

State of Connecticut

THIRTEENTH BIENNIAL REPORT OF THE
COMMISSIONERS

of the

State Geological and Natural
History Survey

1927-1928

Bulletin No. 45



HARTFORD

Published by the State

1929

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State Geological and Natural
History Survey

W. E. BRITTON, PH. D., SUPERINTENDENT

Bulletin No. 45



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Printed for the State Geological and Natural History Survey

1929

State Geological and Natural History Survey

COMMISSIONERS

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JAMES ROWLAND ANGELL, President of Yale University
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SUPERINTENDENT

W. E. BRITTON, PH. D.
Agricultural Experiment Station, New Haven

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**THIRTEENTH BIENNIAL REPORT
OF THE COMMISSIONERS**

of the

State Geological and Natural History Survey

of

Connecticut

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LETTER OF TRANSMITTAL

New Haven, Conn., December 31, 1928.

HIS EXCELLENCY, JOHN H. TRUMBULL,
Governor of Connecticut,

Hartford, Connecticut.

Sir:

I have the honor to transmit to you herewith, in behalf of the Commissioners of the State Geological and Natural History Survey, the thirteenth biennial report of the Superintendent, covering the two years ending December 31, 1928. This report contains some additional matter in commemoration of the twenty-fifth anniversary of the establishment of the Survey.

Respectfully submitted,

W. E. BRITTON,
Superintendent.

**THIRTEENTH BIENNIAL REPORT OF THE
GEOLOGICAL AND NATURAL HISTORY
SURVEY OF CONNECTICUT**

W. E. BRITTON, PH. D., SUPERINTENDENT

WILLIAM NORTH RICE, PH. D., LL. D.

Professor William North Rice, Superintendent of this Survey from its establishment in 1903 until 1916, died in Delaware, Ohio, November 13, 1928, in his eighty-third year. Professor Rice was born in Marblehead, Mass., November 21, 1845, and entered Wesleyan University in 1861, graduating with the degree of A. B. He then attended the Sheffield Scientific School of Yale University where he received the degree of Ph. D. in 1867, being the first recipient of this degree in geology from Yale University. During a portion of the year 1867, he served as pastor of a church in Boston. He studied in Berlin during the year 1867-1868, and in the fall of 1868 returned to Wesleyan as professor of geology and natural history. In 1884 he was made professor of geology, continuing until his retirement in 1918 when he was made Professor Emeritus. The degree of Doctor of Laws was conferred upon him by Syracuse University in 1886, and by Wesleyan University in 1915. He served as Assistant Geologist for the United States Geological Survey in 1891-1892, and was a lecturer at Colgate College and Hamilton Theological Seminary in 1897-1900. At three different times he was appointed Acting President of Wesleyan University, first in 1907, in 1908-1909, and again in 1918.

When the Connecticut Geological and Natural History Survey was established by act of the General Assembly of 1903, the creative act provided for a Board of Commissioners composed of the presidents of the four colleges in the State: namely, Yale University, Wesleyan University, Trinity College, and the Connecticut Agricultural College. Professor Rice was selected by this board to be the first superintendent of the Survey. The appointment came as a surprise and he asked for time to consider the matter, but finally accepted and served until 1916 when he resigned. Thus from the beginning, the work of the Survey was pro-

jected, directed and developed by his experience, judgment and vision, and more than two-thirds of the bulletins already published were planned and arrangements made with their authors during his administration. As Superintendent, Professor Rice prepared the first six biennial reports of the Survey Commissioners, and he was joint author with Professor H. E. Gregory of Bulletin No. 6, "Manual of the Geology of Connecticut," 1906, and with Professor W. G. Foye of Bulletin No. 41, "Guide to the Geology of Middletown, Connecticut, and Vicinity," 1927.

Professor Rice was a thorough scholar and was well-trained in the classics. He was accurate and painstaking in his scientific work and publications, yet with all his great learning he was a paragon of modesty and self effacement. He also gave encouragement and help to others and all who knew him loved and respected him.

Besides his interest in geology, Professor Rice never lost faith or interest in the Church. He was a member of the New York East Conference of the Methodist Episcopal Church from 1869 until his death and was chairman of its board of examiners for thirty years. He was also a member of the council of the Connecticut Federation of Churches, an organization of which he has been honorary president since 1920. Professor Rice was a supporter of the theory of evolution and also of the Christian Church, at a time when the two were regarded as incompatible by many minds, and he wrote books and delivered lectures to show the faith that was in him. Some of these books are: "Christian Faith in an Age of Science," 1903, "The Return of Faith," 1916, "Through Darkness to Dawn," 1917, "Science and Religion," 1925.

Professor Rice was the author of "The Poet of Science and other Addresses," 1919; he edited the Wesleyan University Alumni Record, 1873, and "William Rice, A Memorial," 1898.

In addition to the writings already mentioned, Professor Rice published many papers in scientific and educational journals, and I am indebted to his son, Dr. Edward L. Rice, and to his friend, Dr. L. G. Westgate, both of Ohio Wesleyan University, Delaware, Ohio, for the following list of titles. This is believed to include all the papers in geology and zoölogy, but only the more important papers in the realm of education and the relations of science and religion, except those mentioned in the preceding pages.

- 1867—On the Darwinian theory of the origin of species (doctor's dissertation). New Englander.
- 1875—On the effects of certain poisons on mollusks. American Journal of Science, February.
- 1878—On the animal of *Millepora alaicornis*. American Journal of Science, December.
- 1883—Connecticut minerals. Science, June 29.
- 1884—The geology of Bermuda. United States National Museum, Bulletin 25, pp. 1-32.
- 1885—The geology of Middlesex county. History of Middlesex County, Connecticut. New York. Minerals from Middletown, Connecticut. American Journal of Science, March.
- 1886—The eccentricity theory of the glacial period. Science, August 27, October 15.
On the trap and sandstone in the gorge of the Farmington river at Tariffville, Connecticut. American Journal of Science, Vol. XXXII, pp. 430-6.
- 1888—Science Teaching in the schools. American Naturalist, September, October.
Stizostedion vitreum in the basin of the Connecticut. American Naturalist, October.
- 1889—Natural science in the schools. Methodist Review, July.
Science teaching in the schools. Boston, D. C. Heath & Company.
Report of committee of American society naturalists on science teaching in the schools. Records of American Society of Naturalists, December.
- 1890—Discovery of rutile in Guilford. The Observer, Portland, Connecticut, January.
The place of Natural Science in the educational course. Sixty-first Annual Meeting of the American Institute of Instruction, Proceedings, etc.
Evolution. Sanford's Concise Cyclopedia of Religious Knowledge, New York.
- 1891—The degree of probability of scientific beliefs. New Englander and Yale Review, January.
Report of committee on science teaching in the schools (last five pages).
Records of American Society of Naturalists, Vol. 1, Part 9. (Also reprinted in a separate edition).
- 1894—Geikie's "Fragments of earth lore." American Journal of Science, February.
Twenty-five years of scientific progress. 174 pages. Crowell, New York.
- 1896—Goode's "Principles of museum administration." Science, May 22.
Anticlinorium and synclinorium. American Journal of Science, August.
American association for the advancement of science. Section E, Geology and Geography. Science, n. s. vol. IV, pp. 382-388.

- 1897—Appreciations of the work of the Smithsonian Institution. *Geology and Mineralogy*, The Smithsonian Institution, 1846-1896, Washington.
Dana's text-book of geology, fifth edition. (Editor).
A suggestion in regard to the theory of volcanoes. *Proceedings of American Association for the Advancement of Science*. Also, *American Geology*, vol. XX, p. 198. *Science*, n. s. vol. VI, p. 690.
Remarks on the petrographic excursion. *Bulletin of Geological Society of America*, vol. VIII, pp. 3-5.
- 1899—Scientific thought in the nineteenth century. *Science*, December.
Scientific thought in the nineteenth century. Report of regents of Smithsonian Institution, 1899. *Transactions of Connecticut Academy of arts and sciences*, vol. XI, *Modern Eloquence*.
- 1903—The proper scope of geological teaching in the high school and academy. (Abstract) *Camp. Journal of Education*, July 23.
The proper scope of geological teaching in the high school and academy. *Proceedings of National Educational Association*.
- 1904—The physical geography and geology of Connecticut. Annual report Connecticut Board of Agriculture, vol. XXXVII, pp. 94-113.
- 1905—The classification of mountains. Eighth International Geological Congress, pp. 185-190.
- 1906—On the use of the words synclinorium and anticlinorium (abstract). *Science*, n. s., vol. XXIII, pp. 286-7. Also, *American Proceedings*, vol. LV, pp. 375-6.
- 1907—The contribution of America to geology. *Science*, n. s., vol. XXV, pp. 161-175. Also *American Association Proceedings*, vol. LVI-VII, pp. 461-84.
- 1910—James D. Dana, geologist, 1813-1895. *Leading American men of science*, pp. 233-268. New York.
- 1911—Contributions to the geology of New Hampshire, IV. *Geology of Tripyramid mountain*. (With L. V. Pirsson) *American Journal of Science* (4), vol. XXXI, pp. 269-291.
- 1913—Dana, the man. *Geological Society of America Bulletin*, vol. XXIV, pp. 56-60.
- 1914—Yakutat bay. *Wesleyan Literary Monthly*, February.
- 1915—The geology of James Dwight Dana. *Problems of American Geology*, pp. 1-42. New Haven.
- 1921—Peat in Connecticut. *The Guide to Nature*, September.
- 1924—"The New Geology"—*Methodist Review*, July, August.
- 1925—Evolution. *Outline of Christianity*, Vol. IV, Ch. 5, 6, 7.

TWENTY-FIVE YEARS OF THE CONNECTICUT
GEOLOGICAL AND NATURAL HISTORY SURVEY

This Survey was established by act of the General Assembly of 1903, and as its twenty-fifth anniversary has now been passed, it seems best to make this report an anniversary number. Plans to this effect were made some time ago and Professors Rice and Gregory, former Superintendents, were asked to write brief articles to be included giving their comments on the Survey. Professor Rice has passed on without putting his pen to paper but a very welcome letter received from Professor Gregory is included in this Report, which also contains the portrait of each of the former Superintendents, and a biographical sketch of Professor Rice.

The Survey had a modest beginning. From the first its work has been done quietly and without publicity, and has thus continued for a quarter of a century. Therefore, it seems an appropriate time to look backward over the field, to ascertain the distance traveled by the Survey, chart its course and record its achievements.

Professor William North Rice, of Wesleyan University, was the Superintendent for the first half of this quarter-century period, and arranged with the authors for the preparation of the manuscripts of about three-quarters of all the bulletins which have thus far been published. He resigned in 1916, and Professor H. E. Gregory of Yale University was appointed Superintendent. During the war it was necessary to suspend some of the Survey work, including publication of bulletins and no new projects were started. However, several projects were initiated under the Superintendency of Professor Gregory, who resigned in 1921 to become Director of the Bernice P. Bishop Museum of Honolulu. Dr. H. H. Robinson, succeeded Professor Gregory and served nearly until his death in 1925, when the present Superintendent was appointed. Dr. Robinson was ill for a portion of the time, and therefore was unable to take a very active part in the work of the Survey, yet several new projects were started during his Superintendency.

The three former Superintendents, Messrs. Rice, Gregory and Robinson were all geologists, and Dr. Robinson was also a Civil Engineer. The present Superintendent is an entomologist.

Apparently the Superintendent is the only person who has continued to receive a salary from the Survey since the beginning, but this has always been a part-time salary. For the past three years the Secretary to the Superintendent has received a small portion of her salary each month from the Survey appropriation.

The Survey has never been able to employ any full-time investigators. Such research service as it could employ has usually been for summer vacations, when College professors, instructors or graduate students, would spend a few weeks in the field, receiving modest remuneration, and a portion or the whole of their subsistence. A number of very creditable though not exhaustive studies have been carried out on this plan; but some of the most important papers published have been studies by specialists who have been paid modest honoraria on the submission of the completed manuscripts. From the financial standpoint, this has been perhaps a more satisfactory plan than the employment of investigators directly by the Survey. Several papers when published as bulletins have aided in establishing the scientific reputation of the Survey and have been obtained without cost to the Survey. One of the most conspicuous of these was A Catalogue of the Flowering Plants of Connecticut prepared by a committee of the Connecticut Botanical Society, and published as Bulletin No. 14. Also several theses prepared by graduate students and presented for the doctorate in Yale and other Universities have been published as Survey bulletins. Where the subject-matter deals with some phase of Connecticut geology or natural history, and the paper is meritorious, it is a very desirable and proper arrangement. It is also an advantage to the author, for a dissertation for the doctorate is usually too long to be acceptable in scientific journals.

A MESSAGE FROM PROFESSOR GREGORY

Honolulu, Hawaii,

Dec. 30, 1927.

Dear Dr. Britton:—

It is a pleasure to meet your request for comments on the Connecticut Geological and Natural History Survey for I am deeply interested in the Survey and feel that the time I have given to its organization, administration, and scientific studies has been well spent.

As compared with official scientific surveys of most states, the Connecticut Geological and Natural History Survey is distinctive in three respects: its purpose is educational rather than economic; its scope is exceptionally broad; the appropriations for its support are exceptionally small.

My reason for urging the establishment of the Survey was the belief that such an organization would fill a useful place in the educational system of the State. In the preliminary hearings before the legislative committees there was no attempt to show that a systematic search would reveal new mineral wealth, new agricultural resources, or new fisheries. For those directly concerned, the mines and quarries and forests, the water and the soil were well known and many scientific investigations had been conducted by Federal and State bureaus. But the investigations were patchy; some parts of the State had not been studied at all and much of the information was buried in technical reports or published in Transactions and Memoirs not readily accessible. There seemed to be need for a series of bulletins which would record and describe the rocks, the topography, the plants, and the insects of the State in such manner as to assist the scientific investigator and to aid the teacher and his pupils to get an intelligent picture of the interesting natural features of the State as a whole and of the part where they had their homes. It is gratifying to find that the Governors and the appropriation committees of successive legislatures have supported the Survey as an educational enterprise—making no demands that its work should add to the value of taxable property.

In scope, the Survey was planned broadly and without specific requirements as to kind and amount of investigations. As administered by successive superintendents, all topics of interest to people of the State and which required treatment by scientists have been considered within its field. As a result not one branch of natural sciences but all the major branches are represented by bulletins of solid worth; the geology, the botany, and the zoölogy of Connecticut have been described in a manner which has received commendation from professional and amateur students of those subjects.

The appropriations for the Survey have always been small, not because funds were unobtainable, but because it seemed unwise to build up a large research organization which might duplicate or overlap the work of existing educational institutions and of state commissions concerned with studies in sanitation, fisheries, and agriculture. Fur-

thermore, unless the appropriation was very large the Survey staff must necessarily consist of one or two experienced, high salaried men or a number of inexperienced low salaried men, neither of which arrangement would accomplish the purpose intended. With but one paid officer, and that officer on nominal salary, funds have been sufficient to provide for field work, pay clerical hire and incidental expenses and to offer moderate honoraria to men who are masters of their subjects. The Survey has afforded opportunity for publishing valuable scientific works which otherwise might never appear in print. Few, if any, state surveys list such a group of distinguished authors.

In my opinion the Survey can best serve the State by continuing to act as a clearing house for scientists concerned with Connecticut problems. Its educational purpose should not be changed, but when the list of comprehensive works dealing with the larger subdivisions of geology, zoölogy, and botany is complete, the initiation of specific researches based on Connecticut material might well be considered.

Very truly yours,

(Signed): HERBERT E. GREGORY.

REPORT ON WATER RESOURCES

The General Assembly of 1925, passed the following act:
Chapter 240, Special Acts of 1925.

An Act Concerning an Investigation and Report on the
Potable Water Resources of the State

Be it enacted by the Senate and House of Representatives in General Assembly convened:

The State Geological and Natural History Survey is directed to report to the next session of the general assembly on the water resources of the state. The geological and natural history survey is authorized to call upon other departments of the state for information in their possession in the preparation of such report. The expense of making such investigation and report, which shall not exceed the amount of the appropriation for said geological and natural history survey, shall be paid from such appropriation.

Approved June 15, 1925.

Evidently the intent of this act was to assemble all data now available in the files of the several commissions, and from other sources, and to publish the data in convenient form for reference as a report to the General Assembly at its next session in 1927. Neither time nor money was sufficient for any extensive new investigations of the subject. Fortu-

nately, much work has already been done on the ground waters of the State by the United States Geological Survey in coöperation with the State Geological and Natural History Survey. These papers have been published by the United States Geological Survey and are listed on page 14 of this report. Some measurements of run-off surface waters have been made by the Federal Survey by locating gauging stations in Connecticut rivers and streams. Presumably in the office files of the Public Utilities Commissioners, Health Commissioners, Commissioners on the Pollution of Streams (or Water Commissioners), State Park and Forest Commissioners, Fish and Game Commissioner, as well as those of private and municipal water and power companies, there are many records, however fragmentary, that would be of value in formulating such a report.

Professor Roscoe H. Suttie, Assistant Professor of Civil Engineering in Yale University, who formerly had been employed in this sort of work for the United States Geological Survey, was engaged to prepare this report. He therefore brought together all available records of precipitation, stream flow, data regarding municipal and private water companies, great storms, and made recommendations that some commission be given authority to allocate water resource areas to certain towns and cities needing larger water supplies in the future.

The report was submitted to the Governor's office on January 19, 1927, and acknowledged by the Executive Secretary. The House Journal mentions this report with four or five other reports as having been transmitted by the Governor on February 2, and states that each was referred to the appropriate committee. No committee was named and no further trace of the report could be found in the records of House or Senate, and the manuscript of the report could not be found. It had disappeared altogether. This report cost the Survey between eight and nine hundred dollars. Finally, it was learned that the report was referred to the Committee on Public Health and Safety and later handed to a member of the Committee on Judiciary. Apparently no records were made of this change of reference.

Professor Suttie had kept a duplicate of all pages which had been typed, but many printed tables had been used, and in order to duplicate the entire report it was necessary to purchase extra copies of the publications from which these tables were taken, and to redraw the charts and figures. On account of the time which had elapsed since the preparation of the report it was possible to include additional data. This report has now been published as Bulletin No. 44.

NEW TOPOGRAPHICAL SURVEY

A bill was introduced into the General Assembly of 1927, providing for a new topographical Survey of the State, to be made by the United States Geological Survey, and the usual proportion of the cost to be borne by the State. The State Geological and Natural History Survey was the agency named in the bill to represent the State of Connecticut in the matter. The bill asked for an appropriation of \$150,000 to be expended over a period of about five years to cover the cost of this work to the State.

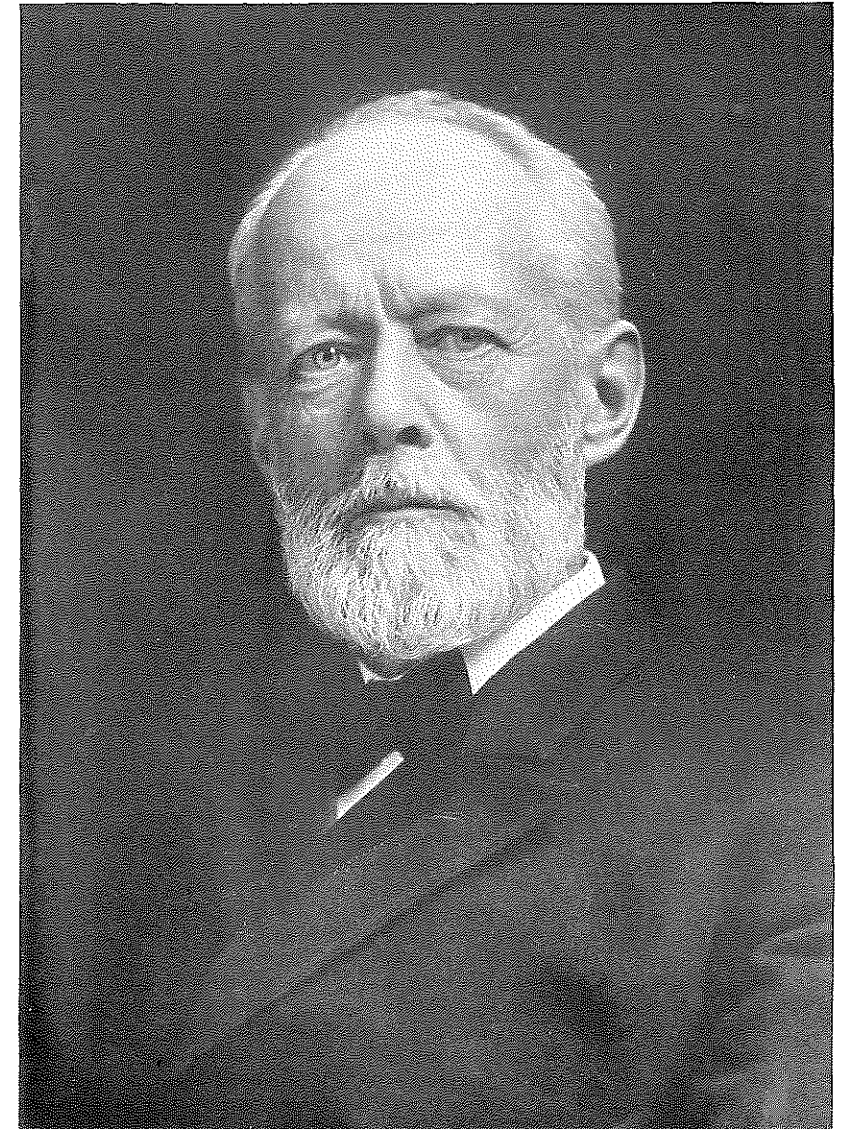
Practically all civil engineers and several State departments recognize the great need of a new survey and therefore presented abundant evidence in support of the bill at a hearing before the Judiciary Committee. On account of the appropriation, however, the bill was rejected. It is reasonably certain that a similar measure will come before the General Assembly of 1929, and likewise before each successive General Assembly until favorable action is obtained.

RECENT PUBLICATIONS

Since publishing Bulletin No. 38, the Twelfth Biennial Report of the Commissioners, six bulletins, (Nos. 39, 40, 41, 42, 43, and 44) have been printed. A brief description of each follows:

Bulletin No. 39. The Odonata or Dragonflies of Connecticut by Dr. Philip Garman, Assistant Entomologist, Connecticut Agricultural Experiment Station, 331 pages, 22 plates, 67 figures. This is a monograph of the dragonflies occurring in the Northeastern United States, and contains descriptions and illustrations of both the adult and immature stages, with keys to the families, genera and species. Records are given for each species which has been collected in Connecticut. The text figures show structural details upon which classification is chiefly based, and the plates show the general appearance of adults and some of the nymphs. This bulletin is Part V in the Guide to the Insects of Connecticut, planned many years ago, and is of interest to entomologists and collectors of insects, and to teachers of biology and nature study as well as to students of these subjects.

Bulletin No. 40. The Geology of the Shepaug Aqueduct Tunnel, Litchfield County, Connecticut, by Dr. William Macdonough Agar, with a chapter by Robert A. Cairns, 38



Wm. North Rice

WILLIAM NORTH RICE

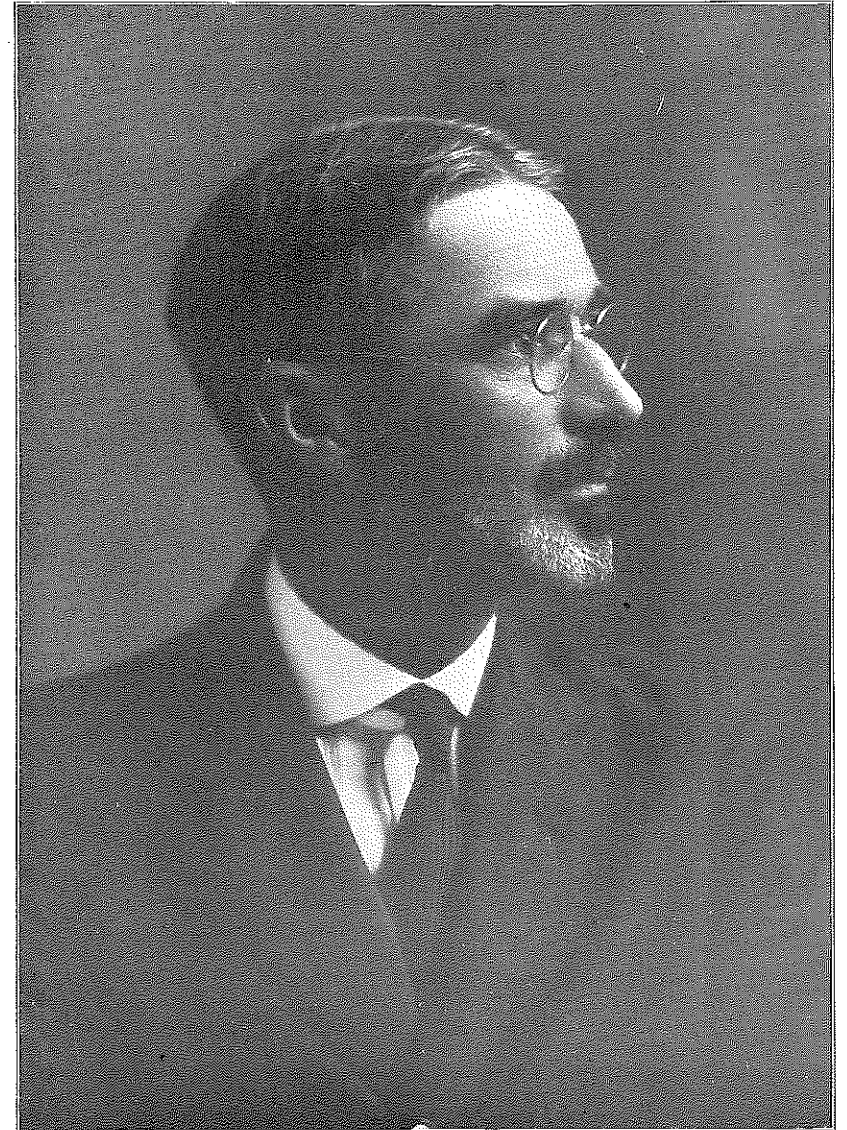
1845-1928

Superintendent 1903-1916



Herbert E. Gregory

HERBERT E. GREGORY
1869-
Superintendent 1916-1921



H. H. Robinson

H. H. ROBINSON
1873-1925
Superintendent 1921-1925

pages, 8 plates, 2 maps, 3 figures. At the time the studies were made, Dr. Agar was a faculty member of the department of geology in Yale University, but has since been called to Columbia University. Mr. Cairns is city engineer of Waterbury and planned this tunnel as a means of obtaining a more adequate water supply for the city. A large portion of this tunnel was blasted through the rock and by following its course the natural rock formation could be studied better than on the surface. The results of Dr. Agar's studies described in this bulletin change the geological map of the State, relating to Litchfield County, and are of interest to geologists, engineers, teachers and pupils.

Bulletin No. 41. Guide to the Geology of Middletown, Connecticut, and vicinity by Professors William North Rice and Wilbur Garland Foye of Wesleyan University, 137 pages, 3 plates, 33 figures. This bulletin described the chief geological features in and around Middletown where for many years Professor Rice conducted his students in the class of geology in Wesleyan University on field excursions. It contains fifteen chapters, each chapter describing the formations to be seen on a single field trip, and will be particularly useful to teachers and pupils and of interest to all who seek an interpretation of the rather striking land formations of the central portion of the State.

Bulletin No. 42. The Algae of Connecticut, by Dr. Clarence John Hylander, now of the Roger Ascham School of White Plains, N. Y., 245 pages, 28 plates. This paper was Dr. Hylander's thesis presented for the degree of doctor of philosophy at Yale University, and gives keys for separating the families, genera and species, and records the distribution and habitat of each species within the State. Both marine and fresh water algae are treated in this bulletin which is well illustrated by 28 plates, drawn by the author. It is of scientific and educational interest to botanists, teachers and students of nature, but it is also of economic interest because the algae are of economic importance. Of the marine algae "Irish moss" is used for human food. The material called agar-agar used in medicine and as culture media for growing bacteria and other organisms in laboratories is manufactured from certain seaweeds, and kelp and other seaweeds have long been gathered and spread upon the land as a fertilizer. Certain fresh water species grow in water supply reservoirs, causing a disagreeable taste or smell, and many of these reservoirs require cleaning annually at great expense. This bulletin has al-

ready been sent to those in charge of the larger public water supplies of the State.

Bulletin No. 43. The Life Forms of Connecticut Plants and Their Significance in Relation to Climate, by Dr. Beulah Ennis, 100 pages, 20 plates. Like Bulletin No. 42, this paper was prepared by the author in the Department of Botany, Yale University, as a dissertation for the degree of doctor of philosophy. Dr. Ennis has investigated the habits of all plants growing without cultivation in Connecticut, and has classified them after the system of Raunkiaer, an eminent Danish botanist, who based his classification on the adaptive features of plants which enable them to live through unfavorable seasons. Some of these adaptive features are shown on the plates. The bulletin should interest all students of plants.

Bulletin No. 44. Report on the Water Resources of Connecticut, by Roscoe Henry Suttie, Assistant Professor of Civil Engineering in Yale University, 168 pages, 7 figures. This report was prepared in compliance with Chapter 240, Special Acts of 1925, and in it Professor Suttie has brought together all available information regarding precipitation, run-off or stream flow, evaporation, great storms and data concerning all municipal and private water companies in Connecticut. The bulletin also makes recommendations regarding needed investigations of stream flow, and the establishment of some State board or commission having the authority to allocate watersheds for supplying centers of population with good supplies of water. This information is certain to prove most useful to all municipalities, and all water companies, municipal and private, engineers, health agencies, and to all the agricultural and manufacturing interests of the State.

PUBLICATIONS

The Survey has now published 44 bulletins altogether containing 6989 pages, 387 plates, 671 figures and 18 maps, not counting the bulletin list in each bulletin. Of this number, 11 bulletins, Nos. 1, 9, 12, 17, 21, 25, 27, 28, 32, 35, and 38, totaling 242 pages, are administrative reports and contain no scientific matter. Of scientific matter, 33 bulletins containing 6747 pages have been published by the Survey. Fourteen bulletins, Nos. 4, 6, 7, 8, 13, 18, 23, 24, 29, 30, 33, 40, 41 and 44 deal with geology and contain 1722 pages, 97 plates, 234 figures and 18 maps. Ten bulletins, Nos. 3, 5,

10, 11, 14, 15, 36, 37, 42 and 43, deal with botany and contain 1645 pages, 156 plates, and 55 figures. Nine bulletins, Nos. 2, 16, 19, 20, 22, 26, 31, 34 and 39 deal with zoölogy and contain 3380 pages, 129 plates and 380 figures. Five of the zoölogy bulletins, Nos. 16, 22, 31, 34, and 39 are devoted to insects, and contain 2528 pages, 63 plates and 267 figures.

Following is a list of the numbers and titles of the bulletins of the survey, which have been published up to this time:

BULLETINS

1. First Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1903-1904; 18 pp., 23 cm., 1904.
2. A Preliminary Report on the Protozoa of the Fresh Waters of Connecticut: by Herbert William Conn, Ph. D.; 69 pp., 34 pls., 23 cm., 1905. (Out of print as a separate bulletin. To be obtained only in Vol. I, containing Bulletins 1-5. Price \$1.75 postpaid.)
3. A Preliminary Report on the Hymeniales of Connecticut: by Edward Albert White, B. S.; 81 pp., 40 pls., 23 cm., 1905. (Out of print as a separate bulletin. To be obtained only in Vol. I, containing Bulletins 1-5. Price \$1.75 postpaid.)
4. The Clays and Clay Industries of Connecticut: by Gerald Francis Loughlin, S. B.; 121 pp., 13 pls., 23 cm., 1905.
5. The Ustilagineae, or Smuts, of Connecticut: by George Perkins Clinton, S. D.; 45 pp., 55 figs., 23 cm., 1905.
6. Manual of the Geology of Connecticut: by William North Rice, Ph.D., LL.D., and Herbert Ernest Gregory, Ph.D.; 273 pp., 31 pls., 22 figs., (10 maps) 23 cm., 1906. (Out of print as a separate bulletin. To be obtained only in Vol. II, containing Bulletins 6-12. Price \$2.75 Postpaid.)
7. Preliminary Geological Map of Connecticut: by Herbert Ernest Gregory, Ph.D., and Henry Hollister Robinson, Ph.D.; 39 pp., 2 maps (1 in pocket), 23 cm., 1907.
8. Bibliography of Connecticut Geology: by Herbert Ernest Gregory, Ph.D.; 123 pp., 23 cm., 1907.
9. Second Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1905-1906; 23 pp., 23 cm., 1906.
10. A Preliminary Report on the Algae of the Fresh Waters of Connecticut: by Herbert William Conn, Ph.D., and Lucia Washburn (Hazen) Webster, M.S.; 78 pp., 44 pls., 23 cm., 1908.
11. The Bryophytes of Connecticut: by Alexander William Evans, Ph.D., and George Elwood Nichols, B.A.; 203 pp., 23 cm., 1908.
12. Third Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1907-1908; 30 pp., 23 cm., 1908.
13. The Lithology of Connecticut: by Joseph Barrell, Ph.D., and Gerald Francis Loughlin, Ph.D.; 207 pp., 6 tables, 23 cm., 1910.

14. Catalogue of the Flowering Plants and Ferns of Connecticut growing without cultivation: by a Committee of the Connecticut Botanical Society consisting of Charles Burr Graves, A.B., M.D., Edwin Hubert Eames, M.D., Charles Humphrey Bissell, Luman Andrews, Edgar Burton Harger, Ph.B., and Charles Alfred Weatherby, A.M.; 569 pp., 23 cm., 1910.
15. Second Report on the Hymeniales of Connecticut: by Edward Albert White, B.S.; 70 pp., 28 pls., 23 cm., 1910.
16. Guide to the Insects of Connecticut: prepared under the direction of Wilton Everett Britton, Ph.D. Part I. General Introduction; by Wilton Everett Britton, Ph.D. Part II. The Euplexoptera and Orthoptera of Connecticut: by Benjamin Hovey Walden, B.Agr.; 169 pp., 11 pls., 16 figs., (1 map,) 23 cm., 1911.
17. Fourth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1909-10; 31 pp., 23 cm., 1910.
18. Triassic Fishes of Connecticut: by Charles Rochester Eastman, Ph.D.; 78 pp., 11 pls., 8 figs., 23 cm., 1911.
19. Echinoderms of Connecticut: by Wesley Roswell Coe, Ph.D.; 152 pp., 32 pls., 29 figs., 23 cm., 1912.
20. The Birds of Connecticut: by John Hall Sage, M.S., and Louis Bennett Bishop, M.D., assisted by Walter Parks Bliss, M.A.; 370 pp., 23 cm., 1913.
21. Fifth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1911-1912; 27 pp., 23 cm., 1912.
22. Guide to the Insects of Connecticut: prepared under the direction of Wilton Everett Britton, Ph.D. Part III. The Hymenoptera, or Wasp-like Insects, of Connecticut; by Henry Lorenz Viereck, with the collaboration of Alexander Dyer MacGillivray, Ph.D., Charles Thomas Brues, M.S., William Morton Wheeler, Ph.D., and Sievert Allen Rohwer; 824 pp., 10 pls., 15 figs., 23 cm., 1916.
23. Central Connecticut in the Geologic Past: by Joseph Barrell, Ph.D.; 44 pp., 5 pls., 23 cm., 1915.
24. Triassic Life of the Connecticut Valley: by Richard Swann Lull, Ph.D.; 285 pp., 3 maps, 12 pls., 126 figs., 23 cm., 1915.
25. Sixth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1913-1914; 24 pp., 23 cm., 1915.
26. The Arthrostraca of Connecticut: by Beverly Waugh Kunkel, Ph.D.; 261 pp., 84 figs., 23 cm., 1918.
27. Seventh Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1915-1916; 17 pp., 23 cm., 1917.
28. Eighth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1917-1918; 21 pp., 23 cm., 1919.
29. The Quaternary Geology of the New Haven Region, Connecticut: by Freeman Ward, Ph.D.; 80 pp., 9 pls., 17 figs., 23 cm., 1920.

30. Drainage Modifications, and Glaciation in the Danbury Region, Connecticut: by Ruth Sawyer Harvey, Ph.D.; 59 pp., 5 pls., 10 figs., 23 cm., 1920.
31. Check List of the Insects of Connecticut: by Wilton Everett Britton, Ph.D.; 397 pp., 23 cm., 1920.
32. Ninth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1919-1920; 18 pp., 23 cm., 1920.
33. Geology of the Stonington Region, Connecticut: by Laura Hatch Martin, Ph.D.; 70 pp., 1 map, 8 figs., 23 cm., 1925.
34. Guide to the insects of Connecticut: prepared under the direction of Wilton Everett Britton, Ph.D. Part IV. The Hemiptera or Sucking Insects of Connecticut: by Wilton Everett Britton, Ph.D., with collaboration of James Francis Abbott, Ph.D., Arthur Challen Baker, Ph.D., Harry Gardner Barber, A.M., William Thompson Davis, Dwight Moore DeLong, Ph.D., William Delbert Funkhouser, Ph.D., Harry Hazelton Knight, Ph.D., Asa Chandler Maxson, Herbert Osborn, D.Sc., Howard Madison Parshley, Sc.D., Edith Marion Patch, Ph.D., Louis Agassiz Stearns, M.Sc., José Rollin de la Torre-Bueno, F.E.S., Edward Payson Van Duzee, Harley Frost Wilson, M.S.; 807 pp., 20 pls., 169 figs., 23 cm., 1923.
35. Tenth and Eleventh Biennial Reports of the Commissioners of the State Geological and Natural History Survey, 1921-1924; 17 pp., 23 cm., 1924.
36. The Uredinales or Rusts of Connecticut and Other New England States: by Willis Roberts Hunt, Ph.D.; 198 pp., 2 figs., 23 cm., 1926.
37. Catalogue of the Lichens of Connecticut: by Alexander William Evans, Ph.D., and Rose Meyrowitz, M.S.; 56 pp., 23 cm., 1926.
38. Twelfth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1925-1926; 23 pp., 1 pl., 23 cm., 1927.
39. The Odonata or Dragonflies of Connecticut: by Philip Garman, Ph.D.; 331 pp., 22 pls., 67 figs., 23 cm., 1927.
40. The Geology of the Shepaug Aqueduct Tunnel, Litchfield County, Connecticut: by William Macdonough Agar, Ph.D. with a chapter by Robert A. Cairns; 38 pp., 8 pls., 2 maps, 3 figs., 23 cm., 1927.
41. Guide to the Geology of Middletown, Connecticut, and Vicinity: by William North Rice, Ph.D., LL.D., and Wilbur Garland Foye, Ph.D.; 137 pp., 3 pls., 33 figs., 23 cm., 1927.
42. The Algae of Connecticut: by Clarence John Hylander, Ph.D., 245 pp., 28 pls., 23 cm., 1928.
43. The Life Forms of Connecticut Plants and Their Significance in Relation to Climate; by Beulah Ennis, Ph.D.; 100 pp., 20 pls., 23 cm., 1928.
44. Report on the Water Resources of Connecticut, by Roscoe Henry Suttie C. E.; 168 pp., 7 figs., 23 cm., 1928.

BOUND VOLUMES

A few hundred copies of each bulletin of the foregoing list have been reserved for binding, and these have been assembled and bound in the following order, Volume VII having been bound recently:

- Volume 1, contains Bulletins 1-5.
- II, contains Bulletins 6-12.
- III, contains Bulletins 13-15.
- IV, contains Bulletins 16-21.
- V, contains Bulletin 22.
- VI, contains Bulletins 23-32.
- VII, contains Bulletins 33-35.
- VIII, contains Bulletins 36-42.

WORK DONE IN COÖPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY

Considerable work has been done by the State Survey in coöperation with the United States Geological Survey. The reports of such investigations have been published by the United States Geological Survey, and are as follows:

REPORT ON GRANITES

Bulletin 484. The Granites of Connecticut, by T. Nelson Dale and Herbert E. Gregory, 137 pp., 12 figs., 7 pls., 1911.

WATER-SUPPLY PAPERS

232. Underground Water Resources of Connecticut, by Herbert E. Gregory, with a study of the occurrence of water in crystalline rocks, by E. E. Ellis, 200 pp., 31 figs., 5 pls., 1909.

374. Ground Water in the Hartford, Stamford, Salisbury, Willimantic, and Saybrook areas, Connecticut, by Herbert E. Gregory and Arthur J. Ellis, 150 pp., 10 figs., 8 pls., 1916.

In addition to the towns given in title, includes Bloomfield, Canaan, East Hartford, East Windsor, Essex, Franklin, Greenwich, Manchester, Newington, North Canaan, Old Lyme, South Windsor, Westbrook, West Hartford, Wethersfield, Windham, and Windsor.

397. Ground Water in the Waterbury area, Connecticut, by Arthur J. Ellis, 73 pp., 10 figs., 4 pls., 1916.

Also includes Ansonia, Beacon Falls, Middlebury, Naugatuck, Oxford, Seymour, Thomaston, and Watertown.

449. Ground Water in the Meriden area, Connecticut, by Gerald A. Waring, 83 pp., 10 figs., 7 pls., 1920.

Also includes Berlin, Cromwell, Middlefield, Middletown, and Rocky Hill.

466. Ground Water in the Southington-Granby area, Connecticut, by Harold S. Palmer, 219 pp., 30 figs., 7 pls., 1921.

Also includes Avon, Barkhamsted, Bristol, Burlington, Canton, Cheshire, Farmington, Harwinton, Hartland, New Britain, New Hartford, Plainville, Plymouth, Prospect, Simsbury, and Wolcott.

470. Ground Water in the Norwalk, Suffield, and Glastonbury areas, Connecticut, by Harold S. Palmer, 171 pp., 18 figs., 12 pls., 1920.

Also includes Darien, East Granby, Enfield, Marlboro, New Canaan, Ridgefield, Weston, Westport, Wilton, and Windsor Locks.

537. A Study of Coastal Ground Water, with Special Reference to Connecticut, by John S. Brown, 101 pp., 20 figs., 6 pls., 1925. Includes a narrow strip and islands along the shore of the towns of Milford, Orange, West Haven, New Haven, East Haven, Branford, Guilford, Madison, and Clinton.

540. Ground Water in the New Haven Area, Connecticut, by John S. Brown, 206 pp., 19 figs., 15 pls., 1928. Includes Milford, Orange, West Haven, New Haven, Woodbridge, Bethany, Hamden, North Haven, East Haven, Branford, North Branford, Wallingford, Guilford, Madison, Killingworth, Durham, Haddam and Chester.

In addition to the published papers listed above, studies have been made of the water supplies of other areas, as follows:

Waters of the Pomperaug Valley.—Field work was done in 1913 by A. J. Ellis, and measurements of stream and well flow, evaporation, and precipitation were made between May 1913 and December 1916, by E. A. and G. A. Parkin and R. V. Woodin, under the direction of Mr. Ellis and H. S. Palmer. On account of the death of Mr. Ellis, the work of preparing the report was assigned to Dr. Norah E. Dowell. The manuscript has now been completed and contains about 200 pages, but has not yet been published.*

CLASSIFICATION OF SURVEY BULLETINS

From the beginning the Survey bulletins have been of two kinds: (1) administrative reports covering the progress of the Survey work but containing no scientific matter; (2) scientific bulletins. The scientific bulletins have dealt with geology, botany, and zoölogy, and, whether consciously or unconsciously, are quite evenly divided between these three subjects. The classified list of bulletins by numbers is as follows:

Administrative reports: Bulletins 1, 9, 12, 17, 21, 25, 27, 28, 32, 35, 38
 Geology: Bulletins 4, 6, 7, 8, 13, 18, 23, 24, 29, 30, 33, 40, 41, 44
 Botany: Bulletins 3, 5, 10, 11, 14, 15; 36, 37, 42, 43
 Zoölogy: Bulletins 2, 16, 19, 20, 22, 26, 31, 34, 39

* Since this report was sent to the printer, the report on the Ground Water of the Pomperaug Basin has been issued as Water-Supply Paper 597-B, U. S. Geological Survey.

DISTRIBUTION OF SURVEY PUBLICATIONS

All bulletins issued by the Survey are distributed by the State Librarian, Mr. George S. Godard, who is the Distribution and Exchange Agent for the Survey. These publications are distributed liberally to colleges and universities, geological and natural history surveys, scientific societies and public libraries. They are usually sent to scientists who are specializing in the subjects covered by the bulletins. They are also sent freely on request to residents of Connecticut, and particularly, when circumstances permit, to teachers for use in their classes. Other persons may purchase them at prices which barely cover the cost of printing and transportation.

Many important scientific books and papers are received by exchange and otherwise, and these are deposited in the State Library at Hartford and help to form a most valuable reference collection, which is constantly being increased.

Mr. Godard writes as follows:

"I think the Connecticut Geological and Natural History Survey is to be congratulated on the standard established and subjects already covered in the several bulletins published. The wide and persistent demand which comes from all parts of our country and abroad for certain of these bulletins, some of which are out of print, indicates that the publications are meeting a real need. It is to be hoped that at the first opportunity there may be either a new edition or a revision of Bulletin 6, Manual of the Geology of Connecticut, which has been one of the most popular bulletins in the series."

The following table shows the date of issue, size of edition, and the number of copies now on hand of each bulletin and bound volume published by the Survey. It will be noted that Bulletins 1, 2, 3, 6 and 28 are already out of print and can be furnished only in the bound volumes. That there is a constant demand for the scientific bulletins is shown by the number of copies on hand, in the right-hand column.

Bulletin	Date of issue	Size of edition	Copies on hand
1.....	1904	3,000	Out of print
2.....	1905	3,500	Out of print
3.....	1905	3,500	Out of print
4.....	1905	3,500	120
5.....	1905	3,500	140
6.....	1906	4,000	Out of print
7.....	1907	3,500	250
8.....	1907	3,500	321
9.....	1906	3,000	600
10.....	1908	3,500	357
11.....	1908	3,000	173
12.....	1908	3,000	60

13.....	1910	3,500	163
14.....	1910	4,000	676
15.....	1910	3,500	900
16.....	1911	3,500	490
17.....	1910	3,000	125
18.....	1911	3,500	1,200
19.....	1912	3,500	1,200
20.....	1913	4,500	580
21.....	1912	3,000	800
22.....	1916	3,500	650
23.....	1915	4,000	1,080
24.....	1915	4,000	762
25.....	1915	2,900	400
26.....	1918	3,000	720
27.....	1917	2,900	400
28.....	1919	2,500	Out of print
29.....	1920	2,500	1,080
30.....	1920	2,500	360
31.....	1920	3,000	520
32.....	1920	2,900	500
33.....	1925	2,500	1,800
34.....	1923	3,000	736
35.....	1924	2,500	200
36.....	1926	3,000	1,545
37.....	1926	3,000	1,100
38.....	1927	2,500	160
39.....	1927	3,000	926
40.....	1927	3,000	1,320
41.....	1927	3,000	825
42.....	1928	3,000	1,600
43.....	1928	3,000	1,494
44.....	1928	3,000	1,550
Volume			
I.....	1905	600	56
II.....	1908	600	30
III.....	1910	600	185
IV.....	1914	600	149
V.....	1916	600	272
VI.....	1921	400	207
VII.....	1926	300	211
VIII.....	1928	300	165

LAW ESTABLISHING THE STATE GEOLOGICAL AND NATURAL HISTORY SURVEY

The State Geological and Natural History Survey was established in 1903 by act of the General Assembly (Chapter 133, Public Acts of 1903) and amended in 1915 (Chapter 185, Public Acts of 1915) to include as one of its commissioners the president of the Connecticut College for Women.

The amended Act is Chapter 115, page 675, of the General Statutes of Connecticut, and reads as follows:

Section 2193. Appointment and duties of commission. As heretofore established, there shall be a State Geological and Natural History Survey, which shall be under the direction of a commission composed of the governor, the president of Yale University, the president of Wesleyan University, the president of Trinity College, the president of the Connecticut Agricultural College, and the president of the Connecticut College for Women, or so many of them as shall accept such office, each of whom shall serve without compensation, but shall be reimbursed for expenses incurred in the performance of official duties; and said commissioners shall have general charge of the survey, and shall appoint as superintendent of the same a scientist of established reputation, and such assistants and employees as may be necessary; and they shall also determine the compensation of, and may remove, all persons employed by the commission.

Sec. 2194. Objects of survey. Said survey shall have for its objects: (1) An examination of the geological formation of the state, with special reference to its economic products, to wit, building stones, clays, ores and other mineral substances. (2) An examination of the animal and plant life of the state, with special reference to its economic and educational value. (3) The preparation of special maps to illustrate the resources of the state. (4) The preparation of special reports, with necessary illustrations and maps, which shall embrace both a general and detailed description of the geology and natural history of the state.

Sec. 2195. Reports. Said commissioners shall cause to be prepared a report to the general assembly before each meeting of the same, showing the progress and condition of the survey, together with such other information as they may deem necessary and useful or as the general assembly may require.

Sec. 2196. Distribution and sale of reports. The regular and special reports of the survey, with proper illustrations and maps, shall be prepared for publication, and when printed, the reports shall be distributed or sold by the commissioners as the interests of the state and of science demand, and all moneys obtained by the sale of the reports shall be paid into the state treasury.

Sec. 2197. Disposition of material collected. All material collected, after having served the purposes of the survey, shall be distributed by the commissioners to the educational institutions of the state in such a manner as to be of the greatest advantage to the educational interests of the state, or, if deemed advisable by said commissioners, the whole or any part of such material shall be put on permanent exhibition.

FINANCIAL STATEMENT

RECEIPTS

Appropriation for biennial period ending June 30, 1927:	
For scientific work	\$5,000.00
For office expenses	1,000.00
Total	\$6,000.00

EXPENDITURES

Salaries and wages	\$4,357.80
Printing and illustrations	53.04
Stationery and office supplies	67.20
Postage	15.48
Telephone and Telegraph	4.00
Express, freight and cartage	2.69
Scientific apparatus and supplies	60.85
Chemical analyses and rock sections	270.75
Traveling expenses	1,138.31
Miscellaneous	24.60
Total	\$5,994.72
Balance June 30, 1927	5.28
GRAND TOTAL	\$6,000.00

RECEIPTS

Appropriation for biennial period ending June 30, 1929:	
For scientific work	\$6,500.00
For office expenses	1,500.00
Total	\$8,000.00

EXPENDITURES

Salaries and wages	\$4,482.46
Printing and illustrations	76.26
Stationery and office supplies	11.06
Postage	11.82
Telegraph and telephone	2.32
Express	1.68
Scientific apparatus and supplies	36.88
Chemical analyses and rock sections	51.00
Traveling expenses	2,553.57
Miscellaneous	23.94
Total	\$7,250.99
Balance, *December 31, 1928	749.01
GRAND TOTAL	\$8,000.00

RESEARCHES NOW IN PROGRESS

Minerals of Connecticut.—For a long time there has been great need for a popular bulletin giving information about the minerals of Connecticut. There have been many commercial developments in the past and a few mines are still worked, but most of them have been abandoned. The openings are soon covered by forest growth and there is grave danger that the sites may be lost to record and forgotten altogether. Dr. J. F. Schairer, while a graduate student at

* A transfer of \$800 from office expenses to Scientific work was made December 20, 1928.

Yale University, began a study of the localities where minerals occur in Connecticut and he has been engaged to prepare a paper for the Survey. These localities will be shown on a map, and data concerning the extent and quality of each mineral, together with history of mining operations will be given. It is not intended that this paper be a guide to the identification of minerals, but to record this other information about them for Connecticut. Dr. Schairer expects that the manuscript will be completed by July 1, 1929.

Glacial Geology of Connecticut.—During the seasons of 1927 and 1928, Dr. Richard Foster Flint of the Department of Geology, Yale University, has been employed by the Survey in making a study, or rather a re-study, of the glacial geology of the State. Dr. Flint has worked rapidly and has already finished most of the field work and is now engaged in mapping and writing his report. He has made discoveries which will cause us to revise our understanding of what occurred in glacial times and his report should prove valuable from the scientific, educational and economic viewpoints. It is expected that the manuscript will be finished before the end of the year, 1929.

Crystalline Rocks of Eastern Connecticut.—For several years, Professor W. G. Foye, of Wesleyan University, has been engaged in studying the bed-rock geology of the eastern Highland of the State. He has done this work during his summer vacations and had nearly finished it, when on account of ill health, was obliged to suspend field operations. He hopes to be able to continue, and perhaps complete the work in 1929. These studies are exceedingly difficult and together with those of Dr. Agar in the Western portion of the State will prove to be important contributions toward a revision of the geology of Connecticut.

Metamorphic Rocks of Western Connecticut.—Dr. W. M. Agar, author of Bulletin 40, has already made a good beginning in a study, or rather re-study, of the bed-rock geology of Western Connecticut. A thorough examination needs to be made of the metamorphic or crystalline rocks in order to determine, if possible, their origin and cause of metamorphism. The studies are very difficult and probably will require several seasons before a comprehensive report can be made. These studies with those of Professor Foye in Eastern Connecticut are necessary contributions to a revision of the Geology of Connecticut as treated in Bulletin No. 6, which is now out of print and a new edition requested.

Coast Erosion and Protection.—On some portions of the Atlantic coast there are considerable changes in shore line due to erosion and deposits by the tides and storms. On the Connecticut shore no very great changes have occurred, but minor changes have been known for many years and a study has recently been made by Mr. Henry S. Sharp, a graduate student in Columbia University. This work has been done under the supervision of Professor Douglas Johnson, of that University, a recognized authority on shore line changes. By defraying a portion of Mr. Sharp's field expenses, the Survey is able to obtain the paper for publication. It will probably be completed early next summer.

Connecticut Weather.—For several years, plans have been made for a bulletin on the weather of Connecticut prepared by Mr. Leonard M. Tarr, local forecast official of the New Haven office of the U. S. Weather Bureau. This bulletin will consider the amount and distribution of rainfall, temperatures, storms, sunny and cloudy days, humidity, direction and velocity of air currents, all of which contribute to what we know as the climate of Connecticut. Mr. Tarr now expects to have this paper completed by the middle of next summer, and it should prove interesting to all residents of the State, when published.

Mammals of Connecticut.—There never has been any publication on this subject, and one year ago, Mr. George G. Goodwin, of the Division of Mammals, American Museum of Natural History, New York, was engaged to prepare the manuscript of such a bulletin. He has already spent one summer of field work in Connecticut, and wishes to devote another season to field studies and also visit some of the large museums in order to obtain records regarding the distribution of species.

The Acarina or Mites of Connecticut.—For several years, Dr. Philip Garman has collected and studied the mites occurring in Connecticut, many of which are of economic importance. Some species annoy or live upon animals, and some injure plants. Already Dr. Garman has discovered in Connecticut several European species not before known to occur in the United States. As little is known about these minute animals, it will probably be several years before a comprehensive treatise can be prepared on the subject, but it is hoped that a preliminary report may be submitted within the year.

The Diptera or Two-winged Flies of Connecticut.—With the assistance of Dr. R. B. Friend, Assistant Entomologist of the Agricultural Experiment Station, the Superintendent of the Survey has projected a rather ambitious work on the Diptera similar to that on the Hemiptera, Bulletin No. 34, and to be a part of the same series, Guide to the Insects of Connecticut. Like the Hemiptera it must be the joint work of a large number of specialists each treating the family or group in which he is a specialist. As much collecting and study must be done, considerable time must necessarily elapse—probably five years at least—before the paper can be finished. Some of the assignments have already been made, and certain families could be written up in a short time, but it will be difficult to work up some of the families and groups or even to get anyone to attempt it. Once finished, however, such a work on the Diptera would prove exceedingly useful.

The Stegocephalian Amphibia of the Connecticut Valley and Its Environs.—Though few, if any, fossil Amphibia have been found in Connecticut, material is much more abundant from adjacent territory and it is fair to assume that they occurred in Connecticut. Mr. Roy L. Moodie, an authority on the subject, has been engaged to prepare a brief paper with illustrations. Such a bulletin will be of interest chiefly to geologists and paleontologists. Mr. Moodie expects to finish the manuscript during the season.

Additions to the Catalogue of Flowering Plants and Ferns.—Since the publication of the Catalogue of the Flowering Plants and Ferns as Bulletin No. 14, in 1910, many additional species have been found in the State. Two or three lists of additions have been printed in botanical journals and yet there are more additions to be published. At my suggestion, the committee of the Connecticut Botanical Society has now brought together all of these additions and as soon as the names, records and annotations can be typed from the cards, this list will be ready for publication. This matter will be published as a separate bulletin but it will really be a supplement to Bulletin No. 14. Probably it will not make a very large pamphlet, but it will be a great convenience to all teachers and botanists using Survey bulletins to have all of this material in the bulletin series of the Survey.

Common or Conspicuous Plant Galls of Connecticut.—The Commissioners have already authorized the preparation

of a popular bulletin on the plant galls and a good start has been made in collecting and photographing material. Certain galls are caused by bacteria, some by fungi, some by mites, but probably the majority in point of both species and individuals are caused by insects, belonging to four orders: the Hemiptera or sucking bugs, the Diptera or two-winged flies; the Hymenoptera or four-winged flies, and the Coleoptera or beetles. As there is much work to be done on this bulletin, it will probably take a year or two to prepare the manuscript.

Rusts of Connecticut.—Drs. G. P. Clinton and W. R. Hunt are now at work on another paper on the rusts, which will supplement Bulletin No. 36, and will contain keys and illustrations to the genera, and list the species occurring in the State.

The Clays of Central Connecticut.—Twenty-three years have now elapsed since the publication of Dr. G. F. Loughlin's paper on the Clays and Clay Industries of Connecticut as Bulletin No. 4 of this survey. Mr. Grant T. Wickwire has reexamined the larger areas in the central portion of the State and has submitted a preliminary report, giving estimates of the probable quantities of brick clays in these areas and the number of years which the supplies will last at the present rate of exploitation.

UNPUBLISHED MANUSCRIPTS

Higher Crustaceans of Connecticut:—This manuscript was mentioned in the Twelfth Biennial Report, Bulletin No. 38, was prepared by Professor A. E. Verrill of Yale University, and contains about 600 typed pages and nearly 100 pages of illustrations. After the death of Professor Verrill in December, 1927, the manuscript was submitted to specialists in the subject who seemed to agree that a revision is necessary before publication. The editorial and revisional work on this paper by specialists, to prepare it for publication, promised to be rather expensive so nothing has been done with it.

Additions and Corrections to the Check-List of the Insects of Connecticut:—This has been prepared by the Superintendent with the assistance of the members of his department staff at the Agricultural Experiment Station and now contains about 140 typed manuscript pages. It undergoes constant revision and we hope to make impor-

tant additions to it during the coming season. It should be issued by the Survey as the First Supplement to the Check-List of the Insects of Connecticut (Bulletin No. 31) though numbered as a separate bulletin.

OTHER NEEDED INVESTIGATIONS

In addition to the investigations enumerated above, in geology, there may be need of studies of quartz, feldspar, limestones, sandstones, sand and gravel, all of considerable economic importance in Connecticut.

In zoölogy, there is need of bulletins on the fish, reptiles and Amphibia of the State; also on the sponges, zoophytes, annulata, spiders and mollusks. Smaller groups of birds of great economic importance might well be given detailed treatment in Survey bulletins. There still remain many orders of insects not covered in Survey publications.

In botany, there are several groups of fungi which should be studied and reports issued regarding them. Some of these are the downy mildews and powdery mildews, and the fungi occurring on shade and forest trees. There should also be a publication dealing with the native trees and shrubs of Connecticut.

APPROPRIATIONS

At the start in 1902, the Survey appropriation was \$3,000 for the biennial period, and the work was conducted on this basis until 1917, when the General Assembly increased the biennial appropriation to \$6,000. This appropriation was renewed by each General Assembly until 1927, when it was raised to \$8,000, \$6,500 being for scientific work and \$1,500 for office expenses. In 1927 and for 1929, \$10,000 was requested; in view of the important part which the Survey plays in the scientific and educational work of the State, not to mention its economic aspects, and considering the very large appropriations granted for other purposes, \$10,000 for two years is not excessive and would hardly be felt by the citizens of the State.