

State of Connecticut



TENTH AND ELEVENTH BIENNIAL REPORTS OF THE
COMMISSIONERS

of the

State Geological and Natural
History Survey

1921-1924

Bulletin No. 35

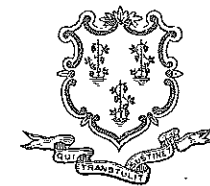
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State Geological and Natural
History Survey

H. H. ROBINSON, SUPERINTENDENT

BULLETIN No. 35



HARTFORD
Printed for the State Geological and Natural History Survey
1924

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State Geological and Natural History Survey

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OF THE COMMISSIONERS

OF THE

State Geological and Natural History Survey

of

Connecticut

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Published by the State
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LETTER OF TRANSMITTAL

STORRS, CONN., December 30, 1924.

HIS EXCELLENCY, CHARLES A. TEMPLETON,
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 tenth and eleventh biennial reports of the Superintendent, covering the period ending December 31, 1924.

Very respectfully,

CHARLES LEWIS BEACH,
Secretary of the Commission.

**TENTH AND ELEVENTH BIENNIAL REPORTS OF THE
GEOLOGICAL AND HISTORICAL SURVEY
OF CONNECTICUT**

SCOPE AND PLAN OF THE STATE SURVEY.

The act of 1903, establishing the Survey, proposed two subjects for investigation: (1) the geology, and (2) the natural history, or botany and zoology, of the State. It has been presumed to be the intent of the law that the work should be divided with some approach to equality between these two groups. The law further specifies three aims with respect to which the work should be prosecuted: (1) the purely scientific aim of advancing our knowledge of the geology and natural history of the State, (2) the economic aim of leading to the most effective utilization and conservation of the resources of the State, and (3) the educational aim of promoting the work of the schools of the State by the publication of the results of investigation, so far as possible, in a form adapted for the use of teachers.

The plan of organization which was outlined in the first biennial report has been retained. Only one salaried officer, the Superintendent, has been appointed by the Commissioners. Other scientists have been engaged, as the occasion called for, to investigate particular subjects and prepare reports thereon.

The contracts made with these scientists provide for an allotment for actual field expenses and for a salary during the time the investigator is at work in the field. In some instances an honorarium is paid to authors, in lieu of the foregoing expenses, for manuscript reports. In making new contracts it is the policy of the Survey to include an agreement as to the date at which the completed report is to be submitted and to discontinue allotments for projects on which no work has been done for several years.

The reports of the Survey are published in the form of paper-covered bulletins which are numbered consecutively. Each bulletin bears the name of the author, or names of the authors, and each author is responsible for his own work. In addition, a small number of the bulletins are published in collected form, in volumes having stiff board covers. Thus the first 32 bulletins have been collected in six large volumes, as indicated in the list of publications which follows. These volumes, on account of their substantial binding, are especially suited for public libraries and other institutions in which complete sets of the publications of the Survey are kept. The paper covered form in which the individual bulletins are issued is most convenient for the large number of scientific investigators, teachers, and students who are interested in a particular subject.

The bulletins are distributed liberally to colleges, public libraries, geological and natural history surveys, scientific societies, and to scientists of repute in the subjects with which the respective bulletins are concerned. They are given freely to the people of our own State and, when circumstances permit, to teachers who can use them in their classes. To other persons it is customary to sell the bulletins at prices sufficient to cover the cost of printing and transportation.

All bulletins issued directly by the Survey are distributed by the State Librarian, Mr. George S. Godard, who is the Distribution and Exchange Agent for the Survey. Many important scientific books and papers are received by exchange. All publications, whether received by exchange or otherwise, are deposited in the State Library, and in this way a valuable reference collection has been brought together which is constantly being increased.

LIST OF PUBLICATIONS.

The Survey has directly issued the following bulletins:

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 Dr. Laura Hatch, 100 pp., 12 figs., 14 pls., (approx.), In press.
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.

The following bound volumes of collected bulletins have been issued:

- I. Contains Bulletins 1 to 5 of the foregoing list.
- II. Contains Bulletins 6 to 12.
- III. Contains Bulletins 13 to 15.
- IV. Contains Bulletins 16 to 21.
- V. Contains Bulletin 22.
- VI. Contains Bulletins 23 to 32.

Reports on work done in co-operation with, and published by, the United States Geological Survey are as follows:

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.

Interest in the publications of the Survey and the usefulness of them to the people of the State and to scientists in general is indicated to some degree by the number of requests for copies. The following summary is furnished by the State Librarian:

Bulletin	Date of issue	Size of edition	Number of 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	200
5.....	1905	3,500	300
6.....	1906	4,000	Out of print
7.....	1907	3,500	Out of print
8.....	1907	3,500	375
9.....	1906	3,000	375
10.....	1908	3,500	350
11.....	1908	3,000	400
12.....	1908	3,000	Out of print
13.....	1910	3,500	725
14.....	1910	4,000	1,000
15.....	1910	3,500	825
16.....	1911	3,500	275
17.....	1910	3,000	575
18.....	1911	3,500	850
19.....	1912	3,500	1,800

Bulletin	Date of issue	Size of edition	Number of copies on hand
20.....	1913	4,500	1,100
21.....	1912	3,000	550
22.....	1916	3,500	950
23.....	1915	4,000	1,000
24.....	1915	4,000	1,000
25.....	1915	2,900	200
26.....	1918	3,000	900
27.....	1917	2,900	900
28.....	1919	2,500	150
29.....	1920	2,500	900
30.....	1920	2,500	500
31.....	1920	3,000	600
32.....	1920	2,900	400
33.....	1922	2,500	Not yet distributed
34.....	1923	3,000	1,000
35.....	1924		Not yet distributed

Volume	Date of issue	Size of edition	Number of copies on hand
I.....	1905	600	200
II.....	1908	600	150
III.....	1910	600	200
IV.....	1914	600	250
V.....	1916	600	350
VI.....	1921	400	300

Bulletins 1, 2, 3, 6, 7 and 12 are now out of print in separate form, although they may still be obtained in the bound volumes of collected bulletins. In view of the steady demand for the scientific bulletins, it seems highly desirable that new editions be prepared. In particular this is true for Bulletin 6, the Manual of the Geology of Connecticut.

The Survey has been very highly commended for the excellent quality of the reports that have been published and for the economical manner in which it has been conducted. The bulletins are widely distributed in this country and are called for by scientists and scientific organizations of foreign countries.

Since the last report of the Commissioners, five scientific reports have been completed. These are: (1) The Geology of the Stonington Region, by Dr. Laura Hatch (Bulletin 33), (2) The Hemiptera of Connecticut, prepared under the direction of Dr. W. E. Britton (Bulletin 34), (3) The Peat Deposits of Fairfield, Hartford, and Windham counties, by C. C. Osbon, (4) The Decapods of Connecticut, by Prof. A. E. Verrill, and (5) The Odonata, or dragon flies, of Connecticut, by Dr. Philip Garman.

Dr. Hatch has made a detailed study of the crystalline rocks of the Stonington quadrangle and of the New London quadrangle east of the Thames, except for a small area in the vicinity of Preston previously studied by Dr. G. F. Loughlin. Detailed study of the physiography and glacial geology was confined to the eastern part of the area. The bedrock geology is extremely complex, but the study has been sufficiently thorough so that the mapping of the region may be considered reasonably final. For this reason

Dr. Hatch's report is a very definite contribution to our knowledge of the geology of the State.

The report on the Hemiptera of Connecticut forms Part IV of the Guide to the Insects of the State. It has been prepared under the direction of Dr. W. E. Britton, who is also part author. He has been assisted by fifteen other entomologists who are specialists in their respective fields. The report is an important contribution to our knowledge of the insects of this Order, many of which are highly injurious to vegetation and are dangerous to animals and man.

The report on the peat deposits of Fairfield, Hartford, and Windham counties by C. C. Osbon, Editor of the Journal of the American Peat Society, consists of two parts: the first deals with the formation, occurrence, and uses of peat, and the second is devoted to a preliminary description of the deposits of the area studied.

Prof. Verrill has prepared an authoritative and comprehensive report on the Decapods of the State. These are ten-legged crustaceans, such as lobsters and crabs, and the report thus has an economic, as well as a scientific and educational, interest.

The report by Dr. Philip Garman on the Odonata, or dragon flies, of Connecticut, will form part of the Guide to the Insects of the State. The insects of this Order have an economic value because they feed on other insects, such as mosquitoes and gnats, which are certainly troublesome, and may be dangerous, to man.

OTHER STATE SURVEY WORK.

Reports have been prepared by Prof. W. G. Foye on the geology of the Guilford, Saybrook, and Norwich quadrangles and on the New London quadrangle west of the Thames. They will form part of a general report on the geology of Eastern Connecticut. The geology of this part of the State is highly complex and for the first time is being studied in sufficient detail to give a definite idea of the character and distribution of the various formations.

A report on the mineralogy of the State is being prepared by Earl V. Shannon of the U. S. National Museum, but owing to the circumstances governing the work it will not be completed for several years. It is intended that the report shall enumerate as completely as possible the different minerals of the State, the localities where they occur, their geological relations, and economic value.

Dr. Ernst Antevs has assisted in his study of the banded clays between Hartford and New Haven. He had previously studied those between Hartford and Springfield, Mass. By the use of

refined methods of study Dr. Antevs has constructed a time scale of calendar years covering the period during which the last ice sheet was retreating northward across Connecticut. The results of his studies can not but prove stimulating to all who are working on, or are interested in, the problems of glacial geology.

The report by Prof. G. E. Nichols on the vegetation of the State is nearing completion and should be ready for publication during the coming year. This report describes the various types of vegetation and their distribution with reference to topography, soil, and water. It furnishes basal data for the reclamation of abandoned lands and the utilization of swamp land.

Prof. Wm. North Rice, for many years Superintendent of the Survey, is preparing a bulletin on the geology and natural history of the region about Middletown which will serve as a guide book for scientists and teachers. It is expected that it will be completed during the coming year.

Arrangements have been made with Leonard M. Tarr, Meteorologist, U. S. Weather Bureau at New Haven, for the preparation of a manual on the climate of the State. The location of the State with respect to storm tracks and the general character of the storms passing over the region will be considered; records will be analyzed to show the characteristics of the weather; and the effects of the weather on various crops will be taken up. It is expected that the report will not be completed before 1926.

Prof. Alex. Petrunkevitch, because of unusual demands upon his time, has found it necessary to postpone the completion of his report on the spiders of the State. It is hoped, however, that this interesting report will be ready for publication by 1926.

CO-OPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY.

Beginning in 1911, the State Geological and Natural History Survey co-operated with the United States Geological Survey in a study of the ground water resources of Connecticut. Thus far, 87 towns have been surveyed which comprise 45 per cent. of the area and include 67 per cent. of the population of the State. By the terms of the contract, the United States Geological Survey assumed responsibility for the prosecution of the work and H. E. Gregory of the Federal Survey, and later Superintendent of the State Survey, was appointed to direct the investigations. The results of these investigations are published by the United States Geological Survey, the expense being met by the Federal Treasury. These reports are not distributed by the State Survey; copies may be obtained by request from The Director, U. S. Geological Survey, Washington, D. C.

The purpose of this study has been to determine the location, amount, and quality of the underground waters of the State. The value of such a survey depends upon its usefulness both to communities having a common supply and to individual landholders, consequently the preparation of the reports has involved detailed mapping and local description. The position of ground water with reference to the land surfaces has been determined, areas of open field, forest, rock, and types of glacial soil have been outlined, water from springs, wells, and brooks has been analyzed, and studies of the most sanitary and economical types of supplies for farms and villages have been made.

It is believed that this work, because of its comprehensive nature, has high value. The reports record basal studies the results of which are not only immediately useful but will become more so as the population increases and problems of water rights and sanitation become more complex. This work can be continued to advantage. The remaining shore, and adjacent towns should be studied, in particular those between Westport and Wilton and the Housatonic River.

The following reports are in course of publication:

Waters of the Pomperaug Valley, by Dr. Norah E. Dowell. This report is based on field work done in 1913 by A. J. Ellis, and a series of stream, well, precipitation, and evaporation measurements carried on from May, 1913 to December, 1916 by E. A. and G. A. Parkin and R. V. Woodin under the direction of Mr. Ellis and H. S. Palmer. Owing to the death of Mr. Ellis the work of completing the report has been assigned to Miss Dowell.

Ground Water in the New Haven area, Connecticut, by John S. Brown. This report deals with the ground water resources of the towns of Bethany, Branford, Clinton, Durham, East Haven, Guilford, Haddam, Killingworth, Madison, Milford, New Haven, North Branford, North Haven, Orange, Wallingford, and Woodbridge.

A study of Coastal Ground Water, with special reference to Connecticut, by John S. Brown. A special study of the contamination by salt water of wells located close to the shore. The results are of much importance to manufacturers who may contemplate developing local supplies for their factories, and to all persons living close to the shore who have to depend on well water.

PROPOSED STATE SURVEY WORK.

Geology.

The Manual of the Geology of Connecticut (Bulletin 6) has been out of print for some years, and in 1922 the edition of the

Preliminary Geological Map of the State (Bulletin 7) was exhausted. Because of the constant demand for these two bulletins, especially No. 6, it is most desirable that new editions be prepared. The original reports, based on work done twenty years and more ago, are in some respects out of date. This applies more particularly to very considerable areas of metamorphic and associated igneous rocks, for our knowledge concerning such kinds of rocks has greatly increased since the original reports were issued. It is inadvisable, therefore, to reprint the original bulletins; on the contrary, they should be thoroughly revised on the basis of fresh study.

With this end in view, Prof. Foye has been remapping the eastern crystalline area during the past five years and hopes to complete his field work this coming season. In the western part of the State the Bridgeport quadrangle and portions of the Granby, Meriden, and New Haven quadrangles have been remapped. Progress has been slow on account of the difficulty of securing the services of geologists familiar with the mapping of highly altered rocks such as occur in this region. The Triassic rocks will require very little restudy. The revised edition of the Manual, therefore, awaits the completion of work in the western crystallines.

A comprehensive study of the glacial geology of the State should be made. The deposits of glacial origin are widespread and include clay, sand, gravel, and all soils. All the lakes and waterfalls are due primarily to glaciation. In addition to its scientific interest, the study thus has a very decided economic bearing. In fact, on account of the amount of work involved, it is preferable to study these two aspects of the subject separately.

The clays and clay industries of the State were studied by G. F. Loughlin in 1904 and the results published in Bulletin 4. In view of the time that has elapsed since that report was made, twenty years, and because of the sustained interest in the subject, it is recommended that the clays and clay industries be restudied and in addition that the sands and gravels be investigated, the two studies to be published in a single bulletin.

Feldspar and quartz have been quarried in Connecticut for many years and it is desirable that a study be made of the location and extent of such deposits and the economic importance, especially, of the unworked veins.

A special study should be made of the Stockbridge limestone formation in the western part of the State for the purpose of delimiting the calcitic and dolomitic beds that compose it. This study is primarily economic and of value to the lime industry.

Up to the present time no reports have been published on the geography of the State, although the physical side of this subject has received incidental treatment in several of the geological bulletins. Connecticut, however, is rich in interesting geographic material and it is believed that a general report covering the various aspects of this subject, such as the physical, economic, and human, should be prepared. A report of this character would undoubtedly be of great educational value.

Botany.

The Catalogue of the Flowering Plants and Ferns of Connecticut (Bulletin 14), published in 1910, contained all the species that were known at that time. Since then a considerable number of new species have been recognized, and others no doubt will be as time goes on. It is recommended that this new material, when sufficient in amount, be published as a supplement to the original report.

It is recommended that the fresh water algæ be restudied, as more recent work has indicated the existence of a much greater number of species than was described in the original report, which was of a preliminary nature. A study should also be made of the marine algæ along the Connecticut shore. The results of both studies should be published, if feasible, in a single bulletin.

A bulletin on the trees of the State should be issued. Preferably it should deal with those species which are of economic value, not only on a large scale but also on a small scale in local industry and on the farm. It should consider how such trees are best grown, the character of the different woods, and the various uses to which they may be put. When one realizes what the forests of the State were and what they now are, the importance of growing trees can hardly be over-estimated.

Zoology.

The various bulletins on the insects of the State, and especially those belonging to the Guide to the Insects of Connecticut prepared under the direction of Dr. W. E. Britton, have been very highly praised and are in wide demand. Requests for the last bulletin (No. 34), for example, have been received from every state in this country and from many foreign countries. It is strongly recommended that additional reports of this character be published.

It is also advisable that bulletins should be issued, as circumstances may warrant, on the mammals, fishes, reptiles, and Amphibia. Publication on these subjects is desirable from both the economic and educational viewpoints.

APPROPRIATION DESIRED.

The work of the Connecticut Geological and Natural History Survey has been fully justified by the results achieved. It has been highly commended by educational and scientific interests and by business men both within and without the State. The simple but flexible form of organization has permitted a large amount of creditable work to be done at an unusually low expense and allows the Survey to meet any request that may be made for its services.

Although a large sum could be profitably spent on numerous problems which properly come within the scope of the Survey, the Commissioners believe that past results warrant a continuation of the policy of utilizing to the utmost a small but regular biennial appropriation.

They request, therefore, that the appropriation of \$6,000 be renewed for the years 1925-1926.