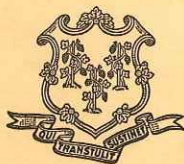


State of Connecticut
PUBLIC DOCUMENT No. 47

TWELFTH BIENNIAL REPORT OF THE
COMMISSIONERS
of the
**State Geological and Natural
History Survey**
1925-1926
Bulletin No. 38



HARTFORD
Published by the State
1927

State of Connecticut
PUBLIC DOCUMENT No. 47

State Geological and Natural
History Survey

W. E. BRITTON, SUPERINTENDENT

BULLETIN NO. 38



HARTFORD

Printed for the State Geological and Natural History Survey

1927

Connecticut Geological and Natural History Survey Library
Department of Environmental Protection
79 Elm Street

State Geological and Natural History Survey

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Agricultural Experiment Station, New Haven

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OF THE COMMISSIONERS

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LETTER OF TRANSMITTAL

STORRS, CONN., December 31, 1926.

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 twelfth biennial report of the Superintendent, covering the two years ending December 31, 1926.

Very respectfully,

CHARLES LEWIS BEACH,

Secretary of the Commission.



H. H. Robinson.

TWELFTH BIENNIAL REPORT OF THE GEOLOGICAL AND NATURAL HISTORY SURVEY OF CONNECTICUT

HENRY HOLLISTER ROBINSON, PH.D.

Dr. Henry Hollister Robinson, Superintendent of this Survey from 1921 to 1925, died at the New Haven Hospital, October 20, 1925. Born in Hartford, June 4, 1873, he was the son of Charles Augustus Robinson of the firm of Smith, Northam and Robinson, grain merchants. He attended the Hartford public schools, graduating from the high school in 1892 in the civil engineering course with Senior honors. Entering the Sheffield Scientific School of Yale University that year, he was graduated in 1895 with the degree of Ph.B. From 1896 to 1897 he returned to Yale as a graduate student, receiving the degree of C. E. in 1897. After a year with the Southington (Conn.) Water Company, he entered the Graduate School of Yale University in 1899, receiving the degree of Ph.D. in 1903. He was elected to the honorary society of Sigma Xi in 1902 and served as instructor in geology at Yale from 1902 to 1908. The year 1909 was spent at his home in Hartford. He assisted in obtaining data and preparing the manuscripts of Bulletins Nos. 6 and 7 of this Survey. From 1909 to 1913 he engaged in geological investigations at Portland, Oregon, then returned to New Haven and continued in geological research. Several summers were devoted to research work in California and Arizona for the U. S. Geological Survey, including studies on extinct volcanoes. He served as secretary and treasurer of his class (1895 S.) from 1905 to 1910 and edited the *Decennial Record*. He was a member of the American Geographical Society, the Geological Society of America, the American Association for the Advancement of Science, the Connecticut Academy of Arts and Sciences, and of the Graduates Club of New Haven and the Yale Club of New York.

At Portland, Oregon, May 18, 1910, Dr. Robinson married Miss Mabel Agnes Sherman, formerly of New Haven. In 1914 they purchased a home near Clintonville, on the New Haven-Middletown turnpike. Mrs. Robinson and four children, Charles Sherman, Edith Ellen, Roger Sherman, and Mary Louise, survive him.

Dr. Robinson was an exceedingly able geologist, painstaking and thorough in his researches, and his work is accorded a high rank by his fellow geologists. A list (probably incomplete) of his papers follows:

On the Determination of Minerals in Thin Rock Sections by Their Maximum Birefringence. With L. V. Pirsson. *Amer. Jour. Science*, October, 1900.

On Octahedrite and Brookite. *Amer. Jour. Science*, Vol. 12, 1901.

The Tertiary Peneplain of the Plateau District, and Adjacent Country, in Arizona and New Mexico. *Amer. Jour. Science*, August, 1907.

Geology of Southeastern Connecticut (in part). Bulletin 6, State Geological and Natural History Survey.

Preliminary Geological Map of Connecticut. With H. E. Gregory. Bulletin 7, State Geological and Natural History Survey.

Ancient Water-Planes and Crustal Deformations, *Jour. Geol.* May-June, 1908.

A New Erosion Cycle in the Grand Canyon District, Arizona, *Jour. Geol.*, November-December, 1910.

The Single Cycle Development of the Grand Canyon of the Colorado. *Science*, Vol. 34, 1911.

The San Franciscan Volcanic Field, Arizona, *U. S. Geol. Surv., Prof. Paper* 76, 1913.

The Summation of Chemical Analyses of Igneous Rocks. *Amer. Jour. Science*, Vol. 41, 1916.

The Piedmont Terraces of the Northern Appalachians. By J. Barrell. Edited by H. H. Robinson. *Amer. Jour. Science*, vol. 49, April, May, and June, 1920.

Tenth and Eleventh Biennial Reports of the Commissioners of the State Geological and Natural History Survey, 1921-1924. Prepared by H. H. Robinson, Supt. Bulletin No. 35, 1924.

During a portion of the year 1925, Dr. Robinson was too ill to do any scientific work and could attend to only the most pressing administrative matters of the Survey. Early in the year he resigned as Superintendent, but the Commissioners did not meet until October 14, when his resignation was accepted and the present superintendent appointed. Dr. Robinson died the following week, October 20.

SCOPE AND PLAN OF THE STATE 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 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.

From an examination of the Act establishing the Survey, it will be seen that a study of the natural resources of the State was one of its prime objects. Especially such materials as stone for construction purposes, clays, ores, and minerals were to be studied and reports issued regarding them. Likewise the animal and plant life of the State was to be investigated and reported upon in its bulletins. Particular attention should evidently be given to such features of these subjects as are of economic importance. But whether of economic importance or

not, these things are of very definite scientific and educational moment, and there is abundant justification for considering them as fit projects for investigation by the Survey. How well these ideas have been followed during the twenty-three years of the work of the Survey is shown by the titles of its bulletins in the following list of publications:

1. First Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1903-1904, 10 pp., 1904.
2. A Preliminary Report on the Protozoa of the Fresh Waters of Connecticut, by H. W. Conn, 69 pp., 34 pls., 1905.
3. A Preliminary Report on the Hymeniales of Connecticut, by E. A. White, 81 pp., 40 pls., 1905.
4. The Clays and Clay Industries of Connecticut, by G. F. Loughlin, 121 pp., 1 fig., 13 pls., 1905.
5. The Ustilagineæ, or Smuts, of Connecticut, by G. P. Clinton, 45 pp., 7 pls., 1905.
6. Manual of the Geology of Connecticut, by W. N. Rice and H. E. Gregory, 273 pp., 22 figs., 31 pls., 1906.
7. Preliminary Geological Map of Connecticut, by H. E. Gregory and H. H. Robinson, 39 pp., 1 fig., 1 map, 1907.
8. Bibliography of Connecticut Geology, by H. E. Gregory, 123 pp., 1907.
9. Second Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1905-1906, 23 pp., 1906.
10. A Preliminary Report on the Algæ of the Fresh Waters of Connecticut, by H. W. Conn and L. W. (Hazen) Webster, 78 pp., 44 pls., 1908.
11. The Bryophytes of Connecticut, by A. W. Evans and G. E. Nichols, 203 pp., 1908.
12. Third Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1907-1908, 30 pp., 1908.
13. The Lithology of Connecticut, by Joseph Barrell and G. F. Loughlin, 207 pp., 6 tables, 1910.
14. Catalogue of the Flowering Plants and Ferns of Connecticut growing without cultivation, by a Committee of the Connecticut Botanical Society, 569 pp., 1910.
15. Second Report on the Hymeniales of Connecticut, by E. A. White, 70 pp., 28 pls., 1910.
16. Guide to the Insects of Connecticut, prepared under the direction of W. E. Britton. Part I, General Introduction, by W. E. Britton; Part II, The Euplexoptera and Orthoptera of Connecticut, by B. H. Walden, 169 pp., 66 figs., 11 pls., 1911.
17. Fourth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1909-1910, 31 pp., 1910.
18. Triassic Fishes of Connecticut, by C. R. Eastman, 77 pp., 8 figs., 11 pls., 1911.
19. Echinoderms of Connecticut, by W. R. Coe, 152 pp., 29 figs., 32 pls., 1912.
20. The Birds of Connecticut, by J. H. Sage and L. B. Bishop, assisted by W. L. Bliss, 320 pp., 1913.
21. Fifth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1911-1912, 27 pp., 1912.
22. Guide to the Insects of Connecticut, prepared under the direction of W. E. Britton. Part III, The Hymenoptera, or Wasp-like Insects, of Connecticut, by Henry Lorenz Viereck, in collaboration with A. D.

Mac Gillivray, C. T. Brues, W. M. Wheeler, and S. A. Rohwer, 824 pp., 15 figs., 10 pls., 1916.

23. Central Connecticut in the Geologic Past, by Joseph Barrell, 44 pp., 9 figs., 1915.

24. Triassic Life of the Connecticut Valley, by R. S. Lull, 285 pp., 126 figs., 12 pls., 3 maps, 1915.

25. Sixth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1913-1914, 24 pp., 1915.

26. The Arthrostraca of Connecticut, by Beverly W. Kunkel, 261 pp., 84 figs., 1918.

27. Seventh Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1915-1916, 17 pp., 1917.

28. Eighth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1917-1918, 21 pp., 1919.

29. The Quarternary Geology of the New Haven Region, Connecticut, by Freeman Ward, 80 pp., 17 figs., 9 pls., 1920.

30. Drainage Modifications and Glaciation in the Danbury Region, by Ruth Sawyer Harvey, 59 pp., 10 figs., 5 pls., 1920.

31. Check-List of the Insects of Connecticut, by W. E. Britton, 397 pp., 1920.

32. Ninth Biennial Report of the Commissioners of the State Geological and Natural History Survey, 1919-1920, 18 pp., 1920.

33. The Geology of the Stonington Region, Connecticut, by Laura Hatch Martin, 70 pp., 1 map, 9 figs., 8 pls., 1925.

34. Guide to the Insects of Connecticut, prepared under the direction of W. E. Britton. Part IV, The Hemiptera of Connecticut, by J. F. Abbott, A. C. Baker, H. G. Barber, W. E. Britton, J. R. de la Torre-Bueno, D. M. DeLong, W. D. Funkhouser, H. H. Knight, A. C. Maxson, H. Osborn, H. M. Parshley, E. M. Patch, L. A. Stearns, E. P. VanDuzee, and H. F. Wilson, 807 pp., 169 figs., 20 pls., 1923.

35. Tenth and Eleventh Biennial Reports of the Commissioners of the State Geological and Natural History Survey, 1921-1924, 17 pp., 1924.

36. The Uredinales or Rusts of Connecticut and the Other New England States, by Willis Roberts Hunt, 198 pp., 2 figs., 1926. (In press).

37. Catalogue of the Lichens of Connecticut, by Alexander W. Evans and Rose Meyrowitz, 56 pp., 1926. (In press).

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 I, 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.

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
 Geology: Bulletins 4, 6, 7, 8, 13, 18, 23, 24, 29, 30, 33
 Botany: Bulletins 3, 5, 10, 11, 14, 15, 36, 37
 Zoölogy: Bulletins 2, 16, 19, 20, 22, 26, 31, 34

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, 7, 12 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.

STATISTICS AND INVENTORY OF SURVEY PUBLICATIONS

| 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 | 270 |
| 5..... | 1905 | 3,500 | 350 |
| 6..... | 1906 | 4,000 | Out of print |
| 7..... | 1907 | 3,500 | Out of print |
| 8..... | 1907 | 3,500 | 384 |
| 9..... | 1906 | 3,000 | 473 |
| 10..... | 1908 | 3,500 | 320 |
| 11..... | 1908 | 3,000 | 294 |
| 12..... | 1908 | 3,000 | Out of print |
| 13..... | 1910 | 3,500 | 375 |
| 14..... | 1910 | 4,000 | 551 |
| 15..... | 1910 | 3,500 | 775 |
| 16..... | 1911 | 3,500 | 270 |
| 17..... | 1910 | 3,000 | 550 |
| 18..... | 1911 | 3,500 | 675 |
| 19..... | 1912 | 3,500 | 700 |
| 20..... | 1913 | 4,500 | 1,000 |
| 21..... | 1912 | 3,000 | 1,150 |
| 22..... | 1916 | 3,500 | 750 |
| 23..... | 1915 | 4,000 | 975 |
| 24..... | 1915 | 4,000 | 790 |
| 25..... | 1915 | 2,900 | 193 |
| 26..... | 1918 | 3,000 | 700 |
| 27..... | 1917 | 2,900 | 890 |
| 28..... | 1919 | 2,500 | Out of print |
| 29..... | 1920 | 2,500 | 875 |
| 30..... | 1920 | 2,500 | 375 |
| 31..... | 1920 | 3,000 | 575 |
| 32..... | 1920 | 2,900 | 300 |
| 33..... | 1925 | 2,500 | 2,150 |
| 34..... | 1923 | 3,000 | 790 |
| 35..... | 1924 | 2,500 | 1,200 |
| 36..... | 1926 | 3,000 | In press |
| 37..... | 1926 | 3,000 | In press |
| Volume | | | |
| I..... | 1905 | 600 | 117 |
| II..... | 1908 | 600 | 89 |
| III..... | 1910 | 600 | 142 |
| IV..... | 1914 | 600 | 226 |
| V..... | 1916 | 600 | 313 |
| VI..... | 1921 | 400 | 223 |
| VII..... | 1926 | 300 | 239 |

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 pl., 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.

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

Waters of the Pomeraug 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. It has not yet been published, and is available for publication by this Survey. The matter is now being considered.

Ground Water in the New Haven Area.—This work was done by John S. Brown, and deals with the ground water resources of the towns of Bethany, Branford, Clinton, Durham, East Haven, Guilford, Haddam, Killingworth, Madison, New Haven, Milford, North Branford, North Haven, Wallingford, Orange, and Woodbridge. The report has now been completed and the manuscript contains about 400 pages. It has also been offered to the State Survey for publication.

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..... | \$2,638.76 |
| Printing and illustrations..... | 2.65 |
| Stationery and office supplies..... | 51.60 |
| Postage..... | 9.37 |
| Telegraph and telephone..... | 1.45 |
| Express, freight and cartage..... | 1.67 |
| Scientific apparatus and supplies..... | 10.25 |
| Chemical Analyses and Rock Sections..... | 270.75 |
| Traveling expenses..... | 713.82 |
| Total..... | \$3,700.32 |
| Balance December 31, 1926..... | \$2,299.68 |

RECENT PUBLICATIONS

Since the last meeting of the Commissioners, authorization has been received for publishing four bulletins, numbered as follows: 33, 35, 36, and 37.

33. *Geology of the Stonington Region, Connecticut.* By Laura Hatch Martin, Ph.D., 70 pages, 1 map, 9 figures, 8 plates.

35. Tenth and Eleventh Biennial Reports of the Commissioners of the State Geological and Natural History Survey, 17 pages.

The two foregoing papers were prepared by or under the direction of the late Dr. Robinson and edited by him, and were ready for the printer at the time of his death. Hence his name, as Superintendent, appears in them.

36. The Uredinales or Rusts of Connecticut and the Other New England States. By Willis Roberts Hunt, Assistant in Botany, Connecticut Agricultural Experiment Station, New Haven, 198 pages, 2 figures.

This paper is not a means for the identification of species but is a check list, giving synonymy, host plants, references to literature, records of collections, and distribution in each of the New England States. The last is shown in a tabular form of index, which gives not only the page number where a particular species will be found, but shows at a glance in which of the six New England States it has been collected. A host index has also been provided. This paper is certain to prove useful to all plant pathologists, teachers of botany and the diseases of plants, and to collectors of the rusts, and to scientific libraries. As it covers not only Connecticut but all the New England States, its field of interest is correspondingly increased. (In press).

37. A Catalogue of the Lichens of Connecticut. By Alexander William Evans, Professor of Botany in Yale University, and Rose Meyrowitz, a graduate student, 56 pages. This is a systematic list, giving synonymy, records of collections within the State, and references to literature. It will be found useful alike to professional and amateur botanists, and is another step toward an inventory of the flora of Connecticut. (In press).

REPORT ON WATER RESOURCES

The General Assembly at its last session in 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. Fortunately, 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.

Following the advice of Dr. Herbert E. Gregory, formerly Superintendent of this Survey, I engaged Professor Roscoe H. Suttie, Assistant Professor of Civil Engineering in Yale University, to prepare this report. Professor Suttie formerly had considerable experience in this kind of work, mostly in other states, with the United States Geological Survey, and seemed to be the best man available to prepare the report on the water resources of Connecticut. His superior officers in Yale University approved the plan and Professor Suttie has devoted his summer vacation to collecting and tabulating the data and in formulating his interpretations and recommendations. The report is now nearly completed and will be submitted to the next General Assembly. It should also be published as a bulletin of this Survey.

UNPUBLISHED MANUSCRIPTS

Higher Crustaceans of Connecticut.—Several years ago Professor A. E. Verrill of Yale University submitted the first part of a manuscript, which has since been completed, on the higher crustaceans of Connecticut. This paper contains some 600 pages with nearly 100 pages of illustrations, and its publication will be rather expensive. But as the group contains the lobsters, crabs, etc. and is of great economic importance, this report would be of interest to teachers in public schools, to zoölogists and nature students, and to the sea-food industry. Publication will be sought at an early date.

Odonata or Dragonflies of Connecticut.—This paper, prepared by Dr. Philip Garman, Assistant Entomologist of the Agricultural Experiment Station, is the result of six years of study on this order of insects in the State. It contains some 400 typed pages and is well illustrated. Except for a few finishing touches, it is ready for the printer, and it is hoped that it may be published early in 1927. It is certain to be in great demand by teachers and entomologists, because the dragonflies are not only of economic importance but they are interesting and are among the oldest living forms of insect life.

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 contains about 100 manuscript pages. Except for a slight and final revision, it is ready for publication, and 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.

Algae of Connecticut.—The Survey was very fortunate in being able to secure for publication a paper on the Algae of Connecticut by Dr. Clarence J. Hylander, prepared as a thesis requirement for his doctorate at Yale in 1925. The manuscript has already been submitted and contains 322 pages. Dr. Hylander is now completing the drawings, and the paper will soon be ready for publication. It contains keys for separating the families and genera, and illustrations will show specific characters. It includes not only the fresh water species but also the marine forms occurring along the Connecticut coast.

Life Forms of Connecticut Plants.—A manuscript of 192 pages and 20 plates, on the *Life Forms of Connecticut Plants and Their Significance in Relation to Climate*, by Beulah Ennis, has been received for examination. This was a dissertation presented to Yale University in candidacy for the degree of Doctor of Philosophy. With slight modifications that will tend to reduction in size, it is probable that this paper may prove acceptable for publication as a bulletin of the Survey.

Peat Deposits.—Mention has been made in preceding reports of a paper by C. C. Osbon on the peat deposits of Fairfield, Hartford, and Windham Counties. It was planned to publish this paper as a bulletin of the Survey, but Mr. M. F. Morgan, Soil Investigator of the Agricultural Experiment Station, who is now engaged in studying the soil types of Connecticut, will probably be able to make a much more complete report on peat

deposits covering the entire state after he has worked two or three more seasons on his researches.

INVESTIGATIONS NOW IN PROGRESS

Geology of Middletown and Vicinity.—Professor William North Rice, Superintendent of the Survey during the first twelve years of its existence, with the collaboration of Professor W. G. Foye, has prepared an interesting paper on the geology of the region about Middletown and Meriden. It covers the same ground over which for many years the authors have conducted their classes in geology, and of course describes the more interesting geological formations which occur in that region. This paper is now about finished and the completed manuscript, with a few illustrations, may be submitted at any time.

Rock-Structure along the Waterbury Aqueduct Tunnel.—During the past two years or longer, the construction of a tunnel through the hills and mountains north of Waterbury, for the purpose of obtaining an increased water supply for the City of Waterbury, has given an excellent opportunity to study the rock-structure as a considerable portion is in solid ledge. Dr. W. M. Agar of Yale University has been employed by the Survey during a portion of his vacations in both 1925 and 1926, and after completing his studies will submit a paper describing the geologic formation along the route of this tunnel.

Minerals of Connecticut.—For many years we have needed a popular bulletin giving information about the minerals of Connecticut. Many of the mines have not been worked during the present generation, and there is grave danger that their sites will be overlooked or forgotten altogether. Mr. J. F. Schairer, a graduate student in Yale University, had begun such a study on his own initiative and had visited some of these localities. Arrangements have now been made whereby he will continue this work, mapping accurately each locality where mineral deposits occur, and giving brief descriptions of each, and histories of those which have been worked. Mr. Schairer expects to submit his paper before October 1, 1927.

Geology of Eastern Connecticut.—Professor W. G. Foye has been engaged for several years in studying the geology of eastern Connecticut and especially in remapping the crystalline area. He has now nearly completed his work east of the Connecticut River, but on account of sickness in his family was unable to finish it last summer. These studies are exceedingly difficult and will prove a valuable contribution toward a revision of the Geology of Connecticut.

Additions and Corrections 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 and varieties 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 is now bringing together all of these additions, to be published as a bulletin of the Survey as a supplement to Bulletin 14. This probably will not make a very large pamphlet but it will be a great convenience to teachers and others using Survey bulletins to have all of this material in one set of publications.

Connecticut Weather.—A bulletin on the weather of Connecticut has been promised by Mr. Leonard M. Tarr, local forecast official of the New Haven Weather Bureau, and it is expected that the manuscript may be finished early in 1927. This paper will consider amount and distribution of rainfall, temperatures, sunny and cloudy days, and the direction and velocity of air currents, all of which comprise the climate of Connecticut, and should prove interesting to all who reside in the State.

Acarina or Mites of Connecticut.—For several years Dr. Philip Garman has been collecting and studying the mites which occur in Connecticut. Many species are of economic importance: some attack animals and some cause injury to plants. Already Dr. Garman has found in Connecticut several species not before known to occur in the United States. As little is known about these minute animals, it will probably be two or three years before a report on them can be made ready for publication.

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.

PROPOSED WORK

Glacial Geology of Connecticut.—A new study should be made of the glacial geology of the State in all its broader relations. It is possible that this work can be started next summer by some one connected with the geological department of Yale or Wesleyan University.

Coast Erosion and Protection.—The coast region of Connecticut is rapidly being developed for residence and recreational purposes. There are rocky points, salt marshes, and beaches, and in some cases dikes and tide gates are necessary. Certain areas

should be set aside for public use, and the salt marsh ditching should be completed to eliminate mosquito breeding. Erosion by storms and tides cause some damage to property each season, and property owners expend modest sums to protect their property without any well-grounded information to guide them. It has been proposed that the Survey attempt to make a study of the matter in its broader aspects.

Further Studies of Ground Water.—Studies of the ground water in the remaining portion of Connecticut not covered in the work done in cooperation with the United States Geological Survey is under consideration. Probably it will be advisable to group these studies according to geographical areas rather than by towns, as has been done heretofore.

Metamorphic Rocks of Western Connecticut.—The metamorphic or crystalline rocks should be thoroughly examined in the western portion of the State to determine, if possible, their origin and cause of metamorphism. The subject is an exceedingly difficult one and probably several seasons' investigation will be necessary before an intelligent report can be made. Such studies are quite necessary as a contribution to our knowledge of the geology of the State, and after they have been made, it will be possible to publish a revision of Bulletins Nos. 6 and 7.

Mammals of Connecticut.—There has never been any publication giving an account of the mammals of Connecticut, and such a bulletin would be of great educational importance, as well as of much economic and scientific value. Of course the number of species would be relatively small when compared with certain other groups of animals and plants. It is believed that an illustrated bulletin giving keys and descriptions for the identification of species, and including an account of their life history, habits, and economic relations, can be prepared in the near future at moderate cost, and should be published as a bulletin of this Survey.

OTHER NEEDED INVESTIGATIONS

In addition to the investigations and proposed work enumerated above, there is need of studies of quartz and feldspar, limestones, clays, sand and gravel, and sandstones; all of which are of great economic importance in Connecticut.

As mentioned by Dr. Robinson in Bulletin No. 35, sometime the Survey should publish a report on various phases of the geography of Connecticut, dealing especially with its physical, economic, and human aspects. Such a report would be not only very interesting but of great educational value.

In zoölogy there is need of bulletins on the fishes, reptiles and Amphibia of the State; also on the sponges, zoöphytes, Annulata, spiders and mollusks. Several orders of insects remain to be treated, in a manner similar to that of the *Euplexoptera and Orthoptera*, Bulletin No. 16, *Hymenoptera*, Bulletin No. 22, and *Hemiptera*, Bulletin No. 34. Among these probably the order Diptera, or two-winged flies, should be given early consideration, not only on account of their great economic importance, but because there is now no single publication covering the Order. There are several books on the butterflies, and at least one on the moths, which can be found in nearly every library. Blatchley's *Coleoptera of Indiana* furnishes a convenient and reliable guide to the identification of the beetles, though it does not contain all genera and species occurring in Connecticut. It may be pointed out that most of the insects of economic importance in Connecticut have been dealt with in the twenty-five annual reports of the State Entomologist.

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

POPULAR BULLETINS

The question of the advisability of the Survey issuing brief popular bulletins should be given serious consideration. Most of the bulletins of the Survey have been monographic in nature or accurate lists of species. Such publications are necessarily rather technical and of course are of great scientific value. A bulletin with a large number of pages is often necessary to cover the subject. These voluminous bulletins are expensive and have been issued in rather small editions, varying from 2500 to 4500 copies.

It has been suggested that smaller bulletins be issued in larger editions, with the subject matter presented in more popular form, illustrated where possible, for the use of schools and nature students. Certain geological formations in a given locality could well be described in such a bulletin. Some other subjects that would lend themselves nicely to this form of treatment are *Common Plant Galls of Connecticut*, some of which are caused by fungi, some by mites, and others by three orders of insects, and would not otherwise appear together in a single publication; woody fungi; butterflies, and certain groups

of insects and birds. Possibly the bulletin on trees should be in this class.

INCREASED APPROPRIATION REQUESTED

The foregoing pages show the results accomplished by the Survey work now in progress, and investigations proposed and needed. The Survey has always been extremely fortunate in obtaining for publication manuscripts which have been prepared by professors or graduate students in our universities, largely as a labor of love. Such papers have been obtained at very slight cost, and doubtless others can also be secured. But special investigations are necessary for the preparation of reports on some of the subjects which need to be covered. The Survey has never had sufficient funds to employ trained investigators except for a short time during the summer vacation period. A larger appropriation would make it possible to employ one or more specialists for their full time until some of these subjects have been covered. An appropriation of \$10,000.00 instead of \$6,000.00 for the biennial fiscal period ending June 30, 1929 has therefore been requested.