th (1902), in volume 2 of the 57th (1903), in volume 4 of the 58th (1904), in volume 2 of the 59th (1905), in volume 1 of the 60th (1906), in volume 2 of the 61st (1907), 62d (1908), 63d (1909), 64th (1910), 65th (1911), v. 2 of the 66th (1912) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum Memoir 4.

Museum bulletins 1887–date. 8vo. (1) *geology, economic geology, paleontology, mineralogy;* (2) *general zoology, archeology, miscellaneous;* (3) *botany;* (4) *entomology.*

Bulletins are grouped in the list on the following pages according to divisions. The divisions to which bulletins belong are as follows:

1 Zoology
2 Botany
3 Economic Geology
4 Mineralogy
5 Entomology
6 "
7 Economic Geology
8 Botany
9 Zoology
10 Economic Geology
11 " "
12 " "
13 Entomology
14 Geology
15 Economic Geology
16 Archeology
17 Economic Geology
18 Archeology
19 Geology
20 Entomology
21 Geology
22 Archeology
23 Entomology
24 "
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66 Miscellaneous
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Geology and Paleontology. 14 Kemp, J. F. Geology of Moriah and Westport Townships, Essex Co., N. Y., with notes on the iron mines. 38p. il. 7pl. 2 maps. Sept. 1895. *Free.*

19 Merrill, F. J. H. Guide to the Study of the Geological Collections of the New York State Museum. 164p. 119pl. map. Nov. 1898. *Out of print.*

21 Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sept. 1898. *Out of print.*

34 Cumings, E. R. Lower Silurian System of Eastern Montgomery County; Prosser, C. S. Notes on the Stratigraphy of Mohawk Valley and Saratoga County, N. Y. 74p. 14pl. map. May 1900. 15c.

39 Clarke, J. M.; Simpson, G. B. & Loomis, F. B. Paleontologic Papers 1. 72p. il. 16pl. Oct. 1900. 15c.

Contents: Clarke, J. M. A Remarkable Occurrence of Orthoceras in the Oneonta Beds of the Chenango Valley, N. Y.

—— Paropsonema cryptophya; a Peculiar Echinoderm from the Intumescens-zone (Portage Beds) of Western New York.

—— Dictyonine Hexactinellid Sponges from the Upper Devonic of New York.
—— The Water Biscuit of Squaw Island, Canandaigua Lake, N. Y.
Simpson, G. B. Preliminary Descriptions of New Genera of Paleozoic Rugose Corals.
Loomis, F. B. Siluric Fungi from Western New York.

42 Ruedemann, Rudolf. Hudson River Beds near Albany and Their Taxonomic Equivalents. 116p. 2pl. map. Apr. 1901. 25c.

45 Grabau, A. W. Geology and Paleontology of Niagara Falls and Vicinity. 286p. il. 18pl. map. Apr. 1901. *Out of print.*

48 Woodworth, J. B. Pleistocene Geology of Nassau County and Borough of Queens. 58p. il. 8pl. map. Dec. 1901. *Out of print.*

49 Ruedemann, Rudolf; Clarke, J. M. & Wood, Elvira. Paleontologic Papers 2. 240p. 13pl. Dec. 1901. *Out of print.*

Contents: Ruedemann, Rudolf. Trenton Conglomerate of Rysedorph Hill.
Clarke, J. M. Limestones of Central and Western New York Interbedded with Bituminous Shales of the Marcellus Stage.
Wood, Elvira. Marcellus Limestones of Lancaster, Erie Co., N. Y.
Clarke, J. M. New Agelacrinites.
—— Value of Amnigenia as an Indicator of Fresh-water Deposits during the Devonic of New York, Ireland and the Rhineland

52 Clarke, J. M. Report of the State Paleontologist 1901. 280p. il. 10pl. map, 1 tab. July 1902. 40c.

56 Merrill, F. J. H. Description of the State Geologic Map of 1901. 42p. 2 maps, tab. Nov. 1902. *Out of print.*

63 Clarke, J. M. & Luther, D. D. Stratigraphy of Canandaigua and Naples Quadrangles. 78p. map. June 1904. 25c.

65 Clarke, J. M. Catalogue of Type Specimens of Paleozoic Fossils in the New York State Museum. 848p. May 1903. $1.20, *cloth.*

69 —— Report of the State Paleontologist 1902. 464p. 52pl. 7 maps. Nov. 1903. $1, *cloth.*

77 Cushing, H. P. Geology of the Vicinity of Little Falls, Herkimer Co. 98p. il. 15pl. 2 maps. Jan. 1905. 30c.

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107 Woodworth, J. B.; Hartnagel, C. A.; Whitlock, H. P.; Hudson, G. H.; Clarke, J. M.; White, David & Berkey, C. P. Geological Papers. 388p. 54pl. map. May 1907. 90c, *cloth.*

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Hudson, G. H. On Some Pelmatozoa from the Chazy Limestone of New York.
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