

State of Connecticut

TWENTY-FOURTH BIENNIAL REPORT
OF THE COMMISSIONERS OF THE

STATE GEOLOGICAL AND NATURAL HISTORY SURVEY

EDWARD L. TROXELL, Ph.D., Director

Bulletin No. 79



HARTFORD

Printed by the State Geological and Natural History Survey

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State Geological and Natural History Survey
of Connecticut

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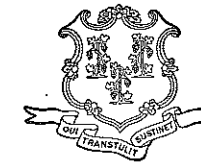
Twenty-fourth Biennial Report of the
Commissioners

OF THE

State Geological and Natural History Survey

1949-1950

BULLETIN No. 79



HARTFORD

Printed by the State Geological and Natural History Survey

1951

LETTER OF TRANSMITTAL

Hartford, Connecticut

February 1, 1951

His Excellency, John Davis Lodge,
Governor of Connecticut
Hartford, Connecticut

Sir:

I have the honor to transmit to you herewith on behalf of the Commissioners of the State Geological and Natural History Survey, in compliance with past custom, the twenty-fourth biennial report of the Survey, covering the two years ending December 31, 1950.

Respectfully submitted,

EDWARD L. TROXELL,

Director.

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TWENTY-FOURTH BIENNIAL REPORT OF THE GEOLOGICAL AND NATURAL HISTORY SURVEY OF CONNECTICUT

INTRODUCTION

The Function of the Survey. It is appropriate that one be reminded of the purpose and function of the Survey; it is threefold: research in natural science broadly, the recording and promulgation of scientific information, and the promotion of our natural resources. To that end and for that purpose the authority of the Survey is invested in a commission representing the chief educational institutions of the state, together with the Governor *ex officio*.

The State, not to mention the Survey itself, is most fortunate in having an executive board of this sort which brings to it the experience and enthusiastic interest which the Commissioners are capable of giving. Not only do these scientists, chosen from the faculties of our colleges, administer the Survey, the funds, the appointments, *et cetera*, but, because of their scientific and administrative training and experience, they are most active in planning and assisting in all of the scientific investigations. It has long been a tradition of the Survey, since its founding by William North Rice and others in 1903, to promote studies and publish the bulletins that have been of importance to science in a deep and broad way everywhere.

While the supervision of the agency is placed in the hands of an appointed administrative officer, the Director, its interests and welfare have been jealously guarded by the board of Commissioners itself. It is a pleasure to recognize and record the generous and able services of Dr. Adolph Knopf who not only has contributed to the functions of the Survey through his writings, discussions, and criticisms, but who served effectively as Acting Commissioner in the absence of Professor Chester Lohgwell, representing Yale University, during the year 1948-1949.

It is readily understandable that considerable concern was felt for the future of the Survey when it was faced recently with a plan for the regrouping of some of the State agencies and administrations. The suggestion was made that the Survey be associated with other commissions of widely diverse interests, that a group of agencies unrelated might be put in the hands of a single supervisor, that our success and hope for support from the Legislature might not have been based entirely on our own achievements alone but also on other considerations

of less importance and consequence. This might have jeopardized the enthusiastic services and support of those who are loyal to the Survey for its own sake and whose wholesome interest is based on its achievement as an individual agency. The Commission would probably then be unwilling to serve merely as advisers if they have no voice in determining policy, selecting our professional specialists, assigning tasks, nor authority to plan and promote our large scientific investigations in natural history. The unique objective service rendered by the Survey would have been sacrificed.

Education in the State in the Natural Sciences. Promulgation of information on geology and the natural sciences is always an important enterprise. There is a definite obligation to release information gathered by the workers on the Survey for its own sake and value, as well as for the pleasure of many people. The Survey has always stood ready to serve the numerous clubs and organizations established in the State for the purpose of studying the various phases of nature, such as minerals, plants, and animals, popular hobbies of our people. Education may be advanced in many ways: through the many printed articles which have been put out and through the display signs, public lectures and exhibits of various sorts which have for their purpose the inspiring of an interest in nature.

As an aid in our program of education the Survey has inaugurated a new type of publication, the Miscellaneous Series. This is suited to the shorter articles, papers, reprints, *et cetera*, which may be presented from time to time and are a result of investigations we have promoted.

At the end of this paper one may see the quadrangles on a map of the State that shows the approximate areas recorded by the operations of the various workers, especially in geology. These improved, larger scale quadrangles with smaller contour interval to show the topography are easier to use and offer the greatest value to engineers, scientists and various other individuals and groups who make use of information on the relief of the land.

Through the activity and enterprise of the Commission of the Survey it has been able for many years to publish bulletins of state, national and international interest. The number of papers runs to 80 approximately; it means more than one and a half papers per year, on the average, since the organization of the Survey. Many of the projects in progress mentioned in the Biennial Report of 1948-1949 are now realized in completed manuscripts; there is therefore an obligation to publish these works that have been encouraged and supported financially. During the last year and a half we have had for the first time a Publication Fund invested in the Survey. This has been entirely exhausted, along with other sums intended for contractual services, in the printing of important papers. Yet our backlog of unpublished manuscripts of a decade is still very large.

The bulletins already printed and investigations that have been completed with manuscripts on hand give great promise of accomplishing one of the purposes of the Survey as set up by law, namely, the presenting of information on science to our people. These papers are based largely on original investigations and will be of great value and wide use. Some of our bulletins have been exceptionally popular; that on the fishes, published a few years ago, was exhausted in one year and had to be reissued. Many of our bulletins go to distant lands and are recognized as authoritative references.

Service in the War Emergency. The Commissioners of the Survey have in mind the devotion of our energies largely to things that will aid the nation in the present crisis and special inquiries will be made to see what can be done to contribute to the general welfare. Until our position in the war is clarified it will be necessary to carry on our routine duties and to attend to those things which through the longer period of time are pressing for our attention. These include general research, the publication of the great backlog of manuscripts on hand, and the duties that regularly occupy the attention of the Director in his office.

Among the things that might contribute most to the war problem at the present time would be the studies of our geological formations that have economic value, of our plants and animals that have a direct bearing on our welfare and needs. With respect to the first the Survey already has a scheme for turning the attention of our geologists toward our limestone deposits; these have many uses and at the moment we are looking forward to the utilization of the carbonate rocks in connection with the proposed new steel plant.

The peculiar limestone which we have in Connecticut, commonly called dolomite, contains magnesium in quantity, and in the last great war this had many uses. The magnesium itself is a light metal which can be used in construction as a substitute for, or as an alloy with, aluminum. It is common knowledge that many of our very effective fire bombs were made from the magnesium metal.

The search for various metals and minerals, their mining and further development, will be a first thought with the geologists in their field work for the State.

THE FUTURE POLICY OF THE SURVEY

Relative to "long time planning" it is well that we have a definite policy in mind, to note and record what we hope to do in ten to twenty years and then to work toward that objective constantly. It will be necessary to modify as occasion and the shifting times demand. The basis for a revision of our plan and purpose would be the making of new discoveries, or our success and our failures in the carrying out of our purpose as the years go by. As an objective for the future we should

endeavor to select the larger problems and attempt their solution, look over the various fields of natural science, and choose the subjects to be studied, whether organic or inorganic. In the field of living things there is a vast area to survey, while many different aspects of geology await our attention.

Having selected our line of research two other factors must be faced, first, the finding of specialists who can carry on the research and, second, the securing of funds. Three things have been listed here: 1) the problem to be considered, 2) the expert who can accomplish the work, and 3) the money to support the study. The order may be changed, as has been done in the past, and having the funds, the scientist to do the work, his advice may then be sought in selecting the field of research. Or we may have the worker, fully appreciate the needs of certain fields of investigation, and then seek financial support.

Various important considerations have a part in our planning for the future and the first should be the publication of manuscripts on hand. Even at the risk of suspending our planned research, our field operations, it may be necessary to pursue this idea as a definite policy. Giving the results of the work accomplished to the public should take precedence over all else; its urgency is often presented and is obvious.

The second objective should be directed to a program of investigation of broad scope in the natural sciences that will yield the results anticipated by the founders of the Survey. One of the basic needs for all field investigations is a suitable map, not only the topographic maps which are now rapidly being completed by the U. S. Geological Survey, but also geological maps. There is great need for the delineation of the areas of our rock formations because these have wide usefulness, not only in the investigation of our mineral resources but for highway, engineering, and many other construction enterprises.

A preliminary geological map seems now almost ready for publication and it will be a fortunate moment when the area completely mapped will include the whole state.

In our plans for the future it is of prime importance that we should be aware of the existence of other agencies in the State that are working on similar lines. This is important in order to refrain from encroaching on their fields of endeavor; but more important is it for the Survey to look to the possibility of cooperating with them. There exists today a ready exchange of ideas and cooperation with such groups as the Health Department, the Water Commission, the Highway Department, the Development Commission, the Park and Forest Commission, and many others. Any long range plan might assume that our Survey will grow and that, in its increased influence, it may be in a position to determine its lines of activity.

LINES OF RESEARCH IN BIOLOGY

It would be well if the Survey could look forward to a thorough study of many of the living things of the State, such as has been done for certain families of the insects. It offers both scientific and economic interest of a high order for us. For the animal life it would be of value to have their life histories, instincts, and behavior, the ecology, breeding habits, and their use to man, presented.

From time to time important studies have been pursued on groups of animals and plants and it is hoped that these investigations may be pressed forward. A bulletin on the fishes, another on the reptiles, one on the amphibians, one on the mammals, have been done with great success. Such studies could go into some detail with respect to the plant life as well, especially since other agencies dealing with our forests and other plants are not concerned with research work as such.

There is prospect of a new bulletin on the mammals to be published under the sponsorship of the Survey and just now two separate lines of investigation are being carried on at Connecticut College in biology.

Studies in the Isolation of Field Mice. Supported by the Survey, Dr. Bernice M. Wheeler of Connecticut College has undertaken the study of the relation of field mice on Block Island and the mainland. The chief purpose has been to determine whether or not a new species has evolved on the island, whether the larger size of the insular animals is indeed indicative of a new variation. It is hoped that these studies may give an answer to this problem.

The research is based on skins and skeletons that have been secured on both the mainland and Block Island, and also on the crossing of the two types to determine whether hybridization can be accomplished. The work may provide an understanding of the species of the Island mice and furnish factors of fundamental importance to the processes of evolution.

Research on the Diptera, the True Flies, of Connecticut. Extensive work has been carried on in a study of the Diptera, or true flies, of the State; several bulletins have already been published, including No. 75 which is described on a later page of this report. It is hoped that more bulletins will come out in the next biennium. The Survey has the manuscript for the fifth group, or fascicle, of these insects in its files at the present time. Two other fascicles will soon be completed, Nos. 6 and 7.

The first six fascicles are old studies of ten or a dozen years standing, begun by Dr. Britton; fascicle 7 will be entirely new. The desirability of early publication of all of these papers rests on the fact that it completes entirely the investigation of the primitive flies, the Nematocera.

The Collection of Plants at the Connecticut Arboretum. The Arboretum established at Connecticut College has for its purpose not merely the scientific investigations but primarily the assembling and display of all the trees and shrubs native to the State. The Survey for some time now has taken pride in contributing to the support of this program. Under the direction of Commissioner Goodwin, Mr. Kaleb P. Jansson has worked as technician and Dr. Katherine H. Heinig has been carrying on the research.

During the Biennium some three dozen different species of woody plants have been added to the Connecticut Arboretum. Through the years sixty other species and varieties of native raspberries, blackberries, and brambles, the genus *Rubus*, have been secured by Mr. Jansson while employed by the Survey.

Dr. Heinig, of the Department of Botany of Connecticut College, in her study of this material has made cytological examinations designed to determine the classification and interrelationship of the various types. Chromosome behavior and pollen grain formations will be further studied to determine the possible existence of true species.

Triassic Footprints of the Connecticut River Valley. Entirely on his own initiative Dr. Richard S. Lull, now retired from Yale University, has undertaken an extensive revision of his earlier work on the dinosaur footprints for the Survey. This will be a description of these relics of the past found distributed widely through Connecticut and Massachusetts and is intended to replace Bulletin No. 24, dated 1915.

The study when published will be almost entirely a new treatment; it will have new drawings to replace the old ones. The revised conclusions and deductions will be based on reconstructions and a study of track patterns rather than isolated footprints. The redrawn figures and diagrams will be most useful in the identification of the species of these ancient reptiles. It is fortunate to have an expert giving attention to the re-writing on this rather popular subject and it is to be hoped that the manuscript will be printed soon after it is completed, in part as a tribute to the author.

Dr. Lull, at the invitation of the Survey, visited the Amherst College Museum to study first hand the extensive footprint collection to be found there, which includes many of the old, original types. It will be interesting to have a new bulletin on these footprints and the animals that made them, about which the poet wrote so long ago: "... footprints on the sands of time."

LINES OF RESEARCH IN GEOLOGY

Among the larger tasks confronting us are problems in the field of geology which can be a further study of minerals and rocks, of topographic features, of glaciation, *et cetera*. Many aspects of this field of

science have already been most satisfactorily treated. In the approach to the matter of mapping the State, decision has been reached on a program to be followed; it is hoped to do this quadrangle by quadrangle. Already six or eight areas have been selected and assigned to our professional specialists; some have been completed, others are in progress. This follows the procedure mapped out at the Yale meeting of May, 1948, when a definite program was proposed and adopted, a plan considered to be consistent with our purpose of carrying on work on those things that are vital and useful.

There are approximately 24 of the old quadrangles, topographic maps on a scale of one inch per mile, together with parts of ten others that border the State or the shore. The State is being remapped by the U. S. Geological Survey on a larger scale and when the work is finished there will be approximately 100, 7½ minute quadrangles, or two inches per mile and of 10 foot contour interval. These maps furnish an excellent foundation for the work in geology in all our field endeavors.

Through the years one item stands out conspicuously in our minds, namely, the need for a broad general discussion of our geology. This must be a review in simple terms, intelligible to the average reader, and yet of considerable scientific value. It should incorporate the latest ideas and techniques, be full of valuable information, and include the most recent discoveries.

A Geological Map of Western Connecticut. Following the footsteps of Dr. William Agar, and using data compiled by him, Dr. Eugene N. Cameron has been considering and working toward the production of a detailed geological map of the western part of the State. This area comprises largely the geology of crystalline rocks and is referred to usually as the Western Highlands. The map when completed will extend nearly to the Hartford line and will include part of the central Connecticut Triassic formations.

A geological map of the entire state would be of great importance and is in constant demand; it is the feeling of the Commissioners that this first step should be taken, toward the completion of a map of the whole State, the presentation of the western half. It is planned to use a scale of 1. to 125,000 and for this half of the State the size of the map will be approximately two by three feet.

Even a map of the western half of the State will be most valuable and generally useful to many organizations as well as to individuals of Connecticut. It is designed to show the locations and outlines of the major rock units, together with their structural relations. It will doubtless be accompanied by cross sections drawn both to show topographic features above and structures beneath, "slices," as it were, down into the crust of the earth. There is promise that the map of the western half of the State will be submitted during the year, 1951.

ACCOMPLISHMENTS OF THE BIENNIUM, PUBLICATIONS

Triassic Sedimentary Rocks of Connecticut, Bulletin No. 73.

One of the most valuable papers published recently is that by Dr. Paul D. Krynine on the Triassic formations of the State; it deals with the various aspects of the geology of these rocks, especially their origin. This important paper suffered greatly by lying in the keeping of the Survey for a dozen years or more pending allocation of funds for its printing. Awaited eagerly by educators for use with their students, the manuscript has now been put into book form. It has been highly praised in reviews and otherwise by those who have read it.

The old problems of the red beds and lava rocks, so familiar in the Connecticut Valley, have been met courageously; the author has brought together what was previously written, going on to original conclusions of his own. Heretofore there has been no extensive, intensive, petrographic study of the rocks of this Newark Series. The analysis of the data collected will serve as a model for other such studies through the years and many students examining similar rocks elsewhere will be helped by the work of Dr. Krynine on the red bed problem. The significance of the detrital feldspar, the role of climate and relief in sedimentation, the interpretations he puts into his study, all are most illuminating.

Dr. Krynine has shown great skill in putting together the various details on the geology into a unified fabric. There is a wealth of assembled information and his conclusions on the origin of the primary colors, the source of materials that accumulated in alluvial fans, the nature of lake and swamp deposits, all of these are well organized and well presented. An important part is based on a study of thin sections and heavy residues. The value of the work is undoubted.

The Geology of the Eastern Highlands, Bulletin No. 74. For a number of years the late Dr. Wilbur G. Foye, Professor of Geology at Wesleyan University, was an ardent student of the geology of the crystalline rocks of eastern Connecticut. For ten years before his untimely death in 1935 he had been mapping the three 15 minute quadrangles, Guilford, Saybrook, and New London. Instead of completing his studies and publishing on these areas immediately he turned to reconnaissance work in the remainder of eastern Connecticut, planning to write a general bulletin on the geology of this part of the State. He had made a pencil draft of his report together with rough copies of most of the illustrations. Selections from Dr. Foye's voluminous notes and drawings were made by Dr. Joe Webb Peoples, Commissioner of the Survey, which were carefully revised and edited by Drs. Knopf and Flint of Yale.

Thus the original work of Dr. Foye has finally been made a permanent record for the information of geologists as a bulletin. This is an important report and gives basic data that will be most useful as a

guide in detailed studies by other students. The areal survey and structure sections will provide the basis ultimately for a map of the whole of the eastern half of the State, a continuance of what has already been done in western Connecticut by Dr. Cameron.

The Fourth Fascicle of the Diptera, Bulletin No. 75. For many years the Survey has sponsored the work and publication of bulletins under the general title, "Guide to the Insects of Connecticut." It is a distinguished series that was initiated in 1911 by Dr. W. E. Britton, then Director of the Survey. Manuscripts dealing with various orders and a few of the 86 families of flies have been completed and the results published. This work was continued by outstanding entomologists in cooperation with the Department of Entomology of the Connecticut Agricultural Experiment Station, under the supervision of Dr. Roger B. Friend.

A new bulletin has just been published on the Tabanidae, common horseflies and deerflies, "gadflies" of the Bible. Dr. G. B. Fairchild, the leading authority on this subject — grandson of Alexander Graham Bell — explains that the females are bloodsucking, a well known pest both to animals and men. The new bulletin provides keys and drawings for the recognition of practically all of the types likely to be found in the State, based on an exhaustive study of the known records. Dr. Fairchild is now a member of the faculty of the University of Minnesota and the Survey is fortunate to have had him take part in this important research.

A portion of Bulletin No. 75 is given over to the family Phoridae; these are tiny humpbacked flies which few except the specialists would recognize. This work was done by Professor Charles T. Brues, formerly of the faculty of Harvard University, an authority on the subject. The Phoridae show many contrasts in structure and form in their adaptation as parasites on the lower invertebrates. Some lay their eggs in the carcasses of dead snails and beetles or even on lowly plants. They are frequently guests of ants and termites and are notable for their highly specialized breeding requirements.

Connecticut has few records of these rare flies and Professor Brues has added considerably to our knowledge of them. His investigations show the various parts of the anatomy of a large variety of the species, especially the wings, which may be entirely lacking in the female.

Other bulletins on the Diptera, or true flies, will be published soon by the Geological and Natural History Survey. Expedition of these publications will depend at this critical time on the funds available.

The Mount Prospect Complex, Bulletin No. 76. For many years Dr. Eugene N. Cameron has been studying and writing on the geology of western Connecticut. This work, in cooperation with Dr. William Agar, has already been referred to in this report in a statement concerning the making of a map of the crystalline highlands.

Dr. Cameron has discovered many features of value in his studies and it is probable that from time to time other writings on the various rock formations will appear. Now we present to the public a manuscript on one specific formation of considerable interest, the complex rocks that underlie Mt. Prospect in the northwest corner of the new Litchfield quadrangle. While this is a problem in pure science and so far as we can see at the present time has no definite economic purpose, it constitutes a valuable piece of research. It provides a pattern, a diagnosis, that may aid greatly in our understanding of this and other similar areas.

Related to this work on Mt. Prospect is the study of an interesting mass of granite in the Woodbury region. A careful investigation of its peculiar structure may ultimately be much more than a mere analysis of the "Woodbury granite" itself; it may help in our general geologic studies of the whole State and lead to a printed bulletin. It is always possible that a problem in pure science such as this may lead to facts of economic importance.

Connecticut Minerals, Bulletin No. 77. Whether merely as an educational offering or for its particular value, the Survey is happy to announce a new bulletin on the minerals of Connecticut. This will take the place of Bulletin No. 51, 1931, long since out of print. This book will be called "Connecticut Minerals," Bulletin No. 77, and it promises to fill a great gap in our science series.

The manuscript of this new bulletin was written by Mr. Julian A. Sohon, Librarian of the Bridgeport Public Library; it is the culmination of studies born of curiosity that began more than 15 years ago. It is based not only on examination of mineral localities but also on data compiled from books in many libraries.

Mr. Sohon first made a bibliography, then an index for minerals and localities. This grew rapidly and indeed in manuscript form proved useful in the search for strategic minerals during the recent World War II. When the manuscript was offered to the Survey and accepted by the Commissioners for publication, to satisfy the author it was subjected to the editorial scrutiny of an expert mineralogist, Dr. Alexander Winchell.

"Connecticut Minerals" lists all the types found in the State; it gives description, location, and the qualities of the mineral species. Unlike the older volume it does not go into the philosophy of minerals nor does it discuss in detail their optical and chemical properties, crystallography, nor the nature of rocks. While it is not presented as a research effort on minerals, yet it is a complete rewriting of the older bulletin and a compilation of data, a reference work intended largely as an aid to the collector.

The Hebron Gneiss, Bulletin No. 78. In the region of Willimantic, including the parts of six quadrangles, Dr. Janet M. Aitken has been investigating the geology of the Hebron gneiss. This work con-

sists of making of stratigraphic sections, examining the petrology and structure, and has led to an 80 page manuscript for publication by the Survey. Specifically the investigation has gone into parts of the following quadrangles: Rockville, South Coventry, Spring Hill, Willimantic, Marlboro, and Columbia. This slightly irregular area, combined with the studies of other scientists in neighboring sections, makes an appreciable step toward the geological mapping of the eastern part of the State.

Dr. Aitken's research involved an irregular area because it is the study of a particular formation, the Hebron gneiss. From it the conclusion is reached, as the investigation proceeds, that we cannot hasten to date our metamorphic rocks; that considerable time is required on the petrology and structure and that much more careful structural work is needed based on petrographic studies to determine the boundaries of the different formations. The report is accompanied by many tables and a detailed geologic map.

A NEW TYPE OF PUBLICATION, THE MISCELLANEOUS SERIES

In order to accommodate some of the smaller papers and reprints to be put out by the Survey the Commissioners have authorized a new type of publication, the Miscellaneous Series. At the present time four of these have been published, two of them original manuscripts and two others, reprints of printed articles, work on which was supported by the Survey.

A Suite of Rocks and Minerals, Miscellaneous Series No. 1.

- This brochure of 20 pages, together with a collection of mineral and rock specimens, has recently been prepared by the Survey. While awaiting the preparation of the more extended treatment of "Connecticut Minerals," Bulletin No. 77, and to supply a specific demand for samples of our minerals, there was prepared a suite of 36 specimens commonly found in the State, this to be accompanied by the printed article. The manuscript was prepared by Mr. Solon W. Stone of Trinity College and was edited by Dr. Adolph Knopf of Yale University.

The descriptive portion serves as a guide for the samples collected; it tells where they may be found and something of their characteristics. It is a source of regret that the first hundred boxes assembled had to be limited largely in their distribution to schools of the State. When, however, the first supply was exhausted by the great demand a new suite of minerals was authorized by the Commissioners and is in process of formation; it is not expected to be for general nor wide distribution.

An Exposure of the Triassic Eastern Border Fault, Miscellaneous Series No. 2. Dr. Ralph E. Digman, publishing in the *American Journal of Science* in January, 1950, explains that the purpose of his paper is to call attention to an exposure of the great fault that bounds the Connecticut Valley Triassic basin on the east. It is of importance because it is the only extensive exposure of this fault yet to be revealed to the eyes of man. He describes the material found in the fault zone, gives the trend of the fault and its angle of dip, and points out that the lava flows widely distributed along the Connecticut River actually reach the faulted zone.

The Litchfield Quadrangle, Miscellaneous Series No. 3. In his studies of the geology of western Connecticut, specifically in the region of Litchfield, Dr. Robert M. Gates has carried on investigations for three field seasons. In addition to this he has done much laboratory work and writing. The first publication coming from these studies of the region is restricted to the Litchfield 7½ minute quadrangle. The report consists of manuscript together with a map of the quadrangle in six colors showing the distribution and structure of the rocks.

This is the first of the series of quadrangle investigations proposed at the Yale meeting of May, 1948, when it was concluded that would be the best manner in which to develop the geology of the State as a whole. This ambitious schedule constitutes a part of our so-called 20-year-plan. These detailed, large scale maps will have information of great value to the Survey, to the Highway Department, to engineers, to soil scientists and agronomists, to industries, and to students of our natural resources.

An intensive study of a single quadrangle such as this offers a basis, a point of departure, for the investigation of the adjoining territory because of the similarity of rock types. Dr. Gates has made routine petrographic studies of the formations along with the compiling of data for the map and the report.

Woody Plants Growing in the Connecticut Arboretum, Miscellaneous Series No. 4. This is reprinted from the *Connecticut Arboretum Bulletin* No. 6, written by Dr. Richard A. Goodwin and Dr. Katherine H. Heinig, both of Connecticut College; the collecting and care of exhibits was in the hands of Mr. Kaleb P. Jansson. The work has been supported by the Survey. Dr. Heinig's investigations are further referred to under "Lines of Research in Biology."

The original article consists of a check list and guide to the Arboretum; it gives a list and the locations of the various species of woody plants and is a labeled, study collection of trees and shrubs native to the State.

QUADRANGLE STUDIES LARGELY COMPLETED

On the map which accompanies this Biennial Report we have outlined several areas in Connecticut which constitute quadrangle studies in various stages of completion. In some cases the investigation may

extend beyond the quadrangle boundary, or may involve only parts of several different quadrangle maps. Two of these areal investigations have been completed and published; they are the reports, the one by Dr. Janet M. Aiken on the Hebron Gneiss, the other by Dr. Robert M. Gates on the Litchfield quadrangle. They have already been described.

For the other sections shown on our index map the reports may be already completed, may be in progress, or may include work accomplished largely by other agencies, the U. S. Geological Survey, for instance. It is a source of great satisfaction to see the detailed investigations going forward in these rather critical areas.

The Geology of a South Central Connecticut Area, by Drs. Harry M. Mikami and Ralph E. Digman. Two geologists are collaborating in the study of an irregular area in the southern part of the State; Dr. Mikami is investigating the petrography and Dr. Digman the structure of the rock formations. Although the areas as originally examined were separate studies they were found eventually to overlap and to combine ideally into a unified investigation; therefore, because of the close cooperation of the authors, both in their field work and their writing, the manuscript will be published as one operation. As usual the accompanying maps and drawings will show rock exposures, the contacts, the formation boundaries, and structures, together with the basis for their interpretations.

Dr. Digman's original thesis emphasized the Killingworth Dome but brought in parts of the Triassic formation of the Connecticut Valley that borders his section on the west. Primarily it was concerned with the structure of the crystalline rocks of the dome, a definite unit which he discusses in its regional relations together with the supposed origin of the dome itself.

The Preston Gabbro of Eastern Connecticut, by Dr. Charles B. Sclar. This is a study of the rocks of a portion of the Jewett City and Old Mystic quadrangles. Because of the advantage of our new topographic maps the work of Dr. Sclar has been greatly facilitated; he has been able to map the rock exposures and the changes from formation to formation in an area of considerable complexity.

The Preston Gabbro itself was once molten material that was intruded into the existing country rocks which in part consisted of limestone. Dr. Sclar's interpretations are somewhat different from those of the older authors who worked in this area as early as 1912.

Interesting results have come from this study in eastern Connecticut, particularly in the identification and reporting on numerous products of economic value; some of them result from the weathering processes and from glaciation, together with the ancient lime carbonate deposits themselves. The work was largely supported by the Survey during 1947-1948 and was conducted under the direction of Professors Knopf and Longwell of Yale.

The New Preston Quadrangle of Western Connecticut, by Dr. Robert M. Gates. Following the pattern of the adjacent Litchfield quadrangle report, Misc. Series No. 3, there is in preparation a 50 page manuscript with photographs, cuts, and a color map of this new area. By reason of the able assistance of Mr. William C. Bradley, Dr. Gates will be able to include a glacial study along with the bedrock geology. Through the combined efforts of both of these scientists from the University of Wisconsin the Survey increased greatly its returns on the cost of the expedition.

The complex crystalline rocks in this area offer many puzzling questions and problems that have come down through the years, the time relation of formations, methods of detecting structures, the identification of features that are ordinarily difficult to recognize; all of these problems may now be solved and reliable conclusions reached. For example, the Berkshire schist probably belongs to the oldest division of rocks that make up the earth's crust; they are definitely Pre-Cambrian in age.

The Geology of the New Milford Quadrangle, by Dr. Gerald Carroll. At the request of the Survey Dr. Carroll has carried on studies, originally undertaken in New York State, across the line into western Connecticut. The examination of these adjacent areas makes the interpretation of each much easier and more reliable. He has before him the complicated and difficult task of subdividing formations and telling exact time relationships.

He too will map the Berkshire schist along with the Hartland schist and other Pre-Cambrian rocks of the area; he will extend his investigations even further and include the relative position of the Stockbridge marble, whether it is above or below the schists. This area is considerably intruded with ancient, molten magmas.

It is probable that during the coming year the quadrangle study and map will be entirely completed. In addition to the quadrangle problem Dr. Carroll has been interested in the making of a guidebook for the geology of the Merritt Parkway, a plan which is being carried out for a number of our important highways.

Studies of the Glastonbury Area, by Drs. Norman Herz and Frederick Stugard, Jr. Dr. Herz is making an intensive study of the Glastonbury 7½ minute quadrangle, an area of unusual interest because of the widespread Glastonbury gneiss formation, a very ancient crystalline rock. This investigation has already resulted in extensive changes in our older geological maps and has also given clues to the origin of the formation. Further work will throw light on the age of the pegmatites and on some of the economic products of the region. It is hoped to have the answer to many now unsolved problems in the quadrangle.

In addition to the study of the Glastonbury quadrangle, Dr. Hertz has been making records of the rocks along Route No. 2 and Route No. 15 of central Connecticut; this is being done while the rocks are freshly exposed through the work of the Highway Department in its excavations. The information is secured now and will be laid away for future reference, but at the same time a guidebook describing the geology may be published for those who travel these routes. The data will be of value to the Highway Department itself in the future, to engineers, and also to the casual geologist.

Although not employed by the Survey, Dr. Stugard has been working extensively for some years in the pegmatite dikes in the Glastonbury area; this work was done for the U. S. Geological Survey. Many mineral collectors will recognize these dikes when one mentions the Strickland Quarry in Portland and other quarries in the area. During World War II interest was greatly stimulated in these dikes by the larger demand for mica and the possibility that some of the ledges might contain commercial quantities of beryllium in the mineral beryl; for many decades the white rocks have produced feldspar in great quantity. The map and descriptive report by Dr. Stugard will be of importance in the future exploitation of the pegmatite minerals in the region from Middle Haddam to Glastonbury.

Work in the Glastonbury area and elsewhere, and along the highways, has been greatly facilitated by drill core records of geological formations. To expedite the excavations needed by the Highway Department of the State in connection with proposed sites of bridges, tunnels, and roads, cores are bored through the bedrock at intervals. Through the good offices of Commissioner Peoples the Survey has secured many of these documents of geological evidence, that might otherwise be lost, and they are now stored in the old Opera House at East Haddam. These cores have been recorded on index maps as to location and classified by geologists for the Survey. They furnish important data on the bedrock where exposures are scant or absent and should help because of their possible scientific and economic value in addition to that gained by the State Highway Department itself. For some of these we have a sample of rock formation, the original of which may now be entirely hidden by debris, covered by water, and otherwise completely inaccessible.

ITEMS OF IMPORTANCE TO THE SURVEY

Meetings of Association of American State Geologists. The Survey has profited in the past by having representation at the national meetings of all State Geologists by one of the Commissioners or the Director. The meetings, usually at Washington, held jointly with the Bureau of Mines and the U. S. Geological Survey, offer much in the way of information and inspiration. The annual meeting for 1951 will convene at Rolla, Mo., to celebrate the founding of the survey of that state about fifty years ago.

The Connecticut Survey itself was established in 1903 and will have served the State a half century in 1953. Already the Commissioners have given thought to a suitable commemoration of the event and the years of service of the Survey to Connecticut, — perhaps to invite the State Geologists of the Nation to assemble here for the occasion.

Not only in preparation for distinguished visitors in 1953 but for our own satisfaction and forward progress, it is proposed that we place signs by the roadside, in parks, and at other points of unusual interest to explain the scientific features. This was suggested by Commissioner Hughes to call attention to the various features of nature: topography, bedrock, forests, and natural history of all sorts.

A SUMMARY OF INVESTIGATIONS IN VARIOUS STAGES OF COMPLETION

Manuscripts That Are Now Ready:

- 1) A Group of Insects, by Johnson, Townes, Shaw and Fischer, constituting the 5th Fascicle of the Flies
- 2) The Gall Gnats, by Pritchard and Felt, 6th Fascicle
- 3) A Group of Small Flies, by Johnson, Curran and Van Duzee, Fascicle 7
- 4) A Checklist of the Mollusca, by Clench
- 5) The Preston Gabbro, by Sclar

Papers That Will Soon Be Completed:

- 6) Dinosaur Footprints of the Connecticut Valley, by Lull
- 7) The Geology of Southern Connecticut, by Mikami and Digman
- 8) The New Preston Quadrangle, by Gates

Investigations Promised in the More Distant Future:

- 9) A Geological Map of Western Connecticut, by Cameron
- 10) The Geology of the New Milford Quadrangle, by Carroll
- 11) The Glastonbury Quadrangle, by Herz
- 12) The Woodbury Granite, by Cameron and Gates

This impressive list of manuscripts now finished or to be completed soon emphasizes the tremendous need for a Publication Fund for the Survey in justice to the authors and to provide the information for the needs of our people.

LEGEND FOR THE INDEX MAP OF AREAS BEING WORKED IN THE STATE

1. New Milford quadrangle where Dr. Gerald Carroll is carrying on his work, continuing from the New York boundary.
- 2-3. Representing the New Preston and Litchfield quadrangles, locations of investigations being done by Dr. Robert M. Gates.
4. The Glastonbury quadrangle, the area of Dr. Norman Herz' studies.
5. Parts of the Glastonbury and Middle Haddam quadrangles, a study of pegmatite veins by Dr. Frederick Stugard, Jr.
6. A series of quadrangles, the basis of a report by Dr. Janet Aitken. This will be Bulletin No. 78, now in press.
7. Parts of two quadrangles, the region investigated by Dr. Charles Sclar.
8. The old 15-minute Guilford quadrangle largely covered in the studies of Dr. Ralph E. Digman.
9. An irregular triangular area covered by the work of Dr. Harry M. Mikami, slightly overlapping the region of No. 8.

