









## MARINE BIOLOGICAL LABORATORY.

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PROCEEDINGS

OF THE

Washington Academy of Sciences

VOL. I

1899

WASHINGTON

APRIL 1899—FEBRUARY 1900

AFFILIATED SOCIETIES

- THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON  
THE BIOLOGICAL SOCIETY OF WASHINGTON  
THE CHEMICAL SOCIETY OF WASHINGTON  
THE ENTOMOLOGICAL SOCIETY OF WASHINGTON  
THE NATIONAL GEOGRAPHIC SOCIETY  
THE GEOLOGICAL SOCIETY OF WASHINGTON  
THE MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA  
THE PHILOSOPHICAL SOCIETY OF WASHINGTON  
THE COLUMBIA HISTORICAL SOCIETY (admitted June 30, 1898)

3669



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- “ 3. Synopsis of Mexican and Central American Umbelliferæ. JOHN M. COULTER and J. N. ROSE. Issued Jan. 8, 1900.
- “ 4. Economic Development of the District of Columbia. CARROLL D. WRIGHT. Issued Dec. 29, 1899.
- “ 5. Political Development of the District of Columbia. HENRY E. DAVIS. Issued Dec. 29, 1899.
- “ 6. Coming of the White Man, and Founding of the National Capital. AINSWORTH R. SPOFFORD. Issued Jan. 18, 1900.
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 H. M. WILSON  
 JOHN M. WILSON  
 A. F. WOODS  
 WILLIAM C. WOODWARD  
 CARROLL D. WRIGHT  
 WALTER WYMAN

\* Deceased.

## ACT OF INCORPORATION

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We, the undersigned, persons of full age and citizens of the United States, and a majority being citizens of the District of Columbia, pursuant to and in conformity with sections 545 to 552, inclusive, of the Revised Statutes of the United States relating to the District of Columbia, as amended by an Act of Congress entitled "An Act to amend the Revised Statutes of the United States relating to the District of Columbia and for other purposes," approved April 23, 1884, hereby associate ourselves together as a society or body corporate and certify in writing:

1. That the name of the society is the WASHINGTON ACADEMY OF SCIENCES.

2. That the term for which it is organized is nine hundred and ninety-nine years.

3. That its particular business and objects are the promotion of science, with power:

*a.* To acquire, hold, and convey real estate and other property and to establish general and special funds.

*b.* To hold meetings.

*c.* To publish and distribute documents.

*d.* To conduct lectures.

*e.* To conduct, endow, or assist investigation in any department of science.

*f.* To acquire and maintain a library.

*g.* And, in general, to transact any business pertinent to an academy of sciences.

4. That the affairs, funds, and property of the corporation shall be in general charge of a Board of Managers, the number of whose members for the first year shall be nineteen, all of whom shall be chosen from among the members of the Academy.

Witness our hands and seals this 18th day of February, 1898:

(Signed)

J. R. EASTMAN

F. W. CLARKE

G. K. GILBERT

ARNOLD HAGUE

L. O. HOWARD

W J MCGEE

C. HART MERRIAM

J. W. POWELL

GEO. M. STERNBERG

H. N. STOKES

CHARLES D. WALCOTT

LESTER F. WARD

FRANK BAKER

BERNARD R. GREEN

## BY-LAWS

(Including Amendments adopted May 12, 1899.)

### ARTICLE I.—*Members.*

SEC. 1. The Washington Academy of Sciences shall comprise four classes of members, as follows: *Resident members, non-resident members, honorary members* and *patrons*.

SEC. 2. *Resident* and *non-resident members* shall be persons who by reason of original research or scientific attainment are deemed eligible to these classes; they only shall be entitled to vote. Resident members shall be chosen from the Affiliated Scientific Societies of Washington. The annual dues of resident members shall be ten dollars; of non-resident members, five dollars. Members whose dues are in arrears for more than one year shall be dropped from the roll of the Academy, unless the Board of Managers shall otherwise determine.

SEC. 3. Nominations for membership shall be endorsed by at least three Members of the Academy, who shall present in writing a statement of the qualifications of the nominee, with a list of his more important publications; and such nominations shall be referred to the Board of Managers for consideration.

SEC. 4. *Honorary Members* shall be persons eminent in science, and may be residents of any country. They shall pay no dues.

SEC. 5. Persons who have given to the Academy not less than \$1,000 or its equivalent in property may be elected *Patrons*.

### ARTICLE II.—*Officers.*

SEC. 1. The officers of the Academy shall be chosen from the resident members, and shall be a President, one Vice-President from each of the affiliated societies, a Secretary, and a Treasurer, whose terms of office shall be one year, and nine Managers, grouped in three classes of three each, whose terms of office shall be three years. Collectively they shall constitute the Board of Managers.

SEC. 2. The Board of Managers shall transact all business of the Academy not otherwise provided for, and shall have power to fill vacancies in its own membership until the next annual election. Vacancies in the office of Vice-President shall be filled on nomination by the appropriate affiliated societies.

### ARTICLE III.—*Meetings.*

SEC. 1. The Annual Meeting shall be held on the third Wednesday of January each year. At this meeting the reports of the Secretary, Treasurer, and Auditing Committee shall be presented and officers for the ensuing year shall be elected.

SEC. 2. Other meetings shall be held at such time and place as the Board of Managers may determine.

SEC. 3. Twenty resident members of the Academy shall constitute a quorum for the transaction of business.

#### ARTICLE IV.—*Committees.*

SEC. 1. The Board of Managers may appoint such standing and special committees as it deems necessary.

SEC. 2. The President shall appoint in advance of the annual meeting an Auditing Committee consisting of three persons, none of whom are officers, to audit the accounts of the Treasurer.

#### ARTICLE V.—*Elections.*

SEC. 1. At each annual meeting there shall be elected by ballot a President, a Secretary, a Treasurer, and three Managers, who shall serve until the close of the meeting at which their successors are chosen. A majority of the votes cast shall be necessary to elect. Members whose dues are in arrears for one year shall not be entitled to vote or be eligible for any office in the Academy.

SEC. 2. Resident members shall be elected by the members of the Academy, and three-fourths of the votes cast shall be necessary to elect. An election shall be void if the person elected does not within three months thereafter pay his annual dues or satisfactorily explain to the Board of Managers his failure to do so.

SEC. 3. Non-resident members, honorary members, and patrons shall be elected by the Board of Managers, and three-fourths of the votes cast shall be necessary to elect. The Board shall have power to determine and change the status of resident members to non-resident.

#### ARTICLE VI.—*Coöperation.*

SEC. 1. The Academy may act as a federal head of the Affiliated Scientific Societies of Washington, with power to conduct joint meetings, publish a joint directory and joint notices of meetings, and take action in any matter of common interest to the affiliated societies: *Provided* It shall not have power to incur for or in the name of one or more of these societies any expense or liability not previously authorized by said society or societies.

SEC. 2. The term 'affiliated societies' shall be held to cover the Anthropological, Biological, Chemical, Entomological, National Geographic, Geological, Medical, and Philosophical Societies and such others as may be hereafter added by a majority vote of the members of the Academy, the vote being taken by correspondence.

SEC. 3. One Vice-President may be nominated by each affiliated society from the members of the Academy, subject to election by a majority vote at a meeting of the Academy.

SEC. 4. Any affiliated society may nominate candidates for membership in the Academy.



## ARTICLE VII.—*Amendments.*

These By-Laws may be amended in the following manner :

Written notice of proposed change, signed by at least three resident members, may be presented at any meeting of the Academy. Such notice shall be referred to the Board of Managers for consideration and recommendation. The Board of Managers shall consider the proposed change and return it to the Academy for action, with such amendment or recommendation as it deems wise. A two-thirds vote of the members voting shall be necessary to adoption.

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### RULES RELATING TO PUBLICATION.

1. The PROCEEDINGS of the Washington Academy of Sciences shall be issued in dated brochures, paged consecutively for the volume.

2. A brochure may comprise one or more papers, according to length, at the option of the Committee on Publication.

3. The date on each brochure shall be that of actual publication, which shall be one day later than the date of delivery by the printer to the Committee.

4. Each brochure shall be distributed on the date of its publication. Copies shall be sent to all members of the Academy, to subscribers, and to a library and exchange list approved by the Board of Managers.

5. At the close of each volume, which shall coincide as nearly as possible with the calendar year, a brochure comprising volume title-page, contents, and index shall be issued.

6. The regular edition shall consist of one thousand copies.

7. Contributors to the PROCEEDINGS must be members of the Academy, or of one of the Affiliated Societies; provided however that in exceptional cases the Board, by a three-fourths vote of the members voting at a stated meeting, may accept for publication papers contributed by non-members of the Affiliated organization.

8. Each paper offered for publication must be accompanied by a written recommendation from the Affiliated Society representing the branch of Science to which the paper relates, except in special cases where publication is ordered by the Board.

9. An Affiliated Society recommending a paper for publication may subscribe for such share of the edition as it may need. In case of special papers ordered published by the Board of Managers, the whole cost of publication shall be borne by the Academy.

10. Papers offered for publication shall be delivered to the Chairman of the Committee on Publication, who shall be Editor of the PROCEEDINGS. The Editor shall submit to the Committee an estimate of cost, and shall see that papers are promptly examined in such manner as the Board of Managers may direct.

11. Manuscript submitted for publication must be in form as well as in substance ready for the printer. It must be complete as to text and illustrations, must be perfectly legible (preferably type-written) and must be preceded by a brief table of contents.

12. The Academy shall not be responsible for the cost of revising manuscripts or illustrations. The cost of proof corrections due to alterations made by the author shall be charged to him.

13. Proofs shall be submitted to authors or persons designated by them whenever practicable; but printing shall not be delayed by reason of absence or inattention of authors.

14. Papers accepted for publication in the Academy's PROCEEDINGS must not be previously published elsewhere except by consent of the Board of Managers of the Academy.

15. Author's separates shall not differ in any particular from the regular edition. Any desired number may be ordered in advance through the Committee on Publication, at the expense of author, and at a rate of cost agreed upon by the Committee and printer.

16. Authors shall receive free of cost thirty copies of their papers.

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## ABSTRACT OF PROCEEDINGS.

February 18, 1898. Meeting for incorporation.

March 5, 1898. Meeting for organization.

March 17, 1898. Second meeting for organization.

March 29, 1898. Third meeting for organization.

May 27, 1898. Business meeting. Election of members, etc.

January 18, 1899. Annual meeting. Election of officers.

January 31, 1899. Special meeting for communication from Mr. Philip Mauro on Developments in the Art of Recording and Reproducing Sounds, with an exhibition of the 'graphophone grand.'

March 15, 1899. Special meeting and informal reception to hear communication from Mr. Charles D. Walcott, on the United States National Museum.

April 19, 1899. Reception given to the members of the National Academy of Sciences. Exhibition of photographs of sound waves and methods of color photography, by Prof. R. W. Wood, of the University of Wisconsin.

May 2, 1899. Business meeting. Amendments to by-laws providing for non-resident members proposed.

May 12, 1899. Business meeting. Amendments to by-laws providing for non-resident members adopted.

May 18, 1899. Business meeting. Admission of additional members.

December 12, 1899. Business meeting. Reports with reference to non-resident members.

December 29, 1899. Reception given to the members of the Geological Society of America. A symposium on the Harriman Alaska Expedition, by C. Hart Merriam, Henry Gannett, G. K. Gilbert, Frederick V. Coville, and William H. Dall.

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The Board of Managers has held numerous meetings for the transaction of business. At its meeting of April 7, 1898, the vice-presidency created by the admission of the Medical Society to the group of Affiliated Societies (see First Annual Report of the Secretary, p. 12) was filled by the election of Dr. Samuel C. Busey.

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The following addresses have been delivered under the auspices of the Academy :

April 19, 1898. Annual address of the President of the Anthropological Society, Dr. Frank Baker, on Primitive Man, the Present State of the Question.

December 4, 1898. Annual address of the President of the Medical Society, Dr. Samuel C. Busey, on The History and Progress of Sanitation of the City of Washington, and the Efforts of the Medical Profession in relation thereto.

January 7, 1899. Annual address of the President of the Philosophical Society, Professor Frank H. Bigelow, on The Function of Criticism in the Advancement of Science.

January 17, 1899. Annual address of the President of the Biological Society, Dr. L. O. Howard, on the subject, Are Insects as a Class Injurious or Beneficial in their Relations with man ?

February 22, 1899. Annual address of the President of the Geological Society, Mr. Arnold Hague, on The Early Tertiary Volcanoes of the Absaroka Range.

February 28, 1899. Annual address of the President of the Anthropological Society, Mr. W J McGee, on The Trend of Human Development.

March 30, 1899. Annual address of the President of the Chemical Society, Mr. Henry N. Stokes, on The Revival of Inorganic Chemistry.

April 28, 1899. Annual address of the President of the National Geographic Society, Mr. Alexander Graham Bell, on Japan.

December 20, 1899. Annual address of the President of the Medical Society, Dr. Samuel C. Busey, on American Medical Ethics.

Also the following series of Saturday Lectures:

March 25, 1899. The Geology and Geography of the District, by W J McGee.

April 1, 1899. The Fauna and Flora of the District, by Frederick V. Coville.

April 8, 1899. The Aboriginal Inhabitants of the District, by F. H. Cushing.

April 15, 1899. The Coming of the White Man and the Founding of the Capital, by A. R. Spofford.

April 22, 1899. The Economic Development of the District, by Carroll D. Wright.

April 29, 1899. The Political Development of the District, by Henry E. Davis.

PROCEEDINGS  
OF THE  
WASHINGTON ACADEMY OF SCIENCES

VOL. I, PP. 1-14.

APRIL 14, 1899.

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FIRST ANNUAL REPORT OF THE SECRETARY.

[Read to the Academy January 18, 1899.]

IT has seemed best to prepare this report in such way that it may serve not only for the information of persons present at this meeting, but also as a permanent record to be printed in the PROCEEDINGS. With a view to such publication it has been made to cover the transactions of the Society and its Board of Managers, as recorded in the Secretary's minutes, but without following the language of the minutes.

It has seemed best also to precede the account of the Academy's work with a brief statement of the conditions and events which led to the Academy's organization.

I. NARRATIVE OF EVENTS ANTECEDENT TO THE FORMATION  
OF THE ACADEMY.

Of the associations from which the membership of the Academy is drawn the one earliest formed is the Medical Society of the District of Columbia, which was organized in 1819. The subject matter of its work is and has been medical science, including sanitation. More than fifty years afterward the Philosophical Society of Washington was organized, beginning its work in 1871 and choosing 'science' as its subject without expressing any limitation. Although the field of the younger society nominally included the field of the older, there was practically no duplication of work as medical papers were rarely presented to the Philosophical Society.

In 1879 the Anthropological Society of Washington was instituted, the movement being begun by antiquaries and carried forward by anthropologists. Its chosen field, indicated by its name, was one which had previously been covered by the Philosophical Society, so that there was a distinct overlap of function. In the following year the biologists, feeling the need for a separate series of meetings, prepared to organize. As biology also was within the field already occupied by the Philosophical Society, it was perceived by members of that organization that the institution of a new society for biological work would trench still further on the material brought before its own meetings, and the question was raised whether differentiation might not be advantageously accomplished within its own body. A new rule was adopted permitting the organization of sections for the consideration of special subjects, each section to have its own officers and hold its own series of meetings. Under this provision a Section of Mathematics was afterward constituted, but the plan did not fully meet the desires of the biologists and they accordingly proceeded to institute a separate society, the Biological Society of Washington.

By the organization of the Anthropological and Biological Societies the scientific men of Washington recognized the importance for certain purposes of differentiation according to subject-matter; but they recognized also the value of integration, and two years after the creation of the Biological Society an attempt was made to bring together the Philosophical, Anthropological, and Biological Societies under a form of confederation involving the constitution of a new body to be called The Academy. After much discussion the plan was formulated by a joint committee of conference and was submitted in the following report:

*Report of Joint Committee of Conference, May 3, 1882.*

The joint committee, composed of the several committees appointed by the Philosophical, Anthropological, and Biological Societies of Washington to consider the desirability of a federation of those societies, recommend to the several societies a federation on the following basis, and for the purposes set forth:

- I. The purposes of this federation shall be—
  - First, the publication of a common body of transactions;
  - Second, periodic meetings of the united societies;
  - Third, the management of courses of popular lectures; and
  - Fourth, such other objects as may be agreed upon.
- II. The federation shall be known as the Washington Academy of Sciences.
- III. The several societies shall retain their own organizations, excepting as hereinafter modified.
- IV. The three societies shall have the same annual fees of membership.
- V. The uniform fee for each of the three societies shall be three dollars.
- VI. The Academy shall be organized by the election of a president, a secretary, a treasurer, and two councilmen by the Academy. The presidents of the several societies shall be *ex officio* vice-presidents of the Academy and members of its council; one secretary from each society shall be a member of the council, and each society shall elect two additional councillors for the council of the Academy.
- VII. A grade of fellowship shall be established in the Academy.
- VIII. The annual fee for fellowship shall be five dollars.
- IX. The existing members of all the societies shall be fellows of the Academy on the payment of the fellowship fee.
- X. The council of the Academy may subsequently elect fellows from the members of the Academy.
- XI. The fellows of the Academy shall be *ex officio* members of all the societies.
- XII. It is recommended to the several societies that the existing committees on conference be continued for the purpose of collecting the sense of the societies on the above propositions and of carrying out such scheme of organization as may be mutually accepted.

WILLIAM B. TAYLOR,  
*Chairman of Joint Committee.*

*Committee of Philosophical Society.*

JOHN W. POWELL.  
 THEODORE GILL.  
 JAMES C. WELLING.  
 JOHN S. BILLINGS.  
 WILLIAM B. TAYLOR.

*Committee of Biological Society.*

LESTER F. WARD.  
 G. BROWN GOODE.  
 CHARLES V. RILEY.  
 RICHARD RATHBUN.  
 JOHN W. CHICKERING, JR.

*Committee of Anthropological Society.*

JOHN W. POWELL.  
 GARRICK MALLERY.  
 JAMES C. WELLING.

The plan was adopted in its entirety by the Anthropological and Biological Societies but was rejected by the Philosophical, and thus failed of realization.

In 1884 were organized the Chemical Society of Washington and the Entomological Society of Washington, in 1893 the Geological Society of Washington, and in 1888 the National Geographic Society with headquarters in Washington. The Chemical, Geological, and Geographic trenched on the field of the Philosophical Society, and the Entomological on that of the Biological.

During the period characterized by this rapid differentiation the opposite tendency found expression in coöperation. Following the initiative of the Philosophical Society, in 1883, all of the organizations except the Medical adopted the custom of inviting the members of the other organizations to listen to the annual address of the presiding officer. This custom has continued to the present time with occasional exceptions due chiefly to the technical nature of subjects chosen for addresses.

In the spring of 1882 the Anthropological and Biological Societies, through the agency of a joint committee, gave a course of nine popular lectures in the National Museum, thus initiating the series since known as the Saturday lectures. Similar courses were provided in the following years, and in 1885 and 1886 the Philosophical Society joined in the work.

Early in the year 1888 the desire for federation which had inspired the attempt to organize an Academy, led to a movement to secure a permanent committee to deal with questions of



common interest, and this movement was successful. The Joint Commission was created, a permanent body consisting of three members each from the Anthropological, Biological, Chemical, Geographic, and Philosophical Societies. The functions of the Commission were advisory, except that it might "execute instructions on general subjects and in special cases from two or more of the societies participating;" but it was provided that no society should be bound by the Commission to an act as to which it had not given instructions.

Through this Commission a joint directory of the scientific societies was issued annually, beginning with 1889. The local arrangements for the Washington meeting of the American Association for the Advancement of Science (1891) were made, and the surplus of money acquired through subscriptions for that purpose was afterward expended in the purchase of furniture for rooms at the Cosmos Club in which meetings of the societies and their governing boards were held. In 1889 and 1890 the Commission conducted the Saturday lectures, but it afterward neglected this function, which was taken up in an irregular way by individual societies.

In 1893 the Entomological Society was added to the coöperating group, with the privilege of a single representative in the Joint Commission, and the following year the Geological was admitted with two representatives.

Early in the year 1895, a further measure of integration was adopted by enlarging the functions of the Joint Commission. It was empowered: "(a) to provide for joint meetings of the Societies, (b) to conduct courses of popular lectures, (c) to prepare a Joint Directory of the members of the Societies, (d) to distribute to all members of the Societies periodic advance notices of the meetings of the several Societies, and (e) to act in the interest of the component Societies at the instance of any of them." The expenses were borne by the several societies in the ratio of their membership. The new Commission was composed of the officers and administrative boards of the several societies, and despite extensive overlapping in the membership it included about ninety persons. The details of its work were entrusted to an Executive Committee comprising the four officers of the Commission and one member-at-large from each society represented.

The new Commission continued the issue of the Joint Directory. In 1896 it tried the experiment of issuing monthly advance notices of the meetings of all the societies, giving the titles of communications to be expected; but the experiment was not regarded as successful and the notices were discontinued. It conducted the Saturday lectures in 1896 and 1897. It conducted fourteen union meetings of the component societies, twelve on the occasions of the annual addresses of retiring Presidents, a memorial meeting in memory of Dana, Huxley, Pasteur, and Von Helmholtz, and a memorial meeting in memory of G. Brown Goode.

The Commission also considered and took action on two matters of public policy affecting the interests of the general body of scientific men. It formally expressed approval of the request to Congress by the Secretary of Agriculture that provision be made for a permanent 'Director-in-chief of Scientific Bureaus and Investigations' in the Agricultural Department; and, through resolutions, correspondence, and the personal efforts of a committee, it antagonized a bill pending in the United States Senate for the restriction of vivisection.

While the motives and opinions leading to these two measures were shared by nearly all members of the Commission, there was serious doubt as to the propriety of permitting a Commission organized primarily for business purposes to attempt to represent the scientific body of Washington on questions of such breadth and importance. The functions specifically contemplated in the organization of the Commission were somewhat routine in their nature, and the officers chosen to execute them were selected with special reference to business qualifications. It was thought by some that the powers of the Commission should be restricted, and by others that large powers were desirable but that the body exercising them should be chosen with less attention to business qualifications and more regard to scientific attainments. An agitation followed in which the Geological Society took the initiative, preparing a historical statement which was printed and distributed for the information of members of all the societies, and which, I may add in passing, has been freely used in the preparation of this report.

## 2. HISTORY OF THE INSTITUTION OF THE ACADEMY.

The record of the successive steps resulting in the creation and organization of the Academy is contained in the manuscript minutes of the Joint Commission, in the minutes of the constituent societies, in the early minutes of the Academy, and in certain printed circulars. The minutes of the Joint Commission have been deposited with the Academy, and the circulars referred to are assembled in a scrap book constituting part of the archives of the Academy.

Under date of September 15, 1897, the council of the Geological Society addressed a circular letter to the councils of the other societies comprised in the Joint Commission, expressing the belief "that the question of a joint organization should be considered by the scientific societies with a view to improving the means for furthering their common interests," and proposing that each society appoint "a committee of conference to meet similar committees from other societies for the consideration of the general subject." All of the societies acted favorably on the suggestion, and the following committees were appointed:

*Anthropological Society:*

FRANK BAKER, LESTER F. WARD, W J MCGEE.

*Biological Society:*

L. O. HOWARD, GEORGE M. STERNBERG, C. HART MERRIAM.

*Chemical Society:*

W. H. SEAMAN, C. E. MUNROE, WIRT TASSIN.

*Entomological Society:*

THEODORE GILL, W. H. ASHMEAD, C. L. MARLATT.

*National Geographic Society:*

GARDINER G. HUBBARD, HENRY GANNETT, G. K. GILBERT.

*Geological Society:*

ARNOLD HAGUE, S. F. EMMONS, WHITMAN CROSS.

*Philosophical Society:*

MARCUS BAKER, J. R. EASTMAN, BERNARD R. GREEN.

The Committee of Conference organized by choosing J. R. Eastman as Chairman, and Whitman Cross as Secretary, held

a series of meetings, and drafted the following resolutions, which were submitted to the several societies for adoption :

1. *Resolved*, that in the opinion of this Committee, some form of joint organization of the scientific societies of Washington is desirable.

2. *Resolved*, that it is the sense of this Committee, that the body representing the federated societies should have a scientific character and be representative in scientific as well as in business matters.

3. *Resolved*, that in the opinion of this Committee, the body under discussion should primarily represent the scientific societies as a federal head, competent to initiate action.

4. *Resolved*, that in the judgment of this Committee, the autonomy of the several scientific societies should be maintained.

5. *Resolved*, that in the judgment of this Committee the Joint Commission should be modified in the following particulars :

1st. That its name be changed to the Washington Academy of Sciences.

2d. That it assume independent scientific functions.

3d. That it have power to add to its members.

6. *Resolved*, that the Committee, therefore, recommends to the several societies that they instruct the Joint Commission to take such action as may be necessary to carry the above recommendations [*i. e.*, of the resolution 5] into effect.

On the 11th of January, 1898, the Joint Commission met and received reports of the action of the societies with reference to the resolutions. The Biological, Entomological, National Geographic, and Geological Societies adopted the resolutions; the Chemical had held no meeting; the Anthropological adopted resolutions 5 and 6; the Philosophical adopted all the resolutions with the proviso that final action should be submitted to it for ratification.

A representative committee of eight was appointed to draft a constitution for the proposed Academy, and was empowered to add to its members. The appointees were :

*For the Joint Commission*, GEORGE M. STERNBERG.

*Anthropological Society*, FRANK BAKER.

*Biological Society*, C. HART MERRIAM.

*Chemical Society*, H. N. STOKES.

*Entomological Society*, L. O. HOWARD.

*Geological Society*, ARNOLD HAGUE.

*Geographic Society*, W J MCGEE.

*Philosophical Society*, J. R. EASTMAN.

The committee met the same evening and increased its membership to fifteen by adding Messrs. MARCUS. BAKER, G. K. GILBERT, LESTER F. WARD, F. W. CLARKE, BERNARD R. GREEN, J. W. POWELL and CHARLES D. WALCOTT.

Other meetings of the committee were held on January 17th and 19th, and its report was submitted to the Joint Commission at its annual meeting January 19th. The report presented a proposed act of incorporation, proposed by-laws, and recommendations concerning procedure. Three alternative plans were suggested for determining the personnel of the nucleus of the Academy. The report was ordered printed and copies were submitted to the constituent societies for their action. On the 25th of January the Joint Commission again met, received reports from the societies on the report as a whole, and on the alternative plans for forming the nucleus, amended the act of incorporation and by-laws in several particulars, and referred the document back to the Committee on Constitution for unification. The plan adopted for the selection of the nucleus was as follows: "Each member of the Joint Commission to prepare a ballot containing not more than one hundred names of persons now members of one or more of the scientific societies of Washington, the ballot to be canvassed by the Executive Committee of the Commission, and the seventy-five persons whose names appear on the greatest number of ballots to constitute the original membership of the Academy."

The ballot thus provided for was cast January 31st, but its result was not promulgated until February 12th, after the ratification of the plan of organization had been completed.

On the 2d of February the Joint Commission received the second report of its committee on constitution and adopted the plan of organization, with modification. The President was instructed to call a meeting of the Academy as soon as ratification by the constituent societies was completed. At the final meeting of the Joint Commission held March 22, 1898, the furniture owned by the Commission was presented to the Cosmos Club, its archives were presented to the Washington Academy of Sciences, and the ballots whereby the nucleus of the Academy was selected were presented to the Academy in a sealed pack-

age with the request that the package be not opened within twenty years. The Commission then adjourned *sine die*.

A preliminary meeting of the Academy was held at the Cosmos Club February 16, 1898, Mr. George M. Sternberg, President of the Joint Commission, acting as temporary Chairman. The following officers were elected:

*President*, J. R. EASTMAN,

*Secretary*, G. K. GILBERT,

*Treasurer*, BERNARD R. GREEN,

*Managers*, GEORGE M. STERNBERG, CHARLES D. WALCOTT, CARROLL D. WRIGHT, FRANK BAKER, C. HART MERRIAM, F. W. CLARKE, H. S. PRITCHETT, A. GRAHAM BELL, and LESTER F. WARD.

The members of the committee appointed by the Joint Commission to draft a constitution for the Academy were chosen as incorporators, and a committee was appointed to make nominations for the immediate enlargement of the membership.

The act of incorporation was executed February 18th at the office of the United States Geological Survey, and the incorporators met again on the 5th of March for the purpose of giving legal status to the by-laws, membership and officers. Under the laws of the District of Columbia the Academy technically began its existence with the act of incorporation, and the incorporators were then its original and only members. The incorporators, therefore, as a matter of form, adopted the by-laws, elected to membership the seventy-five chosen by the Joint Commission as a nucleus, and elected the officers chosen at the preliminary meeting.

At a meeting of the Academy held March 17th Vice-Presidents were elected on nomination of the several societies as follows:

*For the Anthropological Society*, J. W. POWELL.

*For the Biological*, L. O. HOWARD.

*For the Chemical*, H. N. STOKES.

*For the Entomological*, W. H. ASHMEAD.

*For the Geographic*, A. GRAHAM BELL.

*For the Geological*, C. D. WALCOTT.

*For the Philosophical*, F. H. BIGELOW.

A report was received from the committee on enlargement of membership and eighty-four persons were elected, it being voted that they should be counted as original members of the Academy. The full list of original members, or members-elect, comprising 159 names, is as follows :

## LIST OF ORIGINAL MEMBERS-ELECT.

Cleveland Abbe,	J. Walter Fewkes,	G. W. Littlehales,
Henry Adams,	A. K. Fisher,	F. A. Lucas,
Cyrus Adler,	Alice C. Fletcher,	W J McGee,
W. H. Ashmead,	Robert Fletcher,	H. L. Marindin,
Vernon Bailey,	James M. Flint,	C. L. Marlatt,
Frank Baker.	Edgar Frisby,	C. F. Marvin,
Marcus Baker,	E. M. Gallaudet,	Otis T. Mason,
Geo. F. Becker,	B. T. Galloway,	Washington Matthews,
A. Graham Bell,	Henry Gannett,	Geo. W. Melville,
J. E. Benedict,	A. S. Gatschet,	C. Hart Merriam,
Frank H. Bigelow,	G. K. Gilbert,	G. P. Merrill,
Rogers Birnie,	Theo. N. Gill,	William M. Mew,
H. Carrington Bolton,	R. U. Goode,	G. S. Miller, Jr.,
S. M. Burnett,	J. Howard Gore,	James Mooney,
S. C. Busey,	A. W. Greely,	A. T. Mosman,
M. R. Campbell,	Bernard R. Green,	C. E. Munroe,
T. M. Chatard,	E. L. Greene,	E. W. Nelson,
V. K. Chesnut,	J. G. Hagen,	Simon Newcomb,
J. W. Chickering,	Arnold Hague,	F. H. Newell,
F. W. Clarke,	William Harkness,	Herbert G. Ogden,
O. F. Cook,	R. A. Harris,	T. S. Palmer,
D. W. Coquillett,	W. T. Harris,	H. M. Paul,
Elliott Coues,	O. P. Hay,	A. C. Peale,
F. V. Coville,	C. Willard Hayes,	A. J. Pieters,
Whitman Cross,	G. H. Hicks,	C. L. Pollard,
F. H. Cushing,	Robert T. Hill,	J. W. Powell,
William H. Dall,	W. F. Hillebrand,	W. B. Powell,
N. H. Darton,	F. W. Hodge,	Mary J. Pratt,
Arthur P. Davis,	W. H. Holmes,	D. W. Prentiss,
David T. Day,	Walter Hough,	E. D. Preston,
L. H. Dewey,	L. O. Howard,	H. S. Pritchett,
J. S. Diller,	John Hyde,	John R. Procter,
H. G. Dyar,	Arthur Keith,	G. R. Putnam,
J. R. Eastman,	F. H. Knowlton,	Mary J. Rathbun,
Wm. Eimbeck,	Geo. M. Kober,	Richard Rathbun,
Geo. H. Eldridge,	D. S. Lamb,	Chas. W. Richmond,
S. F. Emmons,	S. P. Langley,	Miles Rock,
B. W. Evermann,	F. Lamson-Scribner,	J. N. Rose,
D. G. Fairchild,	A. Lindenkohl,	D. E. Salmon,
B. E. Fernow,	W. Lindgren,	René de Saussure,

C. A. Schott,	H. N. Stokes,	H. J. Webber,
Chas. Schuchert,	G. B. Sudworth,	Walter H. Weed,
E. A. Schwartz,	W. T. Swingle,	Charles A. White,
E. A. de Schweinitz,	Wirt Tassin,	C. David White,
C. D. Sigsbee,	O. H. Tittmann,	C. Whitehead,
C. T. Simpson,	C. H. Townsend,	Milton Whitney,
E. F. Smith,	F. W. True,	H. W. Wiley,
A. R. Spofford,	Henry W. Turner,	Bailey Willis,
T. W. Stanton,	M. B. Waite,	H. M. Wilson,
Matilda C. Stevenson,	Chas. D. Walcott,	John M. Wilson,
Leonhard Stejneger,	Lester F. Ward,	A. F. Woods,
Geo. M. Sternberg.	R. B. Warder,	Carroll D. Wright,
C. W. Stiles,	C. K. Wead,	Walter Wyman.

At a meeting held March 29th the Academy made several amendments to its by-laws and inserted therein the name of the Medical Society of the District of Columbia as one of the affiliated societies. During the progress of the movement to create an Academy the Medical Society made application to the Joint Commission for admission to the group of affiliated societies. The Commission lacked authority to grant the application, but referred it to the several societies with favorable recommendation. The general sentiment in the societies was favorable to the admission of the Medical Society, but as the procedure for the formation of an Academy was already somewhat complicated it was thought best by some of the societies to defer action until the reorganization had been completed. The Medical Society finding its position in the matter undignified withdrew its application. As soon as the organization of the Academy had progressed sufficiently far the Board of Managers recommended to the Academy a resolution inviting the Medical Society to become one of the affiliated societies; but when the matter was presented to the Academy and it was pointed out that the proposed invitation would not materially abridge the procedure necessary to secure the desired result, a more direct course was decided on and the name of the Medical Society inserted in its appropriate place in the by-laws before their final adoption. This action was subsequently ratified by the Medical Society.

As members of the Medical Society had not been eligible, as such, for election to the Academy when the original members were chosen, special provision was made for giving the Society



a proper representation. A committee was appointed to select suitable names from the Medical Society, and these names, with suitable credentials, were submitted to the Academy, together with those of a few other nominees, on the 27th of May. The ensuing vote resulted in the election to membership of the following persons :

Geo. M. Acker,	Henry D. Fry,	Jas. C. Merrill,
Samuel S. Adams,	W. W. Godding,	Willis L. Moore,
I. S. L. Bermann,	Jos. Taber Johnson,	Rupert Norton,
J. Wesley Bovée,	Geo. W. Johnston,	Robert Reyburn,
J. H. Bryan,	W. W. Johnston,	C. W. Richardson,
Thos. S. Claytor,	A. F. A. King,	A. R. Shands,
G. Wythe Cook,	C. H. A. Kleinschmidt,	I. S. Stone.

### 3. MEMBERSHIP.

As stated in the preceding paragraphs the members of the Academy were elected in three groups. A nucleus of seventy-five was chosen by the Joint Commission January 31st, and confirmed by the Incorporators March 5th. Eighty-four other members, accounted as 'original,' were elected March 17th, and twenty-one others, chiefly from the Medical Society, were elected May 27th, making a total of one hundred and eighty members elected. Of this number twelve declined membership, twenty-one others failed to perfect their membership by the payment of dues within the time specified by the by-laws, and of those who perfected their membership three have resigned. The present number of members is one hundred and forty-four.

### 4. TRANSACTIONS OF THE ACADEMY.

The principal work of the Academy in 1898 was organization, the determination of its rules and membership, and the deliberate preparation of plans for future activities. A number of business meetings were held by the Academy and the Board of Managers in the spring, and the Board of Managers held another series of meetings in the autumn and winter. Under the schedule of functions adopted by the Academy the Board has developed the machinery for the publication of proceedings, the conduct of a lecture course, and the holding of occasional meetings for the reception of new scientific material. The function

which has received most attention is publication. A plan for the selection and printing of papers has been carefully matured, and accepted papers will soon go to press. A joint directory for 1899 is now in preparation under the editorship of Mr. Marcus Baker. [Issued February 24, 1899.]

The following addresses by Presidents of affiliated societies have been presented under the auspices of the Academy :

*Primitive Man: The Present State of the Question.* By DR. FRANK BAKER, President of the Anthropological Society, at the Cosmos Club, April 19, 1898.

*The history and progress of Sanitation of the city of Washington, and the efforts of the Medical Profession in relation thereto.* By SAMUEL C. BUSEY, M.D., LL.D., President of the Medical Society, in the Law Building of Georgetown University, December 14, 1898.

*The function of Criticism in the advancement of science.* By F. H. BIGELOW, President of the Philosophical Society, at the Columbian University, January 10, 1899.

*Are Insects as a Class Injurious or Beneficial in their Relations with Man?* By DR. L. O. HOWARD, President of the Biological Society, at the Columbian University, January 17, 1899.

On April 14 the Columbia Historical Society made application for admission to the group of affiliated societies. The Board of Managers reported the application to the Academy May 27th, with recommendation for favorable action. In accordance with the by-laws the vote was taken by correspondence and resulted in the granting of the application. The affiliated societies now number nine. These are :

THE **Anthropological** SOCIETY OF WASHINGTON.

THE **Biological** SOCIETY OF WASHINGTON.

THE **Chemical** SOCIETY OF WASHINGTON.

THE **Entomological** SOCIETY OF WASHINGTON.

THE NATIONAL **Geographic** SOCIETY.

THE **Geological** SOCIETY OF WASHINGTON.

THE COLUMBIA **Historical** SOCIETY.

THE **Medical** SOCIETY OF THE DISTRICT OF COLUMBIA.

THE **Philosophical** SOCIETY OF WASHINGTON.

Respectfully submitted,

G. K. GILBERT,  
*Secretary.*

PROCEEDINGS  
OF THE  
WASHINGTON ACADEMY OF SCIENCES

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REVISION OF THE SQUIRRELS OF MEXICO AND  
CENTRAL AMERICA.<sup>1</sup>

BY E. W. NELSON.

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INTRODUCTION.

THE arboreal squirrels inhabiting the region between the southern border of the United States and the Isthmus of Panama have been studied by several authors, notably J. E. Gray, E. R. Alston and J. A. Allen. The material at the disposal of these revisers was of the most fragmentary character, often without definite localities and in poor condition, hence it is hardly surprising that their conclusions are unsatisfactory.

During the past few years the quantity of material has been greatly increased and its quality much improved. Mr. G. K. Cherrie and Señor Anastacio Alfaro in Costa Rica; Dr. Chas. W. Richmond in Nicaragua; Mr. A. Forrer, the Lumbholtz Expedition, and the late Dr. Audley C. Buller in Mexico, and Dr. E. A. Mearns, U. S. A., on the Mexican Boundary, have

<sup>1</sup>Recommended for publication by the Biological Society of Washington, February 25, 1899.

contributed largely to the extent and value of recent collections. The bulk of new material, however, has been gathered by Mr. E. A. Goldman and myself. Since 1891 we have been engaged in making explorations for the United States Biological Survey, under the Department of Agriculture. Western Guatemala has been explored and Mexico has been repeatedly traversed from north to south and from sea to sea. The routes of nearly every naturalist whose work is recorded have been followed, and almost all the known type localities of Mexican mammals have been visited. The series of squirrels thus brought together has given an insight into the relationships of the members of this group, which lack of material had hitherto rendered impossible. Moreover, familiarity with the topography of the country and the geographic distribution of Mexican and Guatemalan species gave me advantages not possessed by any previous worker on Neotropical squirrels.<sup>1</sup>

During the preparation of the present revision I have been able to examine representatives—and in most cases types or topotypes—of nearly all the known species and subspecies found in Mexico and Central America. Dr. C. Hart Merriam, who had already done some work on the group, generously placed in my hands his MS notes and the Biological Survey series of more than 600 specimens; Mr. F. W. True, Executive Curator of the U. S. National Museum, gave me the use of the National Museum series, and Dr. J. A. Allen, Curator of Mammals in the American Museum of Natural History, forwarded the Tropical American squirrels, including the types of his species, in that collection. These additions brought the total number of specimens up to 919. But after a little study it became evident that, in order to reach satisfactory conclusions on many questions of synonymy, definite information was necessary concerning the types of species described by Gray and others. Accordingly, a series of specimens from the U. S. National Museum and Biological Survey collections answering as closely as possible to the imperfect published descriptions, was sent to Mr. Oldfield Thomas, Curator of Mammals in the British Museum, for comparison with the types preserved in London. Mr.

<sup>1</sup>I am especially indebted to Dr. T. S. Palmer for many valuable suggestions, particularly in connection with the nomenclature and synonymy.

Thomas responded very handsomely, devoting considerable time to the comparison and returning the specimens with annotations which have made it possible to state authoritatively exactly what species were represented.

Within the area covered by the present paper Gray, in 1867, recognized 18 species and varieties, Allen in 1877, 6 species and 3 varieties, and Alston in 1880, only 7 species. As a result of the accumulation of modern material a number of new forms have been described by various authors, and in the present revision 43 species and subspecies are recognized.<sup>1</sup> In order to understand the relationships of these numerous species it is necessary to have a general idea of their surroundings and the topographic features of the region they inhabit.

#### PHYSIOGRAPHY OF THE REGION.

Mexico and Central America present great contrasts of topographic and climatic conditions, accompanied by wonderful variety of animal and vegetable life. The mountain ranges fronting the two coasts of Mexico, and uniting near the Isthmus of Tehuantepec, are of great magnitude and form the outer border or rim of the broad interior tableland. Southward the continental area is narrow and the elevated interior correspondingly reduced. One of the most characteristic features is the comparatively level lowland skirting both coasts between the sea and the base of the mountains. This coastal plain is sometimes 100 miles wide and often broken by hills or low ranges of mountains which extend out from the main interior ranges as short spurs, or rise island-like in the midst of the plain. The hills reach the sea at many points but usually the country near shore is level. The northern parts of the coastal plains, except a very narrow belt along the east shore of Mexico, lie within the Lower Sonoran zone and in passing southward, gradually merge into the Arid Tropical. On the west side the arid character of the coast belt extends at least to Costa Rica, but on the east coast it gives way in the southern half of Vera Cruz to the Humid Tropical zone which, with the exception of the arid

<sup>1</sup> Several South American species have been reported from the Isthmus of Panama but in the absence of any material have necessarily been omitted.

tropical peninsula of Yucatan, continues on to the Isthmus of Panama. The Arid Tropical areas are characterized by low scrubby forests; the Humid Tropical by greater luxuriance of vegetation. The rainfall on the mountain slopes facing the sea on both coasts is much heavier than on the adjacent lowlands, and is distributed more generally throughout the year, producing a heavier forest growth. In eastern Mexico this causes a northward extension of the Humid Tropical area, in the form of a long narrow tongue along the mountains, which reaches eastern San Luis Potosi. On the west coast the uniformity of the Arid Tropical area is broken by humid tropical islands at intervals along the mountains northward nearly to the border of Guerrero, and by belts of heavy forest along streams flowing through the plains.

Above the Tropical zones in Mexico the higher mountain slopes extend through all the succeeding life zones to extreme timberline, and in Central America to altitudes varying from 6000-14,000 feet. Differences of altitude are always accompanied by climatic changes, but in addition local causes also often exert a marked influence. Thus the proximity of high mountains, or the trend of a range or spur in relation to the course of the prevailing wind, frequently has a direct effect upon the rainfall of the surrounding district. In Vera Cruz the north and northeast slopes of mountains are by far the most humid owing to the fact that during the dry winter months 'northers' prevail, bringing fogs and rain. A striking example of the climatic differences that may exist within a limited area is afforded by the slopes of Mt. Orizaba, in western Vera Cruz. The top of this mountain rises over 18,000 feet above sea level and is perpetually covered with snow; its southeastern base reaches the hot coast plain, and at an altitude of 800 feet the foothills are covered with a humid tropical forest so dense in places that the dew drops all day from the undergrowth; while on the opposite side, at an altitude of 8000 feet, lie the arid treeless tablelands.

#### HISTORY AND NOMENCLATURE.

The first tree squirrel of tropical North America to receive a distinctive scientific name was *Sciurus aureogaster*, described

by F. Cuvier in 1829. During the succeeding decade a few species were described, and in 1839 Bachman<sup>1</sup> published several additional species from Mexico. The first general enumeration of Tropical American squirrels appeared in 1842 in Lesson's 'Nouveau Tableau du Règne Animal,' in which seven species were mentioned from the region under consideration. During the next 25 years Wagner, Schinz, Peters, and Gray described a few species, Audubon and Bachman gave accounts of several in their 'Quadrupeds of North America' (1851-54), and Baird in 1857 referred briefly to the Mexican and Central American species in his 'Mammals of North America.'

The year 1867 was marked by the publication of two papers, Fitzinger's 'Natürliche Anordnung der Nagethiere,'<sup>2</sup> which included 10 species and subspecies of squirrels from Tropical North America; and, a few months later, Gray's 'Synopsis of Species of American Squirrels in the Collection of the British Museum.'<sup>3</sup> The latter paper recognized 18 species and varieties north of Panama, several of which were supposed to be new, and was the first formal attempt to revise the Neotropical squirrels. Gray paid little attention to the work of previous authors and consequently renamed a number of species. His descriptions were poor, the synonymy badly involved, and some of the species were given impossible ranges. Dr. J. A. Allen, in revising the group in 1877,<sup>4</sup> not only had the hopeless task of untangling Gray's results with the scanty material afforded by the museums in the United States, but was further handicapped by the prevailing tendency of the time to lump species, and as a consequence did not clear the ground. In the following year, 1878, Alston published a paper 'On the Squirrels of the Neotropical Region,'<sup>5</sup> based on an examination of series in the Berlin, Paris, and British museums, with additional specimens sent him by Dr. Allen. Alston states that this material included the types of forty-one nominal species. In this revision 7 species were recognized as living within the limits

<sup>1</sup> Charlesworth's Mag. Nat. Hist., III, p. 334, 1839.

<sup>2</sup> Sitzungsber. Akad. Wiss. Wien. math.-nat. Cl., lv, pp. 474-480. July, 1867.

<sup>3</sup> Ann. and Mag. Nat. Hist., 3d Ser., XX, pp. 415-434. October, 1867.

<sup>4</sup> Mon. N. Am. Rodentia, 1877.

<sup>5</sup> Proc. Zool. Soc. London, 1878, pp. 656-670.

of Mexico and Central America, as against 6 species and 3 varieties enumerated by Allen. In the Mammalia of the 'Biologia Centrali-Americana,' published in 1880, Alston again recognized 7 species—no more than those mentioned by Lesson in 1842. This wholesale lumping of widely separated species—sometimes under a name inapplicable to any of the forms placed under it—left the group even more complicated than before.

Dr. Allen followed Alston's paper of 1878 by a 'Synonymatic List of American Sciuri, or Arboreal Squirrels'<sup>1</sup> in which he adopted the latter's conclusions. Trouessart, in his 'Revision du Genre Écureuil'<sup>2</sup> in 1880, proposed several subgenera and a few months later enumerated the species in his 'Catalogue des Mammifères Vivants et Fossiles' (Rodentia).<sup>3</sup>

During the last 18 years no extended papers on Neotropical squirrels have appeared, but a number of species have been described from Mexico and Central America by Allen, Thomas, Merriam and myself.

#### NOTES ON DISTRIBUTION AND VARIATION.

Tree squirrels occur in suitable places throughout Mexico and Central America but the distribution of the various species depends largely upon the character of the forests. Thus *Sciurus negligens* is most abundant in the low, dense forests of ebony, less than twenty-five feet high, on the hot coast plains, while its near relative *S. deppoi* loves the shady depths of humid tropical forests on the lower mountain slopes where the damp air produces an exuberant tree growth and an abundance of parasitic plants. The pigmy *Sciurus alfari*, first mistaken by its discoverer for a bird—a Dendrocolaptine creeper—also lives in similar surroundings in the mountains of Costa Rica. The large species exist under even more varied conditions since they occur from the hot coast country to the region of oaks and pines close to timberline, but the ranges of different species or subspecies are never coincident and overlap only in a few instances, as in the case of *S. colliæi nuchalis* and *S. poliopus*

<sup>1</sup> Bull. U. S. Geol. & Geog. Survey Terr., IV, pp. 877-887, 1878.

<sup>2</sup> Le Naturaliste, II, No. 37, pp. 290-293, Oct., 1880.

<sup>3</sup> Bull. Soc. d'Etudes Sci. d'Angers, X, pp. 76-82, 1880.



*colimcensis* on the coast of Colima, and *S. apache* and *S. durangi* in the Sierra Madre. No such antagonism exists between the large species (subgenus *Echinosciurus*) and the smaller ones (subgenera *Guerlinguctus* and *Microsciurus*) which frequently occupy the same ranges.

Many species change their environment by periodical migrations in search of food, moving from one locality to another with the ripening of fruits or seeds upon which they subsist. This is most marked on high mountains where a species may have a vertical range of many thousand feet. Dr. Buller obtained a specimen of *Sciurus polioopus cervicalis* among the pines on the Sierra Nevada de Colima at an altitude of 12,000 feet, but when we visited this mountain at another season, gnawed pine cones were abundant near the summit, but the squirrels had descended to lower levels and were feeding on wild figs and acorns at an altitude of 4000–6000 feet. In eastern Queretaro and northern Hidalgo, *S. aurcogaster*, a tropical species which usually ranges below 4000 feet, was found in winter among the oaks and pines above 8000 feet alt. *S. deppci* likewise at times wanders high above its normal range.

The effect of climate on the character of the pelage is so marked that it is possible to tell with considerable certainty whether a species belongs to the tropics or to the higher mountains. Tropical species have thin pelage, short thin under fur, and coarse, stiff, or almost bristly dorsal hairs; those of the Transition and Boreal zones have thick soft pelage with long dense under fur. These differences are sometimes strikingly shown in subspecies of the same squirrel: thus the tropical *Sciurus aurcogaster hypopyrrhus* has thin coarse pelage, while *S. aurcogaster frumentor*, which ranges between the altitudes of 6000 and 8000 feet on a cold mountain slope, has dense soft pelage. Species of the hot coasts of Central America are characterized by peculiarly coarse, shining, bristly dorsal hairs. Seasonal differences in pelage are usually slight, since there is no area of heavy snow fall or long continued cold weather except in the Sierra Madre of Durango and Chihuahua. Individual variation, on the other hand, is often excessive and renders some species extremely difficult to describe. The large

number of species and subspecies of these squirrels, together with their great individual variation, have hitherto proved an insuperable stumbling block in their treatment. The large series now available for study shows that the group as a whole is in a state of evolution and has developed groups of closely related species or well marked geographic races, often within very limited areas. For example, in the State of Vera Cruz, the typical form of *Sciurus aureogaster* occurs throughout the northern part, *S. aureogaster frumentor* on the west-central border, and *S. aureogaster hypopyrrhus* in the southern part. Many of the subspecies are so different from others of the same species that without the intermediate series no one would for a moment suspect their specific identity.

The extraordinary amount of geographical variation in tropical North American squirrels is due mainly to an unusual plasticity of organization which allows slight climatic differences to produce a visible effect. The most obvious of these influences are differences in temperature and rainfall with their distribution through the year, and consequent effect on the vegetation.

The cool forests of the Transition zone in the interior of southern Mexico and Guatemala are characterized by moderate rainfall and have what may be called an inland climate. The forests of the same zone on the mountains bordering the hot coast plains, exposed to the moisture bearing winds from the sea, receive a much greater annual rainfall accompanied by cloudiness and mists, resulting in an exuberance of vegetation not found elsewhere in this zone. The effects of these differences in humidity upon the squirrels are beautifully illustrated by *Sciurus polioopus* and its subspecies. For example, subspecies *hernandezii*, *nemoralis* and *cervicalis*, of the drier interior mountains, are characterized by dull grayish upperparts and white underparts, and the absence of sharply contrasting nape and rump patches. *Sciurus polioopus* and its subspecies *effugiis* inhabit mountains near the coast, and the effect of the increased humidity is marked by the striking contrast between their gray backs and bright ferruginous underparts. In addition, *effugiis* has an unusually dark nape patch and brilliantly white ear patches.

Increased humidity within the tropics, also, is usually accom-

panied by increased intensity of coloration. This is well shown by the dark, rich colors of *Sciurus aureogaster hypopyrrhus* of the humid tropics compared with the paler colors of the closely related *S. aureogaster*, of the arid tropics a little farther north.

A similar intensification of color is characteristic of the squirrels inhabiting the humid east coast from Vera Cruz to Panama, as contrasted with the paler species of the more arid west coast from Mazatlan to Costa Rica.

### SUBGENERA OF NORTH AMERICAN SQUIRRELS.

The tree squirrels of North America may be separated into ten groups, distinguished by cranial, and sometimes by external characters. Six of these groups have been already recognized as of subgeneric rank, and four others are here named.

In discriminating the subgenera of squirrels one of the characters on which much stress has been laid is the presence or absence of the small upper premolar. The discussion of the groups in detail is prefaced, therefore, with a few remarks on this tooth. Trouessart makes the erroneous statement that in the subgenus *Macroxus* the upper molar series is often  $\frac{5}{4}$  in the young and  $\frac{4}{4}$  in the adult, adding that the rudimentary premolar is more or less speedily shed.<sup>1</sup> Under *Macroxus* he names six Tropical American squirrels, viz., *aureogaster*, *æstuans*, *hoffmanni*, *deppei*, *chrysurus*, and *pusillus*. Of these *æstuans* and *hoffmanni* never have the extra premolar, while all of the others, with the possible exception of *chrysurus*, always have it in the adult skull. The six species named above represent four subgenera, two of which were recognized by Trouessart in the same paper; one has since been separated by Allen; another is described below. In all North American Squirrels having the extra premolar, except the Chickarees or Red Squirrels of the United States and Canada (subgenus *Tamiasciurus*), it is well developed and permanent. Among the Chickarees it is extremely small, variable in size, shape, and position, and frequently absent. Dr. Allen states, in his recent revision, that it is absent

<sup>1</sup> Le Naturaliste, II, No. 37, pp. 292, Oct., 1880.

in thirty percent of the specimens examined. In the skulls of *Tamiasciurus* examined by me the percentage of absences is much smaller than that given by Dr. Allen, but the tooth was frequently so minute that it could be seen only by the aid of a lens. It is smallest, most variable and most frequently absent in the eastern *S. hudsonicus* and its subspecies. In the other groups of North American squirrels, this tooth, when present, is a well-developed peg, reaching nearly or quite as high as the 2d premolar, and often functional, the crown wearing down with the adjacent teeth. Skulls from Mexico show conclusively that in the species of that region, at least, the small premolar is a character of the adult. It is not present with the milk premolar in immature skulls, but appears coincidentally with the permanent premolar and is equally persistent. Since it is persistent in certain groups and always absent in others, it evidently possesses considerable taxonomic value.

The subgenera recognized in the present paper occupy clearly defined geographic areas and, without exception, the ranges of the most closely related groups are separated by a distinct gap. A curious equality is found in the number of subgenera belonging respectively to Tropical and Temperate North America. Five of the ten subgenera belong essentially to Mexico and Central America, only one having a representative within the United States. The remaining five belong to Temperate North America, although four of them have each a single representative in extreme northern Mexico. The distribution of the subgenera may be tabulated roughly as follows :

## MEXICO AND CENTRAL AMERICA.

*Baiosciurus* subgen. nov.  
*Echinosciurus* Trouess.  
*Aræosciurus* subgen. nov.  
 Not represented.  
 Not represented.  
*Guerlinguetus* Gray.  
*Microsciurus* Allen.

## UNITED STATES.

*Tamiasciurus* Trouess.  
*Neosciurus* Trouess.  
*Parasciurus* Trouess.  
*Otosciurus* subgen. nov.  
*Hesperosciurus* subgen. nov.  
 Not represented.  
 Not represented.

The extra premolar is present in all of these groups except *Aræosciurus*, *Parasciurus*, and *Guerlinguetus*. *Guerlinguetus*

and *Microsciurus* are South American groups with numerous species, and occur as intrusive elements in Central America, where each is represented by one or two species. *Otosciurus* and *Hesperosciurus* have few species and belong to the western United States, but cross the border into Mexico.

The first name available for a subgenus of American Squirrels is *Guerlinguetus* Gray, 1821, of which *Macroxus* is a synonym. *Macroxus*, the name which has been commonly used, has been curiously diverted from its original application to include nearly all American squirrels. Lesson was the first to misuse the name, after which Gray went to even greater extremes, in which he was, to a certain extent, followed by Trouessart in 1897. In 1880 the last named author established several subgenera of American squirrels, several of which were accepted by Merriam and Allen; yet in 1897 he again lumped several of them in the ancient confusion under *Macroxus*. The most recently described subgenus is *Microsciurus* Allen, 1895.

LIST OF SUBGENERA WITH TYPE SPECIES.

- Echinosciurus*, type *S. hypopyrrhus* Wagler (p. 25, 38).  
*Hesperosciurus*, type *S. griseus* Ord (p. 27, 83).  
*Neosciurus*,<sup>1</sup> type *S. carolinensis* Gmelin (p. 27).  
*Otosciurus*, type *S. aberti* Woodhouse (p. 28, 85).  
*Tamiasciurus*, type *S. hudsonicus* Erxleben (p. 28, 87).  
*Aræosciurus*, type *S. oculus* Peters (p. 29, 88).  
*Parasciurus*, type *S. niger* Linnæus (p. 30, 97).  
*Guerlinguetus*, type *S. guerlinguetus* Gray (p. 30, 98).  
*Baiosciurus*, type *S. deppei* Peters (p. 31, 101).  
*Microsciurus*, type *S. alfari* Allen (p. 32, 105).

Subgenus ECHINOSCIURUS Trouessart (pl. I, fig. 9).

- Echinosciurus* TROUESSART, Le Naturaliste, II, No. 37, Oct. 1880, p. 292; Cat. Mamm., Rodentia, pp. 80-81, 1880 (part).  
*Macroxus* TROUESSART, Catalogus Mammalium, nov. ed., II, pp. 421-429, 1897 (part).  
Type *Sciurus hypopyrrhus* WAGLER, from Mexico.

<sup>1</sup>*Neosciurus* is included here in order to complete the revision of the subgenera of North American squirrels.

*Distribution.*—All of Central America and Mexico (except extreme northern part). Ranges from Arid and Humid Tropical zones up to Boreal.

*External characters.*—Form and color extremely variable: body usually rather slender; tail long, narrow; pelage coarse, stiff, almost bristly, in typical species.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull short, broad, depressed; brain case not highly arched but expanded laterally and widening to occiput; interorbital area broad, rostrum short, broad, and heavy; nasals about equal to or shorter than interorbital width.

*General notes.*—*S. hypopyrrhus* Wagler was named as the type of *Echinosciurus*, but most of the red bellied Central American squirrels were given that name at the time Trouessart wrote, and he no doubt had in mind some bristly haired species from Central America instead of Wagler's animal. However, Wagler's *hypopyrrhus* belongs to the same natural group and must therefore be retained as the type. Most of the large squirrels in tropical North America belong to this group. The skulls are distinguished from those of other large North American species by the combination of two upper premolars with a short broad rostrum and flattened interorbital region. *Echinosciurus* contains *S. aureogaster*, *S. polioopus*, *S. yucatanensis*, *S. colliæi*, *S. truei*, *S. sinaloensis*, *S. nelsoni*, *S. socialis*, *S. griseoflavus*, *S. goldmani*, *S. managuensis*, *S. boothiæ*, *S. adolphei* and *S. thomasi* with their subspecies. These species occupy nearly all of the hot coast region of tropical North America and range thence over the mountains of Central America and southern Mexico. Those of the highlands of Guatemala and southern Mexico are distinguishable from those of the hot coasts and the interior of Central America by their much longer and softer pelage. In the former series are *S. aureogaster*, *S. polioopus*, *S. truei*, *S. sinaloensis* and *S. griseoflavus*, with their subspecies. The species of the hot districts on the coast and southward are remarkable for the stiff, harsh and usually shining long hairs of the back—the character upon which the name of the subgenus must have been based. *S. yucatanensis* with white ear tufts, and *S. polioopus* with a comparatively long, slender rostrum and soft pelage are least typical. *S. aureogaster hypopyrrhus*, the type, is about midway, in the character of its pelage, between the soft haired species of the highlands and the harsh haired species of Central America. The wide geographic range and large number of species of this group are accompanied by a greater amount of specific variation in the skull than is shown in the smaller groups. In the species of Central

America there seems to be a curious correlation between the increased thickness of the rostrum and the increased coarseness of the pelage, the extreme of which is reached in *S. thomasi*.

HESPEROSCIURUS<sup>1</sup> subgen. nov. (Pl. I, fig. 5).

Type *Sciurus griseus* Ord, from the Dalles of the Columbia.

*Distribution*.—Extreme southwestern Washington, western Oregon, and most of California, to northern Lower California, Mexico. Transition zone and border of Upper Sonoran.

*External characters*.—Size very large—total length about 560 mm.; tail a little shorter than head and body, very broad and bushy.

*Cranial characters*.—Premolars  $\frac{2}{1}$ ; molar series, including small premolar, unusually heavy; skull large and long, with long and deep rostrum; nasals long, expanded anteriorly and much narrowed posteriorly; brain case depressed and broadened across parietal region; postorbital process of malar strongly developed and usually ending in a point. Skull most like that of *Neosciurus*, especially in proportions of rostrum and interorbital area, but decidedly more depressed and broadened posteriorly; the zygomatic process of squamosal thrown out horizontally, and the zygomatic arch inclined less obliquely upward.

*General notes*.—*Hesperosciurus* is a small group containing only *S. griseus* Ord and its subspecies *nigripes* Bryant. It is limited to the Transition and upper part of Upper Sonoran zones of the Pacific Coast States and has its nearest relative in the Gray Squirrels (*Neosciurus*) of the eastern United States. Like the latter the color is uniform gray above and white below, the group distinctions resting mainly on cranial characters.

Subgenus NEOSCIURUS Trouessart.

*Neosciurus* TROU ESSART, Le Naturaliste, II, No. 37, Oct. 1880, p. 292; Cat. Mamm., Rodentia, pp. 76-77, 1880 (part); MERRIAM, Proc. Biol. Soc. Washington, VII, p. 27, 1892 (part).

*Macroxus* TROU ESSART, Catalogus Mammalium, nov. ed., II, p. 421, 1897 (part).

Type *Sciurus carolinensis* Gmelin, from Carolina.

*Distribution*.—Eastern half of United States, not reaching Mexican border. Lower and Upper Austral and Transition zones.

*External characters*.—Form rather slender; tail bushy; upperparts gray or grayish brown; underparts white. Externally much like certain species of *Aræosciurus* but with different tooth formula.

<sup>1</sup> From ἑσπερος, western; + *Sciurus*.

*Cranial characters.*—Premolars  $\frac{2}{3}$ . Skull long and rather narrow; braincase inflated over interparietal region; rostrum long, compressed laterally; nasals much longer than interorbital breadth, much narrowed posteriorly and expanded anteriorly; occiput high and narrow; squamosal process of zygomatic arch turning abruptly down, the arch ascending more obliquely from back to front than in *Hesperosciurus*.

*General notes.*—This subgenus includes *S. carolinensis* and its subspecies of the eastern United States. It is an Austral and Transition zone group. *Neosciurus* is most closely related to *Hesperosciurus*, from which it is distinguished by the braincase, which is highly arched over the interparietals and narrowed and rounded posteriorly. These two groups balance one another in the eastern and western United States much as do *Parasciurus* and *Aræosciurus*.

#### OTOSCIURUS<sup>1</sup> subgen. nov. (pl. I, fig. 2).

Type *Sciurus aberti* Woodhouse, from San Francisco Mt., Arizona.

*Distribution.*—Rocky Mountains and Sierra Madre, from state of Colorado to Durango, Mexico. Transition zone.

*External characters.*—Ears long and broad, with magnificent tufts in winter; tail short and unusually broad; feet very large. Upperparts mainly gray; underparts white, with lateral line more or less distinctly black.

*Cranial characters.*—Premolars  $\frac{2}{3}$ . Skull short and broad; frontal area flattened; braincase depressed, inflated laterally; rostrum compressed laterally, rather light; nasals long (equalling interorbital breadth).

*General notes.*—*Otosciurus* like *Tamiasciurus* has strong external characters by which it may be at once recognized. The group contains three species, *S. aberti*, *S. concolor*, and *S. durangi*, which range through the yellow pine forests of the Transition zone in the southern Rocky Mountains and northern Sierra Madre.

#### Subgenus TAMIASCIURUS Trouessart (pl. I, fig. 8).

*Tamiasciurus* TROUSSERT, Le Naturaliste, II, No. 37, Oct. 1880, p. 292; Cat. Mamm., Rodentia, pp. 81–82, 1880; MERRIAM, Proc. Biol. Soc. Washington, VII, p. 23, 1897; ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., X, pp. 249–298, 1898.

*Macroxus* TROUSSERT, Catalogus Mammalium, nov. ed., II, pp. 421–429, 1897 (part).

Type '*Sciurus hudsonius* Pall.' (= *S. hudsonicus* Erxl.), from Hudson Bay.

<sup>1</sup> From οὖς, ὠτός, ear; + *Sciurus*.



*Distribution.*—Most of the wooded parts of the United States and British America; south to northern Lower California, Mexico. Boreal and Transition zones.

*External characters.*—Size small—under 450 mm.; ears long, well haired, conspicuously tufted in winter; tail short, bushy, flattened; lateral line (present in summer) black.

*Cranial characters.*—Premolars  $\frac{2}{3}$  sometimes  $\frac{1}{3}$  (the first very small and irregular in development); skull short, wide and depressed; rostrum short and stout; nasals shorter than interorbital breadth; anterior end of zygomatic arch unusually broad and abruptly spreading; auditory bullæ proportionately large.

*General notes.*—*Tamiasciurus* was proposed by Trouessart in 1880 and subsequently dropped into synonymy until revived by Dr. Merriam in 1892. Curiously enough Trouessart reduced it again to synonymy in 1897, uniting it with most other North American squirrels under the untenable subgeneric name *Macroxus*. In 1898 Dr. Allen again revived the subgenus, which is unquestionably worthy of recognition as a well marked natural group. *Tamiasciurus* includes all of the Chickarees, *S. hudsonicus*, *S. douglasi* and *S. fremonti* with their subspecies. As already stated by Dr. Merriam, this subgenus is of Boreal origin, but is also common throughout a large part of the Transition zone in the United States.

#### ARÆOSCIURUS<sup>1</sup> subgen. nov. (pl. I, fig. 3).

Type *Sciurus oculus* Peters, from eastern Mexico.

*Distribution.*—Mountains bordering the tableland of Mexico from the volcanoes of Orizaba and Toluca north to central Arizona and west-central New Mexico. Transition zone.

*External characters.*—Size large; body rather slender; tail usually long, sometimes exceeding length of head and body; upperparts gray or yellowish; underparts white or yellowish.

*Cranial characters.*—Premolars  $\frac{1}{3}$ . Skull rather short, depressed; braincase broadened at parietals; occiput low and broad; front of skull depressed at base of rostrum (more arched in *Parasciurus*); rostrum light; nasals narrow, slightly tapering posteriorly; upper end of premaxillæ narrow.

*General notes.*—The subgenus *Aræosciurus* is characteristic of the Transition zone in the mountains bordering the tableland of Mexico from Mts. Orizaba and Toluca northward. It is intrusive in the United

<sup>1</sup> From ἀραιός, slender; + *Sciurus*.

States, where it is represented in Arizona and western New Mexico by a single species, *S. arizonensis*. The group is most nearly related to *Parasciurus* from which the skull characters distinguish it. The following species and subspecies belonging to this subgenus: *S. ocellatus*, *S. o. toluca*, *S. alleni*, *S. nayaritensis*, *S. apache*, *S. arizonensis* and *S. a. huachuca*.

Subgenus PARASCIURUS Trouessart (pl. I, fig. 1).

*Parasciurus* TROUESSART, Le Naturaliste, II, No. 37, Oct. 1880, p. 292; Cat. Mamm., Rodentia, pp. 77-78, 1880 (part); MERRIAM, Proc. Biol. Soc. Washington, VII, p. 27, 1892.

*Macroxus* TROUESSART, Catalogus Mammalium, nov. ed., II, p. 421, 1897 (part).

Type *Sciurus niger* Linn., from Carolina.

*Distribution*.—Eastern half of United States, entering Mexico from western Texas. Upper and Lower Austral (Sonoran) zones.

*External characters*.—Size large; body slender; tail long, rather bushy. Upperparts grizzled blackish or yellowish; underparts blackish or yellowish.

*Cranial characters*.—Premolars  $\frac{1}{4}$ . Skull rather long, rostrum long and broad, nasals broad; braincase long, narrow, not inflated over parietals and narrowed at occiput.

*General notes*.—The subgenus *Parasciurus* is limited to the Fox Squirrels, *S. niger* and *S. ludovicianus* with their subspecies. It is distinguished from *Aræosciurus* mainly by the long narrow braincase and heavier rostrum. The ranges of the two groups do not touch at any point.

Subgenus GUERLINGUETUS Gray (pl. I, fig. 7).

*Guerlinguetus* GRAY, London Medical Repository, XV, p. 304, April, 1821.

*Macroxus* F. CUVIER, Dents des Mamm., p. 162, 1823. (Type, le guerlinguet); Dict. Class. d'Hist. Nat. X, p. 16, 1826; LESSON, Nouv. Tabl. Règn. Anim., Mamm., p. 111, 1842 (part); GRAY, Ann. & Mag. Nat. Hist., 3d Ser., XX, pp. 271, 419-434, 1867 (part); TROUESSART, Le Naturaliste, II, No. 37, 1880, p. 292 (part); Cat. Mamm., Rodentia, pp. 78-80, 1880 (part); Catalogus Mammalium, nov. ed., II, pp. 421-429, 1897 (part).

Type, 'le guerlinguet'—*S. guerlinguetus* Gray (= *Sciurus aestuans* Linn.), from Surinam.

*Distribution*.—Tropical America from Peru and Brazil to Nicaragua.

*External characters*.—Size rather small—total length between 300 and 450 mm.; ears long, thinly haired; tail shorter than body, rather

bushy, flattened; color usually some shade of brown on upperparts and buffy or rufous below.

*Cranial characters.*—Premolars  $\frac{1}{4}$ . Skull rather broad, flattened interorbitally; rostrum broad and deep at base; nasals long, expanded at outer end; braincase not very highly arched but expanded laterally over parietal region; audital bullæ small; post-palatal notch a little farther behind last molar than in *Microsciurus* (about as in *Baiosciurus*); palatal width between molar series great. The skull resembles in size and general appearance that of *Baiosciurus*, from which it is distinguishable by slender rostrum, proportionately greater interorbital and zygomatic breadth, and by the absence of the small premolar.

*General notes.*—*Guerlinguetus*, proposed by Gray in 1821, is the first name available for a subgenus of American squirrels. It was subsequently discarded by its author for *Macroxus*, proposed two years later by Cuvier in the 'Dents des Mammifères.' In the 'Nomenclator Zoologicus,' Agassiz cites *Macroxus* from the 'Dictionnaire des Sciences Naturelles, X, 1818,' but a careful search fails to verify the reference. The name does appear in the Dictionnaire Classique d'Histoire Naturelle, Vol. X, 1826, p. 16, which was probably the citation intended by Agassiz. The 'Dents des Mammifères' was completed in 1825, but on page xvi of the introduction Cuvier states that the work appeared in parts, and that the part containing the rodents was issued in 1823; from which therefore must date *Macroxus*. Subsequent writers have followed Gray in ignoring *Guerlinguetus* in favor of *Macroxus*. The latter name was proposed for the group typified by *Sciurus æstuans* of South America, yet Lesson in 1842, Gray in 1867, and Trouessart in 1880 and 1897, included under it the most diverse squirrels in America. *Guerlinguetus* should be strictly limited to *S. æstuans* with its numerous subspecies and allies, all of which have brownish backs with brown, fulvous, or rufous bellies and a single upper premolar. It is a characteristic group of northern South America, intrusive in Central America where it is represented by *S. a. hoffmanni* of Costa Rica and *S. richmondi* of Nicaragua.

#### BAIOSCIURUS<sup>1</sup> subgen. nov. (pl. I, fig. 4.)

*Type* *Sciurus deppci* Peters, from Papantla, Vera Cruz.

*Distribution.*—Northeastern Honduras, Guatemala, Chiapas and eastern Mexico to Tamaulipas.

<sup>1</sup> From *βαίος*, small; + *Sciurus*.

Proc. Wash. Acad. Sci., May, 1899.

*External characters.*—Size small—total length between 350 and 400 mm.; ears long, thinly haired; tail slightly shorter than body, narrow and flattened.

*Cranial characters.*—Premolars  $\frac{2}{1}$ , well developed; skull rather long and slender; rostrum broad and deep at base; nasals about equal to interorbital breadth; anterior end of zygomatic arch narrow and tapering gradually to junction with premaxilla; braincase rounded and slightly arched on posterior half of frontals; audital bullæ proportionately small, smaller than in *Guerlinguetus* and much smaller than in *Tamiasciurus*.

*General notes.*—*Baiosciurus* contains but two species, *S. deppei* and *S. negligens*. In size and general style of color these squirrels are very similar to members of the subgenus *Guerlinguetus*, but are distinguished by the presence of an extra premolar and other skull characters. Their size, shape of tail, and form of skull distinguish them from *Microsciurus*; and the slender tail, presence of a well developed small premolar, lack of ear tufts, absence of the black lateral line and shape of skull separates them from *Tamiasciurus*. The group is purely tropical, *S. deppei* belonging to the Humid and *S. negligens* to the Arid Tropical zones.

#### Subgenus MICROSCIURUS Allen (pl. I, fig. 6).

*Microsciurus* ALLEN, Bull. Am. Mus. Nat. Hist., VII, p. 332, 1895;  
TROUËSSART, Catalogus Mammalium, nov. ed., II, p. 429, 1897.  
*Type Sciurus alfari* Allen, from Jiménez, Costa Rica.

*Distribution.*—Northern South America north to Costa Rica, Central America.

*External characters.*—Smallest of American squirrels—total length, in nearly or quite all the species, under 300 mm. Ears short, rounded, well haired; tail much shorter than body, slender and rounded.

*Cranial characters.*—Premolars  $\frac{1}{1}$ . Skull short, broad and highly arched over braincase: rostrum short, broad and deep at base; nasals narrow and shorter than interorbital breadth; upper end of premaxillæ very heavy; malar broad and expanded vertically; postpalatal notch only a trifle posterior to last molar.

*General notes.*—*Microsciurus* is a tropical American subgenus with numerous species distributed over a large part of northern South America and may be considered intrusive in Central America, *S. alfari* being the only species known north of Panama. *S. pusillus* Desm., *S. kuhli* (Gray), *S. peruanus* Allen, *S. mimulus* Thomas, and other South American species belong here. Until Dr. Allen de-

fined this group its members were confused with the species of the subgenus *Guerlinguetus* Gray (*Macroxus* Cuvier) which are characterized by a single upper premolar.

KEY TO SPECIES AND SUBSPECIES.

SIZE LARGE, TOTAL LENGTH OVER 450 MM.

Premolars  $\frac{1}{1}$

*Belly buffy or yellowish*

Back gray

Median area on back black; belly usually deep buff  
*oculatus* p. 88.

Median area on back washed with blackish; belly buffy whitish.....*tolucæ* p. 89.

Back yellowish gray

Belly rusty yellow; total length over 500 mm.  
*apache* p. 94.

Belly more dingy yellow; total length under 500 mm.....*limitis* p. 97.

*Belly white*

Back golden buffy or yellowish overlaid with grizzling of black and white.....*nayaritensis* p. 93.

Back gray

Back uniform gray or grayish brown; ears gray; total length under 500 mm.....*alleni* p. 91.

Back gray washed with yellowish on nape and back of shoulders; ears rusty; total length over 500 mm.....*huachuca* p. 96.

Premolars  $\frac{2}{1}$

**Nape patch strongly marked, rump patch present or absent**

*Belly gray, white, or buffy*

Belly gray, rump patch well marked; back dark gray.....*frumentor* p. 44.

Belly white or buffy

Rump patch poorly defined or absent

Back dull whitish; belly white or buffy  
*socialis* p. 62.

Back pale gray; belly white or buffy  
*hernandezi* p. 48.

Rump patch well defined

Middle of back gray; feet gray or blackish; belly white.....*colimensis* p. 52.

Middle of back whitish; feet whitish, belly white or buffy.....*cocos* p. 65.

*Belly rufous*

Feet gray or blackish

Ribs and sometimes shoulders rufous

Back pale gray; top of head iron gray  
*aurcogaster* p. 38.

- Back dark gray; top of head iron gray or blackish.....*hypopyrrhus* p. 42.
- Ribs and shoulders not rufous
- Back dingy whitish; nape patch rusty  
*socialis* p. 62.
- Back bluish gray in middle, remainder sooty brownish.....*hirtus* p. 56.
- Feet white
- Back whitish, rump and nape patches very bright.....*cocos* p. 65.
- Back gray
- Nape patch strongly marked, dark rufous  
*effugius* p. 54.
- Nape patch not strongly marked, rusty yellowish.....*poliopus* p. 46.
- Nape and rump patches absent or not well defined**
- Nape and rump patches not well defined
- Back dark gray, sparingly or not at all mixed with yellowish hairs
- Back and under side of tail dark iron gray; feet gray  
*cervicalis* p. 51.
- Back and under side of tail paler gray; feet white  
*nemoralis* p. 50.
- Back pale gray mixed with yellowish hairs; feet white
- Belly white.....*hernandezi* p. 48.
- Belly rufous.....*poliopus* p. 46.
- Nape and rump patches absent
- Back with broad median band of blackish; rest of body whitish  
*dorsalis* p. 74.
- Back without broad median band of blackish
- Belly pale gray; back coarsely grizzled gray or yellowish gray  
*yucatanensis* p. 70.
- Belly not pale gray
- Belly blackish or white**
- Belly blackish; back sooty blackish grizzled with yellowish gray.....*nelsoni* p. 55.
- Belly white
- Ear tufts present, whitish; back gray or yellowish gray  
*yucatanensis* p. 70.
- Ear tufts absent
- Ears bordered with black*
- Back very dark, lateral line reddish; ear patches rusty.....*boothia* p. 76.
- Back grayer, no lateral line; ear patches very large, white.....*goldmani* p. 82.
- Ears not bordered with black*
- Back pale gray or yellowish, *finely* grizzled with black
- Back gray
- Size large; total length about 570 mm.; back uniform; no lateral line.....*griseus* p. 83.

Size medium, total length about 485 mm.; median dorsal area rufous; lateral line black

*durangi* p. 85.

Back yellowish

Ears pale rusty; flanks like back...*truei* p. 61.

Ears dull rusty; flanks washed with whitish

*sinaloensis* p. 60.

Back yellowish gray, *coarsely* grizzled with black

Ears gray; yellowish of back dull, sometimes very indistinct.....*colliaci* p. 58.

Ears rusty; yellow of back brighter, more buffy.  
*nuchalis* p. 59.

### Belly not blackish or white

Belly buffy

Back with median area blackish or dark brown, rest of body buffy.....*dorsalis* p. 74.

Back with median area not blackish

Ears black edged.....*variegatoides* p. 79.

Ears not black edged.....*managuensis* p. 81.

Belly rufous

Top of head paler than back

All of back blackish brown; feet, legs, lower flanks and belly dull chestnut rufous.....*adolphi* p. 73.

Middle of back blackish or dark yellowish brown or grayish yellow; rest of body rufous

*dorsalis* p. 74.

Top of head not paler than back

Back heavily washed with black

Belly rusty rufous.....*belti* p. 78.

Belly rich dark ferruginous.....*thomasi* p. 71.

Back not washed with black

*Back pale gray or sooty blackish*

Back pale gray

Feet dark gray or blackish; rufous of belly sometimes extending up on ribs

*aureogaster* p. 38.

Feet pale gray; rufous of belly not extending up on ribs.....*chiapensis* p. 69.

Back sooty blackish, with thin wash of yellowish gray

Back uniform.....*nelsoni* p. 55.

Back with area of bluish gray across the middle.....*hirtus* p. 56.

*Back not pale gray or sooty blackish*

Back yellowish brown sometimes thinly washed with gray.....*griseoflavus* p. 67.

Back blackish, grizzled with gray or yellowish; underparts and costal area rufous

*hypopyrrhus* p. 42.

- SIZE SMALL, TOTAL LENGTH UNDER 450 MM.; PREMOLARS  $\frac{1}{1}$  OR  $\frac{2}{1}$   
 Premolars  $\frac{1}{1}$ ; ears medium long, thinly haired (Subgenus *Guerlinguetus*)  
 Tail washed with bright ferruginous.....*hoffmanni* p. 98.  
 Tail washed with yellowish.....*richmondi* p. 100.  
 Premolars  $\frac{2}{1}$   
 Ears large, tufted (Subgenus *Tamiasciurus*)  
 Back gray, belly white, lateral line black.*mearnsi* p. 87.  
 Ears small or medium, not tufted  
 Ears short, rounded, thickly haired; total length under 300 mm. (Subgenus *Microsciurus*)  
 Tail washed with reddish.....*alfari* p. 105.  
 Ears medium long, pointed, thinly haired; tail washed with white; total length over 300 mm. (Subgenus *Baiosciurus*)  
 Back grayish brown.....*negligens* p. 104.  
 Back reddish or yellowish brown.....*deppei* p. 101.

LIST OF SPECIES, TYPE LOCALITIES, AND SPECIMENS  
 EXAMINED.

Name.	Type Locality.	No. of specimens examined.
<i>Sciurus aureogaster</i> F. Cuv.	Eastern Mexico [Typical at Alta Mira, Tamaulipas]	98
<i>hypopyrrhus</i> (Wagl.)	'Mexico' [Typical at Minatitlan, Vera Cruz]	18
<i>frumentor</i> Nelson	Las Vigas, Vera Cruz, Mexico	14
<i>polioopus</i> (Fitzinger)	'Cordillera of Oaxaca' [Typical on Cerro San Felipe] Oaxaca	16
<i>hernandezii</i> Nelson	Mts. w. of Oaxaca City, Oaxaca, Mexico	17
<i>nemoralis</i> Nelson	Patzcuaro, Michoacan, Mexico	32
<i>cervicalis</i> (Allen)	Sierra Nevada de Colima, Jalisco, Mex.	24
<i>colimensis</i> Nelson	Hacienda Magdalena, Colima, Mexico	10
<i>effugius</i> Nelson	Mts. w. of Chilpancingo, Guerrero, Mex.	8
<i>nelsoni</i> Merriam	Huitzilac, Morelos, Mexico	18
<i>hirtus</i> Nelson	Tochimilco, Puebla, Mexico	7
<i>colliiei</i> Richardson	San Blas, Tepic, Mexico	24
<i>nuchalis</i> sub sp. nov.	Manzanillo, Colima, Mexico	17
<i>sinaloensis</i> sp. nov.	Mazatlan, Sinaloa, Mexico	4
<i>truei</i> sp. nov.	Camoá, Rio Mayo, Sonora, Mexico	4
<i>socialis</i> Wagner	Near Tehuantepec City, Oaxaca, Mex.	54
<i>cocos</i> Nelson	Acapulco, Guerrero, Mexico	33
<i>griseoflavus</i> (Gray)	'Guatemala' [Typical near Dueñas]	22
<i>chiapensis</i> subsp. n.	San Cristobal, Chiapas, Mexico	12



LIST OF SPECIES, TYPE LOCALITIES, AND SPECIMENS  
EXAMINED.

(Continued.)

Name.	Type Locality.	No. of specimens examined.
<i>yucatanensis</i> Allen	Merida, Yucatan, Mexico	5
<i>thomasi</i> sp. nov.	Talamanca, Costa Rica	5
<i>adolphei</i> (Lesson)	Realejo, Nicaragua	1
<i>dorsalis</i> (Gray)	W. coast Central America [Typical at Liberia, Costa Rica]	20
<i>boothia</i> Gray	'Honduras' [Typical at San Pedro Sula]	8
<i>Sciurus boothia belti</i> subsp. nov.	Escondido River, Nicaragua	8
<i>variegatoides</i> Ogilby	Salvador, Central America	1
<i>managuensis</i> Nelson	Managua River, Guatemala	3
<i>goldmani</i> Nelson	Huehuetan, Chiapas, Mexico	10
<i>griseus</i> Ord	The Dalles of the Columbia, Oregon	52
<i>durangi</i> (Thomas)	Ciudad Ranch, Durango, Mexico	32
<i>douglasi mearnsi</i> (Town.)	San Pedro Martir Mts., Lower California, Mexico	3
<i>oculatus</i> Peters	Eastern Mexico [Typical at Las Vigas, Vera Cruz]	46
<i>toluca</i> Nelson	Volcano of Toluca, Mexico	15
<i>alleni</i> Nelson	Monterey, Nuevo Leon, Mexico	22
<i>nayaritensis</i> Allen	Valparaiso Mts., Zacatecas	41
<i>apache</i> Allen	Near Bavispe River, Chihuahua, Mex.	33
<i>arizonensis huachuca</i> Allen	Huachuca Mts., Arizona	26
<i>ludovicianus limitis</i> (Baird)	Devil's River, Texas	14
<i>aestuans hoffmanni</i> Peters	Costa Rica [Typical near San José]	25
<i>richmondi</i> Nelson	Escondido River, Nicaragua	18
<i>deppei</i> Peters	Papantla, Vera Cruz, Mexico	73
<i>negligens</i> Nelson	Alta Mira, Tamaulipas, Mexico	23
<i>alfari</i> Allen	Jiménez, Costa Rica	3

SYSTEMATIC DESCRIPTIONS OF SPECIES.<sup>1</sup>Subgenus **ECHINOSCIURUS** Trouessart. (pl. I, fig. 9.)**SCIURUS AUREOGASTER** F. Cuvier. Red-bellied Squirrel.

*Sciurus niger* ERXLEBEN, Syst. Regni Anim., pp. 417-418, 1777 (part: the melanistic form—*Sciurus mexicanus* or *Quautechallotlthilitic* of Hernandez, p. 582. Not *S. niger* Linn., 1758.)

*Sciurus variegatus* DESMAREST, Nouv. Dict. d'Hist. Nat., x, pp. 103-104, 1817 (part); SAUSSURE, Revue et Mag. de Zool., pp. 4, 5, 1861; ALSTON, Proc. Zool. Soc. London, pp. 660-662, 1878 (part); Biol. Cent.-Am., Mamm., pp. 127-128, 1880 (part: specimens from Orizaba, Cordova, Mirador, Santuario and Jalapa, Vera Cruz); SUMICHRAST, La Naturaleza, v, p. 324, 1882 (part: specimens from central Vera Cruz); THOMAS, Proc. Zool. Soc. London, p. 74, 1890. (Not *S. variegatus* ERXLEBEN 1777.)

*Sciurus aureogaster* F. CUVIER, Hist. Nat. Mammifères, VI, livr. LIX, pl. with text, 1829; BACHMAN, Proc. Zool. Soc. London, pp. 88-89, 1838; I. GEOFFROY, Voyage de la Vénus, Zool., Atlas, pl. II, 1846; text, pp. 156-163, 1855 (part: specimens described with rufous lower surface); BAIRD, Mamm. N. Am., p. 282, 1857; ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, pp. 181-182, 1890 (part: specimens from Tampico); Ibid., III, p. 222, 1891 (part: specimens from Valles, San Luis Potosi, and Tampico, Tamaulipas).

*Sciurus rufiventer* LICHTENSTEIN, Abhandl. K. Akad. Wiss. Berlin, p. 116 (1827), 1830.

*Sciurus leucogaster* F. CUVIER, Suppl. d'Hist. Nat. Buffon, I, pp. 300-301, 1831.

*Sciurus mustelinus* AUDUBON and BACHMAN, Proc. Acad. Nat. Sci. Phila., pp. 100-101, 1841 (melanistic); Journ. Acad. Nat. Sci. Phila., VIII, pt. 2, p. 312, 1842; Quad. N. Am., III, pp. 258-259, pl. CLII, 1851.

*Sciurus ferrugineiventris* AUDUBON and BACHMAN, Proc. Acad. Nat. Sci. Phila., p. 101, 1841; Journ. Acad. Nat. Sci. Phila., VIII, pt. 2, p. 313, 1842; Quad. N. Am., I, pp. 292-293, pl. XXXVIII, 1851.

*Sciurus ferrugineiventris* SCHINZ, Synopsis Mamm., II, p. 14, 1845.

*Sciurus aurogaster* AUDUBON and BACHMAN, Quad. N. Am., III, p. 344, 1851.

*Sciurus hypoxanthus* (LICHTENSTEIN MS) I. GEOFFROY, Voyage de la Vénus, Zool. (text), pp. 158-159, 1855 (on labels of squirrels from Berlin Museum).

*Sciurus chrysogaster* GIEBEL, Säugethiere, p. 650 footnote, 1855.

*Macroxus aureogaster* GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 423, 1867 (var. 2 from Mexico).

*Sciurus aureigaster* ALLEN, Mon. N. Am. Rodentia, pp. 750-753, 1877 (part: specimens from Orizaba, Cordova, and Mirador, Vera Cruz); Bull. U. S. Geol. Survey Terr., IV, pp. 882-883, 1878.

*Sciurus hypopyrrhus* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, pp. 222-223, 1891. (Melanistic specimens from Tampico, Mexico.)

*Sciurus leucops* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., IX, p. 198, 1897.

*Type locality*.—'California'—really eastern Mexico. Specimens from Alta Mira, Tamaulipas are typical. Type in Paris Museum?

<sup>1</sup>All measurements are in millimeters; specimens measured in the flesh unless otherwise stated. The basal length of the skull is measured from gnathion to basion, the palatal length from Henselion (posterior alveolus of incisor) to palatal notch.

*Distribution.*—Arid tropical lowlands and adjacent mountains of southern Tamaulipas, northern Vera Cruz, eastern San Luis Potosi, eastern Queretaro and Puebla, northeastern Hidalgo, and thence south to border of Humid Tropical zone in central Vera Cruz, and northern side of Isthmus of Tehuantepec in Oaxaca. (Usually below 4000 ft. alt., but sporadically up to over 8000 ft. in Hidalgo and Queretaro.)

*Characters.*—Size large; color of back pale grizzled gray with nape patch poorly defined, rusty or yellowish brown; underparts bright ferruginous, this color extending up over fore legs and costal area nearly or quite to top of shoulders. Tail long, flat, and rather slender; hairs on back rather coarse and glossy. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—Top of nose and fore part of crown iron gray; nape patch often indistinct and varying from dull yellowish brown to dull rusty rufous, generally grizzled with gray or whitish; rest of upperparts including upper cheeks, sides and top of neck (below and behind nape patch) a median line between shoulders, entire lumbar region, rump and outside of thighs varying from dark iron gray to pale whitish gray; fore feet and sometimes outside of fore legs iron gray, usually darker than back; hind feet varying from blackish faintly grizzled with gray to iron gray like back; sides of nose, lower cheeks and chin pale grizzled gray; rest of underparts bright ferruginous, this color usually extending over outside of fore legs and high up over costal area, sometimes even meeting and forming a band across top of shoulders; base of tail all around like back; rest of tail above black washed with white; below, with a broad median band of ferruginous, bordered by a line of black and edged with white; ring around eye dark buff, with an area of dull yellowish brown extending back nearly or quite to base of ear; ears gray like crown, or rusty reddish like nuchal patch; ear patches (usually absent in summer) dingy gray or whitish. Hairs on back black, with broad white tips, often mixed with others having broad median and sometimes basal yellow rings. The winter pelage differs from that of summer mainly in paler upperparts and distinct whitish ear patches.

*Variation.*—*Sciurus aureogaster* presents a wide range of variation. The underparts range from bright ferruginous to dark rufous, almost like the color of *S. hypopyrrhus*. The back varies from whitish to dark iron gray. The upward extension of ferruginous on the sides varies from a slight wash just back of fore legs to a broad band reaching over costal area and across top of shoulders, covering nearly half of the body.

A specimen from Orizaba in the U. S. National Museum has the

rufous reaching up all along the flanks, covering the outside of thighs and back, and confining the gray dorsal area to a median band on lumbar region and rump; the top of head and nape black, thinly grizzled with gray, and the tail black thinly washed with gray above, and with ferruginous along middle of under side. A specimen from Pinal de Amoles, Queretaro, has the upperparts, including outside of legs, sides of body and upper surface of tail, nearly uniform pale grizzled gray; the underparts dingy rusty. A specimen from Catemaco, Vera Cruz (approaching *hypopyrrhus* in intensity) has the same pattern as the one last described, but the breast and inguinal region are grizzled with gray. The width of the red median band on the under side of tail varies and is sometimes nearly or quite replaced by the widening of the black border. This is a common phase in individuals grading toward *hypopyrrhus*. Specimens from northern Vera Cruz, Queretaro, San Luis Potosi, and Tamaulipas are paler or grayer than those from farther south in central Vera Cruz.

On the east slope of the Cofre de Perote near Jico and Jalapa, Vera Cruz, most of the squirrels are intergrades between *aureogaster* proper and *frumentor*. They are even richer ferruginous below than true *aureogaster*, but have the distinct nape and rump patches and tendency to obsolescence of rufous median band on lower side of tail of *frumentor*. On account of the rufous underparts these specimens are referred to *aureogaster* rather than to *frumentor*; they combine the characters of the two forms in about equal proportion but differ slightly from either. Squirrels from Lake Catemaco, Vera Cruz, and about Guichicovi, Serabia, and Santo Domingo, Oaxaca, on the Isthmus of Tehuantepec, show intergradation between true *aureogaster* and *hypopyrrhus*, and it is frequently puzzling to decide on which side of the line to class them.

Melanism is common in this species; it is particularly prevalent in some localities and at times entirely replaces the normal phase. A melanistic specimen from Alta Mira, Tamaulipas, has the top of the head and rest of upperparts dark rusty brown, thinly washed with black, darkest over the shoulders; tail black slightly washed with gray; entire underparts, including nose and sides of head to eyes, fore feet and legs and hind feet black, and a thin collar of grizzled rusty brown across the under side of neck. A specimen from Forlon in the same state is similar but has a very much heavier wash of black on the back. Very young squirrels show the characteristic color markings.

*Measurements.*—Average of 5 adults from Alta Mira: total length 509; tail 260; hind foot 66.6.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . The skull (pl. I, fig. 9) of this species is typical of a large group of squirrels in Mexico and Central America. It is rather short and robust, with heavy rostrum; the braincase is inflated over the interparietal region; the peg-like 1st premolar is set barely inside and close to the anterior angle of the 2d premolar. Five adult skulls from Alta Mira average: basal length 49.8; palatal length 26.5; interorbital breadth 19.1; zygomatic breadth 34.5; length of upper molar series 11.3.

*General notes.*—This strikingly colored species was the first tree squirrel of Mexico and Central America to receive a distinctive scientific name, and has figured most prominently in scientific literature. Cuvier published an excellent figure of it with the original description, showing the characteristic bright rufous underparts. The figure represents the less common phase of pelage with but slight extension of rufous on the costal area and a poorly defined nuchal patch. By some curious oversight Cuvier, two years later, renamed the species *S. leucogaster*. He gave California as the habitat of this squirrel but mentioned specimens from eastern Mexico; modern explorations have proved conclusively that it occurs only in eastern Mexico. Later authors have placed it under various names, among which *Sciurus variegatus* Erxleben has been frequently used, but as I have recently shown (Science, NS., VIII, No. 208, pp. 897-8, Dec. 23, 1898), the latter name belongs to a ground squirrel—the so called *Spermophilus macrourus* of Bennett and other authors. The *Sciurus ferruginiventris* of Audubon and Bachman is unmistakably the same as Cuvier's *aureogaster*, and like it was said to come from California; and there is little doubt that *S. mustelinus* of the same authors was based on a melanistic specimen of the same animal.

*Sciurus aureogaster* is separable into three well marked geographic races, of which the one most closely agreeing with Cuvier's figure and description inhabits northern Vera Cruz and southern Tamaulipas. Hence specimens from Alta Mira in southern Tamaulipas are here described as typical.

*Habits.*—This squirrel has a wide distribution in the forests of eastern Mexico, ranging from the coastal plains to the slopes of the Cordillera. On the northern side of the Isthmus of Tehuantepec, Oaxaca, as well as near Orizaba and Jalapa, Vera Cruz, and farther north it commonly ranges up to an altitude of 4000 feet.

Still farther north it extends back along the deep river valleys far into the interior of Hidalgo and Queretaro; and on the humid, densely forested slopes of the mountains at Pinal de Amoles, Quere-

taro, and near Encarnacion, Hidalgo, Mr. Goldman took specimens at an altitude of over 5000 feet. The northern part of its range is an arid tropical region where it occurs mainly in heavy woods along streams and canyons. Farther south, on the borders of the humid tropical region, it finds suitable forests more generally distributed; and on the mountain slopes it is usually found in areas of heavy tree growth.

Throughout their range these squirrels do considerable damage to cornfields, and while corn is in the ear it is an easy matter to find them about the edges of fields cleared in the forest. At other times they are dispersed, seeking food wherever wild fruits or nuts may be in season. Their occurrence at an altitude of 5000 feet in Hidalgo and Queretaro is probably due to a migration in search of food, for this is far above their usual range.

*Specimens examined.*—Ninety-eight, from the following localities: Victoria, Forlon and Alta Mira, Tamaulipas; Valles, San Luis Potosi; Pinal de Amoles, Queretaro (5000 feet); Metlatoyuca, Puebla; Sierra Encarnacion, Hidalgo (5000 feet); Papantla, Chichicaxtle, Jalapa, Jico, Mirador, Orizaba, Motzorongo, Otatitlan, Tuxtla, and Catemaco, Vera Cruz; Serabia, Guichicovi, and mountains near Santo Domingo, Oaxaca.

## SCIURUS AUREOGASTER HYPOPYRRHUS (Wagler).

### Fire-bellied Squirrel.

*Sciurus hypopyrrhus* WAGLER, Oken's Isis, pp. 510-511, 1831; WAGNER, Schreber's Säugth., II, Suppl. pl. CCXIII C, 1837; *Ibid.*, Suppl., III, pp. 167-168, 1843; SAUSSURE, Revue et Mag. de Zool., p. 5, 1861; ALLEN, Mon. N. Am. Rodentia, pp. 746-750, 1877 (part); ALSTON, Proc. Zool. Soc. London, pp. 662-664, 1878 (part); Biol. Cent.-Am. Mammalia, pp. 128-131, 1880 (part: specimens from Coatzacoalcos, Vera Cruz).

*Sciurus hypopyrrhus* GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 424, 1867.

*Macroxus morio* GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 424, 1867.

*Macroxus maurus* GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 425, 1867.  
*Sciurus variegatus* SUMICHRAST, La Naturaleza, v, p. 324, 1882 (part: specimens from southern Vera Cruz, Mexico).

*Sciurus rufiventris*? ROVIROSA, La Naturaleza, VII, p. 360 (1885-86) 1887 (Tabasco, Mexico).

*Sciurus aureogaster* ALLEN, Bull. Am. Mus. Nat. Hist., III, pp. 181-182, 1890 (part: specimens from Serabia, Oaxaca).

*Type locality.*—'Mexico.' Specimens from Minatitlan, Vera Cruz, are typical. Location of type specimen unknown—but probably in Berlin Museum.

*Distribution.*—Humid tropical forests of southern Vera Cruz, ad

jacent parts of extreme southeastern Oaxaca, Tabasco, eastern Chiapas, and perhaps extreme northwestern Guatemala (below 4000 feet).

*Characters*.—This form is much darker than true *S. aureogaster*; the intense, almost chestnut rufous of underparts usually extends as a broad band over the costal area and top of shoulders; the pelage is thinner, with much stiffer and more shining dorsal hairs, and the tail slenderer with black predominating. Teats: p.  $\frac{1}{1}$  a.  $\frac{2}{2}$  i.  $\frac{1}{1}$ .

*Color*.—Top of nose and fore part of crown dark iron gray; lumbar region, rump, outside of thighs and base of tail finely grizzled with black, grayish white, and dull rusty or yellowish brown; nape patch indistinct, dull yellowish brown or dingy rufous, often grizzled with black and gray; ears like nape, grizzled gray or reddish brown, sometimes bordered with black; a thin basal patch of dingy grayish white in winter; ring around eyes reddish or dark buffy brown, confluent with area of same color extending back on sides of head below ears; sides of nose, chin, and most of cheeks dingy gray; rest of underparts deep, almost chestnut ferruginous, the same color usually covering all of fore legs and extending up as a broad band over costal area and shoulders; fore and hind feet black, sometimes minutely grizzled with gray; tail above, black thinly washed with white; below, usually with a narrow median line of rich ferruginous, heavily bordered with black and thinly edged with white, the median rufous line frequently absent and replaced by black. Hairs on back (except rufous area) black, with fine tips of white or sometimes narrow subterminal rings of yellowish brown.

*Variation*.—Black squirrels of this form are very common at Minatitlan and in Tabasco. A curious specimen from Minatitlan is uniformly black except on sides of nose, cheeks and chin which are dark gray; flanks and hips thinly grizzled with yellowish gray; upper surface of tail thinly grizzled with gray; underparts, including inside of legs, dark reddish brown. The nuchal patch is sometimes confluent with the rufous area on shoulders, though usually lighter. An immature specimen from the vicinity of Santo Domingo, Oaxaca, is dingy reddish brown above, grizzled with black and gray. The area covered by rufous on sides and across shoulders varies, and the color also varies in intensity. The forelegs are sometimes grizzled iron gray with or without mixture of reddish.

*Measurements*.—Average of 5 adults from Minatitlan: total length, 522.8; tail vertebræ, 266.8; hind foot, 67.3.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull similar to that of typical *aureogaster* but larger and proportionately narrower, with audital

bullæ larger and slightly constricted just in front of middle. Five adult skulls from Minatitlan average: basal length, 52.6; palatal length, 27.1; interorbital breadth 18.4; zygomatic breadth, 34.8; length of upper molar series 11.4.

*General notes.*—Although Wagler merely gave 'Mexico' as the type locality for *S. hypopyrrhus*, his description applies so well to the dark colored race of *S. aureogaster* of southern Vera Cruz that it seems advisable to adopt his name for this form. Specimens from Minatitlan, Vera Cruz, are typical.

An adult from Minatitlan (No. 78082 ♀ ad., U. S. Nat. Mus.) is even darker and more generally ferruginous than the Santo Domingo specimen, and has a blackish area on fore shoulders and blackish rump finely grizzled with dingy yellowish. After comparing this specimen with the type of *Macroxus maurus* Gray, Mr. Thomas writes that it is exactly like one of the two co-types. He also states that the British Museum has a specimen from Teapa, Tabasco, similar to the type of *Macroxus morio* Gray, but a little less melanistic, and that this specimen is the same as our No. 78082 except for a little dash of melanism across the shoulders, thus proving the identity of *maurus* and *morio*.

The name *hypopyrrhus* Wagler has been used indiscriminately by various authors for the rufous bellied squirrels of Mexico, Central America and even northern South America.

*Habits.*—The Fire-bellied Squirrels live in the humid tropical forest where they range from sea level up to an altitude of about 4000 feet. They levy a heavy toll upon cornfields planted in clearings in the forest, and are also fond of cacao beans, gathering about the plantations in large numbers, and are especially destructive in Tabasco and eastern Chiapas. In order to gather a cacao crop the planters are obliged to employ men with guns to patrol the plantations daily, but in some districts, despite such efforts, the squirrels are a serious pest and do great damage.

*Specimens examined.*—Eighteen: from Minatitlan and Catemaco, Vera Cruz; mountains near Santo Domingo and Guichicovi, Oaxaca; Uspanapa River, Tabasco; Tumbala, Chiapas.

### SCIURUS AUREOGASTER FRUMENTOR Nelson.

Perote Squirrel.

*Sciurus aureogaster frumentor* NELSON, Proc. Biol. Soc. Washington, XII, pp. 154-155, June 3, 1898.

*Type locality.*—Las Vigas, Vera Cruz, Mexico. Type no. 54259 U. S. National Museum, Biological Survey Collection.



*Distribution.*—Mixed pine and oak forests of Upper Austral zone on east and north base of the Cofre de Perote and adjacent eastern slope of the Cordillera near Las Vigas, Vera Cruz (alt. 6000–8000 ft.).

*Characters.*—Differs strikingly from typical *aureogaster* in having well marked nuchal and rump patches of yellowish brown or rufous brown; the underparts gray or gray washed with rufous; tail heavier and more bushy; pelage softer. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—Nuchal and rump patches strongly marked, varying from dark yellowish brown to dark rusty red, washed with black, extending forward as a paler area along sides of head to enclose ears and eyes; rest of upperparts including nose and fore crown, fore feet, outside of legs and sides of body, dark grizzled iron gray, usually with rusty or pale rufous subterminal rings on hairs of back and sides; hind feet varying from black, slightly grizzled with gray, to dark iron gray; chin, throat and cheeks dingy gray; rest of underparts varying from pale gray to gray washed with rusty red; tail at base like back, rest of tail above black thinly washed with white; below, with a median band varying from pale rusty yellowish to dark ferruginous, bordered with a black band and edged with white; ears usually like nuchal patch but sometimes grayish and sometimes with a black border; basal patch dingy white, present in winter, usually absent in summer. Hairs on back black, with conspicuous white tips often mixed with others having pale rufous subterminal rings.

*Variation.*—The series of this form and of *aureogaster* show perfect intergradation although the two extremes are strikingly different. Some specimens taken below Las Vigas have the ferruginous of the underparts somewhat grizzled with gray and more dingy than in *aureogaster*. The black on the lower surface of the tail varies from a narrow border to a broad band which reduces the median area to a narrow line. Some specimens show 3 or 4 distinct black and rusty, or reddish, annulations on lower surface of tail, giving a grizzled appearance which does not occur in either *aureogaster* proper or *hypopyrrhus*. No melanistic specimens seen.

*Measurements.*—Average of 5 adults from type locality: total length 504.6; tail vertebrae 249.2; hind foot 68.8.

*Cranial characters.*—Premolars  $\frac{2}{4}$ . Skull indistinguishable from that of typical *aureogaster*. Four adult skulls from the type locality average: basal length 52.5; palatal length 26.1; interorbital breadth 19.7; zygomatic breadth 34.4; length of upper molar series 11.2.

*General notes.*—In several characters this subspecies agrees with the description of *S. nigrescens* Bennett, but after comparing a speci-

men of *frumentor* with Bennett's type, Mr. Thomas writes that they are not the same.

*Habits*.—This form, like true *aurcogaster*, gathers about corn fields to feast upon the ripening ears. At other seasons it feeds mainly upon acorns and pine nuts, moving from one locality to another with the variation in food supply.

*Specimens examined*.—Fourteen: from near Las Vigas and above Jico, Vera Cruz, Mexico.

### SCIURUS POLIOPUS (Fitzinger). Oaxaca Squirrel.

*Sciurus albipes* WAGNER, Abhandl. math.-phys. Cl. K. bayerisch. Akad. Wiss. München, II, pp. 501-504, 506-507, 1837; Suppl. pl. CCXIII D, Schreber's Säugthiere, 1837 (not *S. albipes* Kerr, 1792).

*Sciurus varius* WAGNER, Supplement Schreber's Säugthiere, III, pp. 168-170, 1843 (see Suppl. pl. CCXIII D, 1837). Not *S. varius* Pallas, 1831.

*Sciurus variegatus poliopus* FITZINGER, Sitzungsber. K. K. Akad. Wiss. Wien. math.-naturw. Cl., LV, I. Abth., p. 478, March, 1867. (Based on *S. varius* var.  $\beta$  Wagner, l.c. III, p. 168, 1843.)

*Sciurus variegatus rufipes* FITZINGER, Sitzungsber. K. K. Akad. Wiss., Wien. math.-naturw. Cl., LV, I. Abth., p. 478, March, 1867. (Based on *S. varius* var.  $\gamma$  Wagner, l.c. III, p. 168, 1843.)

*Macroxus leucops* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 427-428, Dec., 1867.

*Sciurus variegatus* ALSTON, Proc. Zool. Soc. London, 1878, pp. 660-662; Biol. Cent.-Am., Mamm., pp. 127-128, 1880 (part: Oaxaca and La Parada, Oaxaca).

*Sciurus wagneri* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, pp. 453-454, Nov., 1898.

*Type locality*.—Cerro San Felipe, Oaxaca, Mexico. Type in Berlin Museum.

*Distribution*.—Pine and oak forests of Transition and Boreal zones on mountains north, east, and south of Valley of Oaxaca, Mexico (alt. 7500-11,000 feet).

*Characters*.—Size large; back grizzled gray; underparts bright ferruginous; feet white. Pelage thick and soft; tail large and bushy. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{3}$  i.  $\frac{1}{4}$ .

*Color*.—Top of nose and fore crown iron gray; nape patch rather indistinct, yellowish brown washed with black; rump patch, when present (usually absent), of same color; rest of back and outside of fore and hind legs gray, more or less plentifully intermixed with hairs having yellowish or rusty brown subterminal rings; feet usually pure white; ears gray or mixed gray and brown, with well marked white basal patches: sides of head gray, or grayish white, paler than back; ring around eyes whitish; chin and throat white or grayish white; rest of underparts rich ferruginous red; tail at base all round like

back; tail above black, washed with white; below, with well defined broad median area varying from grizzled yellowish or rusty brown to clear ferruginous, narrowly bordered with black and edged with white. Hairs of back black with white tips and basal, median or subterminal rings of rufous.

*Variation*.—Most of the series from Cerro San Felipe, Reyes, and Mt. Zempoaltepec agree in having the feet white. When the nape patch is well defined the area between the eye and base of ear is usually yellowish brown.

A Zempoaltepec specimen is brighter rufous below, and the reddish buffy rings of the dorsal hairs are brighter and more conspicuous than usual. The three specimens from the vicinity of Ozolotepec, at the southeast end of the Valley of Oaxaca, are in winter pelage and differ from summer specimens from the Cerro San Felipe in having the sides of the head and ring around eye shaded with dark buffy, and the feet grizzled gray. The squirrels from near Ozolotepec live in an isolated group of mountains, though not distant from the range of which the Cerro San Felipe forms a part, and probably represent a local form not sufficiently differentiated to warrant subspecific recognition. A single specimen from Cerro San Felipe, with feet grizzled gray, represents Wagner's var.  $\beta$  (= *S. variegatus polioopus* Fitzinger); and another with feet white suffused with rufous represents Wagner's var.  $\gamma$  (= *S. variegatus rufipes* Fitzinger) showing that these forms were based upon individual variation. Apparently there is no striking difference between summer and winter pelages. No melanistic specimens seen.

*Measurements*.—Average of five adults from type locality: total length 527.6; tail vertebræ 257.6; hind foot 70.2.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull (pl. II., fig. 3) more slender and rostrum longer than in typical *S. aureogaster*. Five adult skulls from the type locality average: basal length 52.2; palatal length 27.3; interorbital breadth 18.6; zygomatic breadth 34.5; length of upper molar series 10.7.

*General notes*.—In 1837 Wagner named this squirrel *Sciurus albipes*, and in 1843 replaced this name by *S. varius*, mentioning two varieties, var.  $\beta$  ("pedibus nigro-cinereis") and var.  $\gamma$  ("pedibus ferrugineis"). In March, 1867, Fitzinger named these varieties respectively *Sciurus variegatus polioopus* and *Sciurus variegatus rufipes*, and in the following December Gray named the species *Macroxus leucops*. Recently Dr. J. A. Allen has shown that both of Wagner's

names were preoccupied and, overlooking Fitzinger's names, renamed the species *S. wagneri*.<sup>1</sup>

A typical specimen of *S. poliopus* (No. 68183 U. S. Nat. Museum) from Cerro San Felipe, was sent to the British Museum for comparison with the type of Gray's *Macroxus leucops*, and Mr. Thomas informs me that it is exactly like one of the two cotypes (B. M. 58. 10. 22.4.); the other cotype differs only in being rather less rufous and not so gray.

Wagner's specimens were obtained by Karwinski, a botanical collector who did much work on the Cerro San Felipe (a few miles north of the city of Oaxaca) and as the original descriptions apply perfectly to the squirrels of this part of the Cordillera of Oaxaca it is unquestionably the type locality.

*Specimens examined*.—Sixteen: from Cerro San Felipe, Reyes, Mt. Zempoaltepec, mountains near Ozolotepec, and Pluma, Oaxaca.

### SCIURUS POLIOPUS HERNANDEZI Nelson.

#### Oak Woods Squirrel.

*Sciurus albipes quercinus* NELSON, Proc. Biol. Soc. Washington, XII, pp. 150-151, June, 3, 1898 (not *S. quercinus* Erxl., 1777).

*Sciurus wagneri quercinus* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 453, Nov., 1898.

*Sciurus albipes hernandezi* NELSON, Science, NS., VIII, p. 783, Dec. 2, 1898.

*Type locality*.—Mountains 15 miles west of City of Oaxaca, Oaxaca, Mexico. Type no. 68202, U. S. National Museum, Biological Survey Collection.

*Distribution*.—Pine and oak forests of Transition and Boreal zones on mountains west of the Valley of Oaxaca and thence to Lower Sonoran zone in southern Puebla and southeastern Guerrero, Mexico.

*Characters*.—Back grayer than in *S. poliopus*, and intermixed with yellow instead of rufous; underparts white or buffy; median band on lower surface of tail usually grizzled yellowish gray. Pelage thick and soft; tail large and bushy. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color*.—Top of nose and fore part of crown grizzled gray washed with blackish; nape usually faintly yellowish, grizzled with black; rump patch rarely present; rest of upperparts, including outside of legs, pale gray mixed with pale yellowish; feet white; ears gray or mixed gray and yellowish brown with well marked white basal patch; sides of head dingy grayish, sometimes shaded with brown between eye and ear; ring around eye whitish; tail all around at base like

<sup>1</sup> Bull. Am. Mus. Nat. Hist., N. Y., X., pp. 453-4, Nov. 10, 1898.

back; tail above black, heavily washed with white; below, with broad median band varying from dingy grizzled yellowish gray to pale rusty, a poorly defined black border and broader edging (and sometimes wash over entire lower surface) white; chin and throat white; rest of underparts usually white, sometimes varying to pale buffy or rusty buff. Hairs on back black with white tips and yellowish basal rings, mixed with others having subterminal and basal rings of dull yellowish, and still others with black subterminal, and yellowish median rings.

*Variation.*—The yellowish ringed hairs on the back vary somewhat in number but are not sufficiently numerous to appreciably effect the general color. A faint yellowish indication of the rump patch is sometimes present, but always indistinct. No melanistic specimens seen. Specimens from the arid Lower Sonoran and upper edge of the Arid Tropical zones in northwestern Oaxaca, southwestern Puebla, and adjacent part of Guerrero are closely related to *hernandezii*, but are slenderer with backs whiter, nape and rump patches more distinctly yellowish brown; underparts usually buffy but sometimes white, and median area on under side of tail bright rusty ferruginous. The characters presented by these squirrels are almost worthy of subspecific recognition, but the material at hand is too limited to satisfactorily determine their value.

*Measurements.*—Average of five adults from type locality: total length 539.6; tail vertebrae 268.8; hind foot 68.8.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skulls average a little smaller (with longer upper molar series) but are not otherwise distinguishable from those of *S. poliopus*. Five from type locality average: basal length 51.5; palatal length 26.5; interorbital breadth 19.5; zygomatic breadth 34.6; length of molar series 11.

*General notes.*—The name first proposed for this squirrel being preoccupied, the subspecies was renamed in honor of Francisco Hernandez, the author of the *Historiæ Animalium Novæ Hispaniæ*.

*Habits.*—These squirrels feed upon acorns and pine nuts, and at the time of our visit to the type locality, in September, were found in the huge oak trees growing along certain slopes and ridges in the pine forest at an altitude of 8000–9000 feet. They were shy, and instead of concealing themselves at our approach, usually made off through the tree tops.

*Specimens examined.*—Twenty-one: from mountains west of Valley of Oaxaca, southwestern Puebla and southeastern Guerrero.

## SCIURUS POLIOPUS NEMORALIS Nelson.

## Michoacan Squirrel.

*Sciurus albipes nemoralis* NELSON, Proc. Biol. Soc. Washington, XII, p. 151, June 3, 1898.

*Sciurus wagneri nemoralis* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 454, Nov., 1898.

*Type locality*.—Patzcuaro, Michoacan, Mexico. Type no.  $\frac{35358}{47523}$ , U. S. National Museum, Biological Survey Collection.

*Distribution*.—Pine and oak forests of Transition and Boreal zones, from the Volcano of Toluca, State of Mexico, to Nahuatzin, Michoacan, Mexico (alt. 7000–12,000 feet).

*Characters*.—Similar to *S. hernandezii* in having feet and underparts white, but back, including nape and rump patches, decidedly darker. Pelage full and soft; tail large and bushy. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color*.—Top of nose and fore crown dark iron gray washed with shining black; nape patch usually varying from dingy yellowish brown to dark rusty, almost chestnut brown, washed and grizzled with black; rump patch usually paler; rest of upperparts, including outside of legs, iron gray with slight intermixture of rusty; feet usually white; ears dark gray or grizzled gray and yellowish brown, with distinct white basal patches; sides of head whitish gray; ring around eye whitish; sides of head from nape patch to eyes sometimes yellowish brown; underparts usually white, rarely buffy yellow; tail above black, with heavy wash of white; below, with broad median area grizzled gray, yellowish gray or yellowish brown, with poorly defined black border and white edge, the white sometimes extending as a wash over entire lower surface. Hairs of back black, with subterminal and sub-basal rings of dark buffy or yellowish, or with white tips and basal, or subterminal, buffy rings.

*Variation*.—The nape and rump patches vary from dingy yellowish to dark buffy or dingy chestnut, washed more or less heavily with black; nape usually darker than rump. A melanistic phase occurs at Patzcuaro and becomes more common to the southeast until on the Volcano of Toluca it entirely replaces the gray phase. Only two out of nine melanistic specimens from Toluca are grizzled with dingy yellowish gray, the others being uniformly black. Some of the six melanistic specimens from Patzcuaro are sparsely and others abundantly grizzled with gray or dingy fulvous, and the tail is strongly edged with white. In the latter specimens the under surface is usually smoky black, and one has albinistic patches in the axillæ and on the

belly. An immature female from Patzcuaro has the feet gray, but this is rare. Only three of the large series in the gray phase from Patzcuaro have buff underparts. The amount of intermixed rusty on the back varies but is never strong enough to affect the general color.

*Measurements.*—Average of five adult specimens from type locality: total length 537; tail vertebrae 272; hind foot 68.8.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skulls not distinguishable from those of *S. poliopus*. Three adult skulls from the type locality average: basal length 51; palatal length 26.8; interorbital breadth 18.6; zygomatic breadth 34.3; length of upper molar series 11.

*Habits.*—These squirrels feed upon acorns and pine seeds according to the season, and are not so shy as some of their relatives. They were common near Patzcuaro and on the Volcano of Toluca.

*Specimens examined.*—Thirty-two: from Patzcuaro and Nahuatzin, Michoacan, and north slope Volcano of Toluca, Mexico.

### SCIURUS POLIOPUS CERVICALIS (Allen).

#### Colima Mountain Squirrel.

*Sciurus leucops* ALLEN, Mon. N. Am. Rodentia, pp. 753-756, 1877 (part: specimens from Sierra Madre of Colima—not *S. leucops* Gray, 1867).

*Sciurus variegatus* ALSTON, Biol. Cent.-Am., Mammalia, pp. 127-128, 1880 (part: specimens from "Durango, Xantus, U. S. Nat. Mus.;" really from the Sierra Madre of Colima. Not *S. variegatus* Erxl., 1777).

*Sciurus aureogaster leucops* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., II, pp. 166-167, Oct., 1889.

*Sciurus cervicalis* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, pp. 183-185, Dec., 1890.

*Sciurus wagneri cervicalis* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 454, Nov., 1898.

*Type locality.*—Hacienda San Marcos, Tonila, Jalisco, Mexico (at east base of Sierra Nevada de Colima). Type no. 1991, American Museum of Natural History, New York.

*Distribution.*—Pine and oak forests of Upper Austral and Boreal zones of the Sierra Nevada de Colima, Jalisco, Mexico, and thence north along high mountains to Ameca, Jalisco, and east into western Michoacan (alt. 6000-12,000 feet; sporadically down to 4000 ft.).

*Characters.*—Readily distinguished from the other forms of *S. poliopus* by the dark iron gray upperparts, blackish head, dark nape and rump patches, and dark iron gray under surface of tail. Pelage thick and soft; tail large and full. Teats: p.  $\frac{1}{1}$  a.  $\frac{2}{2}$  i.  $\frac{1}{1}$ .

*Color.*—Top of nose and fore crown shiny black with grizzling of grayish white; nape and rump patches usually distinct, dark fulvous or rusty brown heavily washed and grizzled with black; rest of upper-

parts, including outside of legs, dark iron gray (rarely intermixed with yellowish ringed hairs); feet similar but paler; ears dark grayish or yellowish brown with distinct white basal patch; sides of head dingy grayish; ring around eye whitish; area between eye and ear often suffused with brownish; underparts white, sometimes slightly grizzled with black; tail at base like rump; rest of tail, above black heavily washed with white; below, a broad median line of grizzled dark iron gray bordered with black and edged with white, the white often forming a thin wash over under surface. Hairs of back usually black with white tips, but occasionally intermixed with others having a median ring of buffy.

*Variation.*—Specimens from the type locality show comparatively little variation. The upperparts are sometimes paler or darker than in typical specimens and the wash of black on crown and rump is sometimes heavy enough to obscure the yellow patches. The feet vary from iron gray to whitish gray but are never white. Black always predominates on lower side of tail but the amount of gray varies. Compared with typical specimens those from Ameca are paler on the back and lower surface of tail, and the nape and rump patches are more obsolescent.

*Measurements.*—Average of five adults from type locality: total length 536; tail vertebræ 267.2; hind foot 66.4.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull indistinguishable from that of *S. poliopus*. Five adult skulls from near type locality average: basal length 51.2; palatal length 27.6; interorbital breadth 19.8; zygomatic breadth 34.9; length of upper molar series 11.7.

*Habits.*—These handsome squirrels have a wide vertical range. In April they were found at an altitude of 4000 feet feeding on wild figs in the canyon near Plantinar, at the east base of the Sierra Nevada de Colima. On the north slope of the same mountain they were common and feeding on acorns among scrubby oaks at 6000 feet, and we saw many gnawed pine cones at 12,000 feet. Dr. Buller who collected the type took a specimen at the latter altitude on this mountain.

*Specimens examined.*—Twenty-four: from Plantinar, Hacienda San Marcos and elsewhere on slopes of Sierra Nevada de Colima, and at Ameca, State of Jalisco.

SCIURUS POLIOPUS COLIMENSIS Nelson. Colima Squirrel.

*Sciurus leucops* ALLEN, Mon. N. Am. Rodentia, pp. 753-754, 1877 (part: specimens from Rio Coahuyana, Colima, Mexico).

*Sciurus albipes colimensis* NELSON, Proc. Biol. Soc. Washington, XII, p. 152, June 3, 1898.

*Sciurus wagneri colimensis* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 454, Nov., 1898



*Type locality*.—Hacienda Magdalena, Colima, Mexico, Type no.  $\frac{33197}{45202}$ . U. S. National Museum, Biological Survey Collection.

*Distribution*.—Arid tropical coast region in State of Colima, western Mexico (below 2000 ft.).

*Characters*.—Pelage thinner and tail more slender than in other subspecies of *S. poliopus*; nape and rump patches well marked, rusty or yellowish brown; back gray mixed with considerable rusty; feet dark iron gray or blackish. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color*.—Nape and rump patches distinct, varying from yellowish brown to dark rusty shaded with black; nose and forecrown grizzled iron gray, sometimes suffused with yellowish brown extending forward from nape patch; rest of back rather pale grizzled gray, abundantly intermixed with rusty ringed hairs; outside of legs iron gray; fore feet dark iron gray; hind feet darker iron gray varying to black and thinly grizzled with gray; sides of head dingy grizzled gray, sometimes suffused with yellowish brown; ring around eye dingy white or dull buff; ears like nape, with small basal patch of dull whitish or dingy rusty; underparts white; tail at base like back; rest of tail above black thinly washed with white; below, with broad median area dark grizzled iron gray (sometimes faintly washed with yellowish) bordered by black and thinly edged with white. Hairs of back black with white tips and basal, sub-basal or subterminal rings of buffy or rusty.

*Variation*.—The upperparts vary from pale gray to iron gray; the feet are usually darker than the back, but sometimes paler. An immature specimen from the type locality is pale gray with the rusty rump patch nearly obsolete. A female taken in February at Armeria has the inside of fore limbs, thighs, and sides of belly washed with buffy, and median area on under side of tail dark grizzled fulvous. The black border on lower surface of tail varies from a narrow line to a band half an inch wide.

*Measurements*.—Average of five adults from type locality: total length 526; tail vertebræ 267; hind foot 67.6.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull somewhat smaller but not otherwise separable from that of typical *S. poliopus*. Five adult skulls from near type locality average: basal length 502; palatal length 26.7; interorbital breadth 19.1; zygomatic breadth 33.8; length of molar series 11.2.

*General notes*.—*Sciurus p. colimensis* is most closely related to *S. p. cervicalis*, but typical specimens are readily distinguished by paler backs and strongly marked reddish or fulvous nape and rump patches. The feet are darker than in any of the other subspecies of

*poliopus* and, with the exception of *S. p. effugius*, the nape and rump patches are more strongly contrasted with the rest of the back.

*Specimens examined*.—Ten: from Hacienda Magdalena, Armeria, and Rio Coahuylana, Colima.

SCIURUS POLIOPUS EFFUGIUS Nelson. Guerrero Squirrel.

*Sciurus albipes effugius* NELSON, Proc. Biol. Soc. Washington, XII, pp. 152-153, June 3, 1898.

*Sciurus wagneri effugius* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 454, Nov. 10, 1898.

*Type locality*.—High mountains west of Chilpancingo, Guerrero, Mexico. Type no. 70288 U. S. National Museum, Biological Survey Collection.

*Distribution*.—Pine and oak forests of Transition and Boreal zones along summit of Cordillera in southwestern Guerrero (alt. 7500-9500 ft.).

*Characters*.—Back grizzled gray; nape patch conspicuous, dark rufous; ear patches large, white and more conspicuous than in any other form of the species; underparts darker rufous than in *poliopus*; median area on under side of tail deeper, richer rufous. Pelage thick and soft; tail large and bushy. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{3}$  i.  $\frac{1}{4}$ .

*Color*.—Winter pelage: Nape patch rusty rufous, becoming almost rusty chestnut in some specimens; top of nose iron gray intermixed with yellow ringed hairs; rest of dorsal surface finely grizzled iron gray intermixed with rusty ringed hairs; indications of a rump patch similar in color to nape sometimes present but heavily overlaid with grizzling of white and black; extension of nape patch over sides of head, including bases of ears and eyes, slightly paler than main area; ring around eye buffy or whitish; ears reddish brown like crown, but sometimes grizzled with grayish; basal ear patches very large and brilliantly white; outside of legs gray, usually with less mixture of rusty than on back; feet white, often washed with pale rufous; tail at base like rump; rest of tail above black, heavily washed with white (with rufous under color showing through); below, with broad median area nearly pure rich dark rufous, narrow black border, and thin white edge; chin and throat white; rest of underparts rich dark rufous. Hairs on back black, with short white tips and either basal, sub-basal, or median rings of rufous.

*Variation*.—One toptype has the nape patch extending over shoulders and costal region, rest of back strongly suffused with rusty, and a wash of same color on outside of fore legs and feet; another,

probably representing a much worn phase of the summer pelage, has very distinct well defined nape and rump patches of rusty brown; top of nose and back, including outside of legs and feet, pale iron gray with very indistinct rusty rings on intermixed hairs; chin and throat white; underparts pale dull rusty washed with dingy white.

*Measurements.*—Average of five adults from type locality: total length 496.8; tail vertebræ 249; hind foot 68.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skulls average a little smaller but are otherwise like those of *S. poliopus*. Four adults skulls from the type locality average: basal length 50.9; palatal length 26.9; interorbital breadth 19.1; zygomatic breadth 34.5; length of upper molar series 11.

*Habits.*—In December we found these squirrels feeding on acorns of the large oaks among the pines on top of the Cordillera, but the abundance of gnawed cones scattered on the ground showed that at other seasons pines furnish their chief food supply. They were extraordinarily shy and cunning, and it was very difficult to secure specimens.

*Specimens examined.*—Eight: all from the type locality.

#### SCIURUS NELSONI Merriam. Nelson's Squirrel.

*Sciurus nelsoni* Merriam, Proc. Biol. Soc. Washington, VIII, p. 144, Dec. 1893.

*Type locality.*—Huitzilac, Morelos, Mexico. Type no. 51157 U. S. National Museum, Biological Survey Collection.

*Distribution.*—Oak and pine forests of Transition and Boreal zones in mountains on south and west sides of Valley of Mexico, and south side of Valley of Toluca, in the Federal District and States of Mexico and Morelos (alt. 8000-12,000 ft.).

*Characters.*—Body large and heavy; back grizzled, sooty blackish brown; feet black; underparts grizzled blackish, sometimes washed lightly with dingy yellowish brown or rusty rufous. Pelage very thick and soft; under fur long; tail extremely broad and bushy. Teats: p.  $\frac{1}{1}$  a.  $\frac{2}{2}$  i.  $\frac{1}{1}$ .

*Color.*—Upperparts sooty blackish usually washed or grizzled with dull yellowish brown; head usually darker than back and sometimes entirely black, shading gradually into color of back on nape; ears, feet, and sometimes outside of fore legs and lower thighs black; sides of head (when not black) grizzled blackish gray varying to dark yellowish brown; lower cheeks and chin gray; underparts grizzled and varying from dingy blackish brown, thinly washed with dull yellowish, to dark brown washed with dull rusty; tail at base all around like rump, rest of tail above black, washed with grayish white; below

nearly uniform blackish with yellowish gray or brown showing through and thin edging of dingy white, but sometimes with median area very dark grizzled yellowish gray or yellowish brown, washed with black and narrowly edged with dingy white. Hairs on entire back black with narrow subterminal and broader basal or sub-basal rings of smoky buff or brown.

*Variation.*—No melanistic specimens have been seen from the type locality, but two individuals from Tenango del Valle in the Bangs collection are nearly uniform black, having only a thin grizzling of dingy gray along the sides, and one has a pale wash of reddish brown on breast and belly. Another specimen in the same collection from Tenango differs in having a nuchal patch of dark grizzled reddish brown, contrasting with rest of back; feet pale buffy brown, toes dingy whitish; rest of back normal, but entire underparts dull rufous, becoming darker posteriorly. One specimen from Ajusco also has the underparts similarly colored.

*Measurements.*—Average of five adults from type locality: total length, 521.6; tail vertebrae, 262.6; hind foot, 67.6.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull like that of *S. aureogaster*. Five adult skulls from the type locality measure: basal length 50.7; palatal length 26.7; interorbital breadth 19.4; zygomatic breadth 34.9; length of upper molar series 11.9.

*General notes.*—*Sciurus nelsoni* is one of the most distinct of the Mexican squirrels and has a very limited distribution. It has a single subspecies which lives on the slopes of Mts. Popocatepetl and Iztaccihuatl, and serves as a good illustration of the remarkable readiness with which the squirrels of tropical North America vary with climatic conditions. The area inhabited by *S. nelsoni* and *S. nelsoni hirtus* are in the same life zone and not more than 75 miles apart. *S. nelsoni* is much the darker of the two and its coloration is correlated with the somewhat greater rainfall of the area it inhabits.

*Specimens examined.*—Eighteen: from Huitzilac, Morelos; Salazar and Ajusco, Federal District; and Tenango del Valle, State of Mexico, Mexico.

## SCIURUS NELSONI HIRTUS Nelson.

### Mount Popocatepetl Squirrel.

*Sciurus nelsoni hirtus* NELSON, Proc. Biol. Soc. Washington, xii, pp. 153-154, June 3, 1898.

*Type locality.*—Tochimilco, Puebla, Mexico. Type no. 55325 U. S. National Museum, Biological Survey Collection.

*Distribution*.—Oak and pine forests of Transition and Boreal zones on Mts. Popocatepetl and Iztaccihuatl, in States of Mexico, Puebla, and Morelos (alt. 8000 to 12,000 ft.).

*Characters*.—Similar to *S. nelsoni* but differs in having a dark iron gray area on middle of back, grizzled gray feet, and dingy ferruginous underparts. Pelage thick and soft; under fur long; tail extremely broad and bushy. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{3}$  i.  $\frac{1}{4}$ .

*Color*.—Crown, nape, and rump dingy grizzled yellowish or grayish brown; top of nose, middle of back (often reaching down on outside of legs) finely grizzled bluish gray; feet gray, toes paler; ears similar to crown, with conspicuous white basal patches; chin and lower cheeks dull gray; underparts dingy ferruginous; tail above, black heavily washed with white; below, median area grizzled yellowish or rusty brown, with black border and thin white edge. Hairs on gray area of back black, with short white tips, scantily mixed with similar hairs having narrow median or subterminal rings of dull buffy.

*Variation*.—The gray area is sometimes an enclosed spot on middle of back and sometimes covers most of the upper surface; the general color is lighter and less sooty than in *nelsoni*, and the wash on tail is white. The ferruginous of underparts varies from light rusty to dark dull rufous. One specimen from Tochimilco has black ears and feet and a small patch of gray on middle of back, but can be recognized at once by the other characters. Two winter specimens from Mt. Popocatepetl can be distinguished from summer specimens from Tochimilco by the general grayness of the upperparts.

*Measurements*.—Average of five adults from type locality: total length 514.2; tail vertebrae 256.8; hind foot 68.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull like that of *S. aureogaster*. Five adult skulls from type locality average: basal length 50.2; palatal length 26.5; interorbital breadth 19.4; zygomatic breadth 35.1; length of upper molar series 11.8.

*General notes*.—This subspecies seems to be peculiar to the Volcans of Popocatepetl, and probably Iztaccihuatl immediately adjacent. One specimen came from near timberline on the north slope of Popocatepetl, the others from Tochimilco on the southeast slope, and Tetela del Volcan on the south slope.

*Specimens examined*.—Seven: from Tochimilco, Puebla; Mt. Popocatepetl, Mexico; and Tetela del Volcan, Morelos.

## SCIURUS COLLIÆI Richardson. Collie's Squirrel.

*Sciurus colliæi* BACHMAN, Proc. Zool. Soc. London, p. 95, 1838 (nomen nudum); RICHARDSON, Voy. of H. M. S. Blossom, Zool., pp. 8-9, pl. 1, 1839; BACHMAN, Charlesworth's Mag. Nat. Hist., III, p. 334, July, 1839; AUD. & BACH., Quad. N. Am., III, pp. 21-23, pl. CIV, 1851; ALLEN, Mon. N. Am. Rodentia, pp. 738-740, 1877 (part: specimens from San Blas, Mexico).

*Macroxus colliæi* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 421-422, 1867 (part: var. 3, Mexico).

*Sciurus hypopyrrhus* ALSTON, Proc. Zool. Soc. London, 1878, pp. 662-664 (part); ALLEN, Bull. U. S. Geol. Survey Terr., IV, pp. 881-882, 1878 (part).

*Type locality*—San Blas, Tepic, Mexico. Type in British Museum.

*Distribution*.—Arid tropical lowlands and lower slopes of adjacent mountains from northern border of Tepic south to Bay of Banderas (below 2500 feet).

*Characters*.—Body large and slender; upperparts dull yellowish gray or dark grayish; legs and feet grayer; underparts white. Pelage rather thin; hair on back harsh; under fur long and thin; tail long and rather full. Teats: p.  $\frac{1}{1}$  a.  $\frac{2}{2}$  i.  $\frac{1}{1}$ .

*Color*.—Top of nose iron gray; rest of upperparts and base of tail all around nearly uniform dull yellowish gray or brownish gray shaded with black, darkest on crown; lower border of flanks and sides of shoulders rather grayer than back; outside of legs distinctly grayer than back; feet usually paler or more whitish than legs; side of head dull grayish; ring around eye paler or more whitish; ears usually somewhat yellower or browner than crown, with basal patch of dingy whitish or yellowish white; underparts white, sometimes pure and sometimes darkened by the plumbeous under fur showing through; tail above black, washed with white; below, with broad median area dark grizzled black and yellowish gray, or black, dull gray and yellowish brown, with narrow indistinct border of black, edged with white. Hairs of back black, with rather narrow subterminal or median ring varying from pale buffy to brownish gray.

*Variation*.—The variation in the San Blas series is small and confined mainly to the intensity of the yellowish or buffy of the back; some specimens have the feet and toes whiter than others and are grayer on the flanks. Some spring and summer specimens have a curious scorched, rusty brown color on the back, as if burned by the sun.

*Measurements*.—Average of five adults from type locality: total length 506.4; tail vertebræ 264.6; hind foot 65.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull similar to that of *S. aureogaster*, but averaging smaller; jugal slenderer; upper molar series a little narrower and lighter. Four adult skulls from the type locality average: basal length 49; palatal length 25.6; interorbital breadth 18.4; zygomatic breadth 32.6; length of upper molar series 11.

*General notes.*—Specimens from Ixtapa and Las Palmas near the Bay of Banderas are intermediate between the San Blas Squirrel and *S. c. nuchalis*. Specimens from Acaponeta near the northern border of Tepic are yellower than those from San Blas, thus inclining toward the yellow backed *S. sinaloensis* of Mazatlan. The latter may prove a subspecies of *colliei* notwithstanding its striking difference in general appearance.

This species was named in honor of Dr. C. Collie, Surgeon of H.M.S. 'Blossom,' who collected the type during the ship's visit to San Blas in the winter of 1828.

*Specimens examined.*—Twenty-four: from San Blas, Santiago, and Acaponeta, Tepic.

#### SCIURUS COLLÆI NUCHALIS subsp. nov.

##### Manzanillo Squirrel.

Type from Manzanillo, Colima, Mexico. Type no.  $\frac{32657}{44580}$  ♂ ad., U. S. Nat. Museum, Biological Survey Collection. Collected Feb. 2, 1892, by E. W. Nelson.

*Distribution.*—Arid tropical lowlands from the border of Michoacan north along the coast to the Bay of Banderas, Jalisco, and inland to the more heavily wooded mountains near San Sebastian, Jalisco (below 3000 feet).

*Characters.*—Differs from true *colliei* in its rusty rufous ears, buffy yellow suffusion on nape and shoulders and heavy wash of black on lumbar area and rump. Pelage rather thin; hairs of back coarse, stiff and shining: Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Description of type.*—Winter pelage: Upperparts, including crown and base of tail, buffy yellowish or yellowish gray, grizzled with black on crown and nape and heavily washed over lumbar region and rump with shining black; the yellow more rusty on nape and more buffy posteriorly; flanks paler than back; ears rusty rufous, with small basal patches of rusty or rusty whitish; sides of nose and cheeks dingy yellowish brown; ring around eye paler yellowish; feet and outside of legs iron gray, with wash of gray on fore shoulders; underparts white, tail, above black rather thinly washed with white;

below at base, grizzled brownish gray, rest of lower surface with a broad median band of grizzled rusty yellowish, broadly bordered with black and narrowly edged with white. Hair on back black with broad median ring of rusty or buffy yellowish.

*Variation.*—Two of the Manzanillo specimens resemble the type and are very different from typical *colliæi*. Three others are grayer than the type, or less strongly shaded with yellowish on back, but may be distinguished from *colliæi* by the rusty ears, more yellowish suffusion on nuchal area, and heavier wash of black on rump. On three of the specimens the median line on lower side of tail is grizzled yellowish rusty; on two others it is grizzled gray with a yellowish suffusion. Specimens from Ixtapa, Las Palmas, Mascota, and San Sebastian are intermediate but are more like *nuchalis* than like true *colliæi*. Compared with typical *colliæi* all of the twelve specimens from these localities have the ears more yellowish or rusty; the nuchal area yellower than rest of back; the crown, lumbar region and rump more heavily washed with black; the median line on lower surface of tail grizzled rusty rufous on two specimens, and suffused with a paler shade of same on a number of others; pelage coarser and harsher, with grizzling on back consequently coarser.

*Measurements.*—Average of five adults from type locality: total length 530; tail vertebræ 274.8; hind foot 68.4.

*Cranial characters.*—Premolars  $\frac{2}{2}$ . Skull similar to that of typical *colliæi* but larger, with proportionately larger audital bullæ and rather broader, heavier jugals. Five adult skulls from the type locality average: basal length 52.3; palatal length 27.6; interorbital breadth 206; zygomatic breadth 35.9; length of upper molar series 11.4.

*General notes.*—This form is characterized mainly by the increased rustiness on the head, body, and under side of tail. There is a progressive increase in the amount of this color southward from San Blas to Manzanillo.

*Specimens examined.*—Seventeen: 5 from Manzanillo, Colima; 12 (all intermediate) from San Sebastian, Mascota, Las Palmas and Ixtapa, Jalisco.

#### SCIURUS SINALOENSIS sp. nov. Sinaloa Squirrel.

Type from Mazatlan, Sinaloa, Mexico, no. 13753, ♂ ad., American Museum of Natural History, N. Y. Collected Jan. 27, 1897, by P. O. Simons.

*Distribution.*—Arid tropical parts of southern and central Sinaloa (below 2500 feet).



*Characters.*—Crown, nape, and middle of back pale rusty yellowish; flanks, legs, and feet whitish. Tail long, bushy; ears thinly haired; pelage rather full and soft; under fur long. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{3}$  i.  $\frac{1}{4}$ .

*Color.*—Winter pelage: Top of nose gray, shading on fore crown into grizzled yellowish gray, rest of crown, nape, middle of shoulders and rump pale rusty yellow slightly grizzled with black; sides of neck, shoulders, costal area, lower flanks, legs and feet grayish white, palest on feet; sides of nose and ring around eye dingy gray; cheeks pale yellowish brown; ears dull rusty yellow with small basal patch of same; underparts white; tail above brownish yellow, lightly grizzled with black and heavily washed with white; below, a broad median area brownish yellow (thinly grizzled with black and lightly washed with white) narrowly bordered with black and edged with white. Hairs on back black with sub-basal and subterminal rings of rusty.

*Variation.*—Specimens of this squirrel from extreme southern Sinaloa are a little darker than the type.

*Measurements of type.*—Total length 524; tail vertebræ 255; hind foot 62.

*Cranial characters.*—Premolars  $\frac{2}{3}$ . Skull larger and more massive than in true *colliæi*; rostrum decidedly heavier than in *colliæi* or *truei*, and heavier even than in *aureogaster*; nasals broader and more expanded anteriorly. The skull of the type measures: basal length 53; palatal length 26.3; interorbital breadth 20; zygomatic breadth 34; length of upper molar series 11.

*General notes.*—This fine species belongs to the group of which *S. colliæi*, *S. c. nuchalis*, and *S. truei* are the other members. It is the most divergent of all and its rusty yellow back and hoary white sides and tail render it easily recognizable. Specimens from near Rosario, in extreme southern Sinaloa, are darker than those from Mazatlan, and it is possible, notwithstanding its wide difference, that *sinaloensis* may eventually prove to be a subspecies of *colliæi*.

*Specimens examined.*—Four: from Mazatlan, Tatamales, and Plomosas, Sinaloa.

#### SCIURUS TRUEI sp. nov. Sonora Squirrel.

Type from Camoa, Rio Mayo, Sonora, Mexico. No. 96229 ♂ ad. U. S. Nat. Museum, Biological Survey Collection. Collected January 20, 1899, by E. A. Goldman.

*Distribution.*—Scrubby forests of Arid Lower Sonoran zone in southwestern Sonora and northern Sinaloa, Mexico.

*Characters.*—Upperparts of head and body dark yellowish; outside of legs and feet dark gray, in strong contrast to back; ears behind, rusty; underparts white; tail slender; ears thickly haired and sparsely tufted; pelage thick and soft; under fur long. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—Winter pelage: Top of nose gray, rest of upperparts, including sides of neck and flanks, nearly uniform dark yellowish, grizzled with black; outside of legs and feet dark gray, slightly paler on toes; ring around eye whitish; sides of head dingy yellowish gray; ears bordered anteriorly with grayish; behind, including small basal patch, rusty; underparts white; tail at base like back but washed with grayish white below; rest of tail above, grizzled black and dark yellowish, thinly washed with white; below, mainly dark yellowish, grizzled with black, an indistinct narrow black border and thin white edge. Hairs on back black, with sub-basal and subterminal rings of dark yellowish.

*Variation.*—The principal variation in the specimens examined is a difference of intensity in the rusty of the ears.

*Measurements.*—Average of four adults from type locality: total length 487.5; tail vertebrae 247.5; hind foot 66.7.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull markedly different from that of typical *collicii*. It is proportionately broader with brain case more flattened, interorbital area broader; rostrum shorter and heavier; nasals shorter and much more deeply emarginate posteriorly; jugal much broader (exceptionally broad) and expanded vertically; audital bullae larger and scarcely depressed on inner anterior border. Four adult skulls from type locality average: basal length 47.7; palatal length 24.3; interorbital breadth 18.3; zygomatic breadth 33.2; length of upper molar series 11.

*General notes.*—*Sciurus truci* is most nearly related to *S. collicii* from which it may be distinguished by its uniformly dark yellowish back, slenderer tail, and marked skull characters. Mr. Goldman found it inhabiting the fringe of trees along the Rio Mayo and adjacent foothills, and heard of it in the foothills near Alamos, Sonora, close to the border of Sinaloa, so there is no doubt of its occurrence also in the northern part of this State. It is named in honor of Mr. F. W. True, Executive Curator, U. S. National Museum.

*Specimens examined.*—Four: all from type locality.

#### SCIURUS SOCIALIS Wagner. Tehuantepec Squirrel.

*Sciurus socialis* WAGNER, Abhandl. math.-phys. Cl. K. bayerisch. Akad. Wiss. München, 11, pp. 501, 504–507, pl. v, 1837; Supplement Schreber's Säugthiere, 111, pp. 170–171, 1843; GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 428, 1867.

- Sciurus variegatus* ALSTON, Proc. Zool. Soc. London, 1878, pp. 660-662 (part); Biol. Cent.-Am., Mamm., pp. 127-128, 1880 (part: specimens from Tehuantepec); SUMICHRAST, La Naturaleza, v, p. 324, 1882 (part: specimens from southern part of Isthmus of Tehuantepec and Chiapas—not *S. variegatus* Erxl., 1777).
- Sciurus aureigaster* ALLEN, Mon. N. Am. Rodentia, pp. 750-753, 1877 (part: specimens from Tehuantepec and Santa Efigenia, Oaxaca).
- Sciurus leucops* ALLEN, Mon. N. Am. Rodentia, pp. 753-756 (part: specimens from Tehuantepec).

*Type locality*.—Vicinity of Tehuantepec City, Oaxaca, Mexico. Type in Berlin Museum.

*Distribution*.—Arid tropical lowland forests along the Pacific coast from Puerto Angel, Oaxaca, south to Tonalá and Tuxtla, Chiapas, Mexico, and up the river valley to Nenton, Guatemala (below 3000 feet).

*Characters*.—Nape patch usually well defined, rusty rufous; back dingy whitish gray overlying yellowish or rusty; underparts varying from white or buffy to bright ferruginous. Pelage thin, hairs of back coarse and stiff; under fur short; tail long and narrow. Teats: p.  $\frac{1}{1}$  a.  $\frac{2}{2}$  i.  $\frac{1}{1}$ .

*Color*.—Nose and fore part of crown grizzled iron gray; nape patch rusty rufous slightly washed with black; rest of upperparts whitish, rather coarsely grizzled with black, and shaded with underlying yellowish or rusty rufous; rump patch usually obsolete but sometimes more distinctly rusty rufous than surrounding area; feet like back; ears grizzled gray and rufous, with basal patch white; extension of nape patch around bases of ears, and over cheeks, including eyes, paler and more yellowish brown than main area; ring around eye dingy fulvous; sides of nose and cheeks below eyes dingy grayish white; underparts varying from pure white to pale buffy and bright rufous. Tail all around at base like rump; rest of tail, above black heavily washed with white; below, median area varying from pale fulvous gray (in worn fur) to rich orange—or dark rufous (in good fur), bordered by narrow band of black and edged with white. Hairs on back black, narrowly tipped with white and mixed with others having broad sub-terminal rings of rusty rufous; or in some specimens with white tips and broader sub-basal rufous rings.

*Variation*.—*Sciurus socialis* is a variable species, characterized by general hoariness of back with pale rusty under color showing through, and rusty nuchal patch. The color of upperparts varies according to the proportionate amount of grayish white and yellowish rufous; sometimes the back is hoary whitish and sometimes the white is restricted and the underlying reddish or rusty becomes prominent. In

some specimens the nape patch is only slightly marked or entirely replaced by the general whitish color; it is absent in a few specimens from near Tehuantepec, and becomes more and more obsolete to the south. Our large series, representing both summer and winter specimens, shows great variation in color of underparts. Midsummer specimens with few exceptions vary from pale to deep reddish buff; the under side of tail along median line is usually paler (buffy gray, or yellowish rufous), and the ear patches are absent or very small. Specimens taken in winter, and up to close of dry season in May or June (with half a dozen exceptions), are rich rufous below.

A young female from Huilotepec (May 8) is dingy gray below with the buff restricted to axillary and inguinal regions, the middle of the back rather darker and more rusty and the sides grayer, in greater contrast with the back than usual.

An adult female from Tonalá in summer pelage differs from all the others in having the entire back strongly suffused with light rusty red, thinly grizzled with grayish white; underparts dingy yellowish white faintly and minutely grizzled with black; lower surface of tail grizzled dull orange buffy and black, edged with white. Specimens on which rufous ringed hairs predominate on the back are suffused with rufous. In the series from Puerto Ángel north of Tehuantepec City the back is much paler or more grayish white, the nuchal patches darker, and underparts deeper rufous than in typical *socialis*, but in one case the back is uniform grayish white with no sign of a nuchal patch. In the series from the vicinity of Tonalá south of Tehuantepec the nuchal patch is less strongly marked and usually absent; the subterminal rufous on the back is much more conspicuous, often showing through as a strong yellowish rusty suffusion grizzled with white and black; and the underparts vary from pale buffy whitish to dull ferruginous.

*Measurements.*—Average of five adults from type locality: total length 524.4; tail vertebrae 271.4; hind foot 66.6.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull very similar to that of *S. aureogaster*. Five adult specimens from the type locality average: basal length 51.8; palatal length 26.9; interorbital breadth 18.1; zygomatic breadth 33.9; length of upper molar series 11.3.

*General notes.*—This species was described from an immature specimen taken by the botanical collector Karwinski, who reported that it frequented the forest on the southern coast of the Isthmus of Tehuantepec in droves. The idea of its gregarious habits, suggesting Wagner's name, must have come from seeing it during the mating season, when a number are often found together, as in the case of other

squirrels. It frequents low scrubby forests and raids cornfields when the ears are maturing.

*Specimens examined*.—Fifty-four: from Huilotepec (near Tehuantepec City), Tequisistlan, Colotepec, Puerto Angel, Santa Efigenia, Oaxaca; Calera, Tonala, Tuxtla, Chiapas; Nenton, Guatemala.

### SCIURUS SOCIALIS COCOS Nelson. Acapulco Squirrel.

*Sciurus aureogaster* I. GEOFFROY, Voy. de la Vénus, Zoology, Atlas, pl. 10, 1846; text, pp. 156–163, 1855 (specimen with white under surface figured in pl. 10 of Atlas). Not *S. aureogaster* F. Cuvier, 1829.

*Sciurus socialis cocos* NELSON, Proc. Biol. Soc. Washington, XII, pp. 155–156, June 3, 1898.

*Type locality*.—Acapulco, Guerrero, Mexico. Type no. 70644 U. S. National Museum, Biological Survey Collection.

*Distribution*.—Arid tropical lowlands of the Pacific coast from Acapulco, Guerrero, south to Jamiltepec, Oaxaca (below 1500 ft.).

*Characters*.—Nape and rump patches distinct, dark rufous brown; back and feet grayish white; underparts white, buffy, or ferruginous. Pelage thin; hairs on back coarse and stiff; under fur thin and short. Tail long, narrow, and heavily washed with white. Teats  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color*.—Nape and rump patches varying from rusty rufous to deep chestnut rufous lightly washed with black; anterior extension of nape patch along sides of head enclosing bases of ears and eyes, usually rather paler or yellower; ears like nape; top of nose and fore crown pale iron gray; rest of upperparts, including outside of legs and feet, grayish white—latter sometimes creamy white; underparts varying from pure white to pale creamy buff, rufous buffy or rich dark ferruginous; tail above black, heavily washed with white, with rufous basal color sometimes showing through; tail below, with median area varying from rufous buffy to rich dark ferruginous, bordered with black and edged with white, the white extending also over all of under surface as an overlying wash. Hairs of back black, with long white tips, usually intermixed with others having broad rusty sub-basal rings.

*Variation*.—In the series of 33 specimens, all but seven fall within the limits of variation already given. The exceptions are described below. An adult female from Acapulco (Jan. 10) has the usual dark rufous nape and rump patches, the former extending over ears and down to eyes; top of nose and front part of crown clear iron gray; rest of upperparts, including feet and legs white, with a reddish suffusion along back; underparts pale creamy buff; tail above black heavily washed with white; underside of tail obscurely black and rufous heav-

ily overlaid with white. A male taken at same place (Jan. 19) is similar but the white on upper surface is duller and the underparts rich buff.

Another male taken at Acapulco (Jan. 10) has the nape patch even richer or darker rufous than usual; top of nose and fore part of crown clear iron gray; rest of upperparts dingy rusty red, grizzled with grayish white; feet and outside of thighs whiter; underparts bright ferruginous, palest on throat and breast; tail as usual heavily washed with white.

Two males from Acapulco (Jan. 11) are in a curious melanistic condition: One has the nose and fore part of crown black, sparsely grizzled with white, the nape and rump patches very rich dark rufous washed with black, and the intermediate area along the back black, finely grizzled with dark rusty; sides of head, neck and body black, overlaid with fine grizzling of dark fulvous and dingy rufous; feet glossy black; tail black, thinly washed with white above and below, with dark rusty rings near bases of hairs; underparts smoky black washed with fulvous brown and dull rusty. The other melanistic specimen has the top of head as in the last; the nape and rump patches black, the rest of upper parts dull rusty brown grizzled with black and more sparsely with white; chin dark gray; throat grizzled rufous; rest of underparts dark reddish brown becoming darker posteriorly; tail above black heavily overlaid with white; below black, heavily bordered with white.

A female taken at Llano Grande, Oaxaca (Feb. 18) has the nose and fore part of crown black, grizzled with gray; nape and rump patches dingy rusty, heavily washed with black; rest of back grizzled reddish brown and black, shading into dark yellowish brown on sides; feet grizzled black and grayish brown; toes black; underparts dark dingy buff; tail above black, washed with white; below, median band buffy yellow with broad border of black, edged with white.

*Measurements.*—Average of 5 adults from type locality: total length 518.2; tail vertebræ 268; hind foot 66.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull very similar to that of *S. socialis* but somewhat shorter; broader interorbitally; upper molar series slightly shorter. Five adult skulls from the type locality average: basal length 50.8; palatal length 26.5; interorbital breadth 19.3; zygomatic breadth 33.7; length of upper molar series 10.6.

*General notes.*—In the Zoology of the Voyage of the Venus, under the name *S. aureogaster*, is a good figure of a white bellied specimen of this species, which probably came from Acapulco. On

the way south from that port we took the last typical specimen of *S. s. cocos* at Jamiltepec, Oaxaca; the series taken beyond, at Puerto Angel, is intermediate between true *socialis* and *cocos*. We found these squirrels frequenting cocoanut groves near Acapulco and feeding upon the nuts. It is the only squirrel we saw doing this although cocoanut trees are common in the ranges of various other species. The name of the subspecies was suggested by this peculiar habit.

*Specimens examined.*—Thirty-three: from Acapulco, Aguacatillo, San Marcos, and Ometepec, Guerrero; Pinotepa, Llano Grande and Jamiltepec, Oaxaca.

### SCIURUS GRISEOFLAVUS (Gray) Guatemala Squirrel.

*Sciurus ludovicianus* TOMES, Proc. Zool. Soc. London, p. 281, 1861 (from Dueñas, Guatemala. Not *S. ludovicianus* Custis, 1806).

*Macroxus griseoflavus* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 427, 1867.

*Sciurus aureigaster* ALLEN, Mon. N. Am. Rodentia, pp. 750-753, 1877 (part: No. 1156 from Guatemala).

*Sciurus griseoflavus* ALSTON, Proc. Zool. Soc. London, p. 660, 1878; Biol. Cent.-Am., Mamm., pp. 126-127, 1880; ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 880-881, 1878.

*Sciurus affinis* (REINHARDT, MS. in) ALSTON, Proc. Zool. Soc. London, p. 660, 1878 (nomen nudum).

*Type locality.*—'Guatemala.' (Specimens from near Dueñas are typical).

*Distribution.*—Oak and pine forests of the Transition and Boreal zones in central and northwestern Guatemala and adjacent high mountains in southeastern Chiapas, Mexico.

*Characters.*—Size large and heavy. Color of upper parts grizzled yellowish brown, thinly washed with gray (especially in winter); belly fulvous brown or rusty rufous. Pelage full and soft; under fur long; tail broad and flat. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—Upperparts, including crown and base of tail, grizzled yellowish brown, sometimes thinly washed with grayish white; outside of legs like flanks; feet usually grayer, but sometimes grizzled yellow and brown, and sometimes dark yellowish brown; top of nose, sides of head, and ears, grayer than crown; an indistinct dingy grayish ear patch sometimes present; chin and throat pale grayish fulvous; rest of underparts varying from dark dull rufous to dingy grayish washed with reddish fulvous; tail above black washed with white, with underlying yellowish brown showing through; below, with broad median area grizzled yellowish or rufous brown, bordered

by a narrow black line, and thinly edged with white. Some hairs on back entirely black, others black with white tip and either a sub-basal ring or basal and median rings of brownish yellow.

*Variation.*—The gray wash on the back varies greatly, sometimes being entirely absent, especially in specimens from the humid forests fronting the Pacific Ocean; in others it is general over the dorsal surface, and in others still is confined to a band across the back, leaving poorly marked rusty or yellowish brown nuchal and rump patches of varying size. In one specimen the nape patch is chestnut brown, the middle of back washed with light gray and the rump yellowish brown. In winter, the white wash on the back is most conspicuous, and the underparts are duller and less strongly ferruginous. (They may be dark ferruginous, or dark grizzled grayish washed with fulvous, or pale ferruginous). The absence of white tips produces the yellowish brown nape and rump areas, or wholly yellowish brown backs of specimens from the humid forest fronting the Pacific. Such specimens have many hairs with subterminal rings of rusty yellow.

*Measurements.*—Average of two adults from central Guatemala, from dried skins: total length 547.5; tail vertebræ 270; hind foot 68.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull a little longer than that of *S. aureogaster* but otherwise very similar. Four adult skulls from southwestern Guatemala average: basal length 51.8; palatal length 27.2; interorbital breadth 19; zygomatic breadth 34.4; length of upper molar series 11.4.

*General notes.*—A specimen from central Guatemala (No. 61226 U. S. Nat. Museum) sent to London for comparison with Gray's type, was pronounced by Mr. Thomas to closely resemble the two cotypes on the dorsal surface but is richer rufous below with less white on the tail. These differences fall within the minor individual variations.

Gray gave 'Guatemala' as the type locality for this species, and specimens from near Dueñas are typical. Specimens from the dense humid forests near Guatemala City and thence along the slopes of the mountains fronting the Pacific to Pinabete, Chiapas, are darker or browner than those from the higher mountains of the interior. Those from Calel are a little paler than typical specimens, and those from the forest at the Hacienda Chancol are still grayer or nearer the form from the mountains of central Chiapas.

*Habits.*—We found these squirrels rather common in the dense oak forests at about 7000 feet above sea level on the volcano of Santa Maria, near Quezaltenango, but owing to the tangled undergrowth and



the abundance of parasitic plants on the trees it was difficult to secure specimens. Near Calel, and at Hacienda Chancol, they were less common among other species of oaks in the more open forest at an altitude of 9000 to 10,000 feet, but were very shy, and it required cautious and long continued hunting to secure a few specimens.

*Specimens examined.*—Twenty-two: from vicinity of Guatemala City, Volcano Santa Maria, Calel, Hacienda Chancol, Guatemala; and Pinabete, Chiapas.

SCIURUS GRISEOFLAVUS CHIAPENSIS subsp. nov.  
Chiapas Squirrel.

Type from San Cristobal, Chiapas, Mexico. No. 75957, ♂ ad., U. S. Nat. Mus., Biological Survey Collection. Collected Sept. 22, 1895, by E. W. Nelson and E. A. Goldman.

*Distribution.*—Pine and oak forests of Transition and Boreal zones in mountains of central Chiapas (alt. 7500–9500 feet).

*Characters.*—Similar to true *S. griseoflavus* but differing in the decidedly grayer upperparts; paler, often nearly white, feet, and usually more vivid ferruginous underparts. Pelage full and rather soft; under fur long and dense; tail broad and full. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—Winter pelage: Upperparts, including outside of legs, top of nose, and base of tail, dark grizzled gray (rather darker on top of head), interspersed with many scattered hairs having median rings of reddish buffy; ears dingy whitish gray with small whitish basal patches; feet grayish white, the toes often nearly white; narrow ring around eyes pale fulvous, confluent with a darker area of fulvous brown extending back along sides of head to base of ears; sides of nose, lower cheeks, chin and throat, pale grayish; underparts usually rusty rufous, brighter than in true *griseoflavus*; tail at base all around like back; above, black heavily washed with white; below, usually with broad median area of yellowish, yellowish brown or rusty rufous, black border and well marked white edge. Hairs on back black, tipped rather broadly with white and often with broad median rings of reddish buff (most numerous and conspicuous along flanks).

*Variation.*—The series at hand shows but little variation in the upperparts. In some specimens the crown is darker, and the brown area behind the eyes more distinctly marked; the feet vary from grizzled gray to almost white. The greatest variation is in the underparts and tail. Eight of the twelve specimens are bright ferruginous below, one is dull buffy yellow, one dark grizzled gray heavily washed with

rusty rufous, while the two others are washed with rufous except a grizzled gray band about 4 inches broad across the belly. The median area on the lower surface of tail is sometimes broad, sometimes merely a narrow line (the black border increasing in width as the other decreases) and varies from rusty ferruginous to yellowish brown.

*Measurements.*—Average of five adults from type locality: total length 506.2; tail vertebræ 256; hind foot 68.2

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull a little shorter than that of *griseoflavus* but scarcely distinguishable from the latter or from that of *S. aureogaster*. Five adult skulls from the type locality average: basal length 50.9; palatal length, 26.6; interorbital breadth 19.1; zygomatic breadth 34.3; length of upper molar series 11.4.

*General notes.*—The squirrels taken in the oak forest between 9000 and 10,000 feet altitude on the mountains at Todos Santos, Guatemala, are intermediate between *chiapensis* and true *griseoflavus*. Those taken at Calel, Guatemala, are more yellowish brown and much closer to *griseoflavus*. A specimen from the arid subtropical canyon at Nenton, Guatemala (below 3000 feet), and two others from similar localities near Tuxtla, Chiapas, seem to indicate a direct gradation, in this intermediate region, between *S. griseoflavus chiapensis* and *S. socialis*. Unfortunately our series from intermediate points is too limited to satisfactorily decide this point. Surprising as it may appear, the differences between *griseoflavus chiapensis* and *socialis* are not greater than those between the latter and *S. socialis cocos*.

*Habits.*—The Chiapas squirrel feeds upon both acorns and pine seeds, moving from one part of the forest to another with the season.

*Specimens examined.*—Twelve: all from the type locality.

#### SCIURUS YUCATANENSIS Allen. Yucatan Squirrel.

*Sciurus carolinensis* var. *yucatanensis* ALLEN, Mon. N. Am. Rodentia, pp. 705-706, Aug., 1877; Bull. U. S. Geol. Survey Terr., IV, p. 879, 1878.

*Sciurus carolinensis* ALSTON, Proc. Zool. Soc. London, 1878, pp. 658-659; Biol. Cent.-Am., Mamm., pp. 124-125, June, 1880 (part: specimens from Yucatan).

*Sciurus yucatanensis* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., IX, pp. 5-7, 1897.

*Type locality.*—Merida, Yucatan, Mexico. Cotypes nos. 8502-8503. U. S. National Museum.

*Distribution.*—Arid tropical forests of peninsula of Yucatan.

*Characters.*—Back dingy, coarsely grizzled gray; belly white; pelage coarse and harsh but not bristly; thin ear tufts sometimes present, yellowish white; tail rather full.

*Color*.—Upperparts, including feet, rather coarsely grizzled black and gray (sometimes suffused with yellowish), more yellowish along middle of back and paler gray on sides of nose, body, and feet; ring around eye dingy whitish; ears sometimes dark gray and sometimes with distinct dingy white basal patch and small dull yellowish white tuft at tip 8 or 9 mm. long; underparts varying from white to pale grizzled gray. Tail at base similar to back; rest of tail above black, heavily washed with white; below, with median area coarsely grizzled black and gray, or dull, pale fulvous, bordered by black and edged with white. Hairs on back black, with broad median ring of white or yellowish.

*Variation*.—The small series examined does not show much seasonal difference, but the presence of ear patches and small tufts in two specimens (♂ and ♀) and their absence in three others indicate the probable existence of certain marked differences of this kind. One specimen taken at Chichenitza (Mar. 7) is mainly iron gray with slight trace of yellow on the back; the underparts are whitish finely grizzled with black. Another specimen taken at the same locality (Mar. 18) has a strong yellowish shade on the upperparts, and the chin, neck, breast, and middle of belly are nearly pure white, the underparts being grizzled with black only along border of flanks.

*Measurements*.—Average of two adults from Chichen-Itza: total length 451; tail vertebræ 222; hind foot 55.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull very similar in general outline to that of typical *S. aureogaster* but much smaller, with proportionately longer nasals and larger audital bullæ; nasals rounded in front as in *aureogaster*. The single skull at hand shows no approach to the massive rostrum and broad flattened nasals of the *thomasi* group. It measures: basal length 45; palatal length 23; interorbital breadth 16.2; zygomatic breadth 19; length of upper molar series 9.5.

*General notes*.—*Sciurus yucatanensis* is at once separable from *S. carolinensis* and its races, and from *S. alleni*, by the much coarser grizzling on the back, and the stiffer, harsher pelage in addition to the cranial characters. It is a strongly marked species, the presence of whitish ear tufts in certain pelages separating it from the other Mexican and Central American squirrels of the subgenus *Echinosciurus*.

*Specimens examined*.—Five: from Merida and Chichen-Itza, Yucatan.

#### SCIURUS THOMASI sp. nov. Costa Rica Squirrel.

*Sciurus boothiæ* ALLEN, Mon. N. Am. Rodentia, pp. 741–746, 1877 (part: specimens from eastern Costa Rica.—Not *S. boothiæ* Gray, 1842).

*Sciurus hypopyrrhus* ALSTON, Proc. Zool. Soc. London, pp. 662-664, 1878 (part); ALLEN, Bull. U. S. Geol. Survey Terr., IV, pp. 881-882, 1878; (part); ALSTON, Biol. Cent.-Am., Mamm., pp. 123-131, 1880 (part: specimens from interior of Costa Rica); ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, p. 206, 1891; Bull. Am. Mus. Nat. Hist., N. Y., IX, p. 35, 1897; ALFARO, Mamíferos de Costa Rica, pp. 30-31, 1897 (part: specimens from eastern Costa Rica),

*Type* from Talamanca, Costa Rica. No.  $\frac{12044}{33867}$  U. S. National Museum. Collected by Wm. Gabb.

*Distribution*.—Humid tropical forests of eastern Costa Rica.

*Characters*.—Entire upperparts black with underlying dark yellowish or ferruginous brown shining through; underparts rich deep ferruginous; pelage thin; hair on back coarse, stiff, and glossy; under fur short and thin; tail long and narrow.

*Color*.—Upperparts, including crown, base of tail, sides of neck, and outside of legs, nearly uniform glossy black with yellowish or ferruginous brown of underlying color shining through; top of nose, chin, and sides of head dingy grayish brown; ears blackish with thin tufts of black hairs at tips and conspicuous basal patches of ferruginous; feet varying from black to grizzled ferruginous brown, latter color sometimes extending as a wash over outside of legs; entire underparts rich ferruginous, sometimes varied with irregular white areas; tail above black, thinly washed with white; below with median area black grizzled with ferruginous or yellowish brown, narrowly bordered with black and thinly edged with white. Hairs on back shining black with broad median ring of rusty buffy or rufous brown.

*Variation*.—The underlying color of the back and the ear patches vary from yellowish brown to rich ferruginous. The darkest, most intensely colored specimen is from Santa Clara and has the median rings on hairs of back nearly as deep ferruginous as the underparts.

*Measurements*.—Average of four adults from eastern Costa Rica (from dry skins): total length 517.5; tail vertebræ 246.5; hind foot 62.2.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull (pl. II, fig. 6) even broader and stouter than that of *S. boothia belti*; rostrum much broader and heavier; interorbital breadth much greater; occiput broader. The type skull measures: basal length 50; palatal length 26.2; interorbital breadth 22; zygomatic breadth 35.5; length of upper molar series 11.5.

*General notes*.—This species seems to occupy the more humid area of eastern Costa Rica, ranging inland to the border of the more arid western slope where it meets *S. adolphei dorsalis*. It may be

readily distinguished from the latter by the ferruginous ear patches and blackish dorsal surface, the top of head not being paler than back. Although specimens of both *S. thomasi* and *S. dorsalis* are before me from the same locality, La Carpintera, where their ranges meet, there are no intergrades. I take great pleasure in naming this handsome species in honor of Mr. Oldfield Thomas, Curator of Mammals in the British Museum.

*Specimens examined*.—Five: from Talamanca, La Carpintera and Santa Clara, Costa Rica.

### SCIURUS ADOLPHEI (Lesson). Nicaragua Squirrel.

*Macroxus adolphi* LESSON, Rev. Zool., v, p. 130, 1842 (nomen nudum); Nouv. Tabl. Règne Animal, Mamm., pp. 112-113, 1842; GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 433, 1867.

*Sciurus boothia* ALLEN, Mon. N. Am. Rodentia, pp. 741-746, 1877 (part: Nicaragua).

*Sciurus hypopyrrhus* ALSTON, Proc. Zool. Soc. London, 1878, pp. 662-664; ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 881-882, 1878 (part); ALSTON, Biol. Cent.-Am., Mamm., pp. 128-131, 1880 (part).

*Type locality*.—Realejo, Nicaragua. Type in Paris Museum.

*Distribution*.—Tropical lowlands on west coast of Nicaragua.

*Characters*.—Top of head and nape iron gray, paler than back; rest of upperparts and base of tail dark grayish brown; underparts and outside of fore and hind legs reddish chestnut brown, sometimes with patches of white. Pelage thin; hairs of back coarse, stiff, and shining; under fur short.

*Color*.—Top of nose and crown dull iron gray; nape grayish brown; rest of back and upper part of thighs darker brown, with a shade of grayish, slightly paler on flanks; sides of nose, cheeks and sides of neck grayish brown; ears like crown and with well marked white basal patches; feet dark chestnut grizzled with blackish; fore-legs all around (except axillar area), adjacent part of shoulders, lower border of costal area and outer border and inside of thighs (except inguinal area) dark reddish chestnut; underparts (except white chin, throat, axillar and inguinal region), of same reddish chestnut as legs; tail at base dark grizzled brown; tail above black heavily washed with white; below, with broad median area of rusty brown, a narrow black border and white edge. Hairs on back black, with broad median ring of dull yellowish or slightly reddish brown.

*Measurements*.—Adult, No. 8495 U. S. Nat. Museum (from dry skin): total length 440; tail vertebræ 199 (tail imperfect); hind foot 65. In the flesh the total length of this species must exceed 500 mm.

*General notes.*—The type specimen of *S. adolphei* was collected during the voyage of the French ship 'La Pylade' by the ship's surgeon, Adolphe Lesson, in whose honor the species was named. The specimen described above differs from the description of the type only in being a little less intensely colored on the back and in having less white on the underparts. Lesson mentions another specimen from the same locality which had a black dorsal line, grayish sides and flanks, with grizzled gray and white on outside of legs. This squirrel appears to differ from *S. a. dorsalis* mainly in its darker colors.

*Specimens examined.*—One: from west coast of Nicaragua.

### SCIURUS ADOLPHEI DORSALIS (Gray).

#### Banded-backed Squirrel.

*Sciurus dorsalis* GRAY, Proc. Zool. Soc. London, p. 138, 1848; SCLATER, *Ibid.*, 1870, pp. 670-671.

*Sciurus rigidus* PETERS, Monatsber. K. Pr. Akad. Wiss., Berlin, 1863, pp. 652-653.

*Sciurus intermedius* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 421, 1867.

*Macroxus dorsalis* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 422-423, 1867 (part).

*Macroxus nicoyana* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 423, 1867.

*Macroxus melania* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 425, 1867.<sup>1</sup>

?*Sciurus boothiæ* ALLEN, Mon. N. Am. Rodentia, pp. 741-746, 1877 (part: specimens from Costa Rica).

*Sciurus hypopyrrhus* ALLEN, Mon. N. Am. Rodentia, pp. 746-750, 1877 (part: No. 8628 from Costa Rica); ALSTON, Proc. Zool. Soc. London, 1878, pp. 662-664 (part); ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 881-882, 1878 (part); ALSTON, Biol. Cent.-Am., Mamm., pp. 128-131, 1880 (part); ALFARO, Mamíferos de Costa Rica, pp. 30-31, 1897 (part: west coast of Costa Rica).

*Type locality.*—Erroneously given as Caracas, Venezuela. (Specimens from Liberia, Costa Rica, are typical.) Type in British Museum.

*Distribution.*—Comparatively arid parts of tropical western Costa Rica from near Alajuela (or perhaps even farther south) north to district about Liberia, the peninsula of Nicoya, and perhaps adjacent part of Nicaragua.

*Characters.*—Colors brighter than in *S. adolphei*; top and sides of head decidedly paler and grayer than back; broad area along middle of back from nape to base of tail blackish brown or grizzled yellowish brown enclosed by band of lighter or paler grayish along sides; underparts white, buffy yellowish or bright rufous. Tail long and narrow;

<sup>1</sup> This may be a valid species or subspecies but the type was evidently a melanistic specimen and in the absence of material I refer it here. The type came from extreme southern Costa Rica (Point Burica).

pelage thin; hair on dorsal surface coarse and stiff; under fur thin. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{3}$  i.  $\frac{1}{4}$ .

*Color.*—This subspecies has several color phases of which the two most characteristic are described below. *Blackish-backed phase:* Top and sides of head grizzled gray, paler than back; back with broad band (widening on lumbar region and narrowing thence to tail) blackish, blackish brown, or dark yellowish brown, bordered by band (half an inch to an inch wide) of whitish or gray, paler than dorsal area and separating it from color of underparts; lower flanks, all of legs, feet, and underparts nearly uniform white, buffy, or rufous; cheeks, chin and sides of neck grizzled gray or grayish brown; ears grizzled gray or grayish brown, sometimes bordered with black; ear patches white; tail above black, heavily washed with white, below, a broad median area varying from dark rufous to rusty orange or grayish white, bordered by a black line and edged with white.

*Grizzled-backed phase:* Top and sides of head pale gray or grayish brown, paler than back; rest of back grizzled grayish brown, yellowish brown or blackish brown, darkest on upper half and paler or grayer along sides and on legs; sides usually more or less strongly mixed with color of underparts; fore feet like underparts or heavily washed with same color; hind feet similarly washed but more nearly like outside of hind legs; underparts rusty, bright ferruginous, or buffy, sometimes with irregular white patches; ears like top of head; ear patches large, white; sides of head and chin dull grayish or grayish brown; tail above at base like back, rest of upper surface black, washed with white; below with median band of rusty, rufous, or yellowish brown bordered by black and edged with white.

Hairs on middle of back of blackish backed specimens, brownish black with scattered white tips; hairs on flanks of these specimens blackish broadly tipped with white or rufous. Hairs on specimens with grizzled backs, black with median or subterminal ring of rusty buffy, brownish yellow or grayish brown; on flanks similar but usually paler and sometimes with whitish tips.

*Variations.*—This is an extraordinarily variable squirrel. The top of head and upper part of flanks are usually paler than the median dark dorsal area; the underparts, lower flanks and outside of legs and feet may be white, some shade of buff, or bright rufous; or the back may be grizzled brown, with the same color extending over flanks to outside of legs and mixing with the color of the feet. In some cases where the last described phase is most marked the head is but little paler than back, especially in specimens from vicinity of San José and La

Carpintera. At the latter place the range of this subspecies appears to join that of *S. thomasi*, but no intergrades have been seen.

*Measurements*.—Average of four adults from northwestern Costa Rica (from dry skins): total length, 510; tail vertebrae 248.5; hind foot 63.2.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull like that of *S. ~~th.~~ belti*, and similar to that of *S. thomasi* but rather larger with slender rostrum. Two adult skulls from northwestern Costa Rica average: Basal length 51.7; palatal length 27.7; interorbital breadth 21.8; zygomatic breadth 35.2; length of upper molar series 11.7.

*General notes*.—In the original description of *Sciurus dorsalis* Gray gave Caracas, Venezuela, as the type locality. Dr. Sclater has since stated<sup>1</sup> that the type came from Nicaragua, but Mr. Thomas writes that he does not know on what authority. Citations of this squirrel from Nicaragua are probably referable to true *adolphei*. A number of specimens examined by me from northwestern Costa Rica, especially from near Liberia, agree exactly with Gray's description, and one (No. 15759 U. S. Nat. Museum, from Liberia, Costa Rica) sent Mr. Thomas for comparison was pronounced by him to be absolutely like the type.

The type locality of Gray's *Macroxus nicoyana*, based on a rufous color-phase of *S. a. dorsalis*, was given as Nicoya, a town on the peninsula of Nicoya, in northwestern Costa Rica. *S. rigidus* of Peters and *S. intermedius* of Gray are based upon a phase of *dorsalis* in which the head and upper part of flanks are nearly as dark as the middle of the back, but the underparts, lower flanks, and outside of legs and feet are nearly uniform bright rufous. Mr. Thomas has compared a specimen from Alajuela, Costa Rica (No. 15757 U. S. Nat. Museum) with Gray's type of *intermedius* in the British Museum and pronounces it identical, differing only in slightly duller colors. The type of *S. rigidus* came from San José, Costa Rica. The type locality of *intermedius* was given as Guatemala—evidently an error, as no squirrel of this style is found in Guatemala, while it is common in western Costa Rica.

*Specimens examined*.—Twenty: from San José, La Carpintera, Alajuela, Bebedero, San Mateo, Liberia and Nicoya, Costa Rica.

#### SCIURUS BOOTHIÆ Gray. Honduras Squirrel.

*Sciurus richardsoni* GRAY, Ann. & Mag. Nat. Hist., x, p. 264, 1842 (not *S. richardsoni* Bachman, 1838).

<sup>1</sup>Proc. Zool. Soc., London, 1870, pp. 670-671.



- Sciurus boothia* GRAY, List. Spec. Mamm. Brit. Mus., p. 139, 1843; Voy. H. M. S. 'Sulphur,' Zool., p. 34, pl. 13, fig 1, 1863.  
*Sciurus fuscovariiegatus* SCHINZ, Synopsis Mamm., 11, pp. 15-16, 1845.  
*Macroxus boothia* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 424, 1867.  
*Sciurus hypopyrrhus* ALSTON, Proc. Zool. Soc. London, pp. 662-664, 1878 (part); ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 881-882, 1878 (part); ALSTON, Biol. Cent.-Am., Mamm., pp. 128-131, 1880 (part: specimens from Honduras).

*Type locality*.—'Honduras' (specimens from San Pedro Sula are typical). Type in British Museum.

*Distribution*.—Humid tropical coast forests of northern Honduras and border of Guatemala.

*Characters*.—Back dark grayish brown, washed with shining black; belly white; feet blackish; ears black edged, with basal patches dark rusty; upper- and underparts separated by a narrow line of dull reddish brown along flanks. Pelage thin; hairs on back coarse, stiff, and shining; under fur short; tail long and narrow. Teats: p.  $\frac{1}{2}$  a.  $\frac{2}{2}$  i.  $\frac{1}{2}$ .

*Color*.—Upperparts, including top of nose and base of tail, uniform coarsely grizzled dark grayish brown, sometimes faintly suffused with reddish; outside of legs and feet similar, but darker and sometimes almost shining black; ears bordered with black; basal patch on back of ears dingy rusty; chin and sides of head dull grayish brown; entire underparts white; tail at base all around like back; rest of tail above black thinly washed with white; below, median area grizzled dark brownish suffused with yellowish or faint rufous, bordered with black, and thinly edged with white. Hairs on back black, with broad median ring of grayish or buffy brown.

*Variation*.—Three specimens from San Pedro Sula and one from Truxillo, Honduras (July), vary but little, the upperparts being washed with black over brownish, the feet black or blackish, grizzled with grayish brown or dull reddish brown, the underparts uniformly white.

A half grown specimen in the National Museum labeled 'Guatemala' differs from typical specimens in having the outside of the feet and legs black; sides of head and chin finely grizzled dark gray; underparts finely grizzled grayish brown, and lower surface of tail black, grizzled with gray near base.

*Measurements*.—Average of three adults from San Pedro Sula (from dry skins): total length 524; tail vertebræ 255; hind foot 63.3.

*Cranial characters*.—Premolars  $\frac{2}{2}$ . The only skull of this species at hand from San Pedro Sula is immature, but its proportions appear to be the same as those of subspecies *belti*.

*General notes.*—Gray first called this species *S. richardsoni* in 1842, but finding this name preoccupied by *S. richardsoni* of Bachman, 1838, he renamed it *S. boothiæ* in 1843. Overlooking Gray's change, Schinz renamed the species *S. fuscovariegatus* in 1845. Most recent authors have lumped this squirrel with numerous others under the name *hypopyrrhus*.

Mr. Oldfield Thomas, to whom a specimen from San Pedro Sula, Honduras (No. 19549 ♀ ad., U. S. National Museum) was sent for comparison with Gray's type, writes that they agree absolutely in color. Gray gives no definite type locality for this species, but specimens from San Pedro Sula are absolutely typical. Mr. Thomas writes that the type is less than half grown and that in redescribing this species in 1867 (Ann. and Mag. Nat. Hist., 3d. ser., xx, p. 424) Gray mentions, not the type, but specimens received by the British Museum from Honduras in 1845 which have gray instead of white bellies. *S. boothiæ* grades into *S. b. belti* to the south, and it is very probable that another subspecies exists in the mountains of interior Honduras. I have been unable to learn for whom Gray named this species.

*Specimens examined.*—Eight: from San Pedro Sula, Truxillo, and Segovia River, Honduras; Guatemala (1 specimen without definite locality).

#### SCIURUS BOOTHIÆ BELTI subsp. nov.

##### Escondido River Squirrel.

*Type* from Escondido River, 50 miles from Bluefields, Nicaragua. No.  $\frac{36477}{48347}$  ♀ ad., U. S. Nat. Museum, Biological Survey Collection. Collected Nov. 22, 1892, by Chas. W. Richmond.

*Distribution.*—Humid tropical forests of eastern coast region of Nicaragua and north to Segovia River, Honduras.

*Characters.*—Differs from *S. boothiæ* mainly in having the underparts uniformly rusty rufous, and feet grizzled with rusty yellowish. Pelage thin; hair on back coarse, stiff and shiny; under fur short and thin; tail flat and slender. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—Upperparts including top of nose and base of tail all around grizzled grayish brown, more or less heavily washed with black; ears bordered with black, posterior surface and basal patches dull rusty; sides of head and chin varying from yellowish brown to brownish gray; feet black, grizzled with rusty yellowish; outside of fore and hind legs like flanks but appreciably suffused with rusty yellow; tail above black, thinly washed with white; below, median area varying from grizzled yellowish brown to rusty, with narrow black

border and still narrower white edge. Hairs on back, black with a broad dull buffy or yellowish gray median ring.

*Variation.*—The ground color of the back varies from grayish brown with a light suffusion of reddish, to clayey brown with an overlying wash of shiny black. The rusty suffusion on outside of legs is strong in some and light in others. An August specimen is practically the same as others taken in November, thus indicating little or no seasonal change. One from the Segovia River, Honduras, is like those from the type locality, except that the underparts are deeper rufous. Another from the same locality has a brownish shade in the rufous of underparts, and large irregular pectoral and abdominal white areas connected by a narrow white median line. A third has the underparts grizzled rusty brown with a large, irregular median white line. These specimens (June and July) have the back heavily washed with black and in some respects are intermediate between typical *boothia* and *belti*. A single melanistic specimen from Nicaragua is the only one seen.

*Measurements.*—Average of five adults from type locality: total length 512; tail vertebræ 261.6; hind foot 61.7.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull (pl. II, figs. 1 and 5) generally similar to that of *S. aureogaster*, but rostrum broader and heavier, anterior end of nasals broader and more flattened, interorbital width greater, occiput usually broader; the small premolar heavier, thus resembling *S. thomasi*. Four adult skulls from the type locality average: Basal length 48.8; palatal length 25.5; interorbital breadth 19.6; zygomatic breadth 33.7; length of upper molar series 11.4.

*General notes.*—This subspecies is named in honor of Thomas Belt, the well known author of 'A Naturalist in Nicaragua.'

*Habits.*—Dr. Richmond found these squirrels living in the forests along the borders of clearings or other openings.

*Specimens examined.*—Eight: from Escondido River, Nicaragua; and Segovia River, Honduras.

### SCIURUS VARIEGATOIDES Ogilby. Variegated Squirrel.

*Sciurus variegatoides* OGILBY, Proc. Zool. Soc. London, 1839, p. 117; Ann. & Mag. Nat. Hist., v, pp. 62–63, 1840; WAGNER, Supplement. Schreiber's Säugethiere, III, pp. 185–186, 1843.

*Macroxus pyladei* LESSON, Rev. Zool., Paris, v, p. 130, April, 1842 (nomen nudum); Nouv. Tabl. Règne Anim., Mamm., p. 112, 1842.

*Sciurus griseocaudatus* GRAY, Voyage of 'Sulphur,' Mammalia, II, p. 34, pl. 13, fig. 2, pl. 18, figs. 7–12, 1843.

*Sciurus pyladii* BAIRD, Mamm. N. Am., p. 282, 1857.

Proc. Wash. Acad. Sci., May, 1899.

- Macroxus collixi* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 421-422, 1867 (part: var. 1).  
*Sciurus hypopyrrhus* ALLEN, Mon. N. Am. Rodentia, pp. 746-750, 1877 (part: No. 7019 from La Union, Salvador); Bull. U. S. Geol. Survey Terr., IV, pp. 881-882, 1878 (part); ALSTON, Proc. Zool. Soc. London, 1878, pp. 662-664 (part); Biol. Cent.-Am., Mamm., pp. 128-131, 1880 (part).

*Type locality*.—Salvador, Central America. Type in British Museum.

*Distribution*.—Tropical forests of Salvador, west coast of Central America.

*Characters*.—Entire upperparts and base of tail dingy yellowish gray; underparts and feet dull buffy ochraceous. Tail rather slender; pelage thin; hairs of back coarse, stiff and shining; under fur short and thin.

*Color*.—Entire upperparts, including top of head, outside of legs near body, and base of tail all round, nearly uniform dull grizzled buffy gray; backs of ears pale rusty with basal patches of dull buff, and narrow indistinct borders of black; feet, and outside of legs on lower half, dark ochraceous buff; paler or grayer buffy on chin, sides of nose and cheeks; underparts dark dingy buff; tail above, black washed with white; below, with broad median area like back, bordered by line of black and edged with grayish white. Hairs on back black, with broad median rings of pale yellowish gray; under fur dark sooty plumbeous.

*Measurements*.—Dry skin from La Union, Salvador, No. 7020 adult, U. S. Nat. Museum: total length 545; tail vertebræ 280; hind foot 66.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull similar to that of *S. thomasi*, but proportionately narrower and slenderer with much lighter jugals and smaller audital bullæ. It measures: basal length 49; palatal length 26; interorbital breadth 20; zygomatic breadth 34; length of upper molar series 11.

*General notes*.—The specimen described above was compared with Ogilby's type in the British Museum by Mr. Thomas, who pronounces the two identical, and adds that the type of *S. griseocaudatus* Gray differs from them only in having the color of the belly a little richer. Ogilby described this species from a specimen taken during the voyage of the 'Sulphur,' and later Gray described *S. griseocaudatus* from another specimen collected during the same voyage. By an error, Ogilby stated that his specimen came from the west coast of South America, but Gray gave the locality of his type more correctly as the west coast of Central America. Lesson's *S. pyladei* from San Carlos,

Salvador, as shown by the original description, was typical *S. variegatoides*; this, with the specimen in the U. S. National Museum, definitely determines the region where the species is found.

*Specimen examined*.—One: from La Union, Salvador.

SCIURUS MANAGUENSIS Nelson. Rio Managua Squirrel.

*Sciurus boothiæ managuensis* NELSON, Proc. Biol. Soc. Washington, XII, p. 150, June 3, 1898.

*Type locality*.—Managua River, Guatemala. Type no. 62476 U. S. National Museum.

*Distribution*.—Humid tropical forests along Managua River, northern Guatemala.

*Characters*.—Size of *S. boothiæ* but yellower on dorsal surface and uniformly light buffy yellow below. Pelage rather dense; hairs of back coarse, stiff and shining; tail long and narrow. Teats p.  $\frac{1}{4}$  a.  $\frac{2}{3}$  i.  $\frac{1}{4}$ .

*Colors*.—Upperparts, including top of nose and base of tail coarsely grizzled dull yellowish or grayish brown; crown and middle of back washed with shining black; sides of body and outside of legs more suffused with yellowish; feet of type bright buffy yellow only slightly grizzled (much more grizzled in two other specimens); ears edged with black and tipped with thin tuft of rusty hairs; basal patches conspicuous dull buffy yellow; sides of head and chin dingy yellowish or grayish brown; underparts, varying from rich, almost reddish buffy to dingy yellow; tail above black, thinly washed with white; below, with broad median area varying from grizzled grayish brown shaded with yellowish, to yellowish brown, bordered with black and edged with white. Hairs on back black, with broad median rings of dull yellowish buffy, or sometimes grayish.

*Variation*.—Two of the three specimens examined, including the type, are distinctly suffused with yellowish on back and bright yellow below; the third specimen is pale brownish gray above and much paler, dingier yellow below, but has the lower surface of tail slightly shaded with rusty and the feet and back with only a slight suffusion of yellowish.

*Measurements*.—Average of 3 adults from type locality (from dried skins): total length 537, tail vertebræ 270; hind foot 62.7.

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull very similar to that of *S. aureogaster* but somewhat narrower; inner anterior border of auditory bullæ more indented, as in *S. boothiæ*. Two adult skulls from the type locality average: basal length 50.2; palatal length 27; in-

terorbital breadth 19; zygomatic breadth 33.9; length of upper molar series 11.5.

*General notes.*—This squirrel was originally described as a subspecies of *S. boothiæ* and is closely related to that species, but further study of the material at hand shows such strong differences that it seems best to regard the animals as distinct. The difference in size, more vivid yellow shade, and heavier wash of black on dorsal surface are sufficient to distinguish *S. managuensis* from *S. variegatoides*, which resembles it but is a larger, duller colored species.

*Specimens examined.*—Three: all from the type locality.

### SCIURUS GOLDMANI Nelson. Goldman's Squirrel.

*Sciurus goldmani* NELSON, Proc. Biol. Soc. Washington, xii, pp. 149-150, June 3, 1898.

*Type locality.*—Huehuetan, Chiapas, Mexico. Type no. 77903 U. S. National Museum, Biological Survey Collection.

*Distribution.*—Arid tropical forests along southeastern coast of Chiapas, Mexico, and adjacent part of Guatemala (below 1500 ft.).

*Characters.*—Entire upperparts coarsely grizzled iron gray with an underlying yellowish or buffy shade; ear patches white and unusually conspicuous (in winter); ear tufts thin, rusty ferruginous; underparts, white. Pelage on dorsal surface thin; hairs coarse, stiff and shining; tail long and narrow. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—Winter pelage: Nose and crown dark iron gray usually suffused with yellowish or buffy and washed with shiny black; rest of upperparts rather paler, more yellowish iron gray (paler on nape and sides), darker and more washed with shining black along middle of back and rump; fore feet paler, shading through darker gray on outside of legs to yellowish gray of shoulders; outside of thighs like flanks; hind feet grizzled iron gray, toes grayish white; ears, anteriorly dingy grayish with a distinct black border all around, posteriorly the upper half covered by a thin rusty ferruginous tuft and lower half by the large white basal patch; ring around eye narrow, dull buffy brown; sides of nose and cheeks dingy gray or grayish brown; entire underparts white; tail above black, thinly washed with white; below, median area dull grizzled iron gray, varying to grizzled yellowish or rusty, with a narrow black border, broad subterminal area of black, and narrower edge of white. Hairs on back black with broad median rings of pale yellowish gray (sometimes buffy).

*Variation.*—The main variation is in the color of the back which may be gray with a pale yellowish suffusion, or a deep, slightly rusty, buff grizzled with black.

*Measurements.*—Average of five adults from type locality: total length, 550.8; tail vertebrae 280.8; hind foot 66.2.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull closely resembling that of typical *S. aureogaster* but differing in slightly heavier rostrum, larger and longer audital bullæ, and in having the peg-like first premolar set well inside the anterior angle of the second premolar. Five adult skulls from the type locality average: basal length 51.2; palatal length 26.9; interorbital breadth 19.8; zygomatic breadth 33.9; length of upper molar series 11.3.

*General notes.*—*Sciurus goldmani* bears a superficial resemblance to *S. colliæi nuchalis* but may be readily distinguished by the black bordered ears, with large white basal patches, and the uniform color of thighs and back. The hairs on the back are coarser and stiffer.

*Specimens examined.*—Ten: from Huehuetan, Chiapas; and Guatemala.

## HESPEROSCIURUS subgen. nov. (Pl. I, fig. 5; Pl. II, fig. 4).

SCIURUS GRISEUS Ord. California Gray Squirrel.

*Sciurus griseus* ORD., Journ. de Phys., LXXXVII, p. 152, 1818.

*Sciurus fossor* PEALE, Mamm. and Birds U. S. Expl. Expedition, p. 55, 1848.

*Sciurus heermanni* LECONTE, Proc. Acad. Nat. Sci., Phila., p. 149, 1852 (type locality California).

*Sciurus fossor anthonyi* MEARNS, Proc. U. S. Nat. Museum, xx, pp. 501-502, Jan. 19, 1898 (type from Campbell Ranch, Laguna, San Diego Co., California).

*Type locality.*—The Dalles, Columbia River, Oregon. No type specimen. Named from description.

*Distribution.*—Pine and oak forests of Transition (and upper border of Austral) zone from extreme southwestern Washington through western Oregon and most of California (except coast belt south of San Francisco) to northern Lower California, Mexico.

*Characters.*—Size large; tail long and bushy; upperparts gray; underparts white. Pelage full and soft; under fur long and thick; ears thinly haired. Teats: p.  $\frac{1}{1}$  a.  $\frac{2}{2}$  i.  $\frac{1}{1}$ .

*Color.*—Typical June specimens from Oregon: Upperparts, including top of nose and base of tail, pale gray sometimes with slight traces of yellowish on back; outside of legs similar, but fore legs sometimes a little paler; fore feet varying from dingy grayish white to gray scarcely paler than back; hind feet gray, varying from a little paler than back to grizzled blackish gray, occasionally with white markings on hind feet and toes; ears gray, sometimes suffused with

dingy yellowish brown; basal patches small, dingy gray or yellowish gray; sides of head finely grizzled gray, more whitish than back; ring around eye white, poorly defined; underparts white; tail above black with a thin wash of white; below, with broad median area dark grizzled gray, a rather poorly defined black border, and thin white edge. Hairs on back mostly black, with from one to three rings of white or yellowish, intermixed with others entirely black.

*Variation.*—The large series examined shows but little individual variation. Winter specimens from northern California are somewhat darker, more iron gray above, with much less black on upper surface of tail so that the underlying gray shows through; the ears are more hairy and inclining to rusty on backs and basal patches.

*Measurements.*—Average of five specimens from the Columbia River region—near type locality of *S. griseus*: total length 569; tail vertebrae 270.6; hind foot 81.8. Average of five adults from San Diego Co., California—topotypes of '*anthonyi*': total length 566; tail vertebrae 284; hind foot 80.

*Cranial characters.*—Premolars  $\frac{3}{4}$ . Skull (pl. I, fig. 5; pl. II, fig. 4) rather long, tapering anteriorly; nasals long, narrowed posteriorly; posterior part of the braincase inflated; audital bullae small; postorbital process of malar usually ending in a well developed point. Molars unusually massive and the peg-like second premolar stouter than usual. Skulls from the type locality of *S. griseus* '*anthonyi*' average a little smaller than those from the Columbia River region, but the range of individual variation from the two localities is such that it is impossible to find any definite subspecific characters. Five adult skulls from near the type locality in the Columbia River region average: basal length 58.3; palatal length 32.1; interorbital breadth 20.8; zygomatic breadth 38.7; length of upper molar series 12.9. Five adult skulls from type locality of *S. griseus anthonyi* average: basal length 56.3; palatal length 30.2; interorbital breadth 20.9; zygomatic breadth 37.7; length of upper molar series 11.7.

*General notes.*—Ord's *S. griseus* is based on the 'Large Gray Squirrel' of Lewis and Clark, which is said to have been found in a narrow tract of country well covered with white oak timber on the upper side of the mountains just below 'Columbia Falls.' From Lewis and Clark's narrative and the well known character of the country it is evident that the place referred to is near The Dalles of the Columbia, which fixes the type locality with some certainty.

A careful comparison of the type and topotypes of '*S. fossor an*



*thonyi*' in the National Museum, with a large series of typical *S. griseus* from Oregon and Washington, fails to show any character by which they can be satisfactorily separated. The type and some of the topotypes of *anthonyi* can be matched by specimens taken at the same season in Oregon; I am obliged therefore to treat *anthonyi* as synonym of *S. griseus*. Some specimens from the type region of '*anthonyi*' have the feet intermediate in color between *griseus* and *nigripes*.<sup>1</sup>

*Specimens examined*.—Fifty-two: from many localities in Washington, Oregon, and California.

### OTOSCIURUS subgen. nov. (Pl. I, fig. 2).

SCIURUS DURANGI (Thomas). Durango Squirrel.

*Sciurus aberti* THOMAS, Proc. Zool. Soc. London, 1882, p. 372; ALLEN, Bull. Am. Mus. Nat. Hist., v, p. 28, April, 1893. (Not *S. aberti* Woodhouse, 1852.)

*Sciurus aberti durangi* THOMAS, Ann. & Mag. Nat. Hist., 6th ser., XI, pp. 49-50, Jan., 1893.

*Type locality*.—Ciudad ranch (100 miles west of Durango City, Durango, Mexico. Type no. 82.3.20.16., British Museum.

*Distribution*.—Pine forests of Transition and lower border of Boreal zones in Sierra Madre, western Durango and Chihuahua, Mexico (alt. 7000-11,000 feet).

*Characters*.—Similar to *S. aberti*, but much less reddish chestnut on back; sides of nose to eyes usually reddish buffy, feet more or less grizzled gray; tail much less full, and its lower surface uniformly grizzled gray; ears smaller and narrower; ear tufts in winter long (absent in summer). Pelage soft and full; under fur long. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color*.—Summer pelage: Upperparts, including top of nose and base of tail, dingy gray, with dark rufous or reddish chestnut along back from shoulders to rump, but not reaching base of tail as in *S. aberti*; outside of fore legs rather paler than back; fore feet white or pale gray; outside of hind legs like flanks; hind feet uniform grizzled gray like outside of thighs, or gray mottled irregularly with areas of white and sometimes dingy rusty; a poorly defined black line along flanks separating color of upper and lower parts; sides of nose (to eyes) sometimes dingy gray suffused with brownish but usually reddish brown; same color shading fore part and sometimes all of

<sup>1</sup>*S. fossor nigripes* Bryant, Proc. Calif. Acad. Sci., 2d ser., II, pp. 25-26, 1889. [Type from coast region south of San Francisco, probably San Mateo or Santa Cruz Co., Calif.]

white ring around eye; rest of sides of head finely grizzled gray, paler than back; ears dingy gray and thinly haired, sometimes with traces of grizzled gray and black winter tufts; underparts white; tail at base all around like rump; rest of tail above black, heavily washed with white; below uniformly grizzled gray, with narrow indistinct black border, a well marked subterminal black area, and broad white edging. Hairs on back black with two to three rings of grayish white, the rings often becoming rufous on middle of back.

*Variation.*—In some specimens the upperparts are nearly uniform dingy gray, the chestnut dorsal area being indicated merely by a rusty suffusion along the lumbar region. In those with a distinct chestnut dorsal area, numerous rufous ringed hairs are scattered over the back and flanks, giving the gray a slight brownish tinge. The color of the hind feet is very variable and is scarcely alike in any two specimens, but is never pure white as in *aberti*. One of the most striking and constant characters of this species is the entire absence of white on the underside of the tail.

*Measurements.*—Average of five adults from vicinity of type locality: total length 486.4; tail vertebræ 235.4; hind foot 71.2. Five adult topotypes of *S. aberti* average: total length 510; tail vertebræ 229.8; hind foot 75.6.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull (pl. I, fig. 2) generally similar to that of *S. aberti* but somewhat smaller, with notably smaller molars, and shorter and more slender first premolar; audital bullæ relatively larger; braincase a little less drawn out posteriorly. Five adult skulls from vicinity of type locality average as follows: basal length 50.1; palatal length 27.3; interorbital breadth 19.8 zygomatic breadth 34.5; length of upper molar series 10.8. Five adult skulls of *S. aberti* from type locality average: basal length 52; palatal length 27.8; interorbital breadth 19.8; zygomatic breadth 35.1; length of upper molar series 11.2.

*General notes.*—The characters which separate this squirrel from *S. aberti* are so constant in the series before me that it seems best to consider it a distinct species. Each species has a well defined range, there being a broad gap in northern Chihuahua and southern Arizona in which neither occurs.

*Specimens examined.*—Thirty-two: from El Salto (near Ciudad ranch), Durango; Sierra Madre and near Guadalupe y Calvo, Chihuahua (in southwestern corner of State).

Subgenus **TAMIASCIURUS** Trouessart (pl. I, fig. 8).

**SCIURUS DOUGLASI MEARNSI** (Townsend). Mearns' Squirrel.

*Sciurus hudsonius mearnsi* TOWNSEND, Proc. Biol. Soc. Washington, XI, p. 146, June 9, 1897.

*Sciurus mearnsi* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, pp. 286-287, 1898.

*Type locality*.—San Pedro Martir Mountains, Lower California (about 7000 ft. alt.). Type no.  $\frac{18266}{25170}$ . U. S. National Museum.

*Distribution*.—Pine forest of San Pedro Martir Mountains, Lower California, Mexico. Transition zone.

*Characters*.—Generally similar to *S. douglasi albolimbatus* but grayer, with feet pale yellowish, or buffy white. Pelage soft and dense; under fur long; tail short and bushy.

*Color*.—Entire upperparts, including top of nose, outside of forelegs and thighs pale dingy gray, with pale yellowish or rusty suffusion extending from nape along back and out on middle of basal half of tail; sides of nose pale buffy whitish; sides of head grizzled gray, paler than back; ring around eye whitish; ears, in front, like sides of head, behind like crown, with well marked tuft of black hairs, slightly grizzled with gray or dingy fulvous; line along flanks black, distinctly separating color of back from that of underparts; feet pale yellowish white; fore feet inclining to buffy; underparts dingy white; under fur plumbeous, showing through white surface; tail above, median line of basal half like middle of rump, but edged and slightly grizzled with white; rest of upper surface black washed with white tail below, median area of basal two-thirds dingy grizzled gray bordered with black (the black also extends over most of outer third) and narrowly edged with white. Dorsal hairs black with broad median and narrow subterminal rings of pale dull grayish or dingy yellowish (the latter mainly along middle of back).

*Variation*.—The three specimens of this squirrel before me were taken in April and May and show little variation. They are paler than typical specimens of *albolimbatus* taken at the same season but are not strikingly different.

*Measurements*.—Average of three adults from type locality (from dry skins): total length 305; tail vertebræ 111.3; hind foot 50.6. (The total length and tail measurements are, no doubt, too short.)

*Cranial characters*.—Premolars  $\frac{2}{1}$ . Skull (pl. I, fig. 8) much like that of *S. d. albolimbatus*. The type measures: basal length 41; palatal length 25; interorbital breadth 14.5; zygomatic breadth 28; length of upper molar series 8.

*Specimens examined*.—Three: all from type locality.

**ARÆOSCIURUS** subgen. nov. (pl. I, fig. 3.)**SCIURUS OCULATUS** Peters. Black-backed Squirrel.

- Sciurus capistratus* LICHTENSTEIN, Abhandl. K. Akad. Wiss., Berlin (1827), p. 116, 1830. (Not *S. capistratus* Bosc, 1802.)  
*Sciurus carolinensis* SAUSSURE, Rev. et Mag. de Zool., 2e ser., XIII, p. 4, 1861. (Not *S. carolinensis* Gmelin, 1788.)  
*Sciurus oculatus* PETERS, Monatsber. K. Akad. Wiss., Berlin 1863, p. 63.  
*Sciurus hypopyrrhus* ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 881-882, 1878 (part).  
*Sciurus niger melanonotus* THOMAS, Proc. Zool. Soc. London, pp. 73-74, pl. VI, 1890; ALLEN, Bull. Am. Mus. Nat. Hist., v, p. 30, 1893; *ibid.*, ix, p. 198, 1897.

*Type locality*.—Mexico, probably near Las Vigas, Vera Cruz. Type no. 1434 Berlin Museum.

*Distribution*.—Pine and oak forests of Transition and Boreal zones in northern Puebla, western Vera Cruz (Cofre de Perote—Mt. Orizaba), Hidalgo, eastern Queretaro, and southeastern San Luis Potosi, Mexico (alt. 6000-12,000 feet).

*Characters*.—Size large; upperparts gray with large black or blackish area along middle of back; belly buffy. Pelage rather soft and dense; under fur long; tail long and full. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color*.—Crown between ears, and broad band along middle of back from shoulders to base of tail, black or blackish, shading on edges to dark gray like remainder of upperparts; ring around eye well marked, buffy whitish or buffy; cheeks usually grizzled gray like sides of neck but sometimes washed with buff; ears dingy gray frequently washed with dull buff of variable intensity; basal ear patch varying from dingy white to dark buffy (sometimes absent in summer); feet varying from grizzled gray washed with buffy to rich buff shading to gray on outside of fore legs; outside of lower hind legs varying from gray like rest of thigh to dark rusty brownish. Underparts varying from white with pale dull buffy suffusion to rich ochraceous buff; tail above black, heavily washed with white; below, with broad median area of grizzled yellowish gray, bordered with black and heavily edged with white. Hairs of back black, with one or two rings of gray, yellowish gray or brownish gray, mixed with other hairs wholly black.

*Variation*.—The black dorsal band is usually present, sometimes continuous from crown to tail (as in a specimen from Tulancingo), and varies from 25 to 50 mm. in width; but in two specimens from the Cofre de Perote, Vera Cruz, and in nearly all from Pinal de Amoles, Queretaro, it is represented only by a black wash. The buff on underparts of the latter specimens is decidedly richer than on ordi-

nary examples with black backs, and is equally intense in specimens from Encarnacion, Hidalgo, which have the well-marked black dorsal band. Two specimens from Villar, San Luis Potosi, in worn summer pelage, differ in being uniform gray on back, scarcely darker along median line, but they agree with the Pinal de Amoles specimens in the rich, buffy underparts. The buff on feet accompanies and varies in intensity with same color on underparts. The only melanistic specimen in the series is from Pinal de Amoles, Queretaro.

*Measurements.*—Average of five adults from type locality: total length 542.8; tail vertebræ 269; hind foot 72.7.

*Cranial characters.*—Premolars  $\frac{1}{4}$ . Skull (pl. I, fig. 3) proportionately broader and heavier than that of *ludovicianus*; rostrum shorter and heavier; interorbital breadth greater; top of braincase broader and less convex on interparietal outline; occiput decidedly broader and more depressed; audital bullæ appreciably larger and more drawn out anteriorly and posteriorly. Three adult skulls from the type locality average as follows: basilar length 54.6; palatal length 28.5; interorbital breadth 20.3; zygomatic breadth 36.3; length of upper molar series 11.

*General notes.*—Peters described *Sciurus oculatus* in 1864 from a specimen collected by Deppe in eastern Mexico. Thomas redescribed the species in 1890 as *S. niger melanonotus*, from specimens taken at Las Vigas, Vera Cruz. Specimens from Las Vigas agree perfectly with the original description of *S. oculatus*, and since this locality is on the route followed by Deppe it may be considered the type locality.

*Habits.*—This species properly belongs to the pine forests of the Transition and Boreal zones from 7500–12,000 feet, but at Villar, San Luis Potosi, near the northern border of its range, we found it in the oaks of the Upper and Lower Austral zones (5500–6000 feet) where it was feeding on acorns and wild figs in the canyon bottoms. Ordinarily its main food supply is obtained from various species of pines.

*Specimens examined.*—Forty-six: from Mt. Orizaba, Puebla; Cofre de Perote and Las Vigas, Vera Cruz; Real del Monte, Tulancingo and Encarnacion, Hidalgo; Pinal de Amoles, Queretaro; Villar, San Luis Potosi (6000 feet).

#### SCIURUS OCULATUS TOLUCÆ Nelson. Toluca Squirrel.

*Sciurus oculatus toluca* NELSON, Proc. Biol. Soc. Washington, xii, pp. 148–149, June 3, 1898.

*Type locality.*—North slope of the Volcano of Toluca, State of Mexico, Mexico. Type no. 55927 U. S. National Museum, Biological Survey collection.

*Distribution.*—Pine and oak forests of Transition and Boreal zones on tableland slope of the Sierra Madre in the State of Mexico, from the Volcano of Toluca north to border of Michoacan; also arid mountains of southern and western Queretaro, central and eastern Guanajuato, and southern San Luis Potosi, Mexico (alt. 7500–12,000 feet).

*Characters.*—Paler than *S. oculatus*, with a wash of blackish, or blackish brown along middle of back; underparts dingy whitish, with only a faint suffusion of buffy. Pelage and teats as in *S. oculatus*.

*Color.*—Top of head and broad median line down back to base of tail, gray with a faint blackish or dull brownish wash shading laterally into clearer grizzled gray; latter color, however, with slight shading of yellowish on subterminal rings of some hairs; ring around eye grayish white with pale buffy shade; rest of sides of head dingy gray suffused with dull buffy or pale brownish; ears dull gray shaded with buffy; patch behind ear dingy whitish; feet grayish white with buffy wash, usually deeper than on underparts; outside of fore legs and thighs like flanks; thighs near feet suffused with yellowish brown; tail above black, heavily washed with white; below, along median line grizzled yellowish gray or pale yellowish brown, bordered with black and broadly edged with white. Hairs of back black with one or two rings of gray, yellowish or brownish gray, mixed with other hairs wholly black.

*Variation.*—A single melanistic specimen from the type locality is the only one seen. The four normal specimens show little variation, and this mainly in the amount of buffy on the feet and in the intensity of the dark wash along middle of back.

*Measurements.*—Average of four adults from type locality: total length 531; tail vertebræ 263; hind foot 68.7.

*Cranial characters.*—Premolars  $\frac{1}{1}$ . Skull much like that of *S. oculatus*, but in nearly all of the specimens examined the nasals are much narrower posteriorly with a corresponding increase in breadth of the premaxillaries. Two adult skulls from type locality average as follows: basilar length 54; palatal length 29; interorbital breadth 20.5; zygomatic breadth 36.7; length of upper molar series 11.

*General notes.*—This form resembles specimens of *S. oculatus* from Pinal de Amoles very closely in the color of the back, but may be distinguished at once by the whitish ear patches and whitish ventral surface. It was named for the Volcano of Toluca, the type locality.

*Specimens examined.*—Seven: from Volcano of Toluca, Mexico; Tequisquiapan, Queretaro; mountains north of Guanajuato city, Guanajuato, Mexico.

## SCIURUS ALLENI Nelson. Allen's Squirrel.

- '*Sciurus carolinensis*??' BAIRD, Mamm. N. Am., pp. 263-264, 1857 (Santa Catarina, Nuevo Leon, Mexico).  
*Sciurus carolinensis* var. *carolinensis* ALLEN, Mon. N. Am. Rodentia, pp. 706-709, 716, 1877 (part: from Nuevo Leon, Mexico).  
*Sciurus carolinensis* ALSTON, Proc. Zool. Soc. London, pp. 658-659, 1878; Biol. Cent.-Am., Mamm., pp. 124-125, June, 1880 (part: from Nuevo Leon, Mexico).  
*Sciurus arizonensis* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, p. 222, May, 1891 (part: from San Pedro Mines, Nuevo Leon, Mexico).  
*Sciurus alleni* NELSON, Proc. Biol. Soc. Washington, XII, pp. 147-148, June 3, 1898.

*Type locality*.—Monterey, Nuevo Leon, Mexico. Type no.  $\frac{25731}{33131}$   
 U. S. National Museum, Biological Survey Collection.

*Distribution*.—Open pecan and other forests of Lower Sonoran zone near Monterey, Nuevo Leon, extending up to oak and pine forests of Transition zone near Victoria and Miquihuana, Tamaulipas, Mexico (alt. 2000-8500 ft.).

*Characters*.—Upperparts nearly uniform grayish brown or yellowish brown, much as in *Sciurus carolinensis*; feet gray; underparts white. Pelage on back soft and rather dense; tail rather full. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color*.—*Winter pelage*: Entire upperparts yellowish brown, finely grizzled with gray and black, usually darker along back and grayer along sides; top of head similar, but usually a little darker; eye with distinct ring of dingy whitish shaded with buff on outer border; sides of head grizzled dusky gray, often suffused with yellowish brown; ears and basal patch brownish gray; fore feet and outside of fore legs whitish gray, frequently more or less washed with buffy; hind feet whitish gray, usually with a spot of dark buffy on middle of upper surface; outside of thighs like flanks but often with a browner shade near feet; underparts white; color of upper- and lowerparts usually separated by a narrow line of pale grayish; base of tail all around like back; tail above black, heavily washed with white, the yellowish brown or yellowish gray under color often showing through; below with broad median area of grizzled yellowish brown or yellowish gray, narrowly bordered with black and edged with white. Hairs of back black, with one and often two rings of gray, buffy, or buffy brown, the two colors sometimes on same hair and sometimes on distinct hairs. The pelage in summer is darker and more yellowish brown than in winter—due to absence of most of the gray or white tips to hairs.

*Variation.*—The striking differences in proportions between specimens from the lowlands near Monterey and those from the mountains near Miquihuana (alt. 8500 ft.) as shown by the average measurements are not accompanied by similar differences in color. The upperparts are sometimes grizzled brown and vary from that to nearly clear gray. A specimen from the San Pedro Mines, Nuevo Leon, has the upperparts dark yellowish brown, darkest (thinly washed with black) on top of head. The eye is surrounded by a ring of dark buff, the fore feet are washed with buff and the hind feet with grayish white. Another specimen in similar pelage was taken at Miquihuana, Tamaulipas, in June; a winter specimen from Rio San Juan, Nuevo Leon, is almost as dark but has grayer sides and feet. No signs of melanism seen.

*Measurements.*—Average of five adults from vicinity of type locality: total length 471; tail vertebræ 217; hind foot 60.6. Average of five adults from mountains near Miquihuana, Tamaulipas: total length 465; tail vertebræ 230.4; hind foot 65.8.

*Cranial characters.*—Premolars  $\frac{1}{2}$ . Skulls of *S. alleni* are only distinguishable from those of *S. oculatus* by their smaller size. Five adult skulls from region of type locality average: basilar length 50.4; palatal length 26.3; interorbital breadth 18.4; zygomatic breadth 33.7; length of upper molar series 10.5. Five adult skulls from near Miquihuana average: basal length 50; palatal length 25.6; interorbital breadth 18.1; zygomatic breadth 33.7; length of upper molar series 10.3.

*General notes.*—*Sciurus alleni* bears a close superficial resemblance to *S. carolinensis* of Texas, but has only a single premolar. From *S. o. toluæ* it differs mainly in smaller size, grayer feet and whiter belly. The type of this species came from near Monterey, Nuevo Leon. By a slip of the pen in the original description the type locality was given as Monterey, 'Tamaulipas. Baird called attention to this squirrel in 1857, under the name '*Sciurus carolinensis*??' and gave the essential characters which separate it from *S. carolinensis*. Subsequent authors have referred it to the same species or to *S. arizonensis*, but a series in the collection of the Biological Survey shows that it is a well defined species most nearly related to *S. oculatus*. Neither *S. carolinensis*, nor any close relative of that species occurs in Mexico.

*Specimens examined.*—Twenty-two: from Monterey, Linares, Rio de San Juan, and San Pedro Mines, Nuevo Leon; near Victoria and Miquihuana, Tamaulipas.



## SCIURUS NAYARITENSIS Allen. Nayarit Squirrel.

*Sciurus alstoni* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., II, pp. 167-170, October, 1889 (Not *S. alstoni* Anderson, 1878).

*Sciurus nayaritensis* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., II, p. vii, footnote, Feb. 1890 (new name for *S. alstoni* ALLEN); *Ibid.*, III, p. 185, 1890; *Ibid.*, V, p. 30, April, 1893.

*Type locality*.—Sierra Valparaiso, Zacatecas, Mexico. Type no. 1985 American Museum of Natural History, New York.

*Distribution*.—Pine and oak forests of the Transition Zone in the Sierra Madre and outlying spurs of western Zacatecas, southern Durango, eastern Tepic and southern Jalisco, Mexico (alt. 6500-9000 ft.).

*Characters*.—Size large; back dark gray; ears rusty, belly and feet white. Tail bushy; ears thinly haired; pelage thick and soft; under fur long. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{4}$  i.  $\frac{1}{4}$ .

*Color*.—Upperparts dark gray, with underlying rusty yellowish showing through; broad ring around eye white; rest of sides of head gray, frequently shaded with rusty brown; ears varying from dingy grayish to dull rusty brown; outside of fore legs varying from white to grayish white, or white suffused with buffy; fore feet dingy white often suffused with buffy; outside of hind legs paler or more washed with whitish than back; hind feet grayish white, often washed with buffy; toes whitish suffused more or less with buffy; underparts white; tail above at base like back, rest of upper surface black heavily washed with white; below, with broad ferruginous median area, heavy black border, and broad white edge, the white often extending as a wash over the entire lower surface. Hairs on back rusty yellow (sometimes ferruginous) with broad subterminal black rings and narrow white tips.

*Variation*.—Among 17 winter specimens from the type locality 10 have a more or less strong wash of rusty on the back part of crown and nape—thus forming a poorly defined nape patch; and one has a similar rusty wash along middle of lumbar region. This winter series is more whitish on the back than summer specimens from the Nayarit Mts. at Santa Teresa, Tepic; and a series taken in September near Placido, Zacatecas, agrees with the one from Santa Teresa. These summer skins have numerous scattered hairs on the back entirely black; others rusty yellow, or dull rufous, with sub-basal and subterminal black rings, with or without white tips; the white tips when present generally smaller than in the Valparaiso specimens. The result is a generally darker, more rusty, back and an increase of buffy or rusty buff on feet and outside of fore legs. The surface of the tail has less white and the ferruginous median area below is consequently more

distinct. This is probably the summer pelage but may possibly represent a local form. Two specimens from Santa Teresa have the entire underparts dark rusty buffy and are the only ones showing this color below.

*Measurements.*—Average of five adults from type locality: total length 565.8; tail vertebræ 272; hind foot 77.5.

*Cranial characters.*—Premolar  $\frac{1}{4}$ . Upper molars broader and heavier than in *S. ocellatus*, but otherwise the skulls are scarcely distinguishable. Five adult skulls from the type locality average: basilar length 55.5; palatal length 28.4; interorbital breadth 20.7; zygomatic breadth 37.1; length of upper molar series 11.7.

*General notes.*—The type of *S. alstoni* Allen came from the Sierra Valparaiso, but in renaming the species Dr. Allen called it *S. nayaritensis* from the Nayarit Mts., a part of the Sierra Madre about 100 miles southwest of the type locality.

*Specimens examined.*—Forty-one: from Sierra Valparaiso, Sierra Madre, and Plateado, Zacatecas; Sierra Madre, northern Tepic; Sierra de Juanacatlan and Barranca Beltran (east base Sierra Nevada de Colima), Jalisco.

#### SCIURUS APACHE Allen. Apache Squirrel.

*Sciurus griseoflavus* THOMAS, Proc. Zool. Soc. London, 1882, p. 372 (not *S. griseoflavus* Gray, 1867).

*Sciurus niger ludovicianus* THOMAS, Proc. Zool. Soc. London, 1890, p. 73, footnote.

*Sciurus apache* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., v, p. 29, March 16, 1893.

*Type locality.*—Mountains of northwestern Chihuahua (near Bavispe River?), Mexico. Type no.  $\frac{5270}{4302}$ , American Museum of Natural History, New York.

*Distribution.*—Mixed oak and pine forests of Transition zone in the Sierra Madre of western Durango and Chihuahua, eastern Sonora and northeastern Sinaloa, Mexico, and the Chiricahua Mountains of southern Arizona.

*Characters.*—Size large, about equalling *S. ludovicianus* to which it bears a strong general resemblance in color, but is readily distinguishable by its gray ears, darker, more iron gray upperparts, dull rusty ferruginous hind legs and black upper surface of the tail which is thinly washed with pale yellowish white, or rusty buff. Pelage thick and soft; ears thinly haired. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—*Summer pelage:* Upperparts including top of nose and base of tail dark, sometimes almost iron gray, often washed but never

strongly shaded with yellow. Crown and back darker, often becoming blackish along middle of rump and on base of tail; top of back sometimes, and flanks commonly, washed with pale yellowish; sides of head grizzled gray and dark fulvous, the gray sometimes predominating; ring around eye well marked and varying from buffy white to rich fulvous buffy; ears dingy gray sometimes suffused with pale buffy; a scanty basal patch of dull buffy or orange buff sometimes present; feet and often most of fore legs and entire underparts varying from dark dull buffy yellow to rich orange yellow, sometimes suffused with rusty; hind feet usually a little darker than fore feet; outside of hind legs varying from gray suffused with dull rusty to uniform rusty sometimes with a strong tawny rufous shade that extends over inside of thighs; tail above black, with a wash varying from pale yellowish white to rusty yellow; below with broad median area varying from yellowish rusty to dull rusty rufous with a broad indistinct black border and broad edge of pale yellowish, or rusty buffy, the latter colors often forming a wash over entire lower surface. Hairs of back black, with small white or pale yellowish tips and broad buffy or yellowish basal or sub-basal rings.

*Variation.*—The amount of individual variation is comparatively small; the back becomes a little paler or darker, the color on outside of thighs more or less intense, and color of lower parts varies in intensity as already described.

*Measurements.*—Average of five adults from northern Chihuahua: total length 565.8; tail vertebrae 279; hind foot 79.2.

*Cranial characters.*—Premolars  $\frac{1}{4}$ . Skull much larger than that of *S. oculatus*, with audital bullae proportionately smaller. Five adult skulls from western Durango average as follows: basilar length 56.4; palatal length 28.7; interorbital breadth 21.5; zygomatic breadth 37.5; length of upper molar series 11.9.

*General notes.*—Although the color of *Sciurus apache* is very much like that of *S. ludovicianus*, the form of the skull shows that it belongs to the subgenus *Aræosciurus*, of which *S. oculatus* is the type.

During the summer of 1898 we found *S. apache* common in the mixed forest of pines and oaks on the mountains of western Durango. They live in hollow oaks, entering by a knot hole or broken branch and were rarely seen on the pines. The upper limit of their range overlaps the lower limit of *S. durangi* but neither occupies much territory of the other. The type of this fine squirrel came from the region once occupied by the Apache Indians for whom it was named.

*Specimens examined*.—Thirty-three: from El Salto (southwest of Durango City), Durango; near Guadalupe y Calvo, Bavispe River, and Sierra Madre near Arizona border, Chihuahua; Sierra de Choix, northeastern Sinaloa, Mexico; and the Chiricahua Mountains, Arizona.

SCIURUS ARIZONENSIS HUACHUCA Allen.  
Huachuca Squirrel.

*Sciurus arizonensis huachuca* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., VI, p. 349, Dec. 7, 1894; *Ibid.*, VII, p. 245, 1895.

*Type locality*.—Huachuca Mountains, southern Arizona. Type no.  $\frac{9021}{7316}$  American Museum of Natural History, New York.

*Distribution*.—Pine and oak forests of Transition zone, in north-eastern Sonora, Mexico, and Huachuca Mountains, southern Arizona.

*Characters*.—Generally similar to *S. arizonensis* but with a broad band of gray over back of neck and shoulders, separating the median grizzled yellowish or pale rusty area into a narrow patch on crown and ears and a larger one on lumbar region and rump. Pelage full and soft; tail long and bushy. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color*.—May specimens from Ft. Huachuca, Arizona: upperparts, including top of nose and base of tail, pale grizzled gray with rusty yellow wash on back of crown, lumbar region and rump; sides of neck, flanks, and outside of hind legs somewhat paler than top of shoulders; fore feet and outside of legs grizzled grayish white, sometimes pale gray; hind feet pale grizzled gray; ring around eye whitish, or slightly buffy; sides of head whitish gray often with postocular yellowish brown suffusion; ears dingy grayish or dull yellowish, sometimes with small patch of dull gray or rusty yellow behind base; underparts white; tail above black washed with white, heaviest along border; below, broad median area grizzled rusty, dull orange yellow or yellowish brown, with heavy black border and broad white edge. Hairs on back black with white tips and broad yellow sub-basal or basal rings, or with subterminal buffy yellow rings, mixed with other hairs wholly black. Winter pelage similar to that of summer but a little grayer on sides of body and outside of legs and feet; ears more thickly haired and dull rusty with basal patches of same color; white on tail more distinct.

*Variation*.—The type of *huachuca* has a dull yellowish wash on crown, and the ears and basal ear patches are rusty; the rest of the upperparts are grizzled gray, darker along middle of back where an intermixture of rusty forms a small irregular patch; the flanks, outside

of legs and feet are paler. This specimen is exceptionally gray on the back, as it lacks the usual well defined yellowish area on rump. Several worn summer specimens from Huachuca have the area about the mouth and inside of fore feet and legs stained deep brown from the juice of walnut shells, and the underparts of a number of specimens are dingy buffy, probably due to the same cause.

*Measurements.*—Average of four adults from type locality: total length 517; tail vertebræ 247; hind foot 70.5.

*Cranial characters.*—Premolars  $\frac{1}{4}$ . Skull similar to that of *S. oculatus*, but rostrum heavier; parietal region slightly more inflated; occiput higher and narrower; foramen magnum higher, narrower and obtusely triangular; audital bullæ decidedly smaller. Four adult skulls from type locality average: basal length 53.5; palatal length 27.5; interorbital breadth 19.9; zygomatic breadth 36.5; length of upper molar series 10.9. Four adult skulls of *arizonensis* from near type locality average: basal length 53.2; palatal length 27.1; interorbital breadth 20.1; zygomatic breadth 36.4; length of upper molar series 11.4.

*General notes.*—This is not a strongly marked subspecies but the separation of the yellowish dorsal area by the gray band across the shoulders and neck seems to be constant and is accompanied by differences in size. A specimen from the Santa Catalina Mountains, Arizona, between the type localities of *arizonensis* and *huachuca*, is exactly intermediate between the two forms.

*Specimens examined.*—Twenty-six: from Huachuca Mountains, Arizona, and Sonora, Mexico (32 miles south of Nogales).

### Subgenus **PARASCIURUS** Trouessart. (pl. I, fig. 1.)

#### SCIURUS LUDOVICIANUS LIMITIS Baird.

##### Texas Fox Squirrel.

*Sciurus limitis* BAIRD, Proc. Acad. Nat. Sci. Phila., VII, p. 331, 1855; Mamm. N. Am., p. 256, 1857.

*Sciurus niger* var. *ludovicianus* ALLEN, Mon. N. Am. Rodentia, pp. 724-731, 1877 (part: southwest Texas and Nuevo Leon, Mexico).

*Type locality.*—Devils River, Texas. Type no. 351 U. S. National Museum.

*Distribution.*—Wooded parts of Lower Sonoran zone in southwestern Texas and adjacent parts of Nuevo Leon and Coahuila, Mexico.

*Characters.*—Similar to *S. ludovicianus* but considerably smaller, with slenderer tail, thinner pelage and paler colors. Pelage thin, hairs of back rather harsh; under fur thin. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{2}$  i.  $\frac{1}{4}$ .

*Color.*—Entire dorsal surface, including top of nose and base of tail, uniform pale yellowish gray; sides of head dull, dark buffy yellow, grizzled on cheeks with gray and black, sometimes with a slight reddish shade; ring around eye buffy; ears dingy rusty, or buffy yellow; feet dark yellowish buffy shading into gray on upper part of fore legs; outside of hind legs like back but with a buffy or dull rusty wash near feet; underparts varying from orange buff to pale, slightly reddish rusty; tail above, grizzled black and gray with a thin wash of grayish or pale grayish yellow; below, with broad median area of rusty ferruginous or yellowish rusty, often grizzled with black, a narrow black border and thin edging of grayish or pale yellowish. Hairs on back black, with broad subterminal and basal or sub-basal rings of pale yellowish or buffy; along sides of body often tipped with white.

*Variation.*—The series at hand shows very slight individual and little if any seasonal variation. The difference lies mainly in the intensity of the yellow or rusty and the amount of grayness on the back,

*Measurements.*—Average of five adults from region of type locality: total length 482.2; tail vertebræ 234; hind foot 65.2.

*Cranial characters.*—Premolars  $\frac{1}{2}$ . Compared with *S. ludovicianus* the skull (pl. I, fig. 1), is very much smaller. Two adult skulls from Fort Clark, Texas, average: basal length 50; palatal length 25.5; interorbital breadth 18; zygomatic breadth 33.5; length of upper molar series 10.5.

*Specimens examined.*—Fourteen: from near the mouth of Devils River, Fort Clark, and Nueces River, Texas.

### Subgenus **GUERLINGUETUS** Gray. (pl. I, fig. 7.)

#### **SCIURUS ÆSTUANS** HOFFMANNI Peters.

Hoffmann's Squirrel.

*Sciurus astuans* var. *hoffmanni* PETERS, Monatsber. K. Akad. Wiss., Berlin, 1863, pp. 654-655; THOMAS, Proc. Zool. Soc. London, 1880, p. 401 (*Macroxus griseogenus* Gray, referred to this form).

*Macroxus xanthotus* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 429, 1867.

*Macroxus griseogenus* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 429-430, 1867 (part: Costa Rica).

*Sciurus astuans* var. *rufoniger* ALLEN, Mon. N. Am. Rodentia, pp. 757-763, 1877 (part: Costa Rica).

*Sciurus griseogenys* ALSTON, Proc. Zool. Soc. London, pp. 667-668, 1878 (part: Costa Rica, Veragua and Panama.)

*Sciurus hoffmanni* ALLEN, Bull. U. S. Geol. Survey Terr. iv. pp. 885-886, 1878.

*Sciurus astuans* ALSTON, Biol. Cent.-Am., Mamm., pp. 132-133, 1880 (part: Costa Rica and Panama).

*Sciurus astuans hoffmanni* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, pp. 206-207, 1891; *ibid.*, IX, p. 35, 1897; ALFARO, Mamíferos de Costa Rica, p. 31, 1897.

*Type locality.*—Costa Rica, Central America.

*Distribution.*—Humid tropical forests of Costa Rica, south to Valley of upper Cauca River, Colombia.

*Characters.*—Size similar to that of *S. astuans*, but color much darker and more rusty brown on back, more ferruginous red on underparts, and tail heavily washed with bright ferruginous. Tail broad and flat; pelage soft and rather thin.

*Color.*—Entire upperparts, including top of nose and base of tail, finely grizzled dark yellowish or rusty brown; top of head and middle of back usually a little darker than sides and sometimes blackish; outside of legs and feet similar to back but often more yellowish or rusty; ears usually a little darker rusty than top of head, with small basal patch of dingy fulvous or dull rusty; sides of head more yellowish or rusty than back; ring around eye dark buffy or sometimes rusty yellowish; chin and throat dull buffy yellowish, sometimes suffused with rusty; rest of underparts varying from dull rusty buff to deep ferruginous; tail above black, heavily washed with bright ferruginous, sometimes becoming paler but always strongly ferruginous; below with broad median area of grizzled black and dark yellowish brown, bordered with black and edged with ferruginous. Hairs on back, black with narrow sub-terminal rings of buffy or rusty yellow, sometimes with similar sub-basal rings.

*Variation.*—The amount of variation seems to be comparatively small. Specimens from Talamanca and Santa Clara in eastern Costa Rica are darker than those from elsewhere in that country. Some from the valley of the upper Cauca River, Colombia, are a little paler or more olivaceous than Costa Rica specimens, but others from the same district are indistinguishable.

*Measurements.*—Averages of four adults from eastern Costa Rica: total length 426.6; tail vertebræ 187; hind foot 54.3.

*Cranial characters.*—Premolars  $\frac{1}{2}$ . Skull (pl. I., fig. 7) rather broad, braincase arched and inflated over interparietal region and constricted posteriorly, so that the occipital region is a little drawn out; auditory bullæ small and rounded. Five adult skulls from central and eastern Costa Rica average: basal length 43.2; palatal length 23.3; interorbital breadth 17; zygomatic breadth 31.3; length of upper molar series 9.

*General notes.*—A specimen of *hoffmanni* from Costa Rica (no. 12058 U. S. Nat. Museum) has been compared with the type of *Macroxus xanthotus* Gray by Mr. Thomas, who writes that they are the same except that Gray's type is immature. The distribution of *M. griseogena* Gray was given as extending from Venezuela to Mexico, but it is scarcely necessary to state that no species of squirrel has this range. Mr. Thomas writes that the question of the type of *griseogena* is very difficult, but it seems best, as with *tephrogaster*, to take the first named specimens (Dyson's) as the type (B. M. 47.2. 1. 3). This is the only one mentioned by Gray which exactly agrees with his description, and since Venezuela specimens agree best with 47.2. 1. 3. that country becomes the type locality for *M. griseogena*. Mr. Thomas compared a specimen of *S. astuans* from Venezuela (no. 11733 U. S. Nat. Museum) with the type of *griseogena* and found them to agree very closely. The Venezuela squirrels seem to represent a form of *astuans* paler and less rufous than *hoffmanni*.

*Specimens examined.*—Twenty-five: from Boruca, Talamanca, Luis, San José and Santa Clara, Costa Rica; Rio Lima, Las Pabas, Los Tambos, Rio Zapata, Rio Pescado and upper Cauca Valley near Cali, Colombia.

#### SCIURUS RICHMONDI Nelson. Richmond's Squirrel.

*Sciurus richmondi* NELSON, Proc. Biol. Soc. Washington, XII, pp. 146-147, June 3, 1898.

*Type locality.*—Escondido River (50 miles above Bluefields), Nicaragua. Type no.  $\frac{36481}{48851}$  U. S. National Museum, Biological Survey Collection.

*Distribution.*—Dense humid tropical forests of the lowlands along the Escondido River.

*Characters.*—Similar to *S. astuans hoffmanni* but underparts more ochraceous and tail washed with dull yellow. Pelage thin and soft; tail slender. Teats: p.  $\frac{1}{4}$  a.  $\frac{2}{3}$ .

*Color.*—Upperparts, including top of nose and base of tail, nearly uniform dark, ochraceous brown, darker on crown and along middle of back; outside of fore legs and feet like sides of neck, and more ochraceous than back; outside of thighs like back, hind feet sometimes like thighs, but usually more ochraceous; ears like crown, a small dingy yellow basal patch sometimes present; side of head paler or more yellowish brown than back, with a narrow ring of dark brownish buffy about eye; underparts varying from dark buffy yellow



to dingy ferruginous; tail above black, thinly washed with dull yellowish; below, with broad median area grizzled yellowish brown, indistinctly and narrowly bordered with black and thinly edged with dull yellow. Hairs on back, black with narrow subterminal (sometimes median) ring of rusty yellow.

*Variation.*—The series at hand shows comparatively little variation. Four specimens representing the summer pelage (May 10 to Sept. 27) are rather darker above and dingy ferruginous below. Specimens in winter pelage (October to May) have more ochraceous backs and yellower bellies. Apparently there is no seasonal difference in the tail.

*Measurements.*—Average of five adults from type locality: total length 361.4; total vertebræ 169.4; hind foot 51.6.

*Cranial characters.*—Premolars  $\frac{1}{2}$ . Skull averaging a little smaller than that of *S. hoffmanni* but otherwise very similar. Five adult skulls from the type locality average: basal length 42.1; palatal length 22.1; interorbital breadth 16.3; zygomatic breadth 30.4; length of upper molar series 8.3.

*General remarks.*—*Sciurus richmondi* bears a general resemblance to *S. deppei* but is readily recognized by its yellow washed tail and single premolar. It differs from the still nearer *S. æstuans hoffmanni* of Costa Rica by the yellower back and underparts and the slender, yellow washed tail.

*Specimens examined.*—Eighteen: all from the type locality.

## BAIOSCIURUS subgen. nov. (pl. I, fig. 4.)

SCIURUS DEPPEI Peters. Deppe's Squirrel.

*Sciurus deppei* PETERS, Monatsber. K. Akad. Wiss. Berlin, 1863, p. 654; ALSTON, Proc. Zool. Soc. London, 1878, pp. 668-669, (part; Mexico, Guatemala, and Honduras); ALLEN, Bull. U. S. Geol. Survey Terr., IV, p. 885, 1878; ALSTON, Biol. Cent.-Am., Mamm. p. 133, 1880 (part; Mexico, Guatemala, and Honduras); SUMICHRAST, La Naturaleza, v, p. 324, 1882; THOMAS, Proc. Zool. Soc. London, 1890, p. 74; ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., IX, p. 190, 1897.

*Macroxus tephrogaster* GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 431, 1867 (part; Mexico, Guatemala, and Honduras); Ann. & Mag. Nat. Hist., 4th ser., X, p. 408, 1872.

*Macroxus taniurus* GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 431, 1867.

*Macroxus griscogena* GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 429, 1867 (part; Mexico [and Honduras?]).

*Type locality.*—Papantla, Vera Cruz, Mexico. Type in Berlin Museum.

*Distribution.*—Humid Tropical and Austral zones from Truxillo,

Honduras, northward along mountains on both coasts of Guatemala and Chiapas, to the Isthmus of Tehuantepec, and thence along the east coast of Mexico to Papatla, Vera Cruz (alt. below 6000 feet, sporadically up to 9000 feet).

*Characters.*—Size small; upperparts dark rufous or olive brown; fore feet and outside of fore legs dark gray in typical specimens (like back in others); tail above black thinly washed with white. Tail slender; pelage soft and rather full; under fur long; ears long and thinly haired. Teats: p.  $\frac{1}{4}$  a.  $\frac{1}{4}$  i.  $\frac{1}{4}$ .

*Color.*—Eighteen specimens from near type locality: Upperparts including top of nose and base of tail, uniform finely grizzled dark rusty brown varying to dull dark yellowish brown; ears like crown, with small basal patch of white or dingy fulvous; sides of head paler and more yellowish than back; outside of fore legs and fore feet dark gray, contrasting with color of back; outside of hind legs like back, with hind feet similar but a little darker; underparts white, or grayish white, sometimes buffy on breast and inside of thighs, and color of flanks sometimes extending in on inguinal area and inside of thighs; tail above, black thinly washed with white; below, with broad median area varying from grizzled ferruginous brown to dark yellowish brown, bordered with black and edged with white. Dorsal hairs black, with broad subterminal and sub-basal rings of yellowish or rusty brown.

*Variation.*—This species presents considerable individual variation, but in view of its wide distribution there is remarkably little geographical variation. Seasonal changes of pelage are not marked, the only notable differences being the frequent absence, in summer, of the ear patches and white tip of the tail, which is thus left black. There are no signs of melanism. Specimens from the vicinity of Jico and Las Vigas, Vera Cruz, and elsewhere in the higher parts of the range of the species are considerably larger than those from the low country near the type locality, but without accompanying differences in color. Specimens from the damp forests of eastern Mexico are somewhat darker along the middle of back, with underparts more inclining to fulvous than in those from interior and western Chiapas. The series from southwestern Chiapas, and a specimen from Truxillo, Honduras, are more olivaceous above and clearer white below. A specimen from central Guatemala (Coban to Clusec) is decidedly darker and more rusty above and below than the average, but other Guatemala specimens are nearly typical. Most specimens have the underparts soiled whitish or grayish, but there is every gradation through pale buffy to dark fulvous and rusty rufous. A Verreaux specimen (no.  $\frac{3}{87} \frac{61}{407}$  U. S. National Mu-

seum), labeled 'Mexique' is dark rusty red on chest and middle of belly. A half-grown specimen from Catemaco, Vera Cruz, has the middle of back darker than usual, the chin dingy white, rest of underparts deep rusty fulvous, and the usual white tips of hairs at end of tail replaced by rusty fulvous. A specimen from Ocuilapa, Chiapas, has the underparts, outside of thighs and hind feet washed with ferruginous. One from west-central Vera Cruz has the underparts plumbeous gray with a faint whitish wash. Specimens from the region of the type locality usually have the outside of fore legs and fore feet finely grizzled dark gray, contrasting with back, but in those from farther south the color of the back usually extends over this area.

*Measurements.*—Average of 5 adults from vicinity of type locality: total length 384; tail vertebræ 182.4; hind foot 54.4. Average of five specimens from just below Las Vigas, Vera Cruz: total length 393.9; tail vertebræ 173.4; hind foot 57.5.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull (pl. I. fig. 4) in general like that of *S. hoffmanni* but proportionally more slender and otherwise distinguished by the small upper premolar and longer audital bullæ. Skulls from Jico and Las Vigas, Vera Cruz, are sometimes larger than ordinary specimens of *S. hoffmanni* but the differences in proportion remain the same. Four adult skulls from the vicinity of the type locality average: basal length 42.5; palatal length 21.6; interorbital breadth 15.2; zygomatic breadth 28.6; length of upper molar series 9.2.

*General notes.*—*Macroxus tephrogaster* is unquestionably a synonym of *Sciurus deppei*. In the original description of *M. tephrogaster* Gray mentions specimens from Mexico (Sallé), Guatemala, Bogotá and Honduras. Mr. Thomas writes that the Sallé specimen from Mexico (B. M. 56. 8. 1. 11) may be taken as the type, since it agrees exactly with Gray's description. A nearly typical specimen of *S. deppei* from Jico, Vera Cruz (no. 54,981, U. S. National Museum) was sent Mr. Thomas, who writes that it "matches the type of *tephrogaster* and may be accepted as typical." This proves beyond question that *S. tephrogaster* is a synonym of *S. deppei*. Mr. Thomas also writes that the type of *Macroxus taniurus* Gray described from Guatemala, differs from a specimen of *S. deppei* (no. 63671, U. S. Nat. Museum) from Motzorongo, Vera Cruz, only in having the chest and belly washed with yellow—merely a matter of individual variation.

*Habits.*—This species lives in dense humid forests and passes much of its time seeking food on the ground. It is quiet and not often heard, though now and then one will chatter and scold at an intruder.

In some places it is very abundant, notably on the east slope of the Cofre de Perote above Jico, Vera Cruz, and on the mountains above Tapachula, Chiapas.

*Specimens examined*.—Seventy three: from Papantla, Jico, Las Vigas, Jalapa, Cordova, Motzorongo and Catemaco, Vera Cruz; Metlatoyuca and Huachinango, Puebla; Reyes and mountains near Santo Domingo, Oaxaca; Ocuilapa, San Cristobal, Pinabete and Tumbala, Chiapas; Coban to Clusec and central-western Guatemala; Truxillo, Honduras.

SCIURUS NEGLIGENS Nelson. Little Gray Squirrel.

*Sciurus arizonensis* ALSTON, Biol. Cent.-Am., Mammalia, pp. 125-126, 1880 (part: from Tampico, Tamaulipas, Mexico).

*Sciurus deppei* ALLEN, Bull. Am. Mus. Hist., N. Y., III, p. 222, 1891 (part: from Valles, San Luis Potosi; and Victoria, Tamaulipas, Mexico).

*Sciurus negligens* NELSON, Proc. Biol. Soc. Washington, XII, p. 147 June 3, 1898.

*Type locality*.—Alta Mira, Tamaulipas, Mexico. Type no. 93028 U. S. National Museum, Biological Survey Collection.

*Distribution*.—Arid tropical forests of lowlands in extreme northern Vera Cruz, eastern San Luis Potosi, and southern half of Tamaulipas, Mexico (below 1000 ft.).

*Characters*.—Size of *S. deppei*; ears longer and dull rusty; upperparts rather pale grayish brown; underparts white or pale buffy yellow. Pelage soft and rather thin; tail thin and slender. Teats: p.  $\frac{2}{2}$  a.  $\frac{1}{1}$  i.  $\frac{1}{1}$ .

*Color*.—Upperparts, including top of nose and base of tail, rather pale, finely grizzled grayish brown, generally with a slight yellowish or dull rusty suffusion, most marked posteriorly; sides of head and neck, and sometimes nape, dingy yellowish brown; ears varying from dingy rusty to dark ferruginous; a small dingy white basal patch usually present; fore feet, outside of legs, and sometimes adjacent part of shoulders, dull gray; outside of thighs and hind feet usually like rump, but toes sometimes gray; underparts white, varying to uniform deep fulvous or almost rusty yellow; inside of thighs pale buffy in white bellied specimens; chin and throat usually white; tail above black, thinly washed with white; below with broad median area grizzled and varying from yellowish to grayish brown, bordered by a thin line of black and thinly edged with white. Hairs of back black, with narrow subterminal and sub-basal rings of yellowish gray or yellowish brown.

*Variation.*—The main variation is in the amount of rusty on the ears, and in the color of the underparts, which ranges from white to deep buffy yellow. Some specimens are considerably grayer above—less shaded with yellow—than others. No melanistic specimens seen. Spring and autumn specimens show no seasonal differences.

*Measurements.*—Average of five adults from type locality: total length 387.4; tail vertebræ 188.2; hind foot 54.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull indistinguishable from that of typical *S. deppei*. Four adult skulls from type locality average: basal length 41.7; palatal length 21.4; interorbital breadth 15.3; zygomatic breadth 28.4; length of upper molar series 9.1.

*General notes.*—*Sciurus negligens* closely resembles *S. deppei* in size and general appearance, and inhabits the more arid country lying north of the region occupied by the latter species. It is readily distinguished from *S. deppei* by the much grayer color of the upperparts.

*Habits.*—These squirrels are most numerous in the stunted forests of ebony, 15 to 25 feet high, which cover great areas in their range and furnish their main food supply. We found them in the greatest abundance at Velasco, San Luis Potosi, where the ground under the trees was strewn with gnawed seed pods.

*Specimens examined.*—Twenty-three: from Alta Mira and Victoria, Tamaulipas; and Velasco and Jilitla, San Luis Potosi.

## Subgenus **MICROSCIURUS** Allen (pl. I, fig. 6; pl. II, fig. 2.)

### SCIURUS ALFARI Allen. Alfaro's Pigmy Squirrel.

*Sciurus (Microsciurus) alfari* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., VII, p. 333, Nov. 8, 1895; *Ibid.*, IX, p. 35, 1897.

*Sciurus alfari* ALFARO, Mamíferos de Costa Rica, pp. 31–32, 1897.

*Type locality.*—Jiménez, Costa Rica. Type no.  $\frac{11290}{9554}$ , American Museum of Natural History, New York.

*Distribution.*—Dense humid forests of northern, eastern and south-western Costa Rica.

*Characters.*—Size very small; ears short and rounded, upperparts dark, minutely grizzled reddish brown, the reddish most intense on nose and sides of head; ring about eye reddish buffy. Pelage soft and dense; tail slender. Teats: p.  $\frac{1}{4}$  a.  $\frac{1}{4}$  i.  $\frac{1}{4}$ .

*Color.*—(Of type): Entire upperparts including ears and outside of legs, minutely grizzled dark brown, suffused with dull rufous; rufous most intense on head and brightest on narrow ring about eye; feet and toes grizzled rusty brown slightly paler than back; chin, throat,

chest and inside of fore legs pale dull ferruginous, shading posteriorly into dark brown, with only a slight wash of reddish along middle of belly and inside of thighs; tail at base like back; remainder of tail all around, grizzled dark reddish brown and black with fine yellowish brown tips to hairs; hairs of extreme tip forming a black pencil. Hairs on back black with narrow subterminal rings of rusty yellowish.

*Variation.*—Two adults, including the type and one partly grown young, show but little variation except in color of underparts. The immature specimen is slightly more reddish on back and tail; the cheeks, chin, throat, chest and line down middle of abdomen are dark dull ferruginous, and the sides of abdomen are similar to flanks. The other adult is like the type except in the dull brownish buffy of the underparts.

*Measurements.*—Average of two adults (from dry skins): total length 251; tail vertebræ 109; hind foot 37.

*Cranial characters.*—Premolars  $\frac{2}{1}$ . Skull (pl. I, fig. 6; pl. II, fig. 2) short, broad, and much arched over top of braincase, the convex outline descending in an almost unbroken curve to edge of occiput; rostrum short and broad, especially at base where the upper parts of the premaxillaries are very broad and heavy; jugals very broad vertically, much more so than in the other species examined in this subgenus. Measurements of type skull: basal length 29.5; palatal length 14.2; interorbital breadth 13; zygomatic breadth 22; length of upper molar series 6.

*General notes.*—Little is known about the interesting squirrels of the subgenus *Microsciurus*, but, as suggested by Dr. Allen, further work in Central and South America is revealing other species. Mr. Cherrie collected the type in the forest on the slope of the Volcano of Turrialba, near Jiménez, Costa Rica, and the species has been found since in several other parts of the country.

*Specimens examined.*—Three: from Jiménez, San Carlos, and Reventazon, Costa Rica.



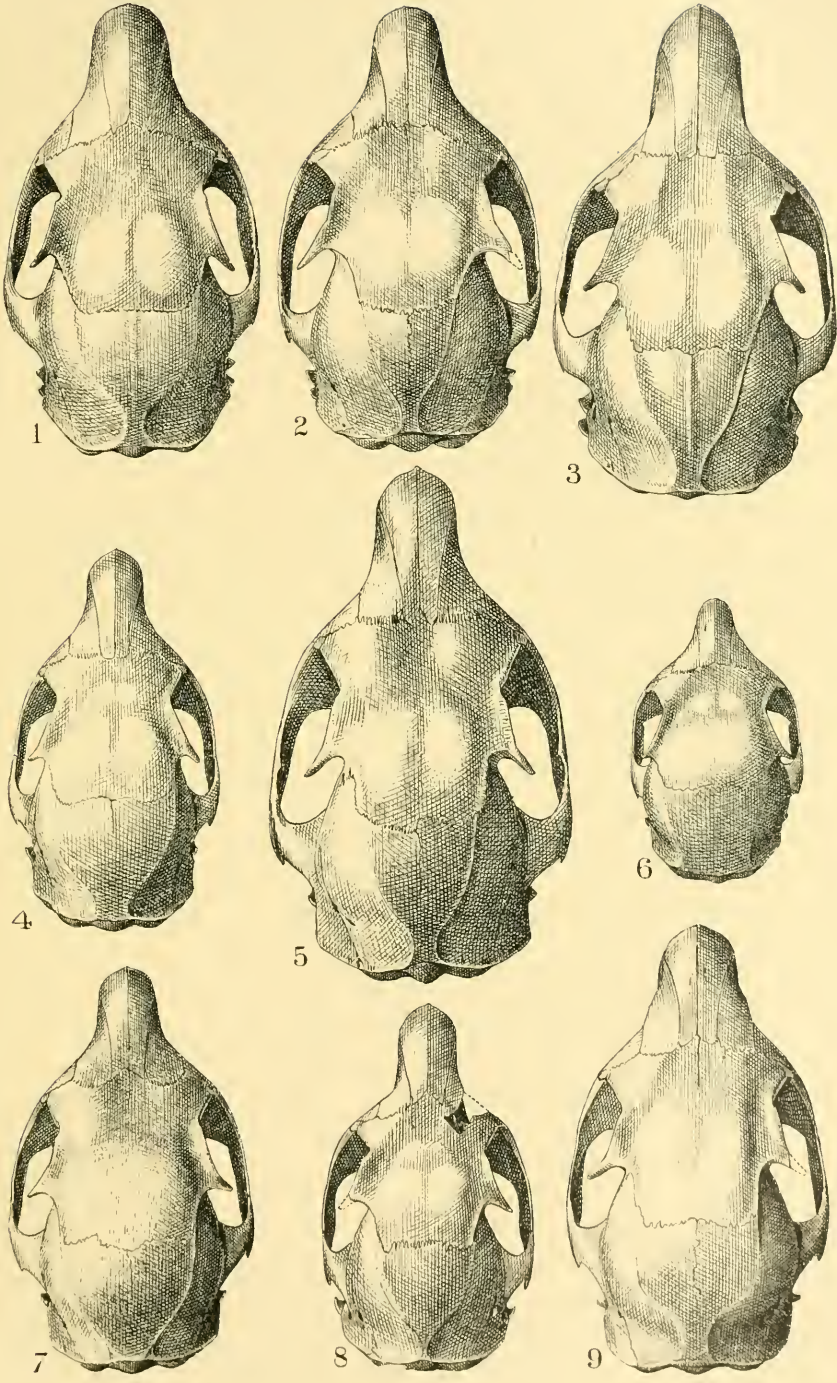
PLATE I.

Skulls of 9 subgenera of Tropical American Squirrels.

[Natural size.]

- Figs. 1. *S. (Parasciurus) ludovicianus limitis*. Kickapoo Springs, Texas.  
(No.  $\frac{2296}{83043}$  ad. U. S. Nat. Mus.)
2. *S. (Otosciurus) durangi*. El Salto, Durango, Mexico.  
(No. 94580 ♂ ad. U. S. Nat. Mus.)
3. *S. (Aræosciurus) oculatus*. Las Vigas, Vera Cruz, Mexico.  
(No. 54238 ♂ ad. U. S. Nat. Mus.)
4. *S. (Baiosciurus) deppei*. Huauchinango, Puebla, Mexico.  
(No. 92998 ♀ ad. U. S. Nat. Mus.)
5. *S. (Hesperosciurus) griseus*. Trout Lake, Washington.  
(No. 89006 ♀ ad. U. S. Nat. Mus.)
6. *S. (Microsciurus) alfari*. Jiménez, Costa Rica.  
(No. 9554 ♂ ad. Am. Mus. Nat. Hist.)
7. *S. (Guerlinguetus) aestuans hoffmanni*. Talamanca, Costa Rica.  
(No. 2811 ♂ ad. Am. Mus. Nat. Hist.)
8. *S. (Tamiasciurus) douglasi mearnsi*. San Pedro Martir Mts., Lower California, Mexico.  
(No. 25170 ad. U. S. Nat. Mus.)
9. *S. (Echinosciurus) aureogaster*. Alta Mira, Tamaulipas, Mexico.  
(No. 93034 ♀ ad. U. S. Nat. Mus.)





SKULLS OF MEXICAN SQUIRRELS.

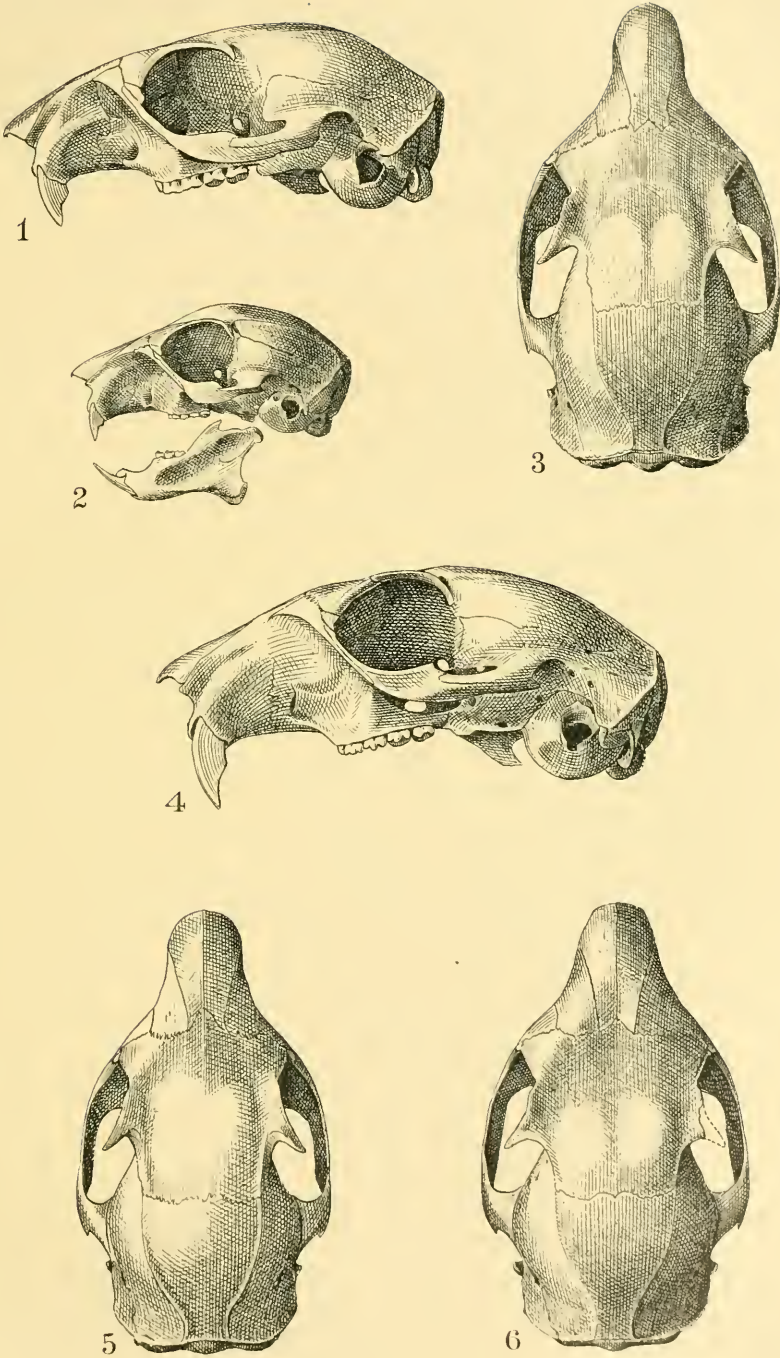




PLATE II.

Skulls of Tropical American Squirrels. [Natural size.]

- Figs. 1. *S. (Echinosciurus) boothiæ belli*. Escondido River, Nicaragua.  
(No. 48847 ♀ ad. U. S. Nat. Mus.)
2. *S. (Microsciurus) alfari*. Jiménez, Costa Rica.  
(No. 9554 ♀ ad. Am. Mus. Nat. Hist.)
3. *S. (Echinosciurus) poliopus*. Cerro San Felipe, Oaxaca, Mexico.  
(No. 68183 ♀ ad. U. S. Nat. Mus.)
4. *S. (Hesperosciurus) griseus*. Trout Lake, Washington.  
(No. 89006 ♀ ad. U. S. Nat. Mus.)
5. *S. (Echinosciurus) boothiæ belli*. Escondido River, Nicaragua.  
(No. 48847 ♀ ad. U. S. Nat. Mus.)
6. *S. (Echinosciurus) thomasi*. Talamanca, Costa Rica.  
(No. 23367 ad. U. S. Nat. Mus.)



SKULLS OF MEXICAN SQUIRRELS.



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A SYNOPSIS OF MEXICAN AND CENTRAL AMERICAN UMBELLIFERÆ.

BY JOHN M. COULTER AND J. N. ROSE.

THE Mexican and Central American Umbelliferæ were first brought together by Mr. W. B. Hemsley in the *Biologia Centrali-Americana*. The fascicle containing them was published in 1880, and the Supplement, including some additions, in 1886. This pioneer work was one of great difficulty, and has been an invaluable assistant to us in the further study of the Umbelliferæ of the region. In that enumeration twenty-five genera are recognized and seventy-six native species named, thirty-two of which belong to the genus *Eryngium*. Four of these genera are now to be excluded from the Mexican flora, viz., *Carum*, *Cymopterus*, *Eulophus*, and *Smyrnum*, leaving twenty-one of the Hemsley genera that are to be retained.

Since 1886 the following new genera from this region have been described, the number of species indicated including those described in the present paper: *Coaxana* (1 species), *Coulterophytum* (4 species), *Deanea* (7 species), *Donellsmithia* (1 species), *Enantiophylla* (1 species), *Museniopsis* (19 species), *Myrrhidendron* (1 species), *Neogoczia* (3 species), *Neonelsonia* (2 species), *Prionosciadium* (15 species), and *Rhodosciadium* (3 species). *Apiastrum*, *Conioselinum*, *Musincon*, and *Pimpinella* have also been found to be members of the Mexican flora; and to these should be added *Ammoselinum*, *Caucalis* and *Leptocaulis*, whose species Hemsley had included under other

genera. These eighteen genera have added sixty-four species to the flora of the region under consideration, while numerous species have been added to other genera, notably to *Eryngium*, *Tauschia*, and *Arracacia*. The Umbelliferæ of Mexico and Central America, therefore, are now known to include thirty-nine genera and one hundred and eighty-two native species, which more than doubles the species known in 1886. It is also of interest to note that ten of the genera and one hundred and forty-eight of the species are endemic.

Certain features of geographical distribution have become evident, but exploration must be more complete before they can become very definite. There are very few Umbelliferæ in the tropical zone of Mexico and Central America, their chief development being in the mountains of the Upper Austral and Transition zones, in such dominant forms as *Eryngium*, *Arracacia*, *Prionosciadium*, *Tauschia*, *Coulterophytum*, and *Rhodosciadium*, the Sierra Madre region having proved most productive of new forms. It is also a matter of interest that the great dominant genus of the Western United States, *Peucedanum*, with its 60 or 70 species, is probably not represented at all south of the Mexican boundary.

In the *Contributions of the National Herbarium* (3: 289-309. 1895) we gave an account of new and noteworthy species, largely bringing together the knowledge of the group which had accumulated since Hemsley's account of 1880. Since 1895, however, exploration has proceeded rapidly, and many new collections have not only contributed numerous new species, but have also thrown much light upon certain genera and doubtful species. The recent collections which have contributed chiefly to our knowledge are as follows:

The veteran collector Mr. C. G. Pringle, whose annual sets of Mexican plants for twenty years have been among the most valuable additions to herbaria, in recent years has been working chiefly in the general region of the City of Mexico, which has been made accessible by the opening up of new railway lines.

Messrs. E. W. Nelson and E. A. Goldman, field naturalists of the Biological Survey of the U. S. Department of Agriculture, have collected over a more extensive area than any others,



bringing to light not only new forms of Umbelliferæ, but of numerous other groups as well.

In 1897, Dr. J. N. Rose spent four months in Mexico, collecting a series of 57 numbered specimens of Umbelliferæ, chiefly in the Sierra Madre of Durango, Zacatecas, Jalisco, and Tepic, 21 of which have proved to be new. In 1899 also Dr. Rose spent three months in Southern Mexico, collecting Umbelliferæ about Cuernavaca in Morelos, Pachuca in Hidalgo, and Guanajuato. The Pachuca collections are of special interest as they include certain little known species of Humboldt and Thomas Coulter from the type localities.

GENERA GIVEN BY HEMSLEY.

Genus.	No. of species in Hemsley	No. of species added since	No. of species transferred	No. of species recognized	No. of endemic species
Angelica	1	4	1	4	4
Apium	3	0	2	1	0
Arracacia	5	19	3	20	20
Astericum	1	0	0	1	1
Berula (Sium)	1	0	0	1	0
Bowlesia	1	1	0	2	0
Carum	0	0	0	0	0
Cicuta	1	1	1	1	1
Cymopterus	1	0	1	0	0
Daucus	3	0	0	3	1
Eryngium	32	20	0	52	43
Eulophus	2	0	2	0	0
Hydrocotyle	7	1	0	8	1
Ligusticum	1	2	1	2	2
Lilæopsis (Crantzia)	1	1	1	1	0
*Micropleura	1	0	0	1	1
Enanthe	0	1	0	1	1
Oreomyrrhis	3	0	2	1	0
Osmorhiza	1	1	1	1	1
Ottoa	1	0	0	1	0
Peucedanum	3	1	2	2	2
Sanicula	2	1	0	3	1
Smyrnum	1	0	1	0	0
Spananthe	2	0	1	1	0
Tauschia	2	10	1	11	10
Totals,	76	63	20	118	89

Dr. T. Altamarano, Director of the Medical Institute of Mexico, has also been of much service in contributing specimens, chiefly from the mountains about the Valley of Mexico.

In the present paper this new material is published, and also revisions of certain genera which are now better understood. One of the most interesting facts is the great increase in our knowledge of *Prionosciadium*, a genus established in 1888 as containing three species, which recent collections have increased to fifteen. The largest genus of the region, *Eryngium*, is now being studied by Mr. Hemsley. His descriptions of several new species, published in Hooker's *Icones*, are herein translated and republished, together with tracings of the plates, made by Miss Anna Snyder. The genus *Arracacia* also has received large additions, seven new species being described in the present paper, and others previously. The genus, however, has lost several species to *Tauschia*, the generic boundary between the two being more definitely understood. It is also of interest to

GENERA ADDED SINCE HEMSLEY.

Genus.	No. of species	No. of endemic species.	No. of species cited by Hemsley under other genera
Ammoselinum	1	1	1 ( <i>Apium</i> ).
Apiastrum	1	0	
Caucalis	1	0	1 ( <i>Daucus</i> ).
*Coaxana	1	1	
Conioselinum	1	1	
*Coulterophytum	4	4	
*Deanea	7	7	
*Donnellsmithia	1	1	
*Enantiophylla	1	1	
Leptocaulis	1	0	1 ( <i>Apium</i> ).
Museniopsis	19	18	2 ( <i>Eulophus</i> ).
Musineon	1	1	
*Myrrhidendron	1	1	
*Neogoezia	3	3	2 ( <i>Oreomyrrhis</i> ).
Neonelsonia	2	1	1 ( <i>Arracacia</i> ).
Pimpinella	1	1	
*Prionosciadium	15	15	3 ( <i>Angelica</i> , <i>Peuce-</i>
*Rhodosciadium	3	3	[ <i>danum</i> ].
Totals,	64	59	

note that the recent genus *Neonelsonia*, founded upon a single species, has been strengthened by the discovery of a species heretofore referred to *Arracacia*.

The accompanying tables will serve to show the development of our knowledge of the Umbelliferæ of the region since Hemsley's presentation of the family in the *Biologia*. The numbers given include only the native and named species. The endemic genera are indicated by asterisks.

The genera are arranged in the sequence given by Drude in Engler and Prantl's *Natürlichen Pflanzenfamilien*, which is by far the most masterly presentation of the group which has yet appeared. The following purely artificial key to the genera may be of service to those not familiar with them.

*Artificial Key to the Genera.*

- Flowers in dense heads; leaves usually with bristly or spiny-toothed margins..... 7. *Eryngium*.
- Flowers not in heads, evidently umbellate; leaves not spiny-toothed.
  - Fruit conspicuously bristly.
    - Fruit covered with hooked bristles.
      - Leaves palmately divided, with broad segments.
        - 6. *Sanicula*.
      - Leaves ternately dissected, with filiform segments.
        - 21. *Leptocaulis*.
    - Fruit with bristles only on the ribs.
      - Bristles barbed at tip; stylopodium obsolete.
        - 39. *Daucus*.
      - Bristles not barbed; stylopodium conical...9. *Caucalis*.
  - Fruit not bristly (except *Osmorhiza*).
- FLOWERS IN SIMPLE UMBELS (sometimes proliferous or even irregularly branching in *Hydrocotyle*).
  - Fruit more or less stellate-pubescent.....3. *Bowlesia*.
  - Fruit not stellate-pubescent.
    - Seed-face more or less sulcate or involute.
      - Fruit narrow.....10. *Oreomyrrhis*.
      - Fruit orbicular.....11. *Neogoezia*.
    - Seed-face not sulcate or involute.
      - Stems creeping..... 1. *Hydrocotyle*.
      - Stems more or less erect and leafy.
        - Leaves cuneate at base ..... 5. *Astericum*.
        - Leaves not cuneate at base.
          - Leaves with naked petioles and reniform blades.
            - 2. *Micropleura*.
          - Leaves with tuft of hairs at top of petiole, and ovate acuminate blades.....4. *Spananthe*.

## FLOWERS IN COMPOUND UMBELS.

**Fruit flattened laterally.***Seed-face more or less deeply sulcate.*

Fruit elongated and narrow, tapering into a stipe-like base.

Lateral ribs not winged; fruit bristly.

8. *Osmorhiza*.

Lateral ribs winged; fruit not bristly.

36. *Coulterophytum*.

Fruit oblong to orbicular, not tapering at base.

Leaves reduced to fistulous, nodose petioles.

19. *Ottoa*.

Leaves not reduced, more or less compound.

Stylopodium conical.

Fruit cordate in outline, deeply notched at base and didymous....13. *Neonelsonia*.Fruit oblong to ovate, not deeply notched or didymous.....18. *Arracacia*.

Stylopodium obsolete.

Fruit with conspicuous obtuse ribs.

17. *Tauschia*.

Fruit with slender and more or less indistinct ribs.

Styles long and ribbon-like.

15. *Musineon*.

Styles short and filiform.

Stems simple; leaflets broad; Guatemalan.....14. *Donnellsmithia*.

Stems mostly branching; leaflets narrow; Mexican.

Oil-tubes numerous.

16. *Museniopsis*.

Oil-tubes solitary.

12. *Apiastrum*.*Seed-face plane.*

Leaves reduced to fistulous, nodose petioles.

27. *Lilaeopsis*.

Leaves not reduced, more or less compound.

Fruit winged.....29. *Coaxana*.

Fruit not winged.

Fruit with prominent acute ribs.

28. *Ligusticum*.

Fruit with obtuse or obscure ribs.

Fruit with conspicuous, obtuse and corky ribs.

Stylopodium conical.....23. *Cicuta*.

Stylopodium obsolete.

Fruit very small, strongly flattened laterally; leaflets filiform (in the native species).

20. *Apium*.Fruit larger, slightly flattened laterally; leaflets broad.....26. *Ænanthe*.

- Fruit with obscure ribs.
  - Fruit somewhat scabrous....22. *Ammoselinum*.
  - Fruit smooth.
    - Involucre and involucels conspicuous.
      - 25. *Berula*.
    - Involucre and involucels not conspicuous (in the native species).....24. *Pimpinella*.
- Fruit flattened dorsally.**
  - Seed-face sulcate.
    - Stylopodium obsolete.....32. *Prionosciadium*.
    - Stylopodium conical .....34. *Deanea*.
  - Seed-face plane.
    - Fruit linear* or oblanceolate in outline; Guatemalan.
      - Fruit linear; arborescent.....37. *Myrrhidendron*.
      - Fruit oblanceolate; perennial herbs.
        - 35. *Enantiophylla*.
    - Fruit orbicular* or nearly so.
      - Stylopodium low conical.
        - Dorsal and intermediate ribs filiform.
          - 33. *Rhodosciadium*.
        - Dorsal and intermediate ribs prominent.
          - Leaves with rather large ovate or lanceolate segments.....31. *Angelica*.
          - Leaves with small segments..30. *Conioselinum*.
      - Stylopodium obsolete.....38. *Peucedanum*.

1. HYDROCOTYLE L. Sp. Pl. 1: 234. 1753.

The genus has a world-wide distribution, and in Hemsley's catalogue eight species, seven of which are named, are enumerated as occurring in the Mexican and Central American region, as follows: *H. bonplandi* Rich., *H. bonariensis* Lam., *H. interrupta* Muhl., *H. mexicana* Cham. & Schlecht., *H. prolifera* Kellogg, *H. pusilla* Rich., and *H. ranunculoides* L. Some of these are perhaps to be excluded, and *H. umbellata* and probably other species are to be added. Of these *H. mexicana* is the only endemic species.

**Hydrocotyle bonariensis** Lam. Encycl. 3: 153. 1789.

Tamaulipas: sand dunes at Tampico, *Pringle* 6359; Alta Mira, *E. A. Goldman* 94, April 20, 1898.

Oaxaca: Tehuantepec City, altitude 45 meters, *Nelson* 2620, May 29, 1895.

**Hydrocotyle mexicana** Cham. & Schlecht. Linnæa 5: 208. 1830.

Chiapas: about Tumbala, altitude 1200-1650 meters, *Nelson* 3301, October 20-29, 1895.

Guatemala: near Nenton, altitude 900-1200 meters, *Nelson* 3623, December 13, 1895; Volcano Santa Maria, altitude 2400-3450 meters, *Nelson* 3702, January 24, 1896.

Costa Rica: altitude 2000 meters, *Tonduz* 4274, July 10, 1891;  
*Tonduz* 7677, March 1893; *Tonduz* 8258, November 1893.

**Hydrocotyle ranunculoides** L. f. *Suppl.* 177. 1781.

Durango: near city of Durango, *Palmer* 216, May 5-June 24, 1896.  
 Costa Rica: San Jose, *Tonduz* 1688, December 1889.

**Hydrocotyle umbellata** L. *Sp. Pl.* 1: 234. 1753.

Tepic: near town of Tepic, *Nelson* 4175, April 9, 1897.  
 Costa Rica: Aguacalienta, *Pittier*, May 2, 1890.

2. MICROPLEURA Lag. in *Ocios Esp. Emigr.* 4: 347. 1825.

A genus of a single species, endemic in the Mexican and Central American region. Both Urban and Drude refer the genus to *Centella*, recently separated again from *Hydrocotyle*, but in our judgment it should be kept distinct. It is restricted to the high mountains, while *Centella*, at least our American species, belongs to the low ground.

**Micropleura renifolia** Lag. l. c.; also *Obs. Aparas.* 15. 1826.

*Centella renifolia* (Lag.) Urban in *Mart. Fl. Bras.* 111: 286. 1879

Oaxaca: San Felipe, *Rose* 4609, June 16-21, 1899.

Chiapas: above San Cristobal, altitude 2100-2400 meters, *Nelson* 3145, September 18-22, 1895.

Tepic: on the mountain between Dolores and Santa Gertrudis,  
*Rose* 2056, August 7, 1897.

3. BOWLESIA Ruiz. & Pav. *Prod. Fl. Peruv.* 44. *pl.* 34. 1794.

Chiefly a South American genus, but two species extending into our region. In addition to *B. lobata* Ruiz. & Pav., given by Hemsley, we cite the following:

**Bowlesia palmata** Ruiz. & Pav. *Fl. Peruv.* 3: 28. *pl.* 251. 1802.

Chihuahua: under cliffs, canyons of the Sierra Madre, *Pringle* 1248, October 3, 1887.

4. SPANANTHE Jacq. *Collect.* 3: 247. 1789.

A genus extending from the Mexican and Central American region into Tropical South America. Hemsley gives the following two species: *S. angulosa* Turcz. and *S. paniculata* Jacq., but, as he remarks, the former is probably a variety if not merely a form of the latter.

**Spananthe paniculata** Jacq. Coll. 3: 247. 1789.

Vera Cruz: in fields near Orizaba, altitude 1200 meters, *Pringle* 6231, October 31, 1895.

Guatemala: along roadside between Nenton and Jacaltenango, altitude 1050-1590 meters, *Nelson* 3565, December 18, 1895.

Costa Rica: altitude 1200 meters, *Pittier* 19, December 12, 1887; *Pittier* 431, August 1888; *Tonduz* 431, August 12, 1889; *Tonduz* 7118, July 1892; altitude 1500 meters, *Pittier* 6980, August 28, 1892.

5. **ASTERICIUM** Cham. & Schlecht. *Linnaea* 1: 254. 1826.

A South American genus, represented in our region by the single endemic species *A. flexuosum* Hemsley, collected but once, and with immature fruit, by *Bates* in "South Mexico."

6. **SANICULA** L. Sp. Pl. 1: 235. 1753.

A genus of about thirty species, belonging to both hemispheres, three of which belong to our region, *S. liberta* Cham. & Schlecht. and *S. mexicana* DC., both cited by Hemsley, the former being endemic, and *S. bipinnatifida* Dougl., a Pacific Coast species extending into Lower California.

**Sanicula mexicana** DC. Prod. 4: 84. 1830.

Vera Cruz: near Jalapa, altitude 1200 meters, *Pringle* 8061, April-May 1899.

Chiapas: above San Cristobal, altitude 2100-2640 meters, *Nelson* 3210, September 18-22, 1895; along the road between Tenejapa and Yajalon, altitude 900-1500 meters, *Nelson* 3245, October 13, 1895.

Guatemala: Volcano of Santa Maria, altitude 2400-3450 meters, *Nelson* 3705, January 24, 1896.

Costa Rica: *Pittier* 255, May 27, 1888; altitude 2000 meters, *Tonduz* 255, August 31, 1889; altitude 2000 meters, *Pittier* 4272, July 1891; *Tonduz* 7676, March 1893.

**Sanicula bipinnatifida** Dougl. in Hook. Fl. Bor. Am. 1: 258. *pl.* 92. 1834.

Lower California: near Ensenada, *Jones* 3690, April 10, 1882.

7. **ERYNGIUM** L. Sp. Pl. 1: 232. 1753.

A genus of about two hundred species, distributed chiefly throughout temperate and subtropical regions, and especially abundant in America. Hemsley, in 1880, enumerated thirty-seven species, five of them without names, and has now about completed a revision of the Mexican and Central American species of the genus, involving numer-

ous changes. Since 1880 the following species have been published, in addition to those republished below: *E. alternatum* C. & R., *E. columnare* Hemsl., *E. involucreatum* C. & R., *E. lemmoni* C. & R., *E. leptopodium* Hemsl., *E. madrense* Watson, *E. mexicanum* Watson, *E. montanum* C. & R., *E. nelsoni* C. & R., *E. reptans* Hemsl., *E. schaffneri* Hemsl., *E. seatonii* C. & R., and *E. tenuissimum* Hemsl. At the present date, therefore, the published species of the region have increased in number to fifty-two, forty-three of which are endemic.

The following species described by Hemsley in Hooker's *Icones* are founded upon material furnished by the National Herbarium. The plates are reproduced through the courtesy of the Director of Kew Gardens.

***Eryngium cryptanthum* Hemsl.**

in Hook. Icon. IV. 6: *pl.*

2509. 1897. Fig. 1.

*E. beecheyanum* Seem. Bot. Voy. Herald 294. 1856, not Hook. & Arn.

Biennial (?), glabrous throughout; stem erect, slender, 1.5 to 4 dm. high, sparsely branched at base, the branches erect and dichotomous or trichotomous; leaves thin, scarcely coriaceous; basal ones rosulate, sessile, 2.5 to 5 cm. long, oblong-spatulate, spinulose-dentate, with white margin; stem leaves smaller, few-lobed; heads few, on slender peduncles, small, ovoid, the largest about 6 mm. long with out the bracts; involucre of 5 to 7 rather rigid, spinulose, lanceolate bracts, 6 to 10 mm. long, enclosing the flowers, mostly 2-toothed at the middle; involucels



FIG. 1. *Eryngium cryptanthum*.

of acute bractlets broad at base and a little exceeding the flowers; calyx-teeth minute, ovate, minutely apiculate, at length incurved; carpels oblong, 1 to 1.5 mm. long, regularly and completely spongy-scaly, with divaricate styles; oil-tubes minute, 1 or 2 or none in the intervals, 2 on the commissural side.

Northwest Mexico: in the Sierra Madre, *Seeman* 2135.



*Eryngium galeottii* Hemsl. in Hook. Icon. IV. 6: *pl.* 2510. 1897.  
 Plate III. *a.*

*E. microcephalum* Willd.? Hemsl. Biol. Centr.-Am. Bot. 1: 563. 1880.  
*E. ghiesbreghtii* C. & R. Contr. Herb. 3: 299. 1895, not Decne.

Perennial (?), glabrous, nearly unarmed, from a cylindrical tuberous root; stem almost simple, slender, 4 to 6 dm. high, bearing 1 to 3 heads; leaves thick, subcoriaceous, scarcely rigid; basal ones with very long petioles, lanceolate, acuminate, rounded at base, crenate-dentate, including the petiole 12.5 to 17.5 cm. long; upper leaves sessile, narrow, gradually smaller upward, aculeate-dentate, bract-like; heads erect on slender peduncles, globose or oblong, without the bracts about 12 mm. in diameter; involucre of 5 to 7 rigid, lanceolate, acute and pungent bracts, often aculeate-dentate with 2 to 6 unequal teeth, 6 to 12 mm. long; involucels of narrow, almost subulate, pungent and incurved bractlets a little exceeding the flowers; calyx-lobes oblong-lanceolate, long cuspidate-acuminate; styles elongated and divaricate; carpels (immature) subtriangular, scaly throughout.

Oaxaca: altitude 2100-2400 meters, *Galeotti* 2767; *Pringle* 4746, in 1894; *A. L. Smith* 877.

Nearest *E. paucisquamosum*, but differs in the lanceolate leaves and aculeate-dentate involucre bracts. Schlechtendal & Chamisso (*Linnaea* 5: 207. 1830) reduce *E. microcephalum* Willd. to *E. bonplandi* Delar., which differs from *E. galeottii* in its small ovate-oblong leaves, very short entire bracts, papillose carpels, and remarkably long, reflexed styles. *E. ghiesbreghtii* Decne. differs in its cordate leaves.

*Eryngium longipetiolatum* Hemsl.  
 in Hook. Icon. IV. 6: *pl.* 2504. 1897. Fig. 2.

Perennial (?), glabrous throughout, wholly unarmed, from a thick fibrous root; stem erect, with few branches, leafy, 3 to 7.5 dm. high, bearing few heads; basal and lower leaves with long petioles (sometimes reaching 25 cm.), thickish, narrowly ovate-oblong, without the petiole 2.5 to 9 cm. long, 2 to 3.5 cm. broad, obtuse or rounded at apex, cuneate at base, truncate-crenate



FIG. 2. *Eryngium longipetiolatum*.

and with white margin; upper stem leaves sessile, auriculate at base, clasping, gradually smaller upward; heads in threes, or solitary on the lateral branches, long peduncled, hemispherical, shorter than the bracts; involucre of 9 to 12 rigid, narrow oblong bracts, 6 to 12 mm. long, mostly rounded at apex, very short spinose, mostly with 2 spinose teeth above the middle, with rarely 2 or 3 additional teeth; involucels of subulate incurved bractlets from a broad base, at length rigid, exceeding the flowers; calyx-teeth narrow, ovate, subspinose-apiculate; carpels about 2 mm. long, covered mostly above the middle with acute scales; styles elongated, recurved; oil-tubes small, mostly 5, of which 2 are on the commissural side.

Chiapas: near San Cristobal, altitude 2100-2640 meters, *Nelson* 3151, in 1895.

A species intermediate between *E. longirameum* and *E. scaposum*, differing in its long-petioled, oblong basal leaves, cuneate at base.

***Eryngium paucisquamosum*** Hemsl. in Hook. Icon. IV. 6: *pl.* 2505. 1897. Plate III *b.*

Perennial, apparently stoloniferous, glabrous throughout; stem erect, very slender, 2 to 6 dm. high, almost naked, bearing 3 to 5 heads; leaves thick, somewhat fleshy; basal and lower ones long-petioled, oblong or elliptical, without the petiole 3.5 to 4.5 cm. long, slightly cordate at base, rounded at apex, crenulate and margined, conspicuously veiny beneath, on a slender petiole 5 to 7.5 cm. long; upper leaves few, sessile, narrower, half-clasping; heads mostly 3 to 5, subglobose, 6 to 8 mm. in diameter, on slender peduncles, lateral peduncles bibracteate near the middle, terminal peduncles naked; involucre of 7 to 10 (mostly 9) thick, rigid, oblong-lanceolate bracts 4 to 8 mm. long, subacute, entire or very rarely bidenticulate, at length reflexed, blue; involucels of scarious bractlets, abruptly subulate-acuminate from a broad base, curved, exceeding the flowers; flowers few, blue; calyx-teeth lanceolate, scarious, apiculate, scarcely rigid, as long as the carpels; carpels semiovoid, without the calyx-teeth about 1 mm. long, with very few scales; styles divaricate, exceeding the calyx-teeth; oil-tubes very small, 5, of which 2 are on the commissural side.

Oaxaca: mountains near Tlapancingo, altitude 1800-2400 meters, *Nelson* 2083, December 7, 1894.

Guerrero: summit of Sierra Madre near Chilpancingo, altitude 2700-3060 meters, *Nelson* 2213, December 24, 1894.

Nearest *E. ghiesbreghtii*, but differs in its thicker, oblong, crenate leaves, and more numerous and contiguous involucre bracts.

***Eryngium rosei*** Hemsl. in Hook. Icon. IV. 6: *pl.* 2579. 1897. Fig. 3.

Perennial, subscapose, glabrous throughout; leaves coriaceous; basal ones distinctly petiolate, strongly unequal, oblong, oblong-ovate, elliptical, or sometimes almost orbicular, without the petiole 1.5 to 5 cm. long, the margin beset with long aculeate bristles; upper leaves few

and only subtending the inflorescence, similar to the basals, but sessile and smaller; scape or flower-bearing stem 15 to 22.5 cm. high, mostly bearing 3 bibracteate peduncles, rarely 1 to 4; heads small, subglobose, without the bracts 6 to 10 mm. in diameter; involucre of 9 to 12 stellately divaricate, thick, rigid, oblong-lanceolate or oblanceolate bracts, 12 to 18 mm. long, mostly entire, sometimes with 1 to 4 teeth, acuminate at apex, white above and at margin; involucels of rigid bractlets, linear-oblong from a broadish base, scarcely acute, a little exceeding the flowers; calyx-teeth ovate, apiculate or scarcely acuminate; carpel (immature) with two forms of scales, those above larger, lanceolate, erect, the others papilliform; styles sub-erect.

Tepic: between Dolores and Santa Gertrudis, *Rose* 2035, August 7, 1897; in the Sierra Madre near Santa Teresa, *Rose* 3456, August 13, 1897.

Zacatecas: east range of the Sierra Madre, *Rose* 3526, August 17, 1897.



FIG. 3. *Eryngium rosei*.

*Eryngium spiculosum* Hemsl. in Hook. Icon. IV. 6: *pl.* 2507. 1897.

Plate III c.

Stem erect, apparently 4.5 to 6 dm. high, slender, dichotomously much branched above, glabrous throughout; lower leaves not seen; upper leaves about sessile, glabrous, thin, palmately divided, the largest 11 cm. long, often 3-lobed, sometimes a few small basal lobes in addition, spinose-dentate, the spines not rigid; heads numerous, distinctly slender-peduncled, ovoid or subglobose, 6 to 10 mm. long without the terminal tuft which is of rigid bractlets 2.5 cm. long or less; involucre of 5 to 8 rather rigid, linear-lanceolate bracts, 12 to 24 mm. long, spinose-acuminate, mostly entire, or sometimes with 1 or 2 teeth below the middle; involucels of subulate rigid bractlets exceeding the flowers; flowers distinctly pedicelled; calyx-teeth scarious, ovate, apiculate; carpels scarcely 1.5 mm. long, oblong, almost terete, very densely clothed with minute branching spicules; oil-tubes often 9, rather conspicuous; styles much exceeding the calyx-teeth, divaricate.

Michoacan: *Hahn*.

Morelos: Miacatlan, *Altamirano* 18, December 1875.

Resembling *E. comosum*, but more branching, much less rigid, with palmately divided stem leaves, and carpels covered with minute branching spicules.

***Eryngium sparganophyllum*** Hemsl. in Hook. Icon. IV. 6: *pl.* 2508. 1897. Fig. 4.

*E. longifolium* Gray, Pl. Wright. 2: 65. 1853, not Cav.

Stem erect, tall, twice or thrice dichotomous branching above, leafless except a few small bract-like toothed leaves at the ramifications, glabrous throughout; basal leaves undivided, very narrow, almost linear, acute, 9 to 12 dm. long, soft and spongy, unarmed except a very few very small bristles, strongly involute when dry; heads few, oblong-ovoid, 12 to 24 mm. long, distinctly pedunculate; involucre and involucels of ovate-lanceolate, spinose-acuminate but scarcely rigid bracts; calyx-teeth ovate, apiculate, widely spreading in fruit; carpels oblong, without the calyx-teeth 4 mm. long, longitudinally subtriangular, clothed at the angles with large and spongy scales and between the angles with smaller ones; styles divaricate, exceeding the persistent calyx-teeth; oil-tubes small, solitary in the intervals, 2 on commissural side.

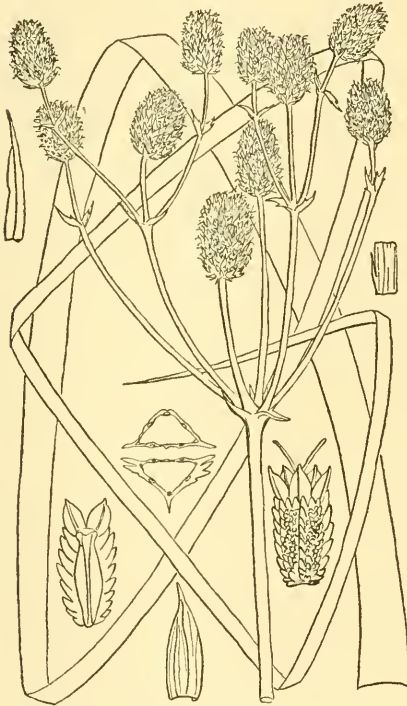


FIG. 4. *Eryngium sparganophyllum*.

New Mexico: Las Playas Springs, near the Sierra de las Animas, *Wright* 1103, in 1851.

Although recorded at present only from New Mexico, this species will very probably be found in Northern Mexico.

The following species from recent collections have been determined by Mr. Hemsley.

***Eryngium beecheyanum*** Hook. & Arn. Bot. Beech. Voy. 294. 1840.

Colima: *Palmer* 62, July 1897.

Jalisco: in the Sierra Madre west of Bolaños, *Rose* 2975, 3739, September 16, 1897.

Tepic: between Acaponeta and Pedro Pablo, *Rose* 1938, August 2, 1897; near Santa Teresa, *Rose* 2108, 3375, 3401, 3404, August 8, 1897.

Siinaloa: Sierra de Choix, *Goldman* 270, October 19, 1898.

Zacatecas: in the Sierra Madre, *Rose* 2393, August 18, 1897; Valparaiso, *Goldman* 4, 12, November and December, 1897.

Chihuahua: Parral, *Goldman* 122, September 19, 1898.

*Eryngium carlinæ* Delar. *Eryng.* 53. *pl.* 23. 1808.

Oaxaca: *A. L. Smith* 882.

Chihuahua: between Guadalupe y Calvo and Parral, *Nelson* 4929, September 7, 1898.

*Eryngium columnare* Hemsl. *Hook. Ic.* IV. 6: *pl.* 2511. 1897.

Durango: near El Salto, *Nelson* 4565, July 12, 1898.

Tepic: near Santa Teresa, *Rose* 2199, August 19, 1897.

Hidalgo: near Pachuca, *Pringle* 6916.

*Eryngium cymosum* Delar. *Eryng.* 63. *pl.* 31. 1808.

Hidalgo: near Pachuca, *Pringle* 6939.

*Eryngium depeanum* Cham. & Schlecht. *Linnæa* 5: 207. 1830.

Oaxaca: *A. L. Smith* 878.

Puebla: Metlaltoyuca, *Goldman* 29, 202, January 1898.

*Eryngium involucratum* C. & R. *Contr. Nat. Herb.* 3: 299. 1895.

Hidalgo: *Pringle* 7624.

*Eryngium longirameum* Turcz. *Bull. Soc. Nat. Mosc.* 20<sup>1</sup>: 171. 1847.

Oaxaca: *A. L. Smith* 880, 881.

Guatemala: mountains near Hacienda of Chancol, *Nelson* 3662, January 2, 1899.

*Eryngium madreense* Watson, *Proc. Am. Acad.* 23: 274. 1888.

Zacatecas: summit of Sierra Madre, *Rose* 2367, August 17, 1897.

*Eryngium montanum* C. & R. *Contr. Nat. Herb.* 3: 300. 1895.

Oaxaca: *A. L. Smith* 884.

*Eryngium nasturtiifolium* Juss. in Delar. *Eryng.* 46. *pl.* 17. 1808.

Tepic: Acaponeta, *Rose* 1425, June 22, 1897.

Tamaulipas: Alta Mira, *Goldman* 97, April 20, 1898.

*Eryngium phyteumæ* Delar. *Eryng.* 51. *pl.* 21. 1808.

Chihuahua: Sierra Madre, near Guachochi, *Goldman* 175, September 27, 1898.

*Eryngium proteæflorum* Delar. *Eryng.* 62. *pl.* 30. 1808.

State of Mexico: Volcano Toluca, *Nelson* 20, September 9, 1893.

**Eryngium scaposum** Turcz. Bull. Soc. Nat. Mosc. 20<sup>1</sup>: 172. 1847.

Oaxaca: La Parada, *Nelson* 1091, August 19, 1894.

**Eryngium seatonii** C. & R. Proc. Am. Acad. 28: 118. 1893.

Puebla: west slope of Mt. Orizaba, *Nelson* 271, March 18, 1894.

**Eryngium wrightii** Gray, Pl. Wright. 1: 78. 1852.

Oaxaca: *Pringle* 6710.

Zacatecas: near Monte Escobedo, *Rose* 3598, August 27, 1897.

8. OSMORHIZA Raf. in Jour. Phys. 89: 257. 1819.

A genus of wide distribution. The single endemic species cited below was referred by Hemsley to *O. brevistylis* DC. of the United States.

**Osmorhiza mexicana** Griseb. Goett. Abb. 24: 147. 1879.

Chihuahua: Mt. Mohinora, *Nelson* 4864, September 1, 1898.

State of Mexico: *Pringle* 6615, 1896.

Chiapas: above San Cristobal, altitude 2100-2640 meters, *Nelson* 3188, September 18-22, 1895.

Guatemala: mountains near Hacienda of Chancol, altitude 3300 meters, *Nelson* 3645, January 2, 1896.

Costa Rica: altitude 2900 meters, *Pittier* 200, March 30, 1888; altitude 3000 meters, *Pittier* 4273, July 1891.

9. CAUCALIS L. Sp. Pl. 1: 240. 1753.

A genus of wide distribution, represented in Mexico by a single species, *C. microcarpa* Hook. & Arn., which is extensively distributed throughout America and perhaps elsewhere.

10. OREOMYRRHIS Endl. Gen. Plant. 787. 1839.

A genus of wide distribution, represented within our range by the single polymorphic Andean species *O. andicola* Endl. (cited by Hemsley as *O. andina*). The two new species doubtfully referred by Hemsley to this genus he has since transferred to his new genus *Neogoezia*.

11. NEOGOEZIA Hemsley, Kew Bull. 354. 1894.

Mr. Hemsley founded this genus upon two species that he had tentatively described under *Oreomyrrhis*, viz., *N. gracilipes* and *N. planipetala*, and added a new one, *N. minor*. The genus is restricted to Mexico, so far as known, and there are indications of a fourth species not yet described.

**Neogoezia planipetala** Hemsl. Kew Bull. 1894: 335. 1894.

Tepic: summit of Sierra Madre near Santa Teresa, *Rose* 2107, 3745, August 8-13, 1897.

Durango: in the high mountains, *Rose*, August 16, 1897.

Zacatecas: in the high mountains, *Rose*, August 18, 1897.

These specimens have been referred by Mr. Hemsley to *N. planipetala*, a species collected but once and then not in fruit. The plants collected by Dr. Rose differ strikingly from *N. planipetala* in size and shape of the bracts as described and figured. They represent a species common on both ranges of the Sierra Madre in the states cited above, at an elevation of 1500-2400 meters, and on the slopes and summits of the mountains. The flowering scapes are about 5 dm. high; leaves 10 to 20 cm. long, with somewhat bipinnatifid segments; involucre bracts 12 to 20 mm. long, 3 to 7-toothed or lacinate near the tip (perhaps sometimes entire); pedicels slender, 8 to 12 mm. long; flowers white, with prominent sepals; fruit 4 mm. long.

The type locality of *N. planipetala* is given as 'Bolaños,' in Jalisco. Of course Hartweg did not get it exactly at Bolaños, as this village is in a hot tropical valley, at an altitude of but 840 meters. It may have come from the mountains to the west, although Dr. Rose found no specimens of this genus in these mountains, his specimens coming from mountains one hundred miles to the north.

12. **APIASTRUM** Nuttall in Torr. & Gr. Fl. 1: 643. 1840.

A North American genus of two species, the following being found in Lower California and its neighboring islands.

**Apiastrum angustifolium** Nutt. l. c.

Cedros Island: *Palmer* 679, in 1889; *Anthony* 310, in 1897.

Lower California: San Quintin, *Palmer* 643, in 1889.

13. **NEONELSONIA** C. & R. Contr. Nat. Herb. 3: 306. 1895.

A genus of two species, the type species being Guatemalan; the other, heretofore referred to *Arracacia*, as seen below, is South American. The genus, therefore, stands as follows:

1. **Neonelsonia acuminata** (Benth.) in Engler & Prantl, Nat. Pflanzfam. 3<sup>8</sup>: 167. 1898.

*Arracacia acuminata* Benth. Pl. Hartw. 187. 1845.

South America: Quitensian Andes near Pichincha, altitude 3600-3780 meters, *J. P. Couthony*, in 1855 (in herb. Gray); New Granada, *Purdie* (in Ball collection).

Proc. Wash. Acad. Sci., December, 1899.

This species agrees with *Neonelsonia* in all essential particulars, and we have no hesitation in referring it to that genus. It differs from *N. ovata* C. & R. in its stronger nerved leaflets of firmer texture, and in the dense ring of short glandular hairs at base of petioles and petiolules, as well as in other details.

The type of this species comes from South America, doubtless not far from the locality of the first specimens referred to above, and the species is restricted to South America. It is stated in the *Kew Index* to be from Mexico, and is likewise included by Mr. Hemsley in the *Biologia Centrali-Americana*. It should be excluded from Mexico as well as from Guatemala; at least the only Mexican specimen referred to by Mr. Hemsley (*Bourgeau* 2837) is a very different species. This specimen is only in flower and its identification was uncertain. Good fruiting specimens, however, were obtained by Mr. Seaton near Bourgeau's locality which permit its characterization, and it is described below as *Arracacia hemsleyana*. The Guatemalan plant referred to by Mr. Hemsley in the *Biologia* proves to be *Neonelsonia ovata* C. & R.

2. *Neonelsonia ovata* C. & R. *Contr. Nat. Herb.* 3: 307. 1895.

Guatemala: from mountains near Hacienda of Chancol, altitude 3300 meters, *Nelson* 3646, January 2, 1896.

Mr. W. B. Hemsley, in a recent letter, writes that Salvin's plant from Volcan de Fuego, in Guatemala, should be referred to the above rather than to *Arracacia*.

14. *DONNELLSMITHIA* C. & R. *Bot. Gaz.* 15: 15. *pl.* 2. 1890.

This genus still remains monotypic and restricted to Guatemala, the single species being *D. guatemalensis* C. & R.

15. *MUSINEON* Raf. *Jour. Phys.* 91: 71. 1820.

A genus of four species, three of which belong to the United States (Rocky Mountains and plains to the eastward from Colorado northward), and the fourth, *M. alpinum* C. & R., is a native of the high mountains of southern Mexico.

16. *MUSENIOPSIS* C. & R. *Rev. N. Am. Umbell.* 123. 1888.

This genus has proved to be one of the large genera of Mexican Umbelliferæ, nineteen species being enumerated below, seventeen of which are endemic. A revision was published by us in 1895, in *Contr. Nat. Herb.* 3: 301-304. Since that time much new material



has been received, which seems to justify a re-enumeration of the species. Under the species repeated from the former revision only critical remarks and new stations are given.

In his revision of the Umbelliferæ in Engler & Prantl's *Nat. Pflanzenfam.* Drude makes *Museniopsis* a section under *Velæa*. Elsewhere in this paper we show that *Velæa* proper must be included in *Arracacia*, a fact which Drude admits in his supplement. This leaves Drude's sections *Museniopsis* and *Deweya* unprovided for, and in our judgment they should both be restored to generic rank.

SYNOPSIS OF THE SPECIES.

*Acaulescent* or nearly so; peduncles single, terminal, elongated; involucl of toothed bractlets.

Leaflets ovate, toothed; peduncles 1 to 1.2 dm. long; fruit obtuse.

1. *M. texana*.

Leaflets filiform; peduncles 3 dm. long; fruit acutish.

2. *M. tenuifolia*.

*More or less caulescent*, much branched; peduncles numerous, short, both terminal and lateral; involucl either wanting or filiform and entire.

**Biennials** from small globose or spindle-shaped tubers.

Basal leaves with ovate, toothed leaflets; involucre and involucl present..... 3. *M. biennis*.

Basal leaves with linear leaflets.

Pedicels much longer than fruit; lateral umbels often sessile.

Involucre present; leaflets more or less toothed.

4. *M. madrensis*.

Involucre wanting; leaflets more elongated and mostly entire.

5. *M. submontana*.

Pedicels about as long as fruit; lateral umbels not sessile.

Fruit slightly beaked..... 6. *M. tenuissima*.

Fruit obtuse.

Rays less than 2.5 cm. long; fruit not glaucous.

7. *M. tuberosa*.

Rays more than 2.5 cm. long; fruit glaucous.

8. *M. glauca*.

**Perennials** from long, slender, and sometimes thickened roots.

Basal leaves with linear, elongated, and entire leaflets.

Glaucous; fruit obtuse, with obsolete ribs; lateral umbels often sessile.

Involucral leaf solitary, elongated; fruit smaller and leaflets shorter than in the next..... 9. *M. ternata*.

Involucre wanting; leaflets very long; fruit large for the genus..... 10. *M. schaffneri*.

Glabrous, not glaucous; involucre wanting; no umbels sessile.

Flowers purple..... 11. *M. purpurea*.

Flowers yellow.

Fruit ovate or oblong, longer than broad, with a short beak and rounded base; ribs thick and filiform.

12. *M. peucedanooides*.

Fruit broadly ovate, broader than long, cordate at base, obtuse; ribs filiform. .... 13. *M. cordata*.

Basal leaves with broader, shorter, more or less toothed leaflets. Glabrous throughout; involucels present.

Flowers purple.....14. *M. reticulata*.

Flowers yellow .....15. *M. dissecta*.

More or less scabrous or pubescent.

Involucels none.

Leaflets elongated, linear, nearly entire.

16. *M. scabrella*.

Leaflets ovate, serrate.

Leaflets with sharp teeth .....17. *M. serrata*.

Leaflets with obtuse teeth .....18. *M. ovata*.

Involucels present .....19. *M. pubescens*.

1. *Musenopsis texana* (Gray) C. & R. Rev. N. Am. Umbell. 123. 1888.

*Tauschia texana* Gray, Pl. Lindh. 2: 211. 1850.

*Eulophus texanus* Benth. & Hook. Gen. Pl. 1: 882 and 885. 1867.

*Velaa texana* Drude, Engler & Prantl, Nat. Pflanzfam. 3<sup>s</sup>: 169. 1898.

2. *Musenopsis tenuifolia* (Watson) C. & R. Contr. Nat. Herb. 3: 302. 1895.

*Eulophus tenuifolius* Watson, Proc. Am. Acad. 23: 276. 1888.

*Velaa tenuifolia* Drude, in Nat. Pflanzfam. 3<sup>s</sup>: 169. 1898.

3. *Musenopsis biennis* C. & R., sp. nov.

Biennials from fusiform tubers; stems slender, 4 to 12 dm. high, branching above; basal leaves with petioles 3 to 5 cm. long, twice ternate, with ovate toothed leaflets; upper leaves much reduced, often with linear leaflets; peduncles either wanting or short; pedicels 4 to 5 mm. long; fruit obtuse, 2 mm. long, broader than long and cordate at base.

Michoacan: pine woods, hills of Patzcuaro, *Pringle* 4620, October 25, 1893.

Morelos: mountain woods above Cuernavaca, altitude 2400 meters, *Pringle* 6156, November 5, 1895.

In Contr. Nat. Herb. 3: 302. 1895, this plant was referred to *Smyrniium ægopodioides* H.B.K. under the name *Musenopsis ægopodioides*.

4. *Musenopsis madrensis* C. & R., sp. nov.

Biennials from a round or somewhat branched tuber; stem slender, erect, somewhat branched, 6 to 8 dm. high; leaves twice to thrice ternate, ultimate divisions usually 3-cleft, linear and entire; umbels of

5 to 8 rays, sessile or on short peduncles (often 6 to 12 cm. long); rays 3 to 5 cm. long; involucre of 1 or 2 pinnate leaves; involucrel none; fruit short oblong, 3 mm. long, slightly cordate at base.

Jalisco: on top of mountains west of Bolaños, *Rose* 2966, September 16, 1897.

5. *Museniopsis submontana* C. & R., sp. nov.

From a spindle-shaped tuber, 3 dm. high, with slender, erect, branching stems; leaves once to thrice ternate; ultimate divisions very narrow and elongated, occasionally toothed; umbels of 4 to 6 rays, sessile on peduncles becoming 5 cm. long, with neither involucre nor involucrel; rays 2.5 to 3.5 cm. long; pedicels 7 mm. long; fruit immature.

Tepec: in the foothills between Dolores and Santa Gertrudis, *Rose* 2064, August 7, 1897.

6. *Museniopsis tenuissima* C. & R., sp. nov.

Stems 6 to 9 dm. high from oblong tubers, slender and diffusely branching, glabrous throughout; basal leaves on long petioles, 6 times ternate, the divisions widely spreading or even refracted; ultimate divisions filiform, 3.5 cm. or less long; lower stem leaves somewhat similar but smaller; upper leaves much reduced, the petioles to small but conspicuous scarious sheaths, the leaflets few and short; umbels of 3 to 5 rays, on peduncles 4 to 5 cm. long, with neither involucre nor involucrel; rays 2.5 to 3.5 cm. long; pedicels 2 mm. long, incurved; flowers bright yellow; fruit glaucous, nearly orbicular, slightly beaked, rounded at base, 3 mm. long.

Jalisco: cool shaded bluffs of mountains near Lake Chapala, *Pringle* 5954, October 18, 1895.

With much the habit of *M. peucedanoides*, but with different fruit and root. The foliage is much like *M. ternata filifolia*, but the fruit is smaller and the pedicels are shorter. Mr. Pringle writes: "The species must be rare, as I found it confined to the shaded bluff of a deep ravine, and searched far and in vain through these mountains for another station."

7. *Museniopsis tuberosa* C. & R. *Contr. Nat. Herb.* 3: 303. 1895.

*Velva tuberosa* Drude, in *Nat. Pflanzfam.* 3<sup>8</sup>: 169. 1898.

Oaxaca: Sierra de San Felipe, altitude 2100–2400 meters, *Charles L. Smith* 897, October 2, 1894.

8. *Museniopsis glauca* C. & R., sp. nov.

Stems about 5 dm. high, erect and much branched above; leaves thrice ternate, ultimate segments filiform; uppermost ones reduced to little more than a scarious sheath; umbels of 5 to 8 rays, loose and spreading, with neither involucre nor involucrel; rays 2 to 4 cm. long;

fruiting pedicels few and short; fruit glaucous, nearly orbicular, obtuse, 3 mm. long.

Zacatecas: on the Sierra de los Morones, near Plateado, altitude 2550 meters, *Rose* 2731, September 1, 1897.

9. *Museniopsis ternata* (Watson) C. & R. Contr. Nat. Herb. 3: 303. 1895.

*Eulophus ternatus* Watson, Proc. Am. Acad. 23: 276. 1888.

*Velaa ternata* Drude, in Nat. Pflanzfam. 3<sup>s</sup>: 169. 1898.

Chihuahua: Mt. Mohinora, *Nelson* 4904, September 1, 1898; Sierra Madre near Guasarachi, altitude 1950-2040 meters, *E. A. Goldman* 158, September 26, 1898.

Durango: near La Providencia, altitude 1950-2400 meters, *Nelson* 4978, 4992, September 11 and 12, 1898.

Tepic: Sierra Madre near Santa Teresa, *Rose* 3439, August 11, 1897. This specimen is only in flower and possibly may belong elsewhere.

- var. *filiifolia* C. & R. Contr. Nat. Herb. 3: 303. 1895.

Tepic: top of Sierra Madre between Santa Gertrudis and Santa Teresa, *Rose* 2121, August 8, 1897.

This specimen is only in flower, and therefore its reference is somewhat doubtful. The basal leaves are thrice ternate, with very long ultimate segments, often 12 cm. long.

10. *Museniopsis schaffneri* C. & R. Contr. Nat. Herb. 3: 303. 1895.

*Velaa schaffneri* Drude, Nat. Pflanzfam. 3<sup>s</sup>: 169. 1898.

11. *Museniopsis purpurea* C. & R., sp. nov.

Stem slender, erect and branching, 6 to 9 dm. high, from an elongated root; leaves twice to thrice ternate; ultimate divisions filiform to linear, and usually elongated; umbels with few rays (3 to 6), and neither involucre nor involucl; rays 1 to 1.5 cm. long; pedicels 4 to 5 mm. long; flowers deep purple; fruit (immature) orbicular, obtuse.

Jalisco: in the Sierra Madre, west of Bolaños, *Rose* 2974, September 15-17, 1897.

Tepic: between Acaponeta and Pedro Paulo, *Rose* 3314, August 2, 1897.

Zacatecas: in the Sierra Madre, *Rose* 2403, August 18, 1897; near Monte Escobedo, *Rose* 2623, August 26, 1897.

Durango: in the Sierra Madre, *Rose* 3472, August 13, 1897.

12. *Museniopsis peucedanoides* (H.B.K.) C. & R. Contr. Nat. Herb. 3: 303. 1895.

*Cnidium peucedanoides* H.B.K. Nov. Gen. et Sp. 5: 15. 1821.

*Eulophus peucedanoides* Benth. & Hook. Gen. Pl. 1: 885. 1867.

*Velaa peucedanoides* Drude, Nat. Pflanzfam. 3<sup>s</sup>: 169. 1898.

Chiapas: along road between Tuxtla and San Cristobal, altitude 690–1650 meters, *Nelson* 3124, September 14, 1895; along road between Tenejapa and Yajalon, altitude 900–1500 meters, *Nelson* 3246, October 13, 1895.

Oaxaca: Sierra de San Felipe, altitude 2000 meters, *Conzatti & González*, 226, July 25, 1897.

Vera Cruz: Orizaba, *Altamirano* 25, July 1890.

Jalisco: near Huejuquilla, *Rose* 2526, August 24, 1897; on tableland near Bolaños, *Rose* 3681, September 9, 1897.

Tepic: on the Sierra Madre near Santa Teresa, *Rose* 2234, August 13, 1897.

Sinaloa: near Colomos, *Rose* 1743, July 18, 1897.

13. *Museniopsis cordata* C. & R. Contr. Nat. Herb. 3: 304. 1895.

*Velaa cordata* Drude, in Nat. Pflanzfam. 3<sup>8</sup>: 169. 1898.

14. *Museniopsis reticulata* C. & R., sp. nov.

Stems about 9 dm. high, erect, branching and rather naked above, from an elongated root; leaflets 5, lower pair distant, simple or 2 or 3-cleft, with sharp and distant serrations, linear-lanceolate, 2 to 4 cm. long, 8 to 14 mm. broad, rigid; umbels compact, with very short rays, usually no involucre, and involuclers of a few linear bractlets; rays (in flower) 4 to 6 mm. long; pedicels 2 to 3 mm. long; flowers deep purple; fruit immature.

Durango: southern Durango, *Rose* 2257, 3512, August 13–15, 1897.

15. *Museniopsis dissecta* C. & R. Contr. Nat. Herb. 3: 304. 1895.

*Velaa dissecta* Drude, in Nat. Pflanzfam. 3<sup>8</sup>: 169. 1898.

16. *Museniopsis scabrella* C. & R. Contr. Nat. Herb. 3: 304. 1895.

*Velaa scabrella* Drude, in Nat. Pflanzfam. 3<sup>8</sup>: 169. 1898.

17. *Museniopsis serrata* C. & R. Contr. Nat. Herb. 3: 304. 1895.

*Velaa serrata* Drude, in Nat. Pflanzfam. 3<sup>8</sup>: 170. 1898.

Oaxaca: Las Sedas (type locality), *Rose & Hough* 4629, June 16–21, 1899.

18. *Museniopsis ovata* C. & R., sp. nov.

Stems erect and slender, 3 to 6 dm. high, somewhat branching, more or less puberulent; leaves twice ternate, the petioles, veins, and margins more or less scabrous; ultimate divisions ovate, with rounded and apiculate teeth; umbels loose, lateral ones often sessile, with 3 to 6 unequal rays, and neither involucre nor involucler; rays (in flower) 1 to 2.5 cm. long; fruiting pedicels elongated; fruit (immature) puberulent.

Zacatecas: east range of the Sierra Madre, *Rose* 2361, 2394, August 16–18, 1897.

19. *Museniopsis pubescens* C. & R., sp. nov.

Stems tall and much branched, 9 dm. high, pubescent throughout; basal leaves twice ternate; ultimate divisions ovate, irregularly lobed, with callous apiculation; umbel with numerous rays, no involucre, and involucre of a few linear bractlets; rays 2 to 3 cm. long; pedicels 4 to 7 mm. long; flowers white; fruit (immature) pubescent, oblong, 4 mm. long.

Chihuahua: in the Sierra Madre, *Nelson* 6087, June 21, 1899.

This is a peculiar species, and mature fruit may show that it belongs elsewhere.

17. TAUSCHIA Schlecht. *Linnæa* 9: 607. 1834.

The genus *Tauschia* was established by Schlechtendal in 1834 upon a single species, *T. nudicaulis*. Two species, *T. coulteri* and *T. texana*, were described by Dr. Gray in 1853 (*Plantæ Lindheimerianæ* 2: 211); and a fourth one indicated but not named by Mr. Hemsley in the *Biologia Centrali-Americana*. *T. coulteri* has recently been transferred to *Arracacia*; *T. texana* has been made the type of a very distinct genus, *Museniopsis*; while the species cited without name is probably not a *Tauschia*. This leaves *Tauschia* with but one of the four species cited by Hemsley.

To the genus *Arracacia*, however, certain anomalous species have been referred from time to time which more properly belong to *Tauschia*, and these are now transferred to it, which with four new species increases the number to eleven, all but the type being endemic, and separating it more clearly from *Arracacia*. The genus *Tauschia*, as outlined above, contains forms of low acaulescent habit, with pinnate leaves, obtuse ribs, and no stylopodium. With this definition it includes the following species, although *T. seatonii* and *T. filiformis* may belong elsewhere.

## SYNOPSIS OF THE SPECIES.

## OIL-TUBES SOLITARY IN THE INTERVALS.

Acaulescent or weak caulescent.

Flowers yellow; bractlets short.

Involucre with palmately lobed or cleft bractlets.

1. *T. nudicaulis*.

Involucre with bractlets linear and entire.

Short-caulescent, weak plants; flowers yellow.

2. *T. decumbens*.

Acaulescent, with erect scape; flowers white.

3. *T. seatonii*.

Flowers not yellow; bractlets elongated..... 4. *T. filiformis*.

Caulесcent, rather stout and somewhat branching.

Involucel with toothed or lobed bractlets; ribs very prominent.

5. *T. edulis*.

Involucel with entire bractlets; ribs distinct but not prominent.

6. *T. vaginata*.

OIL-TUBES SEVERAL IN THE INTERVALS.

Leaves pinnate.

Involucel with bractlets not broad or toothed.

Leaflets elongated, linear.

More robust and erect; leaflets toothed.

7. *T. mariana*.

Delicate and more or less prostrate; leaflets entire.

8. *T. humilis*.

Leaflets short, ovate.

9. *T. madrensis*.

Involucel with broad and toothed bractlets.

10. *T. nelsoni*.

Leaves entire, linear.

11. *T. linearifolia*.

1. *Tauschia nudicaulis* Schlecht.

Linnaea 9: 608. 1834. Fig. 5.

Usually acaulescent, sometimes bearing a small leaf near the base, nearly glabrous; basal leaves numerous, once pinnate; leaflets 3 to 7 pairs, ovate, serrate or cleft, sometimes 3-parted; peduncles several, much longer than the leaves, sometimes 25 cm. long; rays nearly equal, 8 to 15 mm. long; fruit 21 mm. long.

This species is found on the high mountains of Mexico and has been reported from Ecuador, South America (*Spruce* 6065). Mr. Hemsley reports it from between La Joya and San Salvador (*Galeotti*), and we have seen the specimen collected by *T. Coulter* (no. 1200) and *Rose* (no. 4290, May 20, 1899) from mountains near Jalapa. Excellent material has recently been

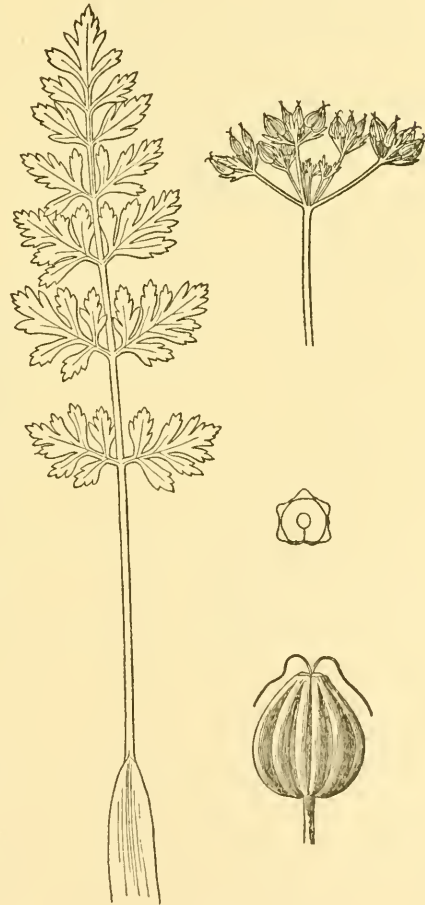


FIG. 5. *Tauschia nudicaulis*.

obtained by *Pringle* from the State of Mexico, August, 1882 (no. 5210), and July, 1894 (no. 4744). Spruce's specimen from South America is similar to the Mexican specimen in habit, but with a somewhat different fruit section and it may yet prove a distinct species.

2. *Tauschia decumbens* (Benth.) C. & R. in Engler & Prantl, Nat. Pflanzfam. 3<sup>8</sup> : 170. 1898. Fig. 6.

*Velea decumbens* Benth. Pl. Hartw. 38. 1840.

*Arracacia decumbens* Hemsley, Biol. Centr.-Am. Bot. 1 : 564. 1883.

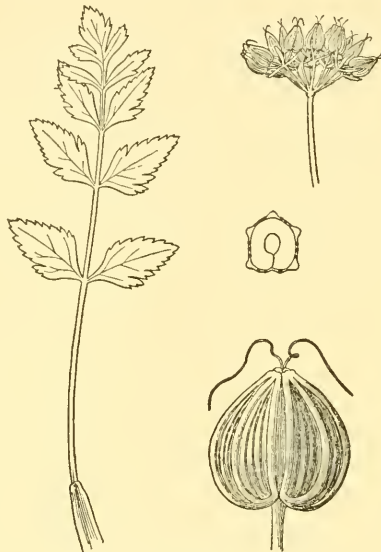


FIG. 6. *Tauschia decumbens*.

Jalisco : Rio Blanco, *Palmer* 51, in 1886; Ferreria, *Jones* 238, in 1892.

3. *Tauschia seatonii* C. & R. Fig. 7.

*Arracacia nudicaulis* C. & R. Proc. Am. Acad. 28 : 119. 1893.

Orizaba : *Seaton* 199, 1891 (type).

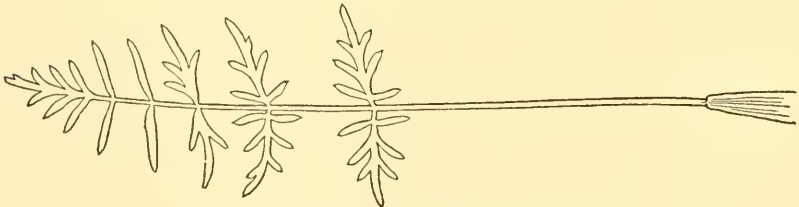


FIG. 7. Basal leaf of *Tauschia seatonii*.



4. *Tauschia filiformis* C. & R. Plate IV b.  
*Arracacia filiformis* C. & R. Hooker's Icones, t. 2429. 1896.  
 Oaxaca: Sierra de San Felipe, *Pringle* 4714, in 1894 (type); same station, *Nelson* 1088, in 1894; Mt. Zempoaltepec, *Nelson* 621, in 1894.
5. *Tauschia edulis* (Watson) C. & R. in Engler & Prantl, Nat. Pflanzfam. 3<sup>8</sup>: 170. 1898. Plate IV c.  
*Arracacia edulis* Watson, Proc. Am. Acad. 21: 430. 1886.  
 Chihuahua: *Palmer*, in 1885; *Nelson* 4799, 4836, 4893, in 1898; *Goldman* 181, in 1898.
6. *Tauschia vaginata* C. & R. Fig. 8.  
*Arracacia* (?) *vaginata* C. & R. Contr. Nat. Herb. 3: 296. 1891.



FIG. 8. *Tauschia vaginata*.

- Oaxaca: "borders of woodlands, Sierra de Clavellinas," *Pringle* 6008, in 1894 (type).
7. *Tauschia mariana* (Watson) C. & R. in Engler & Prantl, Nat. Pflanzfam. 3<sup>8</sup>: 170. 1898. Plate IV a.  
*Arracacia mariana* Watson, Proc. Am. Acad. 26: 136. 1891.  
 State of Mexico: Valley of Toluca, *Pringle* 4198, in 1892.

8. *Tauschia humilis* C. & R., sp. nov.

Weak caulescent, from tuberous thickened roots, glabrous except in the inflorescence; leaves and peduncles more or less decumbent, 1 to 2 dm. long; lower leaves 5-7 cm. long, twice to thrice pinnate, the ultimate segments linear and entire; involucre none or of a single elongated bract; involucl of several linear, distinct, entire bractlets; rays 5 or 6, about 2.5 cm. long; fruiting pedicels very short, 1-2 mm. long, sterile pedicels longer; flowers yellow; fruit glabrous, ovate, 2 mm. long; oil-tubes several in the intervals.

Hidalgo: Sierra de Pachuca, altitude 2940 meters, *Pringle* 6954, August 4, 1898; same station, *Pringle* 7896, October 6, 1899.

9. *Tauschia madrensis* C. & R., sp. nov.

Plate V.

Acaulescent from thick elongated roots; leaves 5 to 10, 5 to 12 cm. long, bipinnate; ultimate segments small, somewhat ovate in outline, 3 to 5-toothed or cut, glabrous except the rachis and some of the larger veins; scape 1 to 3 dm. long, erect or nearly so, longer than the leaves; inflorescence slightly puberulent; involucre none; involucl of several oblong-linear, distinct, entire bractlets longer than the pedicels; fruiting rays 3 or 4, nearly equal, 10 mm. or less long; pedicels very short, 2 to 3 mm. long; fruit glabrous, strongly flattened laterally, broadly ovate, rounded at base, 4 mm. long; oil-tubes several in the broad intervals.

Typic: swampy meadows on top of the west range of the Sierra Madre near Santa Gertrudis, *Rose* 2103, August 8, 1897.

10. *Tauschia nelsoni* C. & R., sp. nov.

Short caulescent, 2-3 dm. high, glabrous; lower leaves 10-15 cm. long, twice to thrice pinnate, the linear and entire segments crowded; involucre none or of a single short scarious bract; involucl of several short, ovate to orbicular, mostly toothed bractlets; rays 8 to 12, 10-15 mm. long; pedicels very short, about 1 mm. long; flowers yellow; fruit glabrous, ovate, 4 mm. long; oil-tubes several in the intervals.

Durango: near El Salto, *Nelson* 4561, July 12, 1898.

11. *Tauschia linearifolia* C. & R., sp. nov.

Plate VI.

Acaulescent or nearly so, from thick elongated roots; leaves 6 to 13, erect, 8 to 20 cm. long, linear, slightly tapering at base into slender petioles, acute, margin entire and slightly revolute, glabrous, pale, parallel-veined; peduncle or scape shorter or longer than the leaves; involucre wanting or of a single bract, and involucl of several bractlets, both orbicular and acuminate, strongly nerved and purplish, 3 mm. in diameter; rays 6 to 10, nearly equal, short (5 to 6 mm.) long; fruiting pedicels 1 mm. long, sterile ones longer; fruit strongly flattened laterally, broadly ovate, cordate at base, slightly tapering at apex, 6 mm. long, 4 mm. broad; oil-tubes several in the broad intervals.

Typic: in a swamp on top of the west range of the Sierra Madre near the little Indian hamlet of Santa Gertrudis, *Rose* 2104, August 8, 1897.

18. *ARRACACIA* Bancr. in Jamaic. Jour. 4: 18. 1826.

A Mexican and Central American genus extending into South America, with one species (the type) in Jamaica. Hemsley enumerated twelve species, only five of which bear names. Of these *A. acuminata* Benth. is referred below to *Neonelsonia*; *A. decumbens* Benth. is referred below to *Tauschia*; while *A. glaucescens* Benth. is restricted to South America. This leaves but two of the named species cited by Hemsley: *A. atropurpurea* Benth. & Hook. and *A. toluensis* Hemsley. Two species, cited by Hemsley under other genera, we have transferred to *Arracacia*, viz., *Tauschia coulteri* Gray and *Smyrnium ægopodioides* H.B.K.

Since 1880 fourteen new species of *Arracacia* from our region have been described, five of which have been transferred to *Tauschia*. In addition to these we describe below seven new species, making the total enumeration of the species of *Arracacia* found in Mexico and Central America reach twenty, all of which are endemic. Of the four remaining species of the genus, three belong to South America and one to Jamaica.

The genus *Arracacia* appears to be properly characterized as containing forms which are tall and branching, with ternate leaves, sharply ribbed fruit, and conical stylopodium. The allied genus *Tauschia*, on the other hand, contains forms which are low and acaulescent or nearly so, with pinnate leaves, obtuse ribs, and no stylopodium.

We present an enumeration of all the known species of *Arracacia*, with descriptions of new species and citations of collections received since the publication of our former paper.

1. *Arracacia andina* Britton, Bull. Torr. Bot. Club 18: 37. 1891.

This species, collected by *Dr. Rusby* in South America, seems not to be an *Arracacia*.

2. *Arracacia ægopodioides* (H.B.K.) C. & R. Plate XI.

*Smyrnium ægopodioides* H.B.K. Nov. Gen. & Spec. 5: 16. 1821.

*Museniopsis ægopodioides* C. & R. Contr. Nat. Herb. 3: 302. 1895, as to reference, but not as to plant.

Hidalgo: on the Sierra de Pachuca, altitude 2700 meters, *Pringle* 6934, July 28, 1898; same station, *Rose & Hough* 4481, June 1, 1899; same station, *Pringle* 7905, October 5, 1899.

The type of this species was collected by Humboldt & Bonpland (altitude 2550 meters) and is now in the Berlin Herbarium. Through the kindness of Dr. K. Schumann we have seen a fragment of the type and also a photograph of it, which is here reproduced. Mr. Pringle's plant seems to agree with it and the species is herewith trans-

ferred to the genus *Arracacia*. The species at first suggests *A. atropurpurea*, but the two are to be kept separate, as the following differences appear to be constant. *A. ægopodioides* is low and herbaceous, arising from a deep-seated, long, spindle-shaped tuber, while *A. atropurpurea* is half shrubby; the former has yellow flowers, the latter purple; in the former the bractlets of the involucre are linear and filiform, insignificant and entire, and not conspicuous and serrate; while the leaflets are more obtuse, with more regular and blunter teeth, etc.

3. *Arracacia atropurpurea* (Lehm.) Hemsl. Biol. Centr.-Am. Bot. 1: 564. 1880.

*Pentacrypta atropurpurea* Lehm. Linnæa 5: 380. pl. 5. fig. 2. 1830.

State of Mexico: Amecameca, *Altamirano* 11, 12, May 11, 1890. Federal District: between San Angel and Fetelpa, *Altamirano* 4, July 13, 1890; Apasco, *Altamirano* 16, November 1890; El Desierto Viejo, *Altamirano* 27, July 1890.

4. *Arracacia bracteata* C. & R. Contr. Nat. Herb. 3: 295. 1895.

Chiapas: above San Cristobal, altitude 2100-2640 meters, *Nelson* 3175, September 18-22, 1895; *Ghiesbreght* 63, in 1864-70 (in Herb. Gray). Type (no. 453) in Nat. Herb.

5. *Arracacia brandegei* C. & R. Proc. Cal. Acad. 2: 2: 165. 1889. Type (no. 507) in Nat. Herb.

6. *Arracacia brevipes* C. & R. Contr. Nat. Herb. 3: 296. 1895. Stems woody, 3 to 15 dm. high.

Oaxaca: in the Sierra de San Felipe, altitude 2850 meters, *Pringle* 6266, December 10, 1895. Type (no. 452) in Nat. Herb.

7. *Arracacia chiapensis* C. & R., sp. nov. Plate VII.

Herb 12 to 24 dm. high, glabrous throughout, more or less branched above; radical leaves not seen; upper stem leaves twice ternate, on short inflated petioles; leaflets lanceolate, acuminate, with a broad cuneate or sometimes truncate base, sharply serrate, 2.5 to 7.5 cm. long, glabrous; peduncles axillary or terminal, 15 cm. or less long; rays of umbel elongated, fruiting ones nearly equal, 6 to 7.5 cm. long; involucre of 3 or 4 linear bracts; involucre of 4 to 8 linear bractlets, generally longer than the pedicels but not extending beyond the fruit; pedicels with fruit usually 3 to 5, rather stout, 5 to 7.5 cm. long; fruit ovate, 8 to 9 mm. long, rounded at base, glabrous; stylopodium long conical; cross-section of carpel nearly terete; seed-face strongly involute, inclosing a central cavity; oil-tubes solitary in the intervals, 2 or 3 on the commissural side; flowers greenish white, the buds often purplish.

Chiapas: near Pinabete, altitude 2100-2400 meters, *Nelson* 3776, February 8, 1896.

8. *Arracacia coulteri* Rose, Contr. Nat. Herb. 3: 296. 1895.

*Tauschia coulteri* Gray, Plant. Lindh. 2: 211. 1853.

Hidalgo: near Real del Monte (type locality), *Rose* 4485, June 2, 1899.

Type in Herb. Gray, drawing in Nat. Herb.

9. *Arracacia dissecta* C. & R., sp. nov.

In dense clumps, 9 to 12 dm. high, scabrous on leaf margins and veins beneath, otherwise glabrous; leaves very large, ternately decomposed; segments linear to linear-oblong, 2 to 4 cm. long, entire or occasionally somewhat toothed or cleft, terminating in a conspicuous callous apex; uppermost leaves alternate or opposite, much reduced, sometimes nearly simple; peduncles axillary or terminal, 5 to 8 cm. long; rays about 12, unequal, 2 to 8 cm. long; involucre and involucels wanting, or occasionally represented by a bract; fruiting pedicels 3 to 4 mm. long; fruit (immature) oblong, 4 mm. long, glabrous.

Pueblo: Acatlan, *Rose & Hough* 4709, June 27, 1899.

10. *Arracacia donnellsmithii* C. & R. Bot. Gaz. 15: 261. *pl.* 15. 1890.

Guatemala: Todos Santos, altitude 3000 meters, *Nelson* 3630, December 26, 1895. Type in Nat. Herb.

11. *Arracacia dugesii* C. & R., sp. nov. Plate VIII.

Tall coarse herbs, probably 1.2 to 2.5 dm. high, in habit and foliage suggesting the genus *Prionosciadium*; leaves several times ternate; ultimate segments linear, 5 cm. or less long, acute, entire or with a few irregular sharp teeth; involucre wanting; involucel of several setaceous bractlets; rays numerous, mostly fruiting, in some umbels often less than 2.5 cm. long and equal, in others more unequal, sometimes 7.5 cm. long; pedicels 3 to 6 mm. long; fruit ovate, 6 mm. long; ribs sharp; oil-tubes 2 or 3 in the intervals, 4 on the commissural side.

Guanajuato: near City of Guanajuato, *Duges* 317, in 1893; same station, *Duges*, in 1895; same station, *Rose & Hough* 4847, July 11, 1899.

12. *Arracacia glaucescens* Benth. Pl. Hartw. 187. 1845.

The type comes from South America, but it has been reported from Mexico.

13. *Arracacia hemsleyana* C. & R., sp. nov. Plate IX.

Stems slender, glabrous; leaves thrice ternate; leaflets lanceolate, long acuminate, 5 cm. or less long, cuneate or truncate at base, sharply serrate, glabrous; inflorescence more or less branching; terminal umbel sessile or short peduncled; rays 6 to 9, slightly unequal, 1.8 to 3 cm. long, somewhat spreading; umbellets several-flowered but only 3 or 4 fruiting; involucre and involucels none, or the latter of a few small bractlets; pedicels 4 to 6 mm. long; fruit 6 to 8 mm. long, oblong; stylopodium conical; flowers purple.

San Luis Potosi: on limestone ledges, Las Canoas and Tamasopo Canyon, *Pringle* 5016, June 13-August 21, 1891.

Orizaba: *Bourgeau* 2837, in 1865-66; *Seaton* 97 (type), July 30, 1891; also according to Mr. Hemsley in litt. from Orizaba (*Botteri* 869).

Chiapas: from pine forests of Pueblo Nueva, *Linden* 586. From its range it should be *A. chiapensis*.

This is *Arracacia acuminata* Hemsley Biol. Cent.-Am. 1: 564 as to Mexican plant, not of Bentham, which is a *Neonelsonia*.

14. *Arracacia luxeanae* C. & R., Bot. Gaz. 18: 55. 1893.

Type in Nat. Herb.

15. *Arracacia longipedunculata* C. & R., sp. nov. Plate X.

Stems 6 to 9 dm. high, somewhat branching, glabrous; radical and lower stem leaves long petioled (20 cm. long), 2 to 3 times ternate; leaflets ovate, acute, coarsely toothed and apiculate, 5 to 6.2 cm. long, the central one cuneate at base, the lateral ones mostly rounded; upper stem leaves much smaller, opposite, once ternate and leaflets linear; inflorescence a single terminal umbel; peduncle 5 to 7.5 cm. long; involucre none; involucrel of 1 to 3 filiform bractlets; rays spreading, 5 cm. or less long, somewhat unequal; pedicels 4 to 6 mm. long; fruit oblong, 5 mm. long, rounded at base, slightly beaked at apex; stylopodium low conical; ribs filiform; oil-tubes 3 in the intervals.

Morelos: in canyons above Cuernavaca, *Pringle* 6333, June 19, 1896.

16. *Arracacia montana* C. & R., sp. nov.

Stems 6 to 10 dm. high, glabrous throughout; leaves large, 3 to 4 times ternate; ultimate segments somewhat lanceolate, paler beneath and slightly scabrous, serrate and apiculate; inflorescence large and naked, with verticillate branches; involucre and involucrels wanting; rays nearly equal, numerous, 20 to 25 mm. long; pedicels 2 to 3 mm. long; fruit 6 mm. long; oil-tubes usually solitary in the intervals.

Zacatecas: between Colotlan and Plateado, *Rose* 2807, September 4, 1897; Sierra de los Morones, *Rose* 3620, September 1, 1897.

Jalisco: near Escabado, *Rose* 2624, August 26, 1897; on the road between Mesquitez and Monte Escabado, *Rose* 3584, August 1897.

The specimens show considerable variation but apparently all belong to the same species.

17. *Arracacia moschata* (H.B.K.) DC. Prod. 4: 244. 1830.

*Conium moschatum* H.B.K. Nov. Gen. et Spec. 5: 14. pl. 420. 1821.

This species is a native of South America, and is the only one of the genus not in our collection.

18. *Arracacia multifida* Wats. Proc. Am. Acad. 26: 136. 1891.

Only known from collections of Mr. Pringle. Type in Herb. Gray.

19. *Arracacia nelsoni* C. & R. Contr. Nat. Herb. 3: 296. 1895.  
Oaxaca: oak forests, Sierra de San Felipe, altitude 2850 meters, Pringle 5955, December 10, 1895. Type (no. 451) in Nat. Herb.
20. *Arracacia ovata* C. & R. Contr. Nat. Herb. 3: 296. 1895.  
Type (no. 448) in Nat. Herb.
21. *Arracacia pringlei* C. & R. Contr. Nat. Herb. 3: 297. 1895.  
Type (no. 450) in Nat. Herb.
22. *Arracacia rigida* C. & R., sp. nov.

Stems several from a common root, 1-2 meters high, branching above, glabrous; lower leaves few, on petioles 30-60 cm. long; leaves large, 3 or 4 times ternate; upper ones once to twice ternate, petiolate or sessile, ovate, rounded at base, acute, regularly and sharply serrate, glabrous on both sides; umbels few, usually terminal; involucre wanting or a single ovate bract with a long acumination; involucler of several filiform bractlets; rays and pedicels puberulent; fruiting peduncle stiff and stout, 12 cm. long (in our specimen); rays stiff, subequal, 2 to 4 cm. long; pedicels 4 mm. long, shorter than fruit; fruit oblong-ovate, 8 mm. long, rounded at base, glabrous; carpel nearly terete in section; ribs very obtuse; oil-tubes solitary in the intervals; flowers purplish.

Hidalgo: by a tumbling brook in a rocky gorge of the Sierra de Pachuca, altitude 2850 meters, Pringle 6953, August 3, 1898.

The whole plant has a strong odor of musk. This species has much the habit and foliage of *A. ovata*, but with sharper toothed leaves.

23. *Arracacia toluensis* (H.B.K.) Hemsl. Biol. Centr.-Am. Bot. 1: 564. 1880. Plates XII, XIII.  
*Ligusticum toluensis* H.B.K. Nov. Gen. et Spec. : 19. pl. 422. 1821.  
*Velæa toluensis* DC. Prod. 4: 231. 1830.  
*Cnidium toluense* Spreng. Syst. 1: 888. 1825.

This species has long been a puzzle both as to genus and species. No material could be found in the recent rich collections from Mexico, while the illustration and description are silent as to the essential generic characters of the group. At the request of Dr. Rose, Mr. Pringle visited the type locality, but found it planted in corn and no specimens could be obtained. Through the kindness of Dr. Karl Schumann photographs of the type of *Velæa toluensis* were obtained (reproduced herewith), which show that Mr. Hemsley has properly referred the species to *Arracacia*. As this species is also the type of *Velæa* that genus must be merged under *Arracacia*.

Proc. Wash. Acad. Sci., December, 1899.

24. *Arracacia xanthorrhiza* Bancr. *Jamaic. Journ.* 4: 18. 1826.

This is the type of the genus and was based upon specimens collected in Jamaica. We have recently received specimens from the Botanical Department of Jamaica.

The following species are to be excluded:

- Arracacia acuminata Benth. = *Neonelsonia* sp.
- “ decumbens B. & H. = *Tauschia* sp.
- “ mariana Watson = *Tauschia* sp.
- “ edulis Watson = *Tauschia* sp.
- “ vaginata C. & R. = *Tauschia* sp.
- “ filifolia C. & R. = *Tauschia* sp.
- “ nudicaulis C. & R. = *Tauschia* sp.
- “ arguta B. & H. = *Deweya* sp.
- “ hartwegi Watson = *Deweya* sp.
- “ kelloggii Watson = *Deweya* sp.
- “ parishii Greene = *Deweya* sp.
- “ vestita Watson = *Deweya* sp.

19. OTTOA H.B.K. *Nov. Gen. et Sp.* 5: 20. 1821.

A South American genus, of a single species, which extends into South Mexico.

*Ottoa œnanthoides* H.B.K. *Nov. Gen. et Sp.* 5: 20. *pl.* 423. 1821.

Vera Cruz: C. de Perote, *Nelson* 2030, May 1893.

Oaxaca: Sierra de San Felipe, altitude 3000 meters, *Charles L. Smith* 894, September 25, 1894.

20. APIUM L. *Sp. Pl.* 1: 264. 1753.

A genus of world-wide distribution. For the Mexican and Central American region Hemsley enumerated five species, four of which bear names. Of these, *A. echinatum* Benth. & Hook. has been transferred to *Leptocaulis*; *A. graveolens* L. is an introduced species; *A. popei* Gray has been transferred to *Ammoselinum*; while *A. leptophyllum* Mull. becomes *A. ammi*, as indicated below. This leaves a single native, but not endemic species for our region.

*Apium ammi* (Jacq.) Urban, *Fl. Bras.* 11<sup>1</sup>: 341. *pl.* 91. 1879.

*Sison ammi* Jacq. *Hort. Vindob.* 2: *pl.* 200. 1772.

*Apium leptophyllum* F. Muel in Benth. *Fl. Austral.* 3: 372. 1866.

Lower California: in the Plaza, La Paz, *Rose* 1322, June 14, 1897.

State of Mexico: Chimalapan, *Altamirano* 8, June 1890.

Federal District: *Altamirano* 5, July 1890.

Vera Cruz: Papantla, *E. A. Goldman* 80, March 7, 1898.

Durango: near City of Durango, *Palmer* 258, April–November 1896.



Chiapas: about Tumbala, altitude 1200-1650 meters, *Nelson* 3341, October 20-29, 1895; Valley of Comitán, altitude 1740-1950 meters, *Nelson* 3483, December 8-10, 1895.

Guatemala: on mountains near Hacienda of Chancol, altitude 3300 meters, *Nelson* 2666, January 2, 1896.

Costa Rica: *Pittier & Tonduz* 1287, August 1889, and 4357, August 1891; altitude 1355 meters, *Tonduz* 7689, March 1893.

21. LEPTOCAULIS Nutt. in DC. Coll. Mem. 5: 39. *pl.* 10. 1829.

A genus of the United States, represented in Northern Mexico by a single species, *L. echinatus* Nutt., which is not endemic. This has not been collected in Mexico for many years, and no Mexican specimens are found in the National Herbarium.

22. AMMOSELINUM Torr. & Gray, Pac. R. Rep. 2: 165. 1855.

A genus of southwestern United States, including but two species, one of which, *A. popei* Gray, has been collected once by *Palmer* near Monterey, Nuevo Leon.

23. CICUTA L. Sp. Pl. 1: 255. 1753.

A genus widely distributed throughout the northern hemisphere. The single endemic species described below Hemsley referred to the common *C. maculata* of the United States. In 1887, Watson described a second Mexican species of *Cicuta* (*C. linearifolia*), which proved to be a *Prionosciadium*.

*Cicuta mexicana* C. & R., sp. nov.

Apparently robust, 9 to 12 dm. high; basal leaves twice ternate and then bipinnate: leaflets lanceolate, 3 to 7 cm. long, serrate, the veinlets running to the sinuses; umbel with numerous unequal rays, with involucre mostly wanting, and involucrel of numerous, rather conspicuous, elongated linear bractlets; rays (in flower) 4 to 8 cm. long, pedicels very unequal, 2 cm. or less long; fruit very immature.

Vera Cruz: Coatzacoalcos, Isthmus of Tehuantepec, *Charles L.*

*Smith* 1161, April 1, 1895; swamps near Jalapa, altitude 1200 meters, *Pringle* 7708, in 1899.

This is undoubtedly the *Cicuta* referred by Hemsley in *Biol. Centr.-Amer.* to *C. maculata*, a species whose range seems to be entirely north of Mexico.

24. PIMPINELLA L. Sp. Pl. 1: 263. 1753.

A large genus of world-wide distribution, represented in Mexico by the single peculiar species *P. mexicana* Robinson, Proc. Am. Acad. 26: 164. 1891.

## 25. BERULA Hoff. in Bess. Enum. Pl. Volh. 44. 1822.

A genus of one or two species, which are said to be of nearly world-wide distribution. Our single species, *B. erecta*, was cited by Hemsley as *Sium angustifolium* L.

**Berula erecta** (Huds.) Coville, Contr. Nat. Herb. 4: 115. 1893.

*Berula angustifolia* Mert. & Koch, in Roehl. Deutschl. Fl. 2: 433. 1826.

*Sium erectum* Huds. Fl. Angl. 103. 1862.

State of Mexico: Lago de Chalco, *Altamirano* 17, June 1891.

Chiapas: above San Cristobal, altitude 2100-2640 meters, *Nelson* 3132, September 18-22, 1895.

## 26. CENANTHE L. Sp. Pl. 1: 254. 1753.

A genus of wide distribution with a single Mexican species. Hemsley reported it in the Mexican flora to include a single unnamed species which later he discovered to be an *Arracacia*. It is restored to the Mexican flora, however, by the discovery of *C. pringlei* C. & R.

## 27. LILÆOPSIS Greene, Pittonia 2: 192. 1891.

A genus represented in the United States by four species, one of which extends into Mexico and South America. This species, *L. schaffneriana* C. & R. (*Crantzia schaffneriana* Schlecht.), Hemsley referred to the common United States species of the Atlantic seaboard, *L. lineata* Greene (*Crantzia lineata* Nutt.). The genus is also represented in Brazil and Australia.

**Lilæopsis schaffneriana** (Schlecht.) C. & R. Bot. Gaz. 24: 48. 1897.

*Crantzia schaffneriana* Schlecht. Linnæa 26: 370. 1853.

Federal District: near Chapultapec (type locality), *Rose & Hough* 4545, June 11, 1899.

Jalisco: Orendain, *Rose & Hough* 4799, July 5-6, 1899.

## 28. LIGUSTICUM L. Sp. Pl. 1: 250. 1753.

A genus widely distributed throughout the northern hemisphere, and represented in Mexico by two species. The only species included by Hemsley, *L. dubium* H B.K., is to be excluded, as it is not a *Ligusticum*, although on account of the disappearance of the type it is difficult to determine its exact place. Specimens collected by *Rose* (no. 4450, June 1, 1899) near the type locality, and satisfying the description, belong clearly to *Prionosciadium*. The genus is represented in Mexico, therefore, only by the two new species described below.

**Ligusticum goldmani** C. & R., sp. nov.

Resembling *L. nelsoni* C. & R., but differing in its less sharply cut

foliage, narrowly oblong fruit which is 8 mm. long and with a more evident minutely reticulate surface, sharper ribs, and more conical stylopodium.

Chihuahua: Sierra Madre, 65 miles east of Batopilas, altitude 2100 meters, *Goldman* 180, October 1 and 2, 1898; near Batopilas, altitude 1650-1950 meters, *Goldman* 209, October 4 and 5, 1898.

*Ligusticum nelsoni* C. & R., sp. nov.

Rather stout, 6-12 dm. high, glabrous throughout; leaves large, biternate then pinnate; the segments laciniately lobed, the lobes sharply cut or entire; umbel of numerous rays, with no involucre and mostly no involucre; fruiting rays about 5 cm. long; pedicels unequal, 6 to 10 mm. long; flowers white; fruit oblong, 4 mm. long, stylopodium low conical.

Chihuahua: Sierra Madre, S. W. Chihuahua, *Nelson* 4809, August 20, 1898; Mt. Mohinora, *Nelson* 4873, September 1, 1898.

Nearest *L. porteri* C. & R., but it differs from the type specimens of that species chiefly in its much more sharply cut leaves, as well as in its distinct range.

29. COAXANA C. & R. Contr. Nat. Herb. 3: 297. 1895.

A monotypic mountain genus, collected by *Nelson* near the summit of Mt. Zempoaltepec, in the state of Oaxaca, at an altitude of 3000 to 3300 meters. The single species is *C. purpurea* C. & R.

30. CONIOSELINUM Fisch. in Hoff. Gen. Umb. 180. 1814.

A genus of about seven species, chiefly found in Western Asia and the United States. The following new species is the only Mexican representative.

*Conioselinum mexicanum* C. & R., sp. nov.

Slender, 6 to 9 dm. high, somewhat leafy, glabrous except the puberulent inflorescence; leaves bipinnate; ultimate segments ovate, lobed or entire; umbel of 7 to 10 nearly equal rays, with no involucre, and involuclers wanting or of filiform bractlets; rays in fruit 2.5 cm. long, pedicels 6 mm. long; flowers white; fruit nearly orbicular, 3 mm. long, with prominent lateral wings.

Chihuahua: Sierra Madre, 65 miles east of Batopilas, altitude 2100 meters, *Goldman* 191, October 1 and 2, 1898.

31. ANGELICA L. Sp. Pl. 1: 250. 1753.

A genus chiefly distributed in the cooler regions of the northern hemisphere, and represented in Mexico by four species. Hemsley enumerates four species, but one of them bearing a name (*A. mexicana* Vatke) and proving to be a *Prionosciadium*. His three un-

named species are *A. seatonii* C. & R., *A. nelsonii* C. & R., and probably *A. polycarpa* C. & R. The fourth *Angelica* of the flora is *A. pringlei* C. & R.

***Angelica polycarpa* C. & R., sp. nov.**

Nearest *A. pringlei* C. & R., but a stouter plant; leaves much coarser, somewhat pubescent, 6 dm. long including the very long petiole, twice or thrice ternate; leaflets 5 to 7.5 cm. long; rays more numerous (about 40), very unequal, 5 to 7 cm. long; fruit larger, 4 to 5 mm. long, with lateral wings thinner and broader (2 mm.), the dorsal and intermediates more prominent especially at base.

Federal district: on streams at Tlalpam, near City of Mexico, altitude 2190 meters, *Pringle* 6467, September 5, 1896.

***Angelica pringlei* C. & R. Contr. Nat. Herb. 3: 295. 1895.**

State of Mexico: by streams, Sierra de las Cruces, altitude 3300 meters, *Pringle* 6147, October 5, 1895.

32. PRIONOSCIADIUM Watson, Proc. Am. Acad. 23: 275. 1888.

This endemic genus was established by Watson in 1888, and included three species, *P. madreense*, *P. mexicana*, and *P. pringlei*. Recent collections have remarkably increased it, no less than twelve additional species being described, and with indications of still others. The genus is justified not only by these additional species, but also by the fact that the earlier known forms were variously referred to such dissimilar genera as *Angelica*, *Peucedanum*, and *Cicuta*.

As at present understood it contains the following species.

#### SYNOPSIS OF SPECIFIC GROUPS.

Main rachis of leaves and its primary branches bearing conspicuous, more or less serrate wings.

Leaf-segments obtuse or acute (not acuminate), somewhat regularly serrate or crenate, thickish.

1. *P. cuneatum*; 2. *P. serratum*.

Leaf-segments acuminate, irregularly incised, serrate, thin.

3. *P. acuminatum*; 4. *P. nelsonii*.

Rachis mostly without wings.

Leaf-segments rather large, oblong to ovate, mostly serrate or crenate, more or less confluent.

5. *P. megacarpum*; 6. *P. mexicanum*; 7. *P. pringlei*.

Leaf-segments small, lanceolate to ovate in outline, pinnatifid toothed or lobed segments.

8. *P. madreense*; 9. *P. macrophyllum*;

10. *P. dissectum*; 11. *P. durangense*.

Leaf-segments elongated, narrowly linear to lance-linear, serrate to pinnately lobed.

12. *P. watsonii*; 13. *P. linearifolium*;

14. *P. filifolium*; 15. *P. tenuifolium*.

1. *Prionosciadium cuneatum* C. & R., sp. nov.

Plant 18 to 24 dm. high, with glaucous stem; leaf-segments scabrous above and pubescent on the veins beneath, oblong in outline, irregularly pinnatifid-lobed or crenate-lobed, usually acute, each pair of segments joined to the one below by the broad wings of the rachis, which form a series of conspicuous wedges connecting the segments; inflorescence widely spreading, with verticillate primary branches and long peduncles (7.5 to 10 cm. long); fruit oblong, about 10 mm. long, wings not as broad as body.

Jalisco: on grassy slope of barranca near Guadalajara, *Pringle* 3868, September 12, 1891 (distributed as *P. pringlei*); between Bolaños and Guadalajara, *Rose* 3047, September 21, 1897; on barranca near Guadalajara, *Rose & Hough* 4822, July 9, 1899.

2. *Prionosciadium serratum* C. & R., sp. nov.

Plant 6 to 15 dm. high, with pubescent stem; leaf-segments somewhat scabrous above and slightly pubescent beneath, oblong to ovate in outline, more or less lobed, sharply serrate and mostly obtuse; the wings of the rachis very conspicuous and serrate, somewhat narrowed below; inflorescence often compact, of a few short verticillate peduncles; rays 10 to 20 mm. long; pedicels 2 mm. long; fruit broadly oblong, 8 to 10 mm. long, wings broader than body.

Durango: in the mountains of Southern Durango, *Rose* 2343, August 16, 1897; on the table-land between Colotlan and Bolaños, *Rose* 2836, September 8, 1897.

Jalisco: on the slopes of the barranca near Guadalajara, *Pringle* 3886, September 18, 1891 (distributed as *P. mexicanum*).

3. *Prionosciadium acuminatum* Robinson in litt., sp. nov.

Stems 12 to 18 dm. high, glabrous or nearly so; leaves large, twice ternate; leaflets ovate, acuminate, more or less lobed and cleft, irregularly and sharply serrate; peduncles short and slender; rays 12 to 18 mm. long; fruit oval or oblong, 8 to 10 mm. long, retuse with cordate base; dorsal and intermediate ribs indistinct; wings thin, as broad as body; seed with involute face, rather broad sulcus, and little, if at all, indented beneath the small oil-tubes.

Jalisco: in barranca near Guadalajara, *Pringle* 3864, September 12, 1891, also *Pringle* 7634, June 10, 1898; same barranca, *Altamirano* 19, October 1891, and *Rose* 3057, September 22, 1897; same station, *Rose & Hough* 4820, July 9, 1899.

*Pringle* 3864 was distributed as a variety of *P. mexicanum*, but it seems to deserve specific rank.

4. *Prionosciadium nelsoni* C. & R., sp. nov.

Coarse herb, 12 to 18 dm. high, somewhat glaucous, more or less branched; basal leaves large, on long petioles (3 dm. or more long), twice pinnate; the primary and secondary rachis with toothed wings; ultimate segments lanceolate, acuminate, sharply and doubly serrate, somewhat puberulent on both sides; upper leaves opposite; upper

flowering branches verticillate; peduncles short; inflorescence pubescent; involucre none; involucre of several filiform bractlets; rays nearly equal, short (2.5 cm. long); pedicels 4 mm. long; fruit nearly orbicular, 6 to 8 mm. in diameter, slightly cordate at base, rounded at apex, pubescent; stylopodium depressed; seed-face with a broad concavity; oil-tubes several in the intervals.

Chiapas: near Tuxtla, altitude 720 to 780 meters, *Nelson* 3079, September 1 to 8, 1895.

Morelos: on bluff of barrancas near Cuernavaca, *Pringle* 6345, June 26 (in flower) and September 18 (in fruit), 1896; same station, *Rose & Hough* 4399, May 27-30, 1899.

This species and *P. pringlei* are the only two described with pubescent fruit. They differ from each other in the shape of the fruit and leaflets, etc.

5. *Prionosciadium megacarpum* C. & R. Contr. Nat. Herb. 3: 308. 1895.

Plant 24 to 45 dm. high, the youngest parts pubescent; leaf segments large (12.5 to 20 cm. long), ovate, crenate, sometimes with two lobes at base, paler beneath; fruit 14 to 20 mm. long, wings much broader than body.

Oaxaca: Sierra de San Felipe, *Pringle* 4688, in 1894; *Chas. L. Smith* 886, in 1894; *Conzatti & González* 305, in 1897.

6. *Prionosciadium mexicanum* (Vatke) Watson, Proc. Am. Acad. 23: 275. 1888.

*Angelica mexicanum* Vatke, Sem. Hort. Barol. 1876: app. 2. no. 12. 1876. Somewhat pubescent; leaflets mostly acute; fruit nearly orbicular, glabrous, 10 to 12 mm. long, with wings much broader than body.

Hidalgo: Mineral del Monte, *Ehrenberg*.

Mexico: near City of Mexico, *L. Hahn* 13; *Bourgeau* 571, in 1865-66; *Altamirano* 3, 6, 7, 28, in 1890; *Pringle* 6426, in 1896.

Guanajuato: near town of Guanajuato, *Duges*.

Zacatecas: near Plateado, *Rose* 2752, in 1897.

7. *Prionosciadium pringlei* Watson, Proc. Am. Acad. 23: 276. 1888.

More pubescent; leaflets mostly obtuse; fruit oblong, somewhat pubescent, 8 to 10 mm. long, with wings as narrow as body.

Chihuahua: La Bufa Mt. above Cusihuiriac, *Pringle* 1249, in 1897.

Durango: *Nelson* 4748, 4971, in 1898.

8. *Prionosciadium madrese* Watson, Proc. Am. Acad. 23: 275. 1888.

Plant 6 to 9 dm. high; leaflets irregularly segmented, the segments narrow, with irregular obtuse lobes, scabrous on the veins as also in the inflorescence; fruit oblong, with wings about as broad as body.

Chihuahua: ledges of river cañon near Guerrero, *Pringle* 1251, in 1887.

9. *Prionosciadium macrophyllum* C. & R., sp. nov.

Glaucous, nearly glabrous throughout, 18-36 dm. high; leaflets (in contrast with *P. madrense*) regularly segmented, the segments ovate, more sharply toothed or lobed; umbel with 8 to 10 nearly equal fruiting rays, no involucre or of several linear bracts, and involucl of several narrow bractlets; rays 20-25 mm. long; pedicels 5-6 mm. long; fruit almost orbicular, 10 mm. long, with wings broader than body, and prominent dorsal and intermediate ribs.

Jalisco: rocky banks of river, Fall of Juanacatlan, *Pringle* 3889, October 6, 1891.

Durango: near El Salto, *Nelson* 4554, in 1898.

Zacatecas: rocky side of barranca near Monte Escabado, *Rose* 3589, August 27, 1897. Differs somewhat from the *Pringle* specimen, which is the type, in having larger leaf-segments and somewhat scabrous inflorescence.

10. *Prionosciadium dissectum* C. & R., sp. nov.

Glabrous throughout; leaves ternate then pinnately dissected; the ultimate divisions narrow, long-acuminate, and lacinately toothed; umbel with 12 to 25 nearly equal fruiting rays, no involucre, and involucl of several linear bractlets; rays 10-35 mm. long; pedicels 2-3 mm. long; fruit oblong, 10 mm. long, the wings about as broad as body or a little narrower.

Jalisco: between San Cristobal and Guadalajara, *Pringle* 3002, August 11, 1889; *Rose* 3000, September 22, 1897; on barranca near Guadalajara, *Rose & Hough* 4809, July 9, 1899.

11. *Prionosciadium durangense* C. & R., sp. nov.

Glabrous throughout; leaves ternate then much dissected; the ultimate divisions shorter than in *P. dissectum* and not acuminate, irregularly toothed or entire; umbel with 6 to 8 nearly equal fruiting rays, no involucre, and involucl of several linear bractlets; rays 15-25 mm. long; pedicels 2-3 mm. long; fruit oblong, 8-10 mm. long, the wings as broad as body.

Durango: Sierra Madre, 15 miles north of Guanacevi, altitude 2250-2550 meters, *Nelson* 4763, August 17, 1898.

Nearest to *P. dissectum*, but with very different foliage.

12. *Prionosciadium watsoni* C. & R. Proc. Am. Acad. 25: 150. 1890.

*Peucedanum mexicanum* Watson, Proc. Am. Acad. 17: 361. 1882.

Leaflets linear to lance-linear, 5 to 7.5 cm. long, prominently toothed or lobed; upper leaves with prominent scarios sheaths; fruit nearly orbicular, with broad wings.

Guanajuato: near town of Guanajuato, *Rose & Hough* 4840, July 11, 1899.

San Luis Potosi: *Parry & Palmer* 288, in 1878; Las Canoas, *Pringle* 3822, in 1891.

Jalisco: near Plateado (no. 2692), near Mesquitez (no. 2568), near Colotlan (nos. 3595, 3675), mountains west of Bolaños (no. 3706), *Rose*, in 1897.

Queretaro: near San Juan del Rio, *Pringle* 7175, in 1896.

Durango: near City of Durango, *Palmer* 508, in 1896; near El Salto, *Nelson* 4548, 4571, in 1898.

Zacatecas: near Valparaiso, *E. A. Goldman* 13, in 1897.

13. *Prionosciadium linearifolium* (Watson) C. & R. Contr. Nat. Herb. 3: 308. 1895.

*Cicuta linearifolia* Watson, Proc. Am. Acad. 22: 415. 1887.

Leaflets narrowly linear, 10 to 15 cm. long, serrate, occasionally lobed at base; fruit oblong, with narrow wings.

Jalisco: near Guadalajara, *Palmer*, in 1896; same station, *Pringle* 2298, in 1888; near San Cristobal, *Rose* 3039, September 21, 1897; on barranca near Guadalajara, *Rose & Hough* 4821, July 9, 1899.

14. *Prionosciadium filifolium* C. & R., sp. nov.

Stems rather low, 6 to 9 dm. high, nearly glabrous below, not at all glaucous; leaves large, ternately much dissected into long filiform leaflets (20 to 45 mm. long); the upper ones similar but much reduced, the uppermost opposite; inflorescence much branched, somewhat scabrous; peduncles short (4 to 5 cm. long); rays somewhat unequal, 2 to 13 cm. long; involucre wanting; involuclers of several linear bractlets longer than the pedicels; fruit somewhat immature, ovate, glabrous, 7 mm. long; oil-tubes several in the intervals.

Jalisco: on hillsides between Colotlan and Bolaños, *Rose* 2834, September 7-9, 1897.

15. *Prionosciadium tenuifolium* C. & R., sp. nov.

Stems rather low, 6 to 12 dm. high, somewhat scabrous roughened throughout; leaves large, ternately much dissected into linear segments; ultimate segments 10 to 20 mm. long, acute, strongly nerved, scabrous on the veins; uppermost leaves opposite; inflorescence much branched; peduncles short, 1 to 5 cm. long; rays nearly equal, 1 to 1.5 cm. long; pedicels short; involucre wanting or of a few linear bracts; involucler of several linear bractlets longer than the pedicels; fruit immature.

Jalisco: near Huijuquilla, *Rose* 2510, August 23, 1897.

*Prionosciadium* sp. — ?

Another species was collected at Colomas with large twice ternate then pinnate leaves; leaflets ovate, acute, irregularly serrate, pubescent beneath; inflorescence glaucous; flowers purple.

Sinaloa: *Rose* 1649, July 14, 1897.

Tepec: perhaps also *Rose* 1982, from between Pedro Paulo and San Blaseto, August 4, 1897, is the same.



**Prionosciadium** sp. — ?

A somewhat similar species, with very large basal leaves ternate then pinnate, the rachis strongly winged and toothed, the leaflets lanceolate and acuminate but pubescent on the lower surface and not at all glaucous.

Sinaloa: above Colomas, *Rose* 1815, July 14, 1897.

These specimens have only leaves, and the generic position is therefore doubtful, but in habit and foliage they are very similar to the species of *Prionosciadium*.

33. **RHODOSCIADIUM** Watson, Proc. Am. Acad. 25: 151. 1890.

A genus of three species endemic in Mexico. In addition to the type species, cited below, two others have been described—*R. dissectum* C. & R. and *R. glaucum* C. & R.

**Rhodosciadium pringlei** Watson, Proc. Am. Acad. 25: 151. 1890.

Jalisco: *Rose* 2567, August 25, 1897; near Bolaños, *Rose* 2865, September 8, 1897; on barranca near Guadalajara (type locality), *Rose & Hough* 4830, July 9, 1899.

In the collections of 1897, cited above, the specimens differ from the type in having very conspicuous calyx-teeth.

**Rhodosciadium dissectum** C. & R. Contr. Nat. Herb. 3: 309. 1895.

Oaxaca: Las Sedas (type locality), *Rose & Hough* 4630, June 16-21, 1899.

34. **DEANEA** C. & R. Bot. Gaz. 20: 372. 1875.

An endemic Mexican genus, founded upon two species. The discovery of five additional species gives an opportunity of stating again its relations with allied genera, and is also the occasion for enlarging somewhat the generic boundary. The only boundary that seems to need explicit definition at present is that which separates *Deanea* from *Prionosciadium*. So far as known, these two genera are constantly distinct in their stylopodia, that of *Deanea* being conical, that of *Prionosciadium* depressed. The relative size of the fruit in the two genera, which at first was supposed to be a usable character, is found to be of no avail, as the new species described in this paper exhibit large fruit in *Deanea* and small fruit in *Prionosciadium*. Also the fruit of *Deanea* is found to be not always round or oval, but in some species it is broadly oblong.

When the species of the two genera are contrasted in appearance the difference is greater than can be expressed easily. The species of

*Deanea* are comparatively small and even delicate, smooth plants, with leaves of moderate dimensions; while those of *Prionosciadium* are large and coarse plants, with very large leaves, which in some species are thickish and rough.

In his presentation of the Umbelliferæ in Engler & Prantl's *Natürlichen Pflanzenfamilien*, Drude regards *Deanea* as not generically distinct from *Rhodosciadium* Wats., and transfers to the latter the two species of *Deanea* then published. In our judgment *Deanea* is in much greater danger of confusion with *Prionosciadium*, as stated above, than with *Rhodosciadium*, whose remarkably flat seed-face is entirely unlike the deeply sulcate or involute one of *Deanea*. The genus is further strengthened by the discovery of the five additional species herein described, all of which accord with the essential features of *Deanea* as established.

#### SYNOPSIS OF THE SPECIES.

Plants with globose tubers and pinnately compound leaves.

*D. tuberosa.*

Plants with branching roots and ternately compound leaves.

Rachis of leaves conspicuously winged.....*D. glauca.*

Rachis of leaves not at all winged.

Inflorescence comparatively simple, with elongated peduncles; fruit small, orbicular, 5 to 8 mm. in diameter.

*D. nudicaulis; D. longibracteata.*

Inflorescence widely spreading and irregular, with shorter peduncles; fruit large, oblong, 12 to 18 mm. long and 8 to 10 mm. broad.....*D. diffusa; D. montana; D. nelsoni.*

1. *Deanea tuberosa* C. & R. Bot. Gaz. 20: 373. 1895.

*Rhodosciadium tuberosum* Drude, Engler & Prantl. Nat. Pflanzfam. 3<sup>8</sup>: 223. 1898.

State of Mexico: Valley of Toluca, *Pringle* 4295, in 1892.

2. *Deanea nudicaulis* C. & R. Bot. Gaz. 20: 372. pl. 27. 1895.

*Rhodosciadium nudicaule* Drude, l. c.

Involucels very small; fruit 5 mm. in diameter.

Oaxaca: Sierra de San Felipe, *Pringle* 4663, in 1894, and *Conzatti & González* 224 and 418, in 1897.

3. *Deanea longibracteata* C. & R., sp. nov.

Stems 6 to 9 dm. high, glabrous, somewhat branching; leaves twice to thrice ternate; leaflets ovate to oblong, obtuse, irregularly cleft or toothed, slightly roughened on the veins; inflorescence simple, terminal or lateral, umbel on an elongated peduncle 3 dm. or less long; involucre a single bract or wanting; bractlets of the involucre 4 to 6, linear, elongated, much longer than the flowers; rays numerous, in fruit 7.5 to 10 cm. long, slightly scabrous as are also the pedicels:

pedicels 6 mm. long; fruit orbicular, 6 to 8 mm. in diameter; seed flattened dorsally, with a broad concavity; oil-tubes solitary in the intervals or often with 1 or 2 shorter accessory ones, 2 on the commissural side.

Federal District: on the Serrania de Ajusco, altitude 3000 meters, *Pringle* 7176, August 18, 1896, also 6674, in 1897.

4. *Deanea diffusa* C. & R., sp. nov.

Stem tall, glabrous and glaucous; stem leaves large, 4 to 5 times ternate; petiole, so far as seen, short, 2.5 to 5 cm. long; leaflets 2.5 to 3.5 cm. long, cleft or strongly toothed and the lower segments again toothed; inflorescence very diffuse, glabrous throughout; peduncles short (2.5 cm. or less long); rays 4 to 6, nearly equal, 12 to 20 mm. long; pedicels 2 to 3 mm. long; involucre wanting; involucrel of few filiform bractlets; fruit glabrous; carpels oblong, 12 to 14 mm. long, 8 to 10 mm. broad, cordate at base, with narrow body and broad thin wings; oil-tubes 1 to 3 in the intervals, 6 on the commissural side; seed section nearly circular, the margins strongly involute, inclosing a small cavity.

Morelos: on lava beds near Cuernavaca, *Pringle* 7177, September 17, 1896.

5. *Deanea montana* C. & R., sp. nov.

Stems about 9 dm. high, glabrous, and somewhat glaucous; leaves two to three times ternate; ultimate segments ovate, acute, somewhat irregularly cleft or serrate, glabrous; peduncles usually elongated, sometimes 20 to 25 cm. long, occasionally wanting; rays about 10, 4 to 6 cm. long; involucre wanting or of 1 or 2 bracts; involucrel of several linear bractlets; pedicels 4 to 5 mm. long; fruit shortly oblong, about 7 mm. long, glabrous; oil-tubes 3 in the intervals; seed-face concave; stylopodium low and broad.

Zacatecas: on the Sierra de los Morones near Plateado, altitude 2700 meters, *Rose* 3623, September 1, 1897.

6. *Deanea nelsoni* C. & R., sp. nov.

Stems 9 to 12 dm. high, glabrous throughout; leaves 3 to 4 times ternate; ultimate segments ovate, acuminate, sharply and irregularly serrate or cleft; upper leaves mostly alternate; inflorescence somewhat irregular; pedicels short; involucre wanting or of one or more linear bracts; involucrel of 5 or 6 lanceolate-linear acuminate bractlets extending beyond the flowers; rays few (4 to 10), nearly equal, 18 to 30 mm. long; pedicels 4 mm. long, slightly scabrous, as are also the rays; fruit strongly flattened dorsally; carpel oblong or slightly broader above, 16 to 18 mm. long, 10 mm. wide, truncate or nearly so at top, slightly cordate at base, glabrous, with narrow body and broad wings; seed-face with strongly involute margins; oil-tubes 3 in the intervals; flowers "dull yellow."

Chiapas: Valley of Jiquipilas, altitude 660-840 meters, *Nelson* 2938, August 16-18, 1895.

7. *Deanea glauca* C. & R., sp. nov.

Stems 9 to 12 dm. high, glabrous and glaucous below; basal leaves very large, once to twice ternate then pinnate, green above, very pale and glaucous beneath; rachis with a broad toothed wing; leaflets lanceolate to linear-lanceolate, sharply serrate, long-acuminate; upper leaves opposite, much reduced, often simple or 3-lobed; inflorescence very irregular, much branched, puberulent; umbels sessile or on short peduncles; involucre of 1 to 3 reduced leaves; involucre of several filiform bractlets; rays 20 to 30 cm. long; pedicels 5 to 6 mm. long; fruit immature, glaucous.

Topic: foothills between Aguacata and Dolores, *Rose* 2029, August 6, 1897.

Sinaloa: near Colomas, *Rose* 1781, July 20, 1897.

35. ENANTIOPHYLLA C. & R. Bot. Gaz. 18: 55. *pl.* 5. 1893.

A genus which still remains monotypic and restricted to Guatemala, the single species being *E. heydeana* C. & R.

## 36. COULTEROPHYTUM Robinson, Proc. Am. Acad.

27: 168. 1892.

The discovery of three additional species of this genus, with the same peculiar fruit, confirms its generic rank. As now understood, the species of this endemic genus are as follows:

## SYNOPSIS OF SPECIES.

Stems shrubby; pedicels slender; carpophore 2-parted.

Petioles short; leaflets small, ovate, short-acuminate.

1. *C. laxum*.

Petioles long; leaflets large, ovate to lanceolate, long-acuminate.

Ovary and fruit glabrous; involucre of bractlets as long as the pedicels..... 2. *C. macrophyllum*.

Ovary pubescent; fruit scabrous; involucre of bractlets much shorter than the pedicels..... 3. *C. pubescens*.

Stems herbaceous; pedicels short; carpophore 4-parted.

4. *C. brevipes*.

1. *Coulterophytum laxum* Robinson, Proc. Am. Acad. 27: 169. 1892.

Only known from bluffs of the barranca near Guadalajara, Jalisco, where it has once been collected by *Mr. C. G. Pringle*, September 15, 1891 (no. 331), until the following collection. There is a duplicate type (no 2) in Nat. Herb.

Jalisco: near Tequila, *Rose & Hough* 4756, July 5-6, 1899.

2. *Coulterophytum macrophyllum* C. & R., sp. nov.

Woody stem 9 to 12 dm. long, branches dying nearly back each year; leaves large, 6 to 9 dm. long, twice ternate then pinnate; leaf-

lets ovate to lanceolate, 8 to 15 dm. long, 3 to 7 cm. wide, long-acuminate, rounded and slightly oblique at base or the terminal ones slightly cuneate, somewhat irregularly serrate; inflorescence branching, leafy; peduncles short, 3 to 6 cm. long; involucre of a long linear bract; involucre of several linear distinct bractlets as long as the pedicels or nearly so; rays numerous, 10 to 25 cm. long; carpels 6 mm. long, glabrous.

Tepic: in the foothills of the Sierra Madre between Acaponeta and Pedro Paulo, *Rose* 1936, 1937 (type), August 2, 1897.

Sinaloa: near Colomas, *Rose* 1814, July 14, 1897.

### 3. *Coulterophytum pubescens* C. & R., sp. nov.

Stems tall (12 to 18 dm. high), weak, much branched; leaves large, once to twice ternate then pinnate; leaflets lanceolate, 8 to 15 cm. long, acuminate, oblique at base, dark green above, pale and puberulent beneath, the margin crenate and apiculate; upper leaves opposite, simple, linear to lanceolate; inflorescence much branched; peduncle 6 to 10 cm. long; rays numerous, nearly equal, 2 to 3 cm. long, puberulent; involucre of several linear short bractlets; pedicels 4 to 7 mm. long; ovary densely puberulent; fruit 10 mm. long.

Jalisco: on the tableland between Colotlan and Bolaños, *Rose* 2863, September 8, 1897.

### 4. *Coulterophytum brevipes* C. & R., sp. nov.

Herbaceous (?), 9 to 15 dm. high; radical leaves 2 or 3, 9 to 12 dm. long (including the petiole 3 to 6 dm. long), 4 to 5 times ternate; leaflets obliquely lanceolate, 5 to 12.5 cm. long, rounded or somewhat cuneate at base, sharply serrate, acuminate, slightly scabrous on the margin and veins beneath; inflorescence somewhat irregular; peduncles 5 to 15 cm. long; rays nearly equal, 2.5 to 5 cm. long; pedicels very short, less than 2 mm. long; fruit 10 mm. long; carpophore 4-parted.

Morelos: on bluff of barranca above Cuernavaca, altitude 1950 meters, *Pringle* 6390, July 30, 1896.

This species differs from *C. laxum* in the shape of leaflets, more caulescent habit, and shorter pedicels, as well as in its remarkable carpophore.

### 37. MYRRHIDENDRON C. & R. Bot. Gaz. 19: 466. *pl.* 32. 1894.

A monotypic genus, found as yet only from the lava beds of Costa Rica. In addition to the original material collected by Mr. John Donnell Smith we cite the following:

#### *Myrrhidendron donnellsmithii* C. & R. l. c.

Costa Rica: *Pittier* 2012, June 2, 1890.

## 38. PEUCEDANUM L. Sp. Pl. 1: 245. 1753.

A very large and polymorphic genus of wide distribution, and represented in Western United States by a peculiar group of numerous species, and perhaps to be excluded from Mexico, but retained here to include *P. tolucense*, cited below, whose generic relationships are doubtful, and also *P. madreense* Watson, a still more uncertain species. Hemsley includes eight species, three of which bear names. Of the named species *P. nevadense* Wats. is included upon the authority of the *Botany of California*, but no collections have verified this statement; *P. mexicanum* Wats. proves to be a *Prionosciadium*; and *P. tolucense* Hemsley is referred to above. The five unnamed species have been variously referred, chiefly to *Prionosciadium*.

*Peucedanum tolucense* (H.B.K.) Hemsley, Biol. Centr.-Am. Bot. 1: 570. 1881.

*Ferula tolucensis* H.B.K. Nov. Gen. et Sp. 5: 12. pl. 418. 1821.

State of Mexico: Sierra de las Cruces, altitude 3600 meters, *Pringle* 5953, October 7, 1895.

Hidalgo: Sierra de Pachuca, altitude 2940 meters, *Pringle* 7650, August 13, 1898.

## 39. DAUCUS L. Sp. Pl. 1: 242. 1753.

A genus of wide distribution, two of which, *D. montanus* Willd. and *D. pusillus* Michx., are natives of Mexico and Central America. In addition to these, *D. carota* L. has become somewhat naturalized. In Hemsley's enumeration these three are given, but his fourth species, *D. brachiatus*, becomes *Caucalis microcarpa* Hook. & Arn.

*Daucus montanus* Humb. & Bonp. in Schult. Syst. 6: 482. 1820.

Chihuahua: in the Sierra Madre, *Nelson* 4791, August 20, 1898; same region, *E. A. Goldman* 166, September 26, 1898.

State of Mexico: El Desierto Viejo, *Altamirano* 26, July 1890; Sierra del Pino, *Altamirano* 1, September 1890.

Tepec: near Santa Teresa, *Rose* 2126, August 8, 1897.

Puebla: Huanchinango, *E. A. Goldman* 21, January 8, 1898.

Chiapas: above San Cristobal, altitude 2100-2640 meters, *Nelson* 3182, 3236, September 18-22, 1895; about Tumbala, altitude 1200-1650 meters, *Nelson* 3340, October 20-29, 1895.

Guatemala: mountains near Hacienda of Chancol, altitude 3300 meters, *Nelson* 3665, January 2, 1896.

Costa Rica: altitude 1500 meters, *Pittier* 6969, August 27, 1892.

## INTRODUCED GENERA AND SPECIES.

The following introduced species have come under our observation.

*Apium graveolens* L. Sp. Pl. 1: 264. 1753.

Puebla: in roadside ditches near the city of Puebla, *Pringle* 5956, December 17, 1895.

- Conium maculatum** L. Sp. Pl. 1: 243. 1753.  
 Michoacan: Patzonaro, *Altamirano* 22, December 1890.
- Coriandrum sativum** L. Sp. Pl. 1: 256. 1753.  
 Chihuahua: Chihuahua City, *Rose & Hough* 4208, May 11, 1899.  
 Sinaloa: in the market at Rosario, *Rose* 1410, June 20, 1897.  
 Costa Rica: altitude 1500 meters, *Pittier* 6970, August 27, 1892.
- Daucus carota** L. Sp. Pl. 1: 348. 1753.
- Eryngium fœtidum** L. Sp. Pl. 1: 232. 1753.  
 Generally cultivated in tropical America.
- Fœniculum vulgare** Mill. Gard. Dict. ed. 8, n. 1. 1768.  
 Puebla: Atlinco, *Nelson*, July 25–August 1, 1893.  
 Oaxaca: in the valley of Oaxaca, *Charles L. Smith* 887, November 7, 1894.
- Petroselinum petroselinum** (L.) Karsten.  
*Apium petroselinum* L. Sp. Pl. 1: 264. 1753.  
 Guanajuato: San Juan del Rio, *Nelson* 3865, May 26, 1896.  
 Sinaloa: in garden at Colomas, *Rose* 1730, July 14, 1897.
- Peucedanum graveolens** (L.) Benth. & Hook. Gen. Plant. 1: 919. 1867.  
*Anethum graveolens* L. Sp. Pl. 1: 263. 1753.  
 Zacatecas: in the Plaza near Monte Escabado, *Rose* 3760, August 26, 1897.

## EXCLUDED OR DOUBTFUL GENERA.

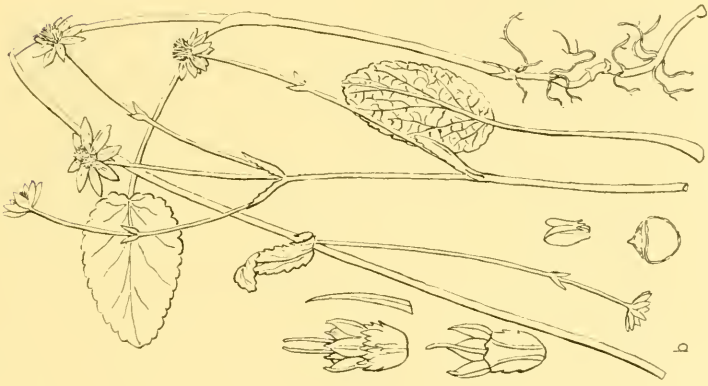
- CARUM was reported by Hemsley to include a species without name.  
 The genus should probably be excluded, as the Oaxaca plant cited is probably not a *Carum*.
- CRANTZIA has become *Lilæopsis*.
- CYMOPTERUS was included by Hemsley upon the authority of a specimen doubtfully named *C. fendleri* Gray, in the Report of the Mexican Boundary Survey. Our present knowledge of the range of that species, however, would suggest that it should be excluded from Mexico. It is very probable that species of this genus may be found along the northern border of Mexico, but none have been reported.
- DRUSA may contain a Mexican species, as suggested by Drude, but we have not been able to confirm it.
- EULOPHUS was reported by Hemsley as represented by three species. The two bearing names have been transferred to *Musenioopsis*.
- SIMUM is to be excluded, as its single Mexican species, *S. angustifolium*, has become *Berula erecta*.
- SMYRNIUM is to be excluded, as its single Mexican representative, *S. ægopodioides*, has proved to be an *Arracacia*.



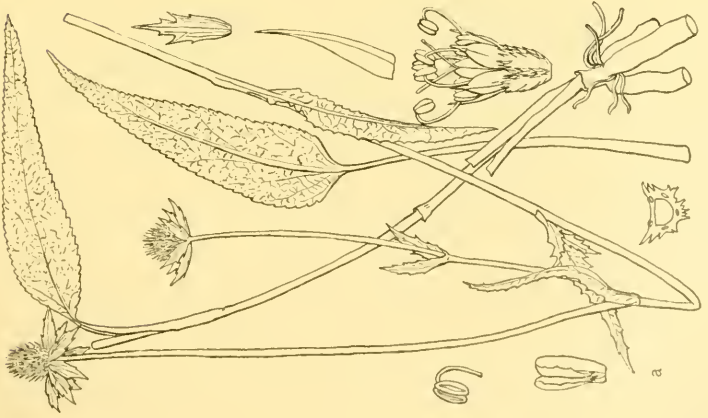




c. *Eryngium spiculosum*.

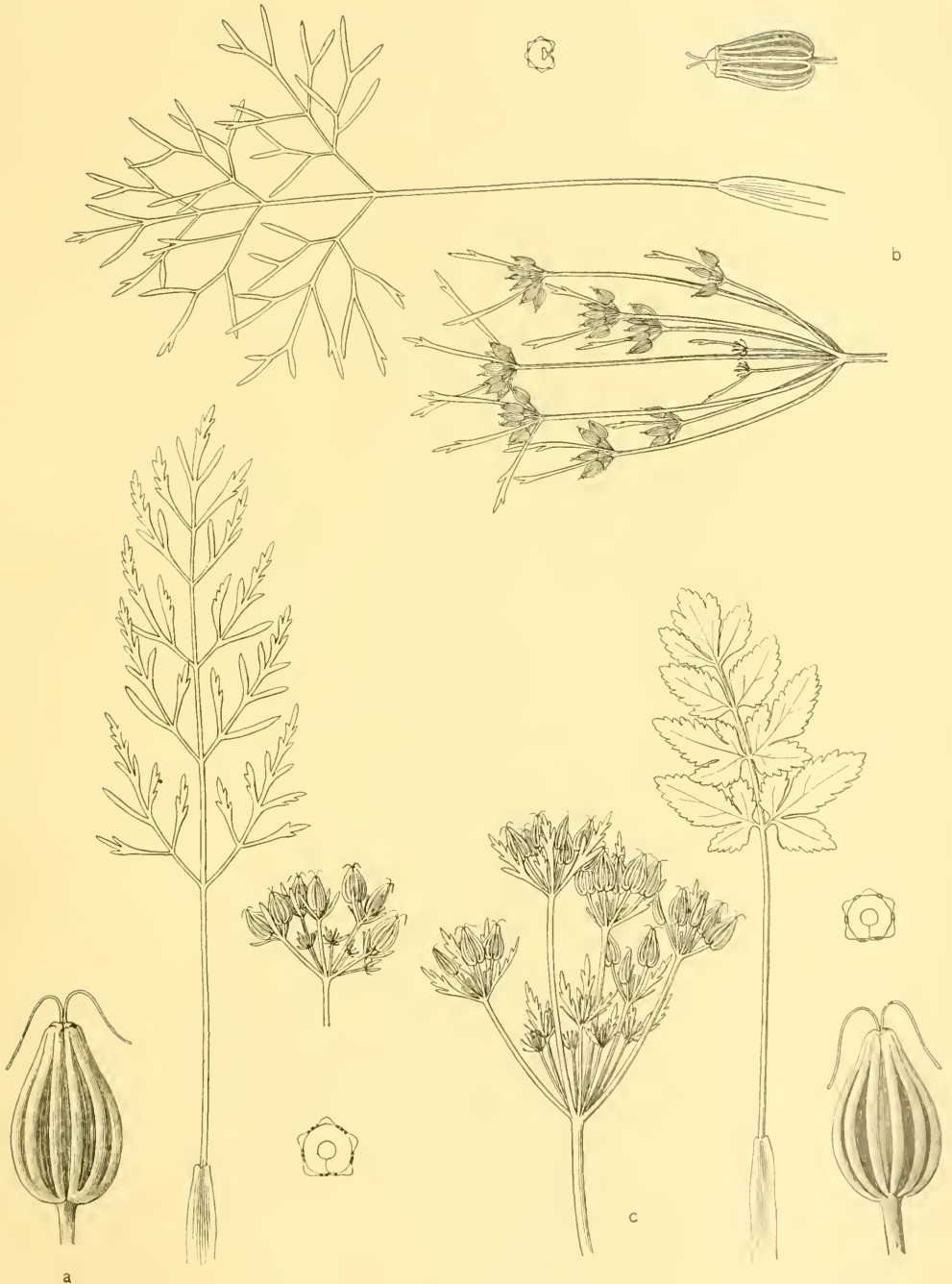


b. *Eryngium paucisquamosum*.



a. *Eryngium galeottii*.





a. *Tauschia mariana*.

b. *T. filiformis*.

c. *T. edulis*.





*Tauschia madrensis* C. & R., sp. nov.





*Tauschia linearifolia* C. & R., sp. nov.







*Arracacia chiapensis* C. & R., sp. nov.





*Arracacia dugesii* C. & R., sp. nov.





*Arracacia hemsleyana* C. & R., sp. nov





*Arracacia longipedunculata* C. & R., sp. nov







*Arracacia aegopodioides.*





*Arracacia toluensis.*





*Arracacia tolocensis.*



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THE ECONOMIC DEVELOPMENT OF THE DISTRICT  
OF COLUMBIA.<sup>1</sup>

BY CARROLL D. WRIGHT, LL.D.

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THE American Congress organized under the Articles of Confederation was obliged to meet at various places, but generally, except when prevented by the movements of the armies engaged in the War of the Revolution, its meetings were held in Philadelphia. It was in session in that city in June, 1783, when it was threatened by a mob of dissatisfied soldiers, in consequence of which the Congress moved to Princeton, after which sessions were held at Annapolis, Trenton, and New York, but Philadelphia was not again the sitting place during the continuance of the Confederation. This migratory condition resulted in various attempts between 1783 and 1790 to settle upon a permanent location for the Federal capital. Under the new Constitution of 1787, which went into effect March 4, 1789, it was provided that "Congress shall have the power to exercise exclusive legislation in all cases whatsoever over such district (not exceeding

<sup>1</sup> Read before the Washington Academy of Sciences, April 22, 1899.

<sup>2</sup> *Sources of Information* : The Constitution of the United States ; the compiled statutes of the District of Columbia ; reports of the Federal census, 1790

ten miles square) as may by cession of particular States and the acceptance of Congress become the seat of the government of the United States."

In pursuance of this provision the State of Maryland, December 23, 1788, passed "An act to cede Congress a district of ten miles square in this State for the seat of the government of the United States," and the State of Virginia, December 3, 1789, passed "An act for the cession of ten miles square, or any lesser quantity of territory, within this State to the United States in Congress assembled for the permanent seat of the general government." After much deliberation and the contentions growing out of measures relating to the assumption by Congress of the war debts of States, these cessions were accepted, as required by the Constitution and the permanent seat of government established by the "Act for establishing the temporary and permanent seat of the government of the United States," which was approved July 16, 1790, and the act to amend the same, approved March 3, 1791. The district of ten miles square was accordingly located and its lines and boundaries particularly established by a proclamation of President Washington March 30, 1791, and by the 'Act concerning the District of Columbia,' approved February 27, 1801, Congress assumed complete jurisdiction over the District, as contemplated by the framers of the Constitution. Philadelphia was made the capital till 1800.

It is not necessary on this occasion to rehearse the various elements and discussions which led to these results; they were varied indeed, and while sectional arguments were freely used, the chief desire among the members of the Congress was to

to 1890, inclusive; reports of the Comptroller of the Currency; reports of the Board of Public Works; 'District Affairs, 1874: Governor Shepherd's Answer;' United States Statutes at Large; reports of Commissioners of the District of Columbia; reports of the Assessor of the District of Columbia; 'The City of Washington,' by John Addison Porter; Crew's 'Centennial History of Washington'; 'The Negro in the District of Columbia,' by Edward Ingle; 'Pictures of the City of Washington in the Past,' by Samuel C. Busey, M.D., 'Statement of Appropriations and Expenditures from the National Treasury in the District of Columbia,' Ex. Doc. No. 84, Senate, Forty-fifth Congress, 2d session; information by leading citizens, especially Hon. Henry A. Willard, Lewis Johnson Davis, Esq., and B. H. Warner, Esq., and special official data kindly furnished by the Secretary of the Treasury and Hon. Matthew Trimble, Assessor of the District of Columbia.



secure a convenient location for the Federal capital. One of the elements, however, which is important in treating the economic development of the District of Columbia, must be considered. The commissioners appointed to select a site after the cessions by Maryland and Virginia were actuated very largely by the dream of making the Federal capital a great commercial center; but in most cases dreams go by contraries, and this was not an exception. Nevertheless, the hope which inspired Washington himself, that the new city was destined to become the "greatest commercial emporium" in the United States, was not without reason, and when the particular location was determined upon, facts and prospects were sufficient to sustain this dream. Of course, a central position, accessibility, agreeable surroundings, were necessary elements in considering the particular location.

The President was given great latitude in the choice of the site. He could locate the city anywhere "between the eastern branch of the Potomac, Anacostia, and the Conogocheague," a stream entering the Potomac at Williamsport, Md. With his great familiarity with the whole territory from which the site could be selected, Washington determined upon the present location of the capital. Georgetown, Alexandria, and Carrollsburg (where the Arsenal now stands), were in existence, but the site of the capital was located between Georgetown and Alexandria, in a section without population except a few farmers.

The economic considerations for the selection lay in the fact that the site was at the head of navigation of the Potomac river and at the terminus of the projected Chesapeake & Ohio Canal. Transportation in that period followed water-courses. Congress, very naturally, paid little attention to land routes. Washington had his eye on what he considered the double advantage of a site which should be at the junction of inland and tide navigation. The Chesapeake & Ohio Canal was projected in 1784, and it was supposed that with its construction the middle west would find an outlet for its products either at Georgetown or at Alexandria, and that Alexandria, then being something of an important port, shipping to all parts of the country and to Europe, would increase and emphasize the wisdom of the

selection at the head of tide water. This was the dream for the greatest commercial emporium in the United States. Transportation by steam power was not anticipated, although Washington himself knew something of its efficiency in manufactures, and prophesied its use in transportation—probably not however to such an extent as to remove from his own mind the thought that the river and the canal would serve as great tracks of travel and freight and bring to the new capital that commercial prosperity which he longed to see.

The Chesapeake & Ohio Canal, although projected at the early date named, amounted to little until 1836, when 64 miles were completed and in operation. It has had an influence in the commercial and mercantile development of the District of Columbia, but not sufficient to warrant its being considered as one of the moving influences in this direction. It was an aid in developing the District for a time, but whatever influence it exerted in bringing the products of the soil and of the mines to the inhabitants of the District, the influence was not felt in any pronounced commercial sense; certainly this influence was not equal to that of the Potomac as a waterway. Ultimately railroads brought new influences to bear upon the development of Washington, and the canal became only a side issue.

Georgetown and Alexandria were brought in as parts of the District of Columbia, the first-mentioned place having a population in 1810 of nearly 5000; it cannot be stated separately from the District for any prior period. Alexandria in 1790 had a population of 2748, and in 1800, when the capital was removed to the District of Columbia, nearly 5000. The population of the rest of the tract was insignificant. At the beginning, in the 100 miles square composing the District there were 14,093 persons.

The farmers of that tract lying between Carrollsburg and Georgetown sold all the land which was needed for public buildings and improvements for 25 pounds per acre. All the lands in the city limits were placed in the hands of trustees. The largest owners of the site of the District made an agreement March 30, 1791, to convey to the government out of their farms all the lands which might be needed for streets, avenues, and

public reservations free of cost. The government divided into building lots and apportioned between itself and the owners all the rest of the land in the District; it was to sell small lots and out of their proceeds pay for large ones. The government made an excellent bargain, and it was fortunate also that there were few owners to deal with and no extensive improvements for demolishing which damages would accrue. Here, again, was one of the economic advantages of the location of the District, for had any large city been selected as a site there would have been great expense on account of the purchase and removal of buildings necessary for the erection of government buildings. The new government was not obliged to advance a dollar for the land which came into its possession. There were 10,136 building lots assigned to the government, which in time proved worth \$850,000. Taking into consideration the public reservations and streets, the government acquired a tract of 600 acres in the heart of the city. Certainly Washington made a good bargain in the interest of the new government.

The commissioners appointed by Congress acted with very commendable speed, for while the cessions of Virginia and Maryland were accepted finally by the act of July 16, 1790, Washington reported to Congress January 10, 1791, that he had fixed the confines of the District. The commissioners ran their lines and the corner-stone was laid April 15, 1791, at Jones's Point, near Alexandria.

It should be remembered that the credit of the Federal government was on a very low plane at the time the Federal capital was located. The expansive plan for the city projected by Major L'Enfant, who drew his inspiration from the cities of the Old World, anticipated the expenditure of large sums of money. His plan was by many considered altogether too grand and chimerical. He really planned a city for half a million, and for this purpose he projected broad avenues, circles, squares, parallel streets and all the other details necessary to secure beauty and uniqueness. The engineer wished to provide for space without incurring waste of land, and symmetry without sameness. All these things resulted in differing opinions as to the future of the capital city. Some thought it an excellent field for speculation;

others were content to see the capital of the nation simply a rendezvous for congressmen for the purpose of passing laws and then adjourning. Very many of the most patriotic citizens of the time hoped that the city of Washington would never become a place of any considerable size. Mr. John Addison Porter, in his interesting work on 'The City of Washington: Its Origin and Administration,' in speaking of this condition of affairs, uses the following language:

After the first influx of speculators—among whom none bought more largely or lost more heavily than Robert Morris, 'The Superintendent of Finance,' and friend of the government during the dark days of 1781—the sale of real estate languished. Foreigners seemed to have more confidence than natives in the success of the experiment. Engraved plans of the city had been well distributed abroad; Congress passed a law allowing aliens to hold land in the city; and for a long time lots brought absurdly high prices in London. But after 1794, the home trade ceased almost entirely. There were some legal difficulties in transferring real estate. One of the main reasons, however, why the city did not grow fast, was that Congress could not remove thither for a number of years.

Washington, himself, proposed to stimulate the sale of lots in the capital by establishing sale-agencies in the principal States and cities of the Union. The plan was finally abandoned with reluctance; another, and at that time a favorite scheme for raising money, viz., by lottery, was subsequently adopted by the commissioners. The failure to dispose of the government lots on advantageous terms was the more serious, as the plan had been to pay for the first public buildings by the sale of these lots.

This statement illustrates thoroughly well the difficulties of establishing the city. To be sure Virginia voted \$120,000 and Maryland \$72,000 for the purpose of beginning the government buildings. These amounts were necessary, because Congress failed to make the necessary appropriation of \$100,000 for this purpose. But later Congress appropriated \$300,000, yet no one was willing to advance the money. The capitalists of Europe did not care to invest in Federal lands. So Washington invoked again the friendly aid of Maryland in behalf of the District, and that State very generously loaned \$100,000, first obtaining the personal security of the commissioners.

With the difficulties of low credit, there was another which interfered with the immediate development of values in the District. There was no certainty as to what part of the city would be the choicest section. Robert Morris, who speculated in District lands, bought east of the Capitol. Some bought in what is now the northwest section, which has become the most fashionable residential quarter of the city. Washington paid about \$1,000 for two lots in the vicinity of the Capitol. He was entirely opposed to the sale of large tracts to individuals, as it was his opinion that this process would retard the real and legitimate growth of the city.

The commissioners, however, while having his advice at hand did not follow it in every instance. The government was embarrassed by the inability of some of the purchasers of the largest tracts to pay therefor. Of course, it was very natural that the lots on Capitol Hill would bring the highest figures; but the chief owner of land in that vicinity held his lots at such high figures that those who desired to purchase in the District were compelled to seek lots in the opposite direction. An owner of land along Pennsylvania Avenue, seeing this determination on the part of the principal owner of Capitol Hill lots, offered his lots to all who would build on them, and thus it was that the population and business were located west instead of east of the Capitol. These experiences have been repeated over and over again in the District of Columbia.

The chief cause of the variation in values at that time, and for three-quarters of a century afterwards was the uncertain attitude of Congress itself or the uncertainty or variableness of its action. It could not be expected, however, that there would be much economic growth until the term of the residence at Philadelphia should terminate. This was the year 1800, although the cornerstone of the capital was laid with Masonic honors by Washington himself, September 18, 1793, and in June of the last year of the 18th century the government moved its entire equipment to the District. The Capitol, White House, Treasury, and War Department buildings were either in process of construction or just completed, but there were no other buildings of any size or importance, not even public houses. The dis-

gust of Members at the uncomfortable conditions they found here, the disappointment of visitors when they found that the city of Washington was a paper city, that there were no streets, sidewalks, nor conveyances, did much to retard the growth of the town.

In the last decade of the eighteenth century a French writer, M. De Maistre, in an essay on 'The Generative Principle of Modern Constitutions,' remarked that all great institutions are the result of development, and, speaking of Washington, said "that the Americans propose to build a town and call it Washington, where Congress is to sit"; and he then made the following challenge: "There is too much of the human element in this affair. You may wager a thousand to one that the town will not be built, or will not be called Washington, or that Congress will not sit there." This statement represents fairly well the general feeling in Europe, which feeling, coupled with the facts already stated, accounts for the discouragement in the building of the city of Washington; but there were other and more important reasons for the slow development of the District.

There was no local government on which responsibility could be fixed, and there was great dissension as to the form of government which should be provided for the city, but Congress decided by act of March 3, 1802, to delegate the active administration of local affairs to a city government, not abandoning of course its own supreme authority over the city and the District. It granted reasonable scope and freedom to residents in managing their own immediate affairs, but of course, and properly, reserved the right to modify, change, or repeal the provisions of the city government. The first municipal election was held June 17, 1802, the Mayor being appointed by the President, and he in turn named his subordinates.

In examining the more immediate facts and conditions bearing upon the economic development of the District of Columbia, one turns naturally to the status of the population as the fundamental element of any economic development. As stated, in 1800, when the government removed its buildings to the District the population was 14,093. In 1810 it had very nearly doubled, being 24,023, an increase of more than 70 percent. The in-

crease between that period and 1820 was less than between 1800 and 1810, in the latter period being but 9000, or 37½ per cent. At the next census (1830) the increase was still less, being but 6795, or 20.57 percent; and still lower in 1840, when the total population was 43,712, an increase in ten years of but 3878, or 9.75 percent, the lowest percent of increase during the history of the District.

Washington was at a very low ebb in 1840. The city government proved entirely inadequate in its comprehension of the real future of the city; Congress had been criminally neglectful of its interest and it was left to grow without stimulation and without exertion. In 1850, however, there was a little improvement, the increase in the number of the population being double what it had been between 1830 and 1840, for the census of 1850 showed a population of 51,687, an increase of 7975 or over 18¼ percent in the ten years. In 1860 the results were still better, the population being 75,000, the increase in numbers being 23,393, as against 7975 in the previous decade, the percentage of increase being 45.25 percent.

During the next ten years a more remarkable increase was shown and it demands special consideration. The war began in 1861 and the city of Washington attracted the attention not only of the country but of the world. Troops from all parts were brought here, Washington being the central post of the armies. Strangers who knew nothing of Washington but the brief statements they had seen in their school geographies were now brought to see the town itself. The business of supplying the great armies, everything connected with the equipment and dispatching of large bodies of troops brought business men in great numbers to the capital. Washington received its greatest advertisement through these means, but another force came in. Slavery had never amounted to very much in the District. In 1860 the population of 75,080 consisted of 60,763 white and 14,317 colored people. Of this number of the colored, only 3185 were slaves. There had been a constant reduction in the number of slaves through various causes, the largest number at any one time being 6377 in 1820. At the next census there was a slight reduction, while in 1840 the number was reduced

to about 4700 and in 1850 to 3687 and in 1860, as stated, to 3185. As a war measure, President Lincoln issued his proclamation of emancipation January 1, 1863, but prior thereto and after much discussion, slavery was abolished in the District of Columbia, April 16, 1862, under an act approved that day. This act appropriated \$1,000,000 for the compensation of the owners of slaves. Under this law 3100 slaves were emancipated and their owners received \$993,406 as compensation for them. With this double action the negroes of the surrounding country of Maryland and Virginia, flocked to Washington, so that the census of 1870 showed a total population of 131,700, an increase of 56,620, or 75.41 percent, a most remarkable increase; of the total 88,278 were white and 43,422 colored. Contrast this with the colored population ten years before, when it was only 14,317. Here then, was an increase between 1860 and 1870 of only 27,515 white persons, or 45.28 percent, and an increase of 29,105 colored, or 203.29 percent. During the decade from 1870 to 1880, the white population increased 29,728, or .33.68 percent and the colored only 16,196, or 37.30 percent, as against 203.29 percent in the previous decade. From 1880 to 1890, when the population of the District was 230,392 and the total increase 52,768, or 29.71 percent, the white population increased 36,689, or 31.09 percent and the colored population 16,079, or 26.97 percent.

With these facts in view, it is also interesting to learn the proportions of the white and colored of the total population at different periods, and in this, strangely enough, it is found that the proportion varies very little. In 1800 the colored constituted 28.57 percent of the whole population, and in 1810, 33.07 percent. This proportion has never been exceeded, except at one census, that of 1880, when it was 33.56 percent. The percent was lowest in 1860 when it was 19.07. To make a general statement, therefore, and looking at the percentages at the different censuses it is seen that the colored population has varied around one-third of the whole, where it now stands. Sometimes it has been a little below and sometimes a very little above, but at the present time it is perfectly safe to say that the colored population constitutes one-third of the total population of the District of Columbia.



With these percentages of increase before us, that of the decade from 1880 to 1890 being 29+percent, from 1870 to 1880 nearly 35 percent from 1860 to 1870 over 75 percent, and from 1850 to 1860 more than 45.25 percent, it is reasonable to put the percentage of increase during the decade from 1890 to 1900 at 22, as estimated by the District Commissioners. This will give the District a population next year of about 280,000.

While Alexandria was a part of the District, its population, up to the time of its recession to Virginia July 9, 1846, increased from 2748 to 8459. This recession, of course, caused some of the reduction and a decrease in the percentage of increase between 1840 and 1850 that have been noted. Alexandria now has a population of over 14,000, there having been a very steady although slow growth during the whole century. Georgetown has about the same population that Alexandria now has. Its growth has been from 4948 in 1810 to 14,046.

The growth of population in the District has been ample to warrant commercial and industrial growth, but speaking of the economic development of the District from a purely industrial sense, it is safe to say that such development has not been commensurate with the growth of population. The subject of economic growth in this territory must be approached from two lines—first, the conventional or industrial economic development, and, second, the economic development from a sociological view. In this latter sense the development of the District of Columbia has been unique, presenting phases and elements not to be found in any other city in the country and perhaps in the world. A brief review of the economic development from the industrial sense is interesting, however, and ought to precede the consideration of any of the unique or sociological features.

The territory on which the city of Washington proper now stands was farming land. Georgetown had a considerable trade. Alexandria was a port of some importance, but that city need not be considered, as it now forms no part of the District. Unfortunately, official statistics of the agricultural and manufacturing interests of the District of Columbia cannot be given with much accuracy for the first half century of its life. The agricultural statistics begin with the year 1840, when the total

value of agricultural products was given at \$64,318, of which \$19,280 were from Alexandria. The products were insignificant, except those of market gardens, the value of which for the District, exclusive of Alexandria, was over \$38,000. The next statement relative to farm products of the District of Columbia is for 1870, when they had risen to \$319,517, but this included some values of betterments not purely products. In 1880 the products were valued at \$514,441, but through extensions of streets and avenues the values fell to \$373,070 in 1890. The fisheries in 1890 were valued at \$26,028. The number of farms in 1850 was 267 and in 1890 382, while the average size of the farms in 1850 was 103 acres and in 1890 but 37 acres. These figures show conclusively that the District of Columbia cannot be considered as an agricultural territory, and that as the city expands the farming interests, of course, diminish.

The contrary is true when we consider manufactures. As early as 1810, when the first attempt was made by the Federal census to secure returns as to manufacturing establishments, the District produced goods to the value of nearly \$1,000,000 per annum, about \$354,000, however, belonging to Alexandria and \$572,750 to the rest of the District. Washington had some cotton factories in those days, and it produced \$20,000 worth of blended cloths and stuffs. It also made \$60,000 worth of fur hats. The products of its breweries amounted to \$9000. Its glass works produced \$36,000 worth of goods, its rope walks \$232,000 worth, and its grist mills \$211,250 worth. In 1840, Alexandria still being in the District, the total product of its manufactures were \$1,313,584, \$750,000 worth belonging to Alexandria and \$577,000 worth to the rest of the District. Its chief manufacturing interest was that of flour and grist mills, amounting to \$176,870. Among the leading industries at that time are found bricks and lime, hats and caps, leather and leather goods, carriages and wagons, furniture, and the building of houses, which in that year (1840) amounted to nearly \$87,000.

In 1850 the products of the manufactures of the District amounted to over \$2,690,000, in 1860 to nearly \$5,500,000, in 1870 to over \$9,250,000, in 1880 to \$11,882,316, while, accord-

ing to the last census, that of 1890, the manufactures reached the handsome sum of \$39,331,437. This latter statement under analysis indicates a peculiar state of affairs. There were 2295 manufacturing establishments reported, with an aggregate capital of \$28,865,089. These establishments employed, on the average, over 23,000 persons, to whom was paid in wages \$14,622,264. The analysis shows further that but very little of the manufactured product was sent out of the city of Washington. Among the largest items are to be found the products of bakeries, the building of carriages and wagons, clothing, engraving, flour and grist mills, painting and papering, plumbing and gasfitting, printing and publishing, each of these industries producing more than a million dollars worth of goods or work. An examination of the list in detail shows that the goods made by the manufacturers of Washington are practically consumed by its inhabitants.

If we turn to the wealth of the city the most satisfactory results are observed. Taking the true valuation of real and personal property, that is, the market value and not the value for purposes of assessment, it is found that in 1850 the total amounted to over \$14,000,000, being \$271 per capita, while the per capita for the United States at large was \$308. Eighteen sixty showed a vast increase, owing, first, to lack of completeness in the statistics of 1850, and, second, to the real progress of the town, to over \$41,000,000, the per capita rising to \$547, more than that for the United States taken as a whole, when it was \$514; the per capita wealth of the District has kept in advance of that of the whole country since that period. In 1870 the total valuation was nearly \$127,000,000, or \$963 per capita, as against \$780 for the United States at large. In 1880 it was \$220,000,000, or \$1239 per capita, as against \$870 for the United States. In 1890 it was over \$343,500,000, or nearly \$1500 per capita, as against \$1036 for the United States. It is to be regretted that the per capita wealth of different cities cannot be brought into comparison with that of Washington.

These figures must not be considered as accurately representing the wealth of the District of Columbia, but only as indicating it, and yet for 1890 I am inclined to the opinion that the figures

are very near the truth. The per capita wealth of the District of Columbia is greater than that of any of the States in the Union, except the mining States, where the presence of rich mining districts in relation to a sparse population makes the per capita much larger than in other parts of the country.

These conventional facts that have been recited are those which would be used in considering, as I have already indicated, the economic development of any locality, and on the whole they are fairly satisfactory when it is considered that the District of Columbia is not a great commercial emporium nor a great manufacturing center. The economic development of the District has been due largely to causes other than the presence of business interests, the business interests being those identified almost entirely with the population of the District itself, the District having but little relation to the outside world so far as production is concerned, but bringing here, through its peculiar industry, that of law-making and governmental business, the products and wealth from the outside. It is this consideration which is the most interesting and in which the sociological aspect of economic conditions, unique in themselves, is to be found.

In this consideration we must take cognizance of the different forms of government under which the affairs of the District have been conducted, for in this lies one of the most emphatic exemplifications of the influence of law or the action of government upon values. The District of Columbia now consists of  $69\frac{1}{4}$  square miles of territory instead of 100, when it was established. The municipal government of Alexandria was organized under charter in July, 1749. It became a part of the District when it was established, but was receded to Virginia July 9, 1846, and need not be considered as an integral part of the District. To be sure, it has in a sense furnished some facilities in the way of transportation and residence which have had their influence upon the development of the District itself, but these influences are not of sufficient magnitude to delay the consideration of the development of Washington.

Georgetown, always a part of the District of Columbia, was founded in 1751, and incorporated by the legislature of Maryland in 1789. Its citizens then were actively engaged in do-

mestic trade and foreign commerce. It was a port of entry to which large consignments of British goods were made, consisting mainly of hardware, drygoods, and wines, in exchange for tobacco, furs, and Indian goods. Its exports in 1794 amounted to nearly \$129,000. Large quantities of sugar, molasses, and rum were also imported from the West Indies. These imports were exchanged in trade with the farmers of Maryland, Virginia, and Pennsylvania, carried on by means of the river craft and wagon transports, which came heavily laden with the farm products and returned along their routes to the near and distant country freighted with dry goods, groceries and farm products, salt and fresh shad and herring during their season, for barter with the farming people. It is but natural that a population numbering between 4000 and 5000, actively engaged in trade and commerce by land and water, with one or more good hotels, should have supplied accommodations for statesmen and officials who could find no suitable residence in the new territory designated as the Federal capital.<sup>1</sup>

Georgetown remained under its own form of city government until the establishment of the territory of the District of Columbia by the act approved February 21, 1871. Washington itself remained under the local jurisdiction of the commissioners created by Congress for the proper planning and laying out of the new city, till the first city charter was granted in 1802, and from that time until the territorial government established in 1871 the local government was under the city form, although there were various modifications and changes in the charters. There was a mayor, sometimes elected by the people and sometimes appointed by the President, with a board of aldermen and a council.

During all this period, that prior to 1871, there had been no very extensive improvements in the city. Georgetown, as indicated, offered the opportunity for residence for persons connected with the government and for others in the beginning, but gradually, of course, the streets and squares of Washington were developed and residences were erected. The population had grown, as already stated, to 131,700 in 1870. The spas-

<sup>1</sup> Cf. 'Pictures of the City of Washington in the Past,' S. C. Busey, M.D.

modic efforts of the city government at various times to develop and beautify the city met with little encouragement from the inhabitants through investment or otherwise, although many efforts were made to secure proper administration of local law. Congress gave but little attention to the affairs of the District. So when the war came, in 1861, Washington was a shabby town, with little or no architecture to attract attention, other than that displayed in the public buildings, its dwellings and business blocks being built along the lines of what was popularly known in those days as "carpenters' architecture." There is much of this style of building still remaining, the plain front, flat roof, and unornamental coping sufficiently characterizing the style prevailing in the olden days. Values had not appreciated in any degree at all commensurate with the importance of the place.

With the notoriety gained by the presence of many strangers during the Civil War the country itself began to feel somewhat ashamed of its capital city. My own personal recollections date from 1862. The sights familiar in Washington then, common as they were, would be considered absolutely disgraceful at the present time. There was but one street car line, poorly equipped and badly managed. There were very few paved streets and avenues, and although the city possessed all the elements out of which a beautiful town could be created, they had not been utilized. Cattle and swine roamed the streets, and continued to until 1871. Citizens and strangers familiar with Washington at that time will remember well the presence of swine, even in places near this hall—no farther away, in fact, than New York avenue—and a heavy army wagon would often sink to the hubs in the mud of the same avenue. All these things brought numerous petitions for improved local government and the inauguration of general improvements. The Board of Health had but little power under the old charters and possessed but little activity. Prior to the act of February 21, 1871, establishing the territorial government, under which was created the Board of Public Works and the Board of Health given fairly increased powers, patriotic and public-spirited citizens had done all they could to secure from the city government an ordinance

to empower the Board of Health to clear the streets of animals. Those citizens who had fenced in their parkings and the citizens generally were constantly annoyed and their property subjected to damage, but the city government either had no wish or no power to carry out the suggestions made to it. The tradition is that the cackle of a goose set Rome free. This tradition finds its parallel in an actual fact, under which it might be stated that the rooting of a pig did much to bring Washington out of the chaos of the past. The Board of Health, as stated, did not or could not act with any force. One of the prominent citizens of Washington, who came here in 1847, has related to me an incident showing how little things sometimes result in bringing about great improvements. A distinguished Senator, according to my informant, who had the courage to erect a residence, was very much annoyed one morning after completing his terrace to find that the pigs had rooted it up, and although he promptly shot one of two of them, he was nevertheless very much exercised; and in going to the Capitol that morning he met my friend, who had endeavored to secure through the city government the removal of the nuisances of which the Senator complained, and stated to him that he proposed to introduce a bill that morning for the removal of the capital. He said that the capital of the United States ought to be located in a city where the municipal government had some public spirit and force enough to make it a place suitable for a residence for the President and Congress. My friend begged him to do nothing of the kind, but suggested that instead he secure the passage of a bill which would give the Board of Health proper power. The Senator agreed to introduce the bill if the gentleman referred to would draw the same, and this was done. So there is found in the act providing a government for the District of Columbia a provision for a Board of Health, whose duty it was to declare what shall be deemed nuisances injurious to health and provide for the removal thereof; to make and enforce regulations to prevent domestic animals from running at large in the cities of Washington and Georgetown, etc., etc. This became a part of the organic law of the new government, and the action of the Senator referred to had much influence in securing that act.

The new government established in 1871 was a territorial one in form. There was a legislature elected by the people and a governor appointed by the President, but the chief feature of the new government was the Board of Public Works, consisting of the governor and four other persons, to be appointed by the President, by and with the advice and consent of the Senate. This board was invested with great powers, and it at once began the improvement of the city of Washington. This government existed until June 20, 1874, one month less than three years, but into this time it injected the delayed activity of three-quarters of a century. It constructed sewers, extended the water works of the city, laid out streets and parks and circles and carried its enthusiastic endeavors to such extent that the general government was petitioned to investigate it, to restrict it in its powers, or to do away with it entirely. The men composing it were subjected to all sorts of abuse and villification; but they made Washington, and the citizens of to-day give the board, and especially Governor Shepherd, the credit of having honestly and patriotically performed their duties. There was no corruption in the board by which the members profited, although there may have been injudicious contracts made by it. The taxes were enormous, and special assessments frightened the people. Outside capital, of course, would have nothing to do with the city. The vast increase of the negro population after the emancipation, and to which reference has been made, now had its economic effect. The immense work performed by the board gave employment to many thousands of the colored citizens.

The territorial government went out by the act of June 20, 1874, when a temporary commission was established on a tentative plan. This form of government became permanent by the act of June 11, 1878, and still exists. Prior to the territorial government and all through the city administrations there had been a constantly increasing debt, although not very large; nevertheless, since the beginning of the city it had not been out of debt. Under the jurisdiction of the Board of Public Works this debt was increased to a vast amount, something like \$24,000,000, and at the time of the assumption of the government by the board of commissioners in 1878, it was about \$21,-



000,000. There have been no additions to the debt of the District under the present form of municipal administration, while on the other hand the debt has been gradually reduced, until at the present time it is \$16,043,920.18.

It was expected that under the rule of the Board of Public Works, carrying out as it did, extensive improvements, values would appreciate rapidly. This was not the case, however. The reason may be found in the attitude of Congress, although the high taxes and special assessments had much to do with the non-appreciation. The property owners in the city of Washington until 1878 felt that there was no stability in values of property in the District. Congress had done but little, as stated, in the way of expenditures from the general treasury for the benefit of Washington. This was a discouraging feature to property holders, while the constant efforts to secure the removal of the capital to some other part of the country prevented confidence in property values, discouraged buyers, and really retarded the development of the city. With the act of 1878 creating the present form of government, Congress declared its policy relative to its duty in sharing the expenses of the government of the District. It had in a way, by the act of May 15, 1820, in the new charter to the city of Washington, provided for the reimbursement to the city of a proportion of the expenses incurred in improving any of the streets or avenues bordering upon or adjoining any of the public squares or buildings, and in some other ways sharing the expense of the city of Washington, but it was really not until 1878 that Congress fully recognized the great fact that Washington was the capital of the United States and not a local city in which the capital was situated. It realized that while it owned a large proportion of the property which was exempt from taxation, it was in duty bound to provide for the government's share in the maintenance and development of the country's capital city. So in a general way it provided for one-half of the local expenses of the District of Columbia and a proportionate share in conducting improvements. Then property values began to appreciate. Then a new industry came into the life of the city—the dealing in real estate.

Up to 1876 the Federal Government had expended in the District of Columbia for public and private purposes, exclusive of salaries, a little over \$92,000,000; since the creation of the new government it has expended about \$110,000,000—that is, in about 22 years it expended more than in the 76 years prior thereto. People found here a pleasant residence for the winter months. They erected handsome buildings—palaces, in fact,—and helped to beautify the city. Values appreciated rapidly. As an instance, the land in the vicinity of the British Embassy was sold in 1870 or 1871 for from 70 to 90 cents a square foot; it rapidly appreciated after 1878 to \$4 and \$5 per foot. Land on G street, in the vicinity of business enterprises, which sold for \$1.50 in 1873 was sold in 1889 at \$15 a foot. This was due to some extent to the removal of many of the business houses from Pennsylvania Avenue to F and G streets, and along F street property which prior to the stable conditions fixed by Congress was worth \$2 or \$3 a foot, and maybe more at times, has been sold for as high as \$40 per foot. Extension of streets under the present liberal policy of Congress and the able administration of the District government have caused values in the suburban districts to appreciate rapidly. Of course, the reverse has taken place in the central portions of the city, where values are more stationary, and will be until some reaction takes place.

These movements for the improvement of the city have given some wag the opportunity to say that the population of Washington is divided into two classes—real estate agents and those who are not—but the usual facetious remark about real estate agents is offset, and more than offset, by the fact that they have been instrumental in a very large degree in carrying on the improvements that make the present city of Washington. They formed the Board of Trade, and the Board of Trade has exerted its influence always in the interest of the prosperity of Washington. They have been courageous in taking great risks and in demonstrating that Washington as a place of residence cannot be excelled. Some of them have profited by their courage and their risks; others, too conservative, have lost. On the whole, however, it is not too much to say that Washington owes a debt to what it likes to call sometimes the “speculators in real estate.”

So the action of government, allied to that of public-spirited men, has made Washington what it is. The Federal Government prevented its development for three-quarters of a century, but its concentrated influence in the last quarter of a century has been of immense value in the District's economic development.

Another factor exists here which makes the economic conditions of Washington unique as compared with those of other municipalities. These influences are varied in their effect. There are employed under the Federal Government in the District of Columbia, in round numbers 20,000 persons, to whom is paid more than \$23,000,000, or an average of a little over \$1100 per capita.<sup>1</sup> These 20,000 persons represent, with themselves, 80,000 of the population. The industry of government, therefore, is at the basis of our economic conditions and our social well-being. The expenditure of this vast sum annually preserves the commercial stability of the city. Industrial depressions, except in their moral effect, do not seriously cripple the business affairs of Washington. The body of citizens to whom this large sum is paid is safely the most intelligent group of employees that can be found in the United States. So large a group, too, representing intelligent men and women, reflects the highest civilization and insists upon the best moral and intellectual conditions. So the churches of Washington flourish, and its schools rank with the first in the land.

It is a reading public that the government supports and I believe that the service this group renders is as efficient and intelligent as is rendered by any class of people; in fact, the integrity of the government itself depends upon the efficiency and honest discharge of the duties of the great mass of government employees. They are very largely property owners and hence interested in the social welfare as well as the economic development of the District. They have had their influence, and no slight one at that, in securing from Congress a recognition of its duties towards the whole body of citizens here. It is they in large degree that made Washington attractive. They are public-spirited and interested not in a temporary way but permanently.

<sup>1</sup> Omitting members of Congress, the per capita compensation is a little over \$1000.

The lack of tenure of office prior to the enactment of the civil service law in January, 1883, was also a disturbing influence relative to values. Since that time, with a reasonably sure tenure, governmental employees have felt warranted in purchasing their homes rather than in living in rented houses. This, of course, has not resulted in an increase of population nor in an increased demand for tenements, but it has resulted in the increased stability of the population here and hence the civil service law has had an effect upon the price and value of real estate. It is one of the elements to be considered in the economic characteristics of the District.

Allied to their interest is that of the people who come here for a few months' residence in the winter. They spend their money here, to be sure, and take a certain interest in the welfare of the city because of their property interests and further, because of their social relations, but they are not influential factors in securing development. Their public spirit must be exercised in other places, where they pay their taxes and have their property and business interests. Their influence here is an indirect one. They help to show their friends the desirability of Washington as a residence and hence it is true that constantly and in a healthy way they influence its development; and it is probably true that they have helped Congress to understand the necessity of doing its share in supporting the District, for they have brought here a public sentiment which has been crystallized in many cases by direct efforts to secure proper legislation. With the great body of taxpayers employed by the Government, they have recognized the justice of the present method. So peculiar conditions surrounding taxations have been understood by them in a way which has resulted in their influence being more powerful often than that of permanent residents.

The total taxable real and personal property<sup>1</sup> in the District of Columbia at the present time is valued, in round numbers, at \$196,500,000. This is only 47½ percent of the property of the District. Over 49 percent of the real estate belongs to the United States and is exempt from taxation. Two and one-third

<sup>1</sup>The grand total valuation of all property in the District of Columbia is about \$408,000,000, of which 47½ percent is taxable.

percent is church and school property, also exempt from taxation. So without the fair and just assumption of a share of expenses by Congress, all the expenses of the District would fall upon 47½ percent of the property, the remainder being held for the benefit of the United States. Property holders soon saw the justice and the fairness of the United States paying its share of the expenses. In the light of this state of affairs there were the great forces at work to secure justice—the old property owners and real estate men who were projecting improvements, the great body of employees in the city, in so far as they were taxpayers, and those citizens from abroad who came here to spend their winters and who paid taxes on their property.

With stable economic conditions, the cessation of retarding influences through the agitation of the removal of the capital, with a well-employed constituency, with the best street-car service in the United States, with excellent markets and sources of supply, with ample banking facilities, with strong local insurance companies and opportunities for savings through savings banks and building and loan associations, with the general cost of living as favorable as in other localities, with the attractive suburban developments that are going on, with the extension of streets and the beautification of squares and circles, the District of Columbia, it may be said, now has few, if any, economic problems demanding solution.

The District is one of the most industrious places in the country. In the United States at large nearly 48 percent of the population over 10 years of age are engaged in some remunerative occupation. In the District of Columbia over 53 percent of its population over 10 years of age are so engaged. This is the more remarkable, because the great body of colored people residing here constitute one-third of the total population. They have a few representatives in the clerkships of the Government; they have their professional men, and old families of means and standing—in fact, an aristocracy, which is commendable for its intelligence and progressive ways—but the great body of colored people is excluded in a large degree from the higher lines of service. They must earn their living in a hand-to-mouth manner, and in the ordinary occupations connected with com-

mon labor. This state of affairs constitutes an economic problem. Probably any forced attempt to solve it will not succeed. The schools are doing much in teaching the young how to earn a living. This is well, and in this probably lies the chief means the public can take to solve this particular question. The ordinary business of the town, its local manufactures, etc., offer employment, but the industrial development of Washington does not offer, for the future, sufficient opportunity for the absorption of this great body of our citizens to an extent which will relieve the congestion of common labor. So far there have been no especially unhappy results, but as time goes on the District will have to meet the problem of a constantly increasing body of laborers not met by a constantly increasing industrial development; for the development of the District of Columbia will be as peculiar and as unique in the future as it has been in the past.

This economic position is approached more fairly from the sociological side than from the purely industrial point of view. Wages are higher here, on the whole, than in any other part of the country, so far as skilled labor is concerned, and so far as the clerical work of the Departments is taken into consideration, compensation is much greater than in private business. These two elements offset the element of common labor, and brings an equalization which may prevent any general economic disturbance.

The dream at the beginning of the history of the District of Columbia, that the capital city of the nation would become a great commercial emporium, has not been realized—it probably never will be—and it is well, it seems to me, that it has not been, not that trade and commerce are not right and grand in themselves, nor that mechanical industry has not a civilizing influence, but in the case of Washington, except, perhaps, the suburbs, it is well that the city should develop as the capital of the nation. It is the only instance of any importance where the capital city grew from the rough. I know of no instance of such an experience in foreign lands. As it has grown without industry, without commerce, is it not well to preserve Washington as the center of legislative action, of scientific development, of art, and of education? It can prosper on these lines, and the country at large, I believe, will gladly support and encourage it in its future grand development.

## TABLES.

Population of District of Columbia, with increase, from 1800 to 1890.

[Formed March 30, 1791.]

Census Years.	Popula- tion.	Increase.		Census Years.	Popula- tion.	Increase.	
		No.	P. Cent.			No.	P. Cent.
1800	14,093			1850	51,687	7,975	18.24
1810	24,023	9,930	70.46	1860	75,080	23,393	45.26
1820	33,039	9,016	37.53	1870	131,700	56,620	75.41
1830	39,834	6,795	20.57	1880	177,624	45,924	34.87
1840	43,712	3,878	9.74	1890	230,392	52,768	29.71

White and colored population of District of Columbia, from 1800 to 1890.

Census Years.	Aggregate Population.	White.	Colored.		
			Total.	Free.	Slave.
1800	14,093	10,066	4,027	783	3,244
1810	24,023	16,079	7,944	2,549	5,395
1820	33,039	22,614	10,425	4,048	6,377
1830	39,834	27,563	12,271	6,152	6,119
1840	43,712	30,657	13,055	8,361	4,694
1850	51,687	37,911	13,746	10,059	3,687
1860	75,080	60,763	14,317 <sup>1</sup>	11,132 <sup>1</sup>	3,185
1870	131,700	88,278	43,422 <sup>2</sup>	.	.
1880	177,624	118,006	59,618 <sup>3</sup>	.	.
1890	230,392	154,695	75,697 <sup>4</sup>	.	.

Increase in white and colored population of District of Columbia, from 1800 to 1890.

Census Periods.	White.		Colored.	
	Number.	Per Cent.	Number.	Per Cent.
1800 to 1810	6,013	59.74	3,917	97.27
1810 to 1820	6,535	40.64	2,481	31.23
1820 to 1830	4,949	21.88	1,846	17.71
1830 to 1840	3,094	11.23	784	6.39
1840 to 1850	7,284	23.76	691	5.29
1850 to 1860	22,822	60.15	571	4.15
1860 to 1870	27,515	45.28	29,105	203.29
1870 to 1880	29,728	33.68	16,196	37.30
1880 to 1890	36,689	31.09	16,079	26.97

<sup>1</sup> Includes 1 Indian.<sup>2</sup> Includes 3 Chinese and 15 Indians.<sup>3</sup> Includes 13 Chinese, 4 Japanese, and 5 Indians.<sup>4</sup> Includes 91 Chinese, 9 Japanese, and 25 Indians.

Percentage of white and colored of total population of District of Columbia, from 1800 to 1890.

Census Years.	White.	Colored.	Census Years.	White.	Colored.
1800	71.43	28.57	1850	73.41	26.59
1810	66.93	33.07	1860	80.93	19.07
1820	68.45	31.55	1870	67.03	32.97
1830	69.19	30.81	1880	66.44	33.56
1840	70.13	29.87	1890	67.14	32.86

Population of Alexandria, Virginia, from 1790 to 1890.

Census Years.	Population.	Census Years.	Population.
1790	2,748	1850	8,734
1800	4,971 <sup>1</sup>	1860	12,652
1810	7,227 <sup>1</sup>	1870	13,570
1820	8,218 <sup>1</sup>	1880	13,659
1830	8,263 <sup>1</sup>	1890	14,339
1840	8,459 <sup>1</sup>		

Population of Georgetown, District of Columbia, from 1810 to 1890.

Census Years.	Population.	Census Years.	Population.
1810	4,948	1860	8,733
1820	7,360	1870	11,384
1830	8,441	1880	12,578
1840	7,312	1890	14,046
1850	8,366		

True valuation of real and personal property, total and per capita, in District of Columbia, from 1850 to 1890.

Census Years.	Total Valuation.	Per Capita.	Per Capita U. S.
1850	\$ 14,018,874	\$ 271	\$ 308
1860	41,084,945	547	514
1870	126,873,618	963	780
1880	220,000,000	1,239	870
1890	343,596,733	1,491	1,036 <sup>2</sup>

<sup>1</sup> Part of District of Columbia; ceded to Virginia, July 9, 1846.

<sup>2</sup> In computing this per capita the true valuation of Indian Territory is excluded.



Value of real property in District of Columbia as assessed for taxation, from 1871 to 1899, inclusive.

[From Report of Assessor for District.]

Years.	Washington.	Georgetown.	County.	Total.
1871	\$66,818,886	\$6,213,467	\$6,965,101	\$79,997,454
1872	62,421,331	6,036,434	6,500,000	74,957,765
1873	72,880,380	6,366,488	8,623,056	87,869,924
1874	80,539,782	6,272,010	9,621,280	96,433,072
1875	82,292,906	6,312,099	9,270,036	97,875,041
1876	78,818,034	5,849,317	8,784,433	93,452,684
1877	81,246,847	5,953,932	8,728,622	95,929,401
1878	83,101,484	6,028,041	8,480,365	97,609,890
1879	75,555,801	5,242,224	6,693,417	87,491,442
1880	76,085,940	5,291,313	6,603,103	87,980,356
1881	77,256,610	5,282,096	6,414,372	88,953,078
1882	78,515,793	5,266,943	6,525,759	90,308,495
1883	80,615,448	5,307,116	6,611,101	92,533,665
1884	80,293,418	4,013,888	6,541,368	90,848,674
1885	82,825,255	4,074,358	6,602,851	93,502,464
1886	85,132,151	4,160,222	6,760,956	96,053,329
1887	99,383,486	4,741,540	7,172,075	108,302,101
1888	99,430,297	4,908,345	7,406,186	111,744,830
1889	102,886,043	4,987,632	7,611,678	115,485,353
1890	119,613,603	5,395,021	12,617,795	137,626,419
1891	123,110,219	5,550,976	12,948,696	141,609,891
1892	126,383,584	5,682,676	13,415,018	145,481,278
1893	138,104,771	5,796,237	13,123,268	147,024,276
1894	160,269,876	7,623,070	23,524,858	191,417,804
1895	161,054,761	7,751,615	23,748,670	192,555,046
1896	165,399,819	. . . . .	23,522,524	188,922,343
1897	156,854,384	. . . . .	23,522,524	180,376,908
1898	158,532,366	. . . . .	22,723,918	181,256,284
1899	159,559,921	. . . . .	23,596,450	183,156,371

Value of personal property in District of Columbia assessed for taxation, from 1877 to June 30, 1899, inclusive.

[From Report of Assessor for District.]

Years.	Assessed Value.	Years.	Assessed Value.
1877	\$15,429,873	1889	\$11,728,672
1878	17,239,051	1890	11,023,167
1879	13,336,920	1891	11,697,650
1880	11,421,431	1892	11,826,190
1881	10,895,712	1893	12,045,290
1882	9,666,272	1894	11,206,364
1883	9,028,812	1895	11,449,485
1884	11,311,622	1896	10,971,737
1885	12,795,934	1897	9,532,851
1886	12,658,949	1898	9,780,658
1887	11,934,245	1899	13,431,475
1888	10,943,458		



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THE POLITICAL DEVELOPMENT OF THE DISTRICT  
OF COLUMBIA.<sup>1</sup>

BY HENRY E. DAVIS.

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THE District of Columbia is unique among the social communities of the world. The political center of a people which threw into the sea the tea which must bear a tax in the levying of which that people had no voice; the capital of a nation born of the declaration that taxation without representation sounds a note having no place in the harmony of freedom; the very ultimate product of the spirit which produced among the powers of the earth the one which proclaimed as its reason to be that all governments derive their just powers from the consent of the governed, it yet is bearing without murmur taxes the levying of which it cannot affect in the slightest degree, and has no effec-

<sup>1</sup> Read before the Washington Academy of Sciences, April 29, 1899.

tive voice in the making of the laws by which it is governed. Nevertheless, the District of Columbia is the best governed community of its day and generation.

The reason of this presents the most interesting question possible to the student of sociology, and makes that question the most difficult possible of apprehension by the superficial observer: a question not softened in its difficulties by the fact that the District has come to be what it is in the face of executive and judicial notice of its anomaly in the early days of its history. In his second annual message to Congress in 1818, President Monroe spoke as follows:

The situation of this District, it is thought, requires the attention of Congress. By the Constitution, the power of legislation is exclusively vested in the Congress of the United States. In the exercise of this power, in which the people have no participation, Congress legislate in all cases directly on the local concerns of the District. As this is a departure, for a special purpose, from the general principles of our system, it may merit consideration whether an arrangement better adapted to the principles of our Government and to the particular interests of the people may not be devised which will neither infringe the Constitution nor affect the object which the provision in question was intended to secure.

And in 1820, in the case of *Loughborough v. Blake* (5 Wheaton, 317, 323-5), the Supreme Court of the United States which had been appealed to to declare, in effect, that the government of the District of Columbia, in that it involved taxation without representation, was contrary to the spirit of our institutions, disposed of the matter in these words:

If, then, the language of the Constitution be construed to comprehend the Territories and District of Columbia, as well as the States, that language confers on Congress the power of taxing the District and Territories as well as the States. If the general language of the Constitution should be confined to the States, still the 16th paragraph of the 8th section [of Article 1], gives to Congress the power of exercising "exclusive legislation in all cases whatsoever within this District."

On the extent of these terms, according to the common understanding of mankind, there can be no difference of opinion; but it is contended that they must be limited by that great principle which was asserted in our Revolution that representation is inseparable from taxation.

The difference between requiring a continent, with an immense population, to submit to be taxed by a Government having no common interest with it, separated from it by a vast ocean, restrained by no principle of appointment and associated with it by no common feelings and permitting the representatives of the American people, under the restrictions of our Constitution, to tax a part of the society, which is either in a state of infancy advancing to manhood, looking forward to complete equality so soon as that state of manhood shall be attained, as is the case with the Territories; or which has voluntarily relinquished the right of representation and has adopted the whole body of Congress for its legitimate government, as is the case with the District, is too obvious not to present itself to the minds of all. Although in theory it might be more congenial to the spirit of our institutions to admit a representative from the District, it may be doubted whether, in fact, its interests would be rendered thereby the more secure; and certainly the Constitution does not consider its want of a representative in Congress as exempting it from equal taxation.

It is thus seen that the American people have not allowed their capital to become what it is in ignorance of what was happening; and it is my pleasant task to review today the steps by which the result which you see about you came to be.

As is well known, the establishment of the District as a political entity came about through events which, for want of a more philosophical expression, or rather, in the absence of reflection, we denominate fortuitous, but which, in their analysis and results are entitled to be deemed truly Providential. Superficially speaking, and judged by the act at the time, by way of composing certain controversies, which now interest us historically only, the territory contributed originally by Maryland and Virginia was chosen as the site of the Federal Capital; and by way of avoiding the possibility of disturbances such as beset the national authorities when domiciled in Philadelphia, there was written into the 8th article of the Federal Constitution that supremely wise provision that "the Congress shall have power \* \* to exercise exclusive legislation in all cases whatsoever, over such District (not exceeding ten miles square), as may, by cession of particular States, and the acceptance of Congress, become the Seat of the Government of the United States."

As is equally well known, this territory, originally ceded by Maryland and Virginia, in fact comprised ten miles square, or one hundred square miles in all. The legislative acts of Maryland and Virginia providing for the cession were passed respectively December 23, 1788, and December 3, 1789, and the first Act of Congress on the subject was approved July 16, 1790, an amendment thereof being approved March 3, 1791. The earlier Act of Congress, that of 1790, accepted for the permanent seat of the Government of the United States a district of territory not exceeding ten miles square, to be located on the river Potomac between the mouths of the Eastern Branch and Conogocheague, the same to be laid out by commissioners provided for by the Act; and it provided that by the first Monday in December, 1790, all offices attached to the seat of Government of the United States should be removed (from New York) to Philadelphia, and there remain until the first Monday in December, 1800, on which day the seat of Government of the United States should be transferred to the district and place aforesaid, and all offices attached to the said seat of Government, accordingly, be removed thereto by their respective holders, and after said day cease to be exercised elsewhere. The later act of Congress, that of 1791, amended the earlier act by providing that the whole of the contemplated district need not be located above the mouth of the Eastern Branch, but that a part of it might be located below the said limit and include, with other territory, the city of Alexandria, Virginia. On January 24, 1791, President Washington proclaimed a tentative location of the District by metes and bounds, and afterwards, and on March 30, 1791, he proclaimed the metes and bounds as fixed in accordance with the act of Congress of that year. This latter proclamation located the District of Columbia as it existed until, in conformity with the act of Congress of July 9, 1846, the Virginia portion was retroceded to the State of Virginia, and from the date of this retrocession (which became an accomplished fact only upon the vote of the people of the county and town of Alexandria in manner prescribed by the act), the District of Columbia has consisted exclusively of the territory, about sixty-four square miles in extent, originally ceded by

the State of Maryland. In accordance with the provisions of the act of Congress of April 24, 1800, which authorized the President to direct the removal of the offices of the government to the District at any time that he might judge proper after the adjournment of the then present session of Congress, those offices were so removed, and the government of the people of the United States made its permanent home on the banks of the Potomac.

I might, doubtless, in this presence have avoided going thus into detail, but I have had an object in so doing; for in order to indicate fully the matters entering into the political development of the District it is necessary for us to know at how many points the principles of political science have touched us in our birth and growth; for, odd as it may seem, the situation demands treatment from the top, instead of from the bottom, which latter is the natural and proper order. For as between local and inter-local law the former is naturally the first to be considered; and that form of inter-local law which we call international is the latest of all. Yet, as I am to deal with the political development of the District of Columbia as it now is, I must first get rid of so much of the District as formerly was, but now is not. This demands a word as to the political make-up of the original District, and leads to a consideration first of inter-local or international law as bearing upon our subject.

It is a cardinal rule of international law that whenever there is a change of sovereignty only, the laws of the territory subjected to the new sovereignty continue until duly changed by that sovereignty. It is no exception to this rule to say that such laws may be changed by the treaty or other act occasioning the change of sovereignty, for this is the same as to say that the former laws are duly changed. In the original act of Maryland relating to the cession of its portion of the District of Columbia (the act of 1788), that State provided only that its representatives in Congress should cede "to the Congress of the United States" any district in the State not exceeding ten miles square which Congress might fix upon and accept for the Seat of Government of the United States. But after the territory of Columbia had been definitely located, the General Assembly of Maryland by act of December 19, 1791, in addition to making sundry

provisions in relation to the territory in general and the city of Washington in particular, enacted specifically as follows :

That all that part of the said territory, called Columbia, which lies within the limits of this state, shall be and the same is hereby acknowledged to be forever ceded and relinquished to the congress and government of the United States, in full and absolute right, and exclusive jurisdiction, as well of soil as of persons residing, or to reside, thereon, pursuant to the tenor and effect of the eighth section of the first article of the constitution of government of the United States: PROVIDED, That nothing herein contained shall be so construed to vest in the United States any right of property in the soil, as to affect the rights of individuals therein, otherwise than the same shall or may be transferred by such individuals to the United States: AND PROVIDED ALSO, That the jurisdiction of the laws of this state, over the persons and property of individuals residing within the limits of the cession aforesaid, shall not cease or determine until congress shall by law provide for the government thereof, under their jurisdiction, in manner provided by the article of the constitution before recited.

Similarly, the State of Virginia, in making cession of its part of the original District enacted :

That nothing herein contained shall be construed to vest in the United States any right of property in the soil, or to affect the rights of individuals therein, otherwise than the same shall or may be transferred by such individuals to the United States.

AND PROVIDED ALSO, That the jurisdiction of the laws of this commonwealth over the persons and property of individuals residing within the limits of the cession aforesaid, shall not cease or determine until congress, having accepted the said cession, shall, by law, provide for the government thereof, under their jurisdiction, in manner provided by the article of the Constitution before recited.

As is thus apparent, the acts of Maryland and Virginia provided for the continuance in the two portions of the newly-formed District of the laws of those States respectively until provision should be made by the Congress of the United States for the Government of the District. And when Congress came to deal with the matter, duly observing the rule of international law above noted, and not being ready to make new law in the premises, it enacted as follows on February 27, 1801 (2 Stats. 103) :



That the laws of the State of Virginia, as they now exist, shall be and continue in force in that part of the District of Columbia, which was ceded by the said State to the United States, and by them accepted for the permanent seat of government; and that the laws of the State of Maryland, as they now exist, shall be and continue in force in that part of the said District, which was ceded by that State to the United States, and by them accepted as aforesaid.

This enactment of Congress left the two portions of the original District where they were at the time of its creation, and but for the act of retrocession of the Virginia portion my task would be much enlarged. As it is, however, we have now to do with only the Maryland portion, and to that I ask your attention.

As you look at the map, you observe that where it washes the District of Columbia the Potomac river runs almost due south, though with some bearing towards the east, and that the uppermost and lowermost points of the original square of the District are due north and south from one another; and that the present territory of the District is bounded on its eastern sides by the Maryland county of Prince George and on its northern and western sides by the county of Montgomery. So also you will observe that below the county of Prince George in Maryland lie the counties of Charles and St. Mary, and that all three of these counties, Prince George, Charles and St. Mary are situated between the Potomac river on the west and the Patuxent river on the east. Originally the county of St. Mary was the only county of Maryland west of the Patuxent river, and in contemplation of law it comprised the whole of the State west of that stream. From April 23, 1696 (Act of 1695, ch. 13), however, the northern boundary of the county was fixed by a line drawn from Bud's Creek on the Potomac to Indian Creek on the Patuxent, and the land above this line and as far up as Mattawoman and Swanson creeks and branches constituted the county of Charles, and all the land above Charles constituted the county of Prince George, so named because the 23d day of April is St. George's day. The present District of Columbia, was, accordingly, at first wholly within this county.

In 1748 (Act of 1748, ch. 14), it was provided that as of the

date December 10th of that year there should be erected out of Prince George county a new county named in honor of Prince Frederick, son of George II, and "beginning at the lower side of the mouth of Rock creek and thence by a straight line joining to the east side of Seth Hyatt's plantation to the Patuxent river." This new county embraced part of the present county and original City of Washington and all that part of the present City of Washington formerly known in law, and still colloquially known as Georgetown; the remainder of the present District continuing in Prince George county.

On September 6, 1776, the Revolutionary, or Provincial, Convention of Maryland, erected out of Frederick county two other counties named respectively after Generals Washington and Montgomery, the boundaries of the latter beginning at the east side of Rock Creek and running thence with the Potomac River to the mouth of the Monocacy, thence to Par spring and thence with the line of the original Frederick county to the place of beginning. This, it is seen, threw Georgetown and part of the remainder of the present District into the new county of Montgomery, and thus, at the time of the creation of the District of Columbia the Maryland portion, that is to say all of the present District, comprised parts of Prince George and Montgomery counties.

The interest of this seemingly unnecessary detail lies in the fact that the beginnings of the local government of the District were in these respective counties, and the political development of the District starts with the institutions in existence therein. I regret that time forbids my giving you a complete picture of a Maryland county government in those early days, but I must forego the temptation to do so. I must, however, ask attention to some features of that government, for the reason that those features survived in the District until within a very few years, as we shall presently see.

Maryland, as we all know, was settled in March, 1634, upon the landing of the first emigrants at St. Mary. Those emigrants brought with them the principles of law and government of the mother country and the charter of Maryland establish-

ing a palatinate under the all but royal rule of Lord Baltimore. Again I must resist a temptation: the temptation, namely, to give you a glimpse of the system of manors and hundreds prevailing throughout the Province, and to tell you the very interesting story of the early assemblies of the freemen, their make-up, proceedings and the rest. It must suffice, however, that I point out to you the fact that, in the absence of the Lord Proprietary of the Province, the general executive powers were vested in the Governor or Lieutenant General, while the general legislative powers (subject to the approval of the Lord Proprietary and liable to the disapproval of the crown), were vested in the general assembly of the freemen of the Province; and quite from the beginning there was a Lord Chief Justice of the Province. The affairs of the Province were managed by these various officials and the Assembly, but as early as the Session of 1638-9 a system of Government of the Counties was inaugurated, and in this system began the local government of the District of Columbia.

For in March of that year, more than two hundred and sixty years ago, there was introduced into the Assembly the bill out of which grew the Maryland County Court, the predecessor in certain of its features of the Levy Court so familiar to those of us of the District who are not sensitive about our ages: for the Levy Court of the County of Washington and District of Columbia was a living body until the first day of June, 1871, less than twenty-eight years ago.

The bill so introduced into the Assembly so many years ago, and which ultimately became a law, is a perfect illustration of the way in which all Anglo-Saxon institutions have grown up. You will recall that in the beginning of the English judicial system the King, as the fountain of justice, was the ultimate judge, and that he first appointed justiciars or justices to aid him in his judicial work, and then, in the person of that very greatest of all English monarchs, Henry II, sent certain persons, constituted justices for that purpose, into the several shires or counties of England to hold court and administer justice for him. Similarly, our legal ancestors of Maryland, sitting in that early assembly at St. Mary in 1638-9, provided that all

causes of a general nature should be heard in the several parts of the state in a county court by the Chief Justice of the Province for the time being, "or" as the bill read, "by and before such other commissioner or commissioners as the Lord Proprietary of this Province or the Lieutenant General shall authorize to hear and determine the same." The bill further provided for a register to attend each session of the County Court and that "the said Chief Justice or Commissioners for the time being and the said register shall be a court of record and shall be called the County Court, and the said court shall or may have, use, exercise and enjoy all or any the same or the like powers, privileges, authorities and jurisdictions within this Province (in the causes aforesaid), as one of the King's courts of common law in England useth or may use and exercise within the realm of England (except where it is otherwise provided by any law of this Province)." To this Court, or, more accurately, to the Commissioners provided by the enactment, was committed the management of local affairs generally, including the making of levies for the public charges and expenses.

Not to go into unnecessary detail, it may be said generally that from this time forth it was the practice for the Commissioners of the several counties, or of the several county courts, as they were indifferently styled in subsequent enactments, to make all necessary levies for the public charges and expenses and to administer the various county affairs. In some instances the levies were made upon the counties and in others upon the several hundreds within the counties, and in every instance the levy was upon the taxable freemen or upon such freemen and the "visible estates in the Province."

In later years the duties of the County Commissioners in respect of the levies were performed by the justices of the peace, who had also been provided for at the same time as the county court; and by a gradual process, but one in entire harmony with the manner of growth of all institutions under our English system, the justices of the peace wholly supplanted the Commissioners in the respect under consideration; until finally the meeting of the justices of the peace for the purpose indicated came to be designated as Levy Courts, and in 1794 (Act of 1794, ch. 53),

we find the Assembly speaking of the Levy Courts as definitely established bodies, and providing that such courts may impose assessments for repairs of their court-houses and the county prisons, and for the erection and repair of bridges; and, further, that the justices of the peace in the respective counties, or any five of them, shall meet annually between the first of March and the first of October "to adjust the ordinary and necessary expenses of their several counties," and to levy the necessary and proper assessments in the premises; and finally, so far as we have to do with Maryland in the matter, in 1798 (Act of 1798, ch. 34), it was enacted that seven justices of the peace of those annually commissioned should be commissioned by the Governor and Council as justices of the Levy Court in each county, and designated in their commissions as 'Justices of the Levy Court.'

Accordingly, when on February 27, 1801, Congress assumed jurisdiction over the District of Columbia, its government was in the hands of such a Levy Court, or, speaking accurately, of two of such Courts, one each for the counties of Prince George and Montgomery, except as to that portion of the District, or Montgomery County as it then was, which was occupied by the town of Georgetown, for which, as we shall presently see, a separate municipal government had already been provided.

Again following the course of things under the English system, when Congress assumed jurisdiction over the present District of Columbia, which was created a county by the name of Washington (as the Virginia portion of the original District was created a county by the name of Alexandria), provision was made for the appointment by the President of officers familiar to the people of the territory, including the constituents of a Levy Court, namely, justices of the peace, and by act of March 3, 1801 (2 Stats. 115), it was specifically enacted:

That the magistrates, to be appointed for the said district, shall be and they are hereby constituted a board of commissioners within their respective counties, and shall possess and exercise the same powers, perform the same duties, receive the same fees and emoluments, as the levy courts or commissioners of county for the state of Maryland, possess, perform and receive; and the clerks and collectors, to be by them appointed, shall be subject to the same laws, perform the same duties, possess the

same powers, and receive the same fees and emoluments as the clerks and collectors of the county tax of the state of Maryland are entitled to receive.

In accordance with this enactment the Levy Court of the County of Washington was organized and carried on its operations in accordance with the Maryland system. On July 1, 1812 (2 Stats. 771), Congress conferred certain specific powers upon the body, or "the board of commissioners or levy court for the county of Washington," as the language of the act is, and provided that thereafter the board of court should be composed of seven members to be designated annually by the President from among the existing magistrates of the county, two to be from the county east of Rock creek and outside of the city of Washington, two from the county west of Rock creek and outside of the city of Georgetown, and three from the city of Georgetown. "Taxation without representation" still pursued the city of Washington; for while it had no representative in the Levy Court, it was required by the same act to bear one-half of all the general county expenses and charges other than those for roads and bridges. But in 1848 (9 Stats. 223, 230), this was righted by the provision by Congress for the appointment annually of four additional members of the court from the city of Washington, so that thereafter the court should consist of eleven members.

The Act of August 11, 1856 (11 Stats. 33), authorized the Court to appoint School Commissioners, and provided fully for a system of schools in the county, prescribing the powers and duties of the Levy Court in relation thereto. By Act of May 3, 1862 (12 Stats. 383), the Court was given further specific powers, and the requirement that its members should be appointed from among the justices of the peace was repealed. And by Act of May 3, 1863 (12 Stats. 799), entitled "An Act to define the Powers and Duties of the Levy Court of the County of Washington, District of Columbia, in regard to Roads, and for other Purposes," which was in effect a code in relation to the county, Congress made full provision for the Court, defining accurately its jurisdiction and duties and reducing the number of its members to nine, who were provided to be

appointed by the President and confirmed by Senate, and to hold office for three years; of the members to be first appointed one-third to be appointed for one year, one-third for two years and one-third for three years, so that the body might be kept continuous and permanent.

There are several subsequent acts conferring certain powers on the Court and regulating its action in given cases, but the character and importance of the Court were in no wise affected thereby, and until its abolition in 1871, it remained substantially as fixed by the Act of 1863.

The character of this body cannot be better stated than in the language of Mr. Justice Miller of the Supreme Court of the United States, speaking for that Court in the case of *Levy Court v. Coroner* (2 Wall. 501, 507-8) as follows:

The Levy Court is the body charged with the administration of the ministerial and financial duties of Washington County. It is charged with the duty of laying out and repairing roads, building bridges, and keeping them in good order, providing poor-houses, and the general care of the poor; and with laying and collecting the taxes which are necessary to enable it to discharge these and other duties, and to pay the other expenses of the county. It has the capacity to make contracts in reference to any of these matters, and to raise money to meet these contracts. It has perpetual succession. Its functions are those which, in the several States, are performed by "county commissioners," "overseers of the poor," "county supervisors," and similar bodies with other designations. Nearly all the functions of these various bodies, or of any of them, reside in the Levy Court of Washington. It is for all financial and ministerial purposes the County of Washington.

I have said that at the time Congress assumed jurisdiction over the District, and the Levy Court went into operation for the County of Washington as a separate territory, there had already been created a separate municipal government for Georgetown. The history of this government is not less interesting than that of the Levy Court.

Certain of the inhabitants of Frederick County having set forth in a petition to the Assembly of Maryland that there was a convenient place for a town on the Potomac, above the mouth of Rock Creek, and praying that sixty acres of land might there

be laid out and erected into a town, the assembly by Act of June 8, 1751 (ch. 21), appointed seven commissioners to buy the necessary land and lay out the same in eighty lots, to constitute a town by the name of Georgetown. The act provided no government for the new town, which remained subject to the Levy Court of the County of Frederick, except that the Commissioners were empowered to remove nuisances from the streets and alleys (Sec. 13), and except also as appears in the following interesting breath from the past (Sec. 12):

AND WHEREAS it may be advantageous to the said town to have fairs kept therein, and may prove an encouragement to the back inhabitants, and others, to bring commodities there to sell and vend; *Be it Enacted*, That it shall and may be lawful for the Commissioners of the said town, to appoint two fairs to be held therein annually, the one fair to begin on the second Thursday in April, and the other on the first Thursday in October, annually; which said fairs shall be held each for the space of three days; and, that during the continuance of such fair or fairs, all persons within the bounds of the said town shall be privileged and free from arrests, except for felony, and breach of the peace; and all persons coming to such fair or fairs, or returning therefrom, shall have the like privilege of one day before the fair, and one day on their return therefrom; And the Commissioners for the said town, are hereby empowered to make such rules and orders for the holding of the said fairs, as may tend to prevent all disorders and inconveniences that may happen in the said town, and such as may tend to the improvement and regulating of the said town in general: so as such rules, except in fair-time, affect none but livers in the said town, or such person or persons as shall have a lot or freehold therein; any law, statute, usage, or custom, to the contrary notwithstanding; Provided always, That such rules and orders be not inconsistent with the laws of this province, nor the statutes or customs of Great Britain.

And as showing that the feudal system was not yet fully dead, witness the following further provision of this Act (Sec. 15):

That all and every person and persons taking up and possessing the lots aforesaid, or any of them, shall be, and are hereby, obliged to pay unto the right honorable the lord proprietary, his heirs or successors, the yearly rent of one penny sterling money for each respective lot by them so taken up and possessed, to be paid in the same manner as his land rents in this province now are, or hereafter shall be paid.



By Act of December 26, 1783 (Chap. 27), provision was made for Beall's Addition to the town of sixty-one acres of the tract known as the Rock of Dumbarton, and by Act of January 22, 1785 (Acts of 1784, Ch. 45), similar provision was made for Peter, Deakins, Beatty and Threlkeld's Addition of about twenty and one-half acres of the several tracts bearing the attractive names of Frogland, Discovery, Conjuror's Disappointment and Resurvey on Salop.

At last, on Christmas Day 1789 (ch. 23), the Assembly incorporated the town, which by this time had fallen within Montgomery County. The act of incorporation is interesting in many particulars. Thus, in part imitation of the Charter of London, the town as a body corporate was made to consist of a mayor, recorder, six aldermen and ten common council-men, and was given the corporate name of "The Mayor, Recorder, Aldermen and Common Council;" and the act appointed by name the first Mayor, Recorder and Aldermen, leaving the common council-men to be elected by a *viva voce* vote of the qualified freemen, and providing for the annual election of a mayor from among the aldermen and for filling vacancies in the several offices. The Recorder and all the aldermen and common council-men were to hold office during good behavior; the Recorder was always to be "a person learned in the law," and vacancies in the board of aldermen were to be filled by election from among the common council-men. The Mayor, Recorder, and Aldermen were constituted justices of the peace and given power to elect a sheriff and appoint constables and other necessary officers for the town, and were also required to hold a court to be called the Mayor's Court, the jurisdiction of which was specifically defined; and other municipal powers were granted to the corporation. By subsequent legislation (*e. g.* 1797, ch. 56, 1799, ch. 85), the tenure of the officers was limited in time, the limitation of the choice of Mayor to be from among the Aldermen was removed, additional powers were given the corporation, and the limits of the town were variously enlarged, altered and more clearly defined.

By its first act on the subject, that of March 3, 1805 (2 Stats. 332), Congress amended the charter of Georgetown by provid-

ing that after the second Monday in March of that year the corporation of the town should be divided into two branches, the first to be composed of five members and a recorder, and called 'The Board of Aldermen,' and the second to be composed of eleven members and called 'The Board of Common Councilmen,' all to be elected. The first election was provided to be by the then existing members of the corporation, who should choose five of their number to compose the Board of Aldermen, the remainder to be the Board of Common Councilmen and all to remain in office until the fourth Monday of February following. The then Recorder was to be president of the Board of Aldermen until the same day, and the then Mayor to remain in office until the first Monday of January following. For the future, Aldermen and Common Councilmen were to be elected by the people, the former for two years and the latter for one year; while the two branches by joint ballot were annually to elect a Mayor and Recorder, the latter still to be a "person learned in the law." The act defined the powers and territorial jurisdiction of the corporation, provided for the filling of vacancies in the several offices, and contained other useful provisions. Finally, by Act of May 31, 1830 (4 Stats. 426), Congress provided for the election of the Mayor by the people on the same day as the councilmen were chosen, and fixed the tenure of his office at two years; and provided for filling a vacancy in the office by the two branches until the next regular election. And, in the meanwhile, by the Act of May 20, 1826 (4 Stats. 183), Congress had deprived the Levy Court of the County of Washington of the power to assess any tax in Georgetown, so that the latter city from this time on stood as a quite fully equipped and independent Municipal Corporation, retaining its powers until 1871, and its separate name until the passage of the Act of 1895, hereafter to be noticed.

Turning now to the City of Washington, it has already been pointed out that Congress effectively assumed jurisdiction over the District of Columbia by the Act of February 27, 1801 (2 Stats. 103). At that time there was, of course, no such thing as a corporation of the City of Washington; nor was there un-

til after the passage of the Act of Congress of May 3, 1802 (2 Stats. 195). By the Act for establishing the temporary and permanent seat of government of the United States, approved July 16, 1790 (1 Stats. 130), a board of three Commissioners was provided for, which board was charged with the duty of surveying, defining and limiting the district to be accepted for the permanent seat of government, and providing suitable government buildings. These officials were called in the later Act of April 24, 1800 (2 Stats. 55), "the Commissioners of the City," and were recognized as being in effect entrusted with the affairs of the city in general. By Act of Congress of May 1, 1802 (2 Stats. 175), this board of commissioners was abolished and the affairs of the City of Washington, which had heretofore been under the care and superintendence of the said commissioners, were put under the direction of a superintendent, to be appointed by and to be under the control of the President of the United States; which superintendent was vested with the powers and charged with the duties formerly vested with or required to be performed by the said commissioners by virtue of any Act of Maryland or of Congress, or the deeds of trust from the original proprietors of the lots in the City, or in any other manner whatsoever.

By act of April 29, 1806 (3 Stats. 324), the office of this Superintendent was abolished and its powers and duties, as also the duties of the earlier board of three commissioners, were devolved upon one commissioner, thereafter known as the commissioner of public buildings; and by act of March 2, 1867 (14 Stats. 466), the office of this commissioner was in turn abolished and those powers and duties devolved upon the Chief of Engineers of the Army.<sup>1</sup>

By the Act of May 3, 1802 (2 Stats. 195), Congress provided that the inhabitants of the City of Washington should be a corporation "by the name of a Mayor and Council of the City of

<sup>1</sup>A complete and accurate account of the creation of the City of Washington as the Federal City, including a full exposition of the manner in which and the terms on which the lands for the purpose were conveyed to the original commissioners, may be found in the opinion of the Supreme Court of the United States in the case of *Morris v. United States* (commonly called the 'Potomac Flats Case'), decided May 1, 1899. (174 U. S. 196).

Washington," and that the city should be divided into three divisions or wards, as then divided by the Levy Court, with power in the council to increase the number of wards in its wisdom. The council was provided to consist of twelve members, elected annually by the qualified voters, and when elected the twelve were to choose from their number by joint ballot five to constitute the second chamber, the remaining seven to constitute the first. The Mayor was provided to be appointed annually by the President of the United States, and the corporation was given usual municipal powers. A somewhat unique provision was "that the by-laws or ordinances of the said corporation shall be in no wise obligatory upon the persons of non-residents of the said city, unless in cases of intentional violations of bye-laws or ordinances previously promulgated." By its terms, and in imitation of the very wise practice of the State of Maryland at the time, the act was limited in force to two years and to the end of the next session of Congress thereafter. By the supplementary act of February 24, 1804 (2 Stats. 254), the original act was continued in force for fifteen years from the end of the next session of Congress; certain additional powers were given the corporation; the Levy Court was deprived of the power to impose any tax upon the inhabitants of the city, and the constitution of the Councils was changed by provision that future councils should consist of two chambers of nine members each, to be chosen by distinct ballots, and that any vacancy should be filled by the chamber in which it should happen by an election by ballot from the three persons next highest on the list to those elected at the preceding election.

The Charter of the City was radically changed by the Act of May 4, 1812 (2 Stats. 721). By the terms of this act, after the first Monday of June of that year the corporation was composed of a Mayor, a board of aldermen and a board of common council, and its corporate name was "The Mayor, Aldermen and Common Council of the City of Washington." There were eight aldermen, two from each ward, and twelve common councilmen, three from each ward, and all were elected by ballot by the qualified voters, the former for two years and the latter for one year. The Mayor was elected annually by ballot by the

two chambers in joint meeting, and in case of three ballots without an election he was to be chosen by lot. Quite full municipal powers were given the corporation, including the power to pass all laws necessary for carrying into execution the powers specifically conferred upon and vested in the corporation, whether by the act itself or any former one. Among the powers specifically conferred by the act was that "to authorize the drawing of lotteries for effecting any important improvement in the city, which the ordinary funds or revenues thereof will not accomplish: *Provided*, that the amount to be raised in each year shall not exceed the sum of ten thousand dollars: and *provided also*, that the object for which the money is intended to be raised shall be first submitted to the President of the United States and shall be approved by him." This act was amended February 20, 1819 (3 Stats. 485), providing for tax-sales, and by act of February 28, 1820 (3 Stats. 543), it was extended to March 3, 1821, unless sooner repealed.

The act of May 15, 1820 (3 Stats. 583), was still more thorough. It repealed all former enactments so far as inconsistent with its provisions; continued the corporation under its later name; granted many new powers; made elaborate provisions respecting tax-sales; prohibited any tax upon property in the city by the Levy Court, and limited the contributions by the corporation to the expenditures of that court; and made specific provision for the division of the city into wards. For the first time the Mayor was to be elected by the people, and he was to be chosen every second year; and, as before, there were to be two aldermen chosen from each ward for two years, and three common council-men from each ward for one year. The act was limited in duration to twenty years or until Congress should by law determine otherwise.

An interesting and important provision of this act, foreshadowing the existing division of expenditures between the United States and the District, is section 15, as follows:

That the commissioner of the public buildings, or other person appointed to superintend the United States disbursements in the city of Washington, shall reimburse to the said corporation a just proportion of any expense which may hereafter be incurred, in laying open, paving or otherwise improving, any

of the streets or avenues in front of, or adjoining to, or which may pass through, or between, any of the public squares or reservations, which proportion shall be determined by a comparison of the length of the front, or fronts, of the said squares or reservations, of the United States, on any such street or avenue, with the whole extent of the two sides thereof; and he shall cause the curb stones to be set, and foot ways to be paved, on the side or sides of any such street or avenue, whenever the said corporation shall, by law, direct such improvements to be made by the proprietors of the lots on the opposite side of any such street or avenue, or adjacent to any such square or reservation; and he shall cause the foot ways to be paved, and the curb stones to be set, in front of any lot or lots belonging to the United States, when the like improvements shall be ordered by the corporation in front of the lots adjoining, or squares adjacent thereto; and he shall defray the expenses directed by this section, out of any moneys arising from the sale of lots in the city of Washington, belonging to the United States, and from no other fund.

A supplementary act was passed May 26, 1824 (4 Stats. 75), providing more fully for tax sales, and providing also (by section 14), for the removal of nuisances from lots belonging to the United States, at the expense of the United States, to be defrayed out of moneys in the hands of the City Commissioner from the sale of public property in the city.

The last general act of Congress in relation to the corporation of Washington is that of May 17, 1848 (9 Stats. 223), entitled 'An act to continue, alter and amend the Charter of the City of Washington.' This act provides for continuing in force for the term of twenty years from its date, or until Congress should by law determine otherwise, the acts of May 15, 1820, and May 26, 1824, "and the act or acts supplemental or additional to said acts which were in force on the fourteenth day of May, eighteen hundred and forty, or which may, at the passing of this act, be in force." The act deals largely with the levy and collection of taxes; provides for the election of a board of assessors, a register, a collector and a surveyor; and prescribes more fully the qualifications of electors and the jurisdiction, duties and tenure of office of justices of the peace. Sections 12 and 13 of the act are of especial interest as dealing further with the duty and liability of the general government in respect of open-

ing streets and repairing pavements and highways. In view of the popular error that Congress is doing a generous thing by the District in sharing expenses with it, these two sections should be read in full. They are as follows :

That the commissioner of public buildings, or other officer having charge and authority over the lands and property of the United States lying within the city of Washington, shall from time to time cause to be opened and improved such avenues and streets, or parts or portions thereof, as the President of the United States, upon application of the corporation of the said city, shall deem necessary for the public convenience, and direct to be done ; and he shall defray the expenses thereof out of any money arising, or which shall have arisen, from the sale of lots in the city of Washington, belonging, or which may have belonged to the United States, and from no other fund. And it shall be the duty of the said commissioner, or other United States officer, as aforesaid, upon the application of the mayor, to repair and keep in repair the pavements, water-gutters, waterways and flag foot-ways which have been made or shall be made opposite or along the public squares, reservations, or other property belonging to the United States ; as also, on like application, to repair and keep in repair such streets and avenues, or parts thereof, as may have been, or shall hereafter be, opened and improved by the United States ; the expense of all such repairs to be paid out of the fund before mentioned.

That the commissioner of public buildings be, and he is hereby required to perform the duties required of the city commissioner by the fourteenth section of the act of the twenty-sixth of May, eighteen hundred and twenty-four, supplementary to the act of the fifteenth of May, eighteen hundred and twenty, incorporating the inhabitants of the city of Washington. And it shall be the duty of the commissioner of public buildings, within ninety days after the sale of any lots or squares belonging to the United States in the city of Washington, to report the fact to the corporation of Washington, giving the date of sale, the number of the lot and square, the name of the purchaser or purchasers, and the said lots or squares shall be liable to taxation by the said corporation from the date of such sale. And no open space, public reservation, or other public ground in the said city, shall be occupied by any private person, or for any private purposes whatever.

With a few alterations, all appertaining to detail and none affecting the general scheme of the government, the charter of the

City of Washington remained to the end substantially as the act of 1848 left it. There were thus for some years side by side in the District three separate municipal governments, the Corporation of Washington, the Corporation of Georgetown and the Levy Court. Each of these governments had and exercised the power of making ordinances and laws, and there accordingly existed at the same time one set of such ordinances or laws for Washington, another set for Georgetown and a third set for the county. Perhaps no greater anomaly than this can be presented for a territory of sixty-four square miles, especially when it is considered that this territory is the seat of Time's latest and best offspring in the way of government; and I am constrained to wonder what the Puritan forebears of sturdy New England would have thought could they have come to life so lately as within the past quarter of a century to find that the same act committed on the same Sunday would have met with one punishment in Georgetown, another in the county and none at all in Washington. Yet this very fact, for fact it is, is the highest possible testimonial to the conservatism which characterizes the origin and growth of law and institutions in our English system: the conservatism which has made us and our kin beyond the sea the foremost in the universal brotherhood now happily becoming so generally recognized.

In the growth and administration of these three municipalities, helped along by the oversight of the Federal power, there of course came into being as occasion required the needful detail agencies of government: courts greater and smaller, judicial and fiscal officers, surveyors, school officials, boards of health, constabularies, and the like. And although our institutions were thus growing and being added to in strict conformity to the principles of the distinction between Federal and local government which underlies the whole American system, there was at the same time coming more and more into play the other seemingly inevitable principle, so far as result is concerned, that the national must and will to a great extent override the local, and the general must and will supplant the particular.

This was first manifested in the establishment of courts and judicial officers and general laws, of jurisdiction and authority



extending throughout the District; but, as is so often the case, it was reserved for the stress of war to occasion the first comprehensive step in the way of unity, at first seeming radical but in the end coming to be recognized as so natural as to make the wonder to be that it was so long delayed. This first step is to be found in the Act of Congress of August 6, 1861 (12 Stats. 320), forming the cities of Washington and Georgetown and the county outside of the limits of those cities, in a word the entire District, into "The Metropolitan Police District of the District of Columbia." There was provided for this Police District a Board of Commissioners of Police, consisting of the Mayors of Washington and Georgetown and five other members, three from Washington, one from Georgetown and one from the county, to be appointed by the President by and with the advice and consent of the Senate; which Board was vested with the police powers to be exercised throughout the District: including the preservation of the peace, the prevention of crime and arrest of offenders, the protection of rights of person and property and the public health, and the enforcement of the laws generally applicable to matters of police. A police force was established, possessing in every part of the District the common-law and statutory police powers of constables, and provision was made for the division of the District into police precincts, with convenient station houses, for the more efficient administration of the police power, and a superintendent was created to act as "the head and chief" of the force, subject to the orders and regulations of the Board. The several municipalities were stripped of the police power as such, and the existing constabularies were abolished. The initial act was several times amended and supplemented, but in the main the police system as originally devised remains to this day.

This was, in the beginning, not a popular departure from the old system, but its wisdom was soon abundantly manifested; and it is, perhaps, not too much to say that a more necessary, and, in the result, a more justifiable step was never taken; for the possibilities of the situation, had the old system been left in operation, are difficult, if not impossible, of exaggeration.

The establishment of the Metropolitan Police District bore,

within less than a decade, fruit not looked for at the planting. For by act of February 21, 1871 (16 Stats. 419), Congress created the whole of the District "into a government by the name of the District of Columbia." The Corporations of Washington and Georgetown and the Levy Court, and all the offices appertaining thereto, were abolished at the date of June 1, 1871, although all the ordinances and laws of the two corporations and the Levy Court, not inconsistent with the act, were continued in force in their respective territories, until modified and repealed by Congress or the Legislative Assembly created by the act; and the powers of the Levy Court were continued for certain purposes. The new corporation, the District of Columbia, was made successor to the municipal bodies which were abolished, and vested with all the property of those bodies. The Government of the District was vested in a Governor, a Secretary and a Council of eleven, two from Georgetown, two from the county and the rest from Washington, all to be appointed by the President by and with the advice and consent of the Senate; and a House of Delegates, twenty-two in number, to be elected by the people. The Governor and the Secretary were to hold office four years, the members of the Council two years and the Delegates one year. The first Council was to be divided into a one year class of five and a two year class of six, and afterwards all were to be appointed for two years. It is interesting to note, as in the case of the latest legislation respecting the constitution of the Levy Court, the persistence of this principle, first applied in the case of the United States Senate.

Besides these general municipal officials, the act provided a Board of Health and a Board of Public Works and gave the District the only direct representation which it has ever had in Congress, in the person of a delegate to the House of Representatives to have the same rights and privileges as delegates from the Territories, and, besides, to be a member of the committee on the District of Columbia. The Board of Public Works was provided to consist of the Governor and four citizens and residents of the District to be appointed by the President and Senate for four years, of whom one was to be from

Georgetown, one from the County, and one a civil engineer. This Board was given entire control of, and authorized to make all regulations which it should deem necessary for keeping in repair the streets, avenues, alleys and sewers of the City (its powers were extended to the County by the Legislative Assembly), and all other works which might be entrusted to it by the Legislative Assembly or Congress. The principle of division of expense between the United States and the District was again recognized here, as in the further provision of the act that all officers to be appointed by the President were to be paid by the United States and all others to be paid by the District for their services.

An interesting provision of the scheme, though one that was never acted upon, indicates the extent to which the principle of local government in local affairs still held sway; for it was provided by the act that the Legislative Assembly might divide the portion of the District outside of the cities into townships, not exceeding three, and create township officers and prescribe their duties, but that all township officers should be elected by the people of the townships respectively.

The Supreme Court of the District of Columbia in the case of *Roach v. Van Riswick* (MacA. & M., 171, decided November 18, 1897), held that much of this act, so far as it concerned the Legislative Assembly, was unconstitutional and void, for the reason that Congress had no power to delegate general legislative authority to the local government of the District, but could give that government only such powers as might properly be conferred upon a municipal corporation; a decision which may yet be brought under review, to somebody's disaster, as I think: for it seems to me clearly wrong, seeing that the Constitution only gave Congress the potential right of jurisdiction over the District, and that it was Maryland, the sovereign of the territory, that "ceded and relinquished" that territory,—not delegated any powers—"to the Congress and government of the United States, in full and absolute right, and exclusive jurisdiction, as well of soil as of persons residing or to reside thereon." This is not delegation: it is absolute cession of territory and abdication of all rights therein, and the suc-

cessor to territory and all rights therein is surely under no hamper of delegated authority.

The fate of the territorial government, as it is generally called, is too freshly in mind to call for extended comment; and it suffices to say that between the riot of extravagance of the Board of Public Works and the orgy of suffrage, which some of our good citizens long to have restored, that government, after a fevered life of a little more than three years, deservedly fell. And its fall ushered in what I hope is to be the last stage of the District's political development.

When Congress could no longer endure its creature of 1871, it enacted on June 20, 1874 (18 Stats. 116), that all provisions for an Executive, Secretary, Legislative Assembly, Board of Public Works and Delegate to Congress from the District should be repealed (saving the term of office of the then sitting delegate), and that for the time being, and until otherwise provided by law, the government of the District should be committed to a board of three commissioners to be appointed by the President and Senate and vested with all the powers formerly belonging to the Governor and Board of Public Works, except as otherwise provided by the act; and that the powers of the Chief Engineer of that Board should be exercised by an officer of the Engineer Corps of the Army of the United States, to be detailed by the President. In addition, a Board of Audit, consisting of the First and Second Comptrollers of the Treasury was provided, with the authority and duty to audit all claims growing out of the acts of the Board of Public Works in the execution of its "comprehensive plan of improvements," the cost of which the District is yet paying and to pay through the medium of the familiar and much-to-be-desired 3.65 bonds.

After a four years' trial of this form of government for the District, Congress very wisely decided to make it, with certain improvements, permanent, and on June 11, 1878 (20 Stats. 102), passed the act under which, as amended and supplemented from time to time, we now live. The Government of the District under this legislation which at the outset I made bold enough to speak of as the best possible for a municipality may be generally described as follows:

The powers and authority of government are lodged in a board of three Commissioners, two of whom are civilians, citizens of the United States and actual residents of the District of Columbia for three years before their appointment and having, during that period, claimed residence nowhere else. These two Commissioners are appointed for three years by the President and Senate, and the third is an officer of the Corps of Engineers of the United States Army whose lineal rank is above that of captain, although the President may, in his discretion, detail for this duty a Captain of fifteen years' service. This board of Commissioners has all the powers and authority formerly belonging to the Governor and Board of Public Works of the District, and is, besides, vested with the powers and authority formerly belonging to the Boards of Police, Health and Public Schools. It has the power of appointment and removal of all the officers provided for the administration of the municipal affairs, may abolish any office, and may consolidate any two or more offices. Within the limitations of law on the subject, it fixes the rate of taxation, which, however, is applied to assessments of value made by a board of assessors of its own appointing, which latter board acts also as an Excise board for the granting and regulating of liquor licenses. Besides its more purely executive powers, into the details of which it is unnecessary to go, the Board of Commissioners has large powers of a legislative nature: as the powers to make and enforce building and coal regulations (20 Stats. 131), police regulations (24 Stats. 368; 27 Stats. 394), elevator regulations (24 Stats. 580), regulations for public safety on bridges (27 Stats. 544), and in theatres (27 Stats. 394), regulations for the location and depth of gas-mains (27 Stats. 544), plumbing regulations (27 Stats. 21), regulations relative to medical and dental colleges (29 Stats. 112), and regulations for the occupation of sidewalks and street parkings (30th Stats. 570) and the platting of subdivisions of land (25 Stats. 451). It has also the power to order the erection of fire-escapes (24 Stats. 365), to order work in the nature of special improvements at the cost, in part, of the adjoining property owners (26 Stats. 296, 1066; 28 Stats. 247), and to condemn lands for sites for school, fire and

police buildings, and rights of way for sewers (26 Stats. 302); to constitute or appoint to various boards and institutions: as, to fill vacancies in the board of trustees of Columbia Hospital (27 Stats. 551), to appoint Dental Examiners (27 Stats. 42), and a Board of Medical Supervisors and boards of Medical Examiners (29 Stats. 198), to appoint trustees of the Free Public Library and Reading Room (29 Stats. 244), and trustees for the Industrial Home School (29 Stats. 410), and to appoint a board for the licensing of plumbers and gas-fitters (27 Stats. 21; 30 Stats. 477). It also has the power to grant pardons for offenses against the laws of Washington, Georgetown, the Levy Court and the Legislative Assembly and against the Police and Building Regulations (27 Stats. 22). That a body of three American citizens, mixed civil and military, vested with so numerous, varied and large powers exercises them with so little irritation and so little just cause of complaint is surely a high tribute to the American character, just now so much in evidence throughout the world, and just now taking on so many new responsibilities, to which, it goes without saying, it will prove fully adequate.

One of the most interesting features of our local government needs yet to be noticed, the feature of its cost. The Commissioners annually submit to the Secretary of the Treasury estimates of the expenses of the government of the District for the fiscal year beginning the first day of July following. The Secretary of the Treasury passes upon these estimates and sends to the Commissioners a statement of the amount approved by him, and this statement and their own original estimates the Commissioners transmit to Congress; and to the extent to which Congress approves of the estimates it appropriates one-half, and the remaining half is levied upon the taxable property and privileges in the District other than the property of the United States and the District of Columbia; but the rate of taxation in any one year cannot exceed one dollar and fifty cents on every hundred dollars of real property and personal property not taxable elsewhere, or one dollar on the hundred for agricultural property.

What I wish especially to be noticed in this connection is the oft-mentioned division of expense between the United States and the District. As we have seen, Congress took notice of this principle in the act of 1820 relating to the Corporation of Washington, and in its act of 1848 on the same subject gave the principle more specific and extended application. In short, the principle may be said to have existed from the first: and with good reason, seeing that the District was established primarily for the purposes of the National government and that that government is the owner of quite half of all the property here with which governmental agencies as the fruit of taxation are concerned, as in protection against fire and theft, water supply, &c. Moreover, the National government always bore its due share of the cost of street improvements, &c., adjoining its properties and for long bore exclusively the cost of the fire service and almost exclusively the cost of the water service in the District. All in all, if either party to the double government of the District ought to be favored in the matter of expense it is the local and not the National government.

I have expressed the hope that this latest phase of our political development will be its last. If not this, it seems destined to be the last for some time to come, in view of the light in which it is regarded by the Supreme Court of the United States. In *Eckloff v. District of Columbia* (135 U. S. 240, 243-4), that Court, speaking of the act of 1878 says:

The court below placed its decision on what we conceive to be the true significance of the act of 1878. As said by that court, it is to be regarded as an organic act, intended to dispose of the whole question of a government for this District. It is, as it were, a constitution for the District. It is declared by its title to be an act to provide "a permanent form of government for the District." The word permanent is suggestive. It implies that prior systems have been temporary and provisional. As permanent it is complete in itself. It is the system of government. The powers which are conferred are organic powers. We look to the act itself for their extent and limitations. It is not one act in a series of legislation, and to be made to fit into the provisions of the prior legislation, but it is a single complete act, the outcome of previous experiments, and the final judgment of Congress as to the system of government which should ob-

tain. It is the constitution of the District, and its grants of power are to be taken as new and independent grants, and expressing in themselves both their extent and limitations. Such was the view taken by the court below: and such we believe is the true view to be taken of the statute.

The last act in what may be termed the unification of the District was the passage by Congress of the law of February 11, 1895 (28 Stats. 650), abolishing the city of Georgetown and its name, repealing all of its general laws, regulations and ordinances, and extending to it all general laws, regulations and ordinances of the city of Washington. And by an agency more effective than the most solemn statute, namely, the usage of the people, the further result has been accomplished that to all practical intents and purposes, and in the eyes of the nation at large, the entire District now passes by the name of the Father of our Country, originally given to our city, but which, like the illustrious character from whom it was taken, has drawn to itself its whole environment.

And the political development of the District of Columbia suggests to me the plan of this beautiful city of ours, not built upon an uninviting plain and not laid out in exclusively right lines, but set in an environment of rare attractiveness; with its system of wide streets overlaid by intersecting avenues which break the otherwise mathematical stiffness of its thoroughfares, and set with beautifying and refreshing parks unrivaled by any intra-urban park system of the world. So with our political growth and development: beginning with the simple institution of the Levy Court, taking up as occasion required the forms of municipal government felt to be adapted to the situation from time to time, and finally taking the form of a wisely-conceived and skillfully-constructed scheme of local government, and yet all the while under the play of the essentially American distinction between the National and local systems. While on every hand we find statutory provisions, with their artificiality of conception and rigidity of expression, we yet meet at every point the freer action of those natural and more elastic elements of usage, tradition and fundamental principle which are at the bottom of all things English and out of which only all true law and political development spring and



grow. While we find everywhere minute regard for the local, as in the case of the Levy Court and the simple forms of municipal government of the cities, we are everywhere also brought face to face with the National, as in the original Commissioners of the city, the Superintendent of the City, the Commissioner of Public Buildings, the Chief of Engineers of the Army, the Metropolitan Police and the Board of Public Works. And, strangest of all, at the very heart of a nation grounded in the notion of "government of the people, by the people and for the people," we see from the beginning the almost aggressive expression of distrust of the popular vote, the absence of which has so often been remarked as the most striking feature of the government of the Capital. Thus always the Levy Court was in its personnel the creature of the President and Senate, while for long the Mayors of the cities were either the choice of the President or of the vote of the people only when filtered through the Aldermen and Councils. Anomalous enough this seems; but how much more anomalous is it that in the existing and best form of government of the District yet devised, local suffrage is wholly eliminated and that the only real guarantee of local participation in government is the residence qualification of the civilian Commissioners. Food for thought there surely is in this, and an irresistible suggestion to turn again and again to those words of President Monroe which I read to you in the outset.

But who shall be heard to complain of any of this, when we look about and see the result as shown in our beautiful and orderly city? beautiful in its topography, plan and embellishment, and orderly beyond all other cities; rich in wealth and richer still in intelligence: the very Mecca of the patriotism and intellect of the country; the site of the great public institutions of our land and the depository of its priceless archives and scientific and literary collections, which are at once the possession and the pride of the people of the whole nation; in a word, truly the City of Washington: Washington, who has been aptly characterized as "the greatest of good men and the best of great men," and of whom the soundest of English historians, John Richard Green, has truly said that "no nobler figure ever stood in the forefront

of a nation's life," and that men learned to cling to him "with a trust and faith such as few other men have won, and to regard him with a reverence which still hushes us in the presence of his memory." To Patrick Henry in 1795 he spoke one dear wish of his heart in the memorable words, "I want an American character;" and in his will, devising a portion of his property for the founding of a National University here, he expressed his "ardent wish to see a plan devised on a liberal scale, which would have a tendency to spread systematic ideas through all parts of this rising empire, thereby to do away with local attachments and State prejudices, as far as the nature of things would or indeed ought to admit, from our National Councils." If you seek Washington's true monument, look upon your ideal city, at once the training school of the American character and the University of his dream.

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THE COMING OF THE WHITE MAN, AND THE  
FOUNDING OF THE NATIONAL CAPITAL.<sup>1</sup>

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IN this age, when nearly all the old histories have to be re-written, when every fact is questioned, and every opinion must show its reason for being, I am honored with a request to outline the early history of the region in which it is our happiness to live.

What manner of people were they who dwelt in these regions of the globe a hundred years ago? What was their prevailing character, education, religion? What kind of houses did they dwell in, what were their manners and habits, their costume, employments, amusements, domestic regimen, and social life? I have sought diligently for such answers to these questions as exist in contemporaneous journals, letters, and travellers' observations, since no other authorities than those having personal knowledge can be trusted. What I have gathered, though

<sup>1</sup> Read before the Washington Academy of Sciences, April 15, 1899.

greatly condensed, may serve to give a fairly truthful picture of the life of the white man in Maryland and Virginia, at the time when our national capital was carved out of the territories of those contiguous states.

First, however, I must briefly establish the chronology of the earlier coming of the white man. Passing by the Norse and the Spanish discoveries of the New World as foreign to our theme, let us note the first English settlements on American soil. Sir Walter Raleigh and Sir Humphrey Gilbert divide between them the honor of having been the father of British American colonization. Gilbert, in 1578, obtained from Queen Elizabeth a patent for planting an English colony in America. Raleigh, half-brother to Gilbert, was interested in the scheme, and sailed with him in 1578 for America. Gilbert was forced to return, but Raleigh made an attack on Spanish vessels near the Cape Verde Islands, and then sailed for England in 1579. In 1583, Sir Humphrey Gilbert sailed on his second voyage, took possession of Newfoundland, and sailed to the coast of New England, but was lost at sea in 1584. That year, Raleigh secured a charter for planting the new lands in America, and sent out an expedition which left a colony on Roanoke Island, in North Carolina, in 1585. Queen Elizabeth named the whole region Virginia, and appointed Sir Walter Governor of Virginia. The Roanoke colony did not prosper, and was soon abandoned.

#### VIRGINIA.

In 1606, the first Virginia Company was formed in London, with larger means, and a distinct purpose of permanent settlement in America. The Company consisted of noblemen, gentlemen, and merchants of London; was known as 'the London Company for Virginia,' and sometimes called 'the Adventurers for Virginia.' The manuscript Records of their careful and systematic government of Virginia now form one of the most precious possessions of the Library of Congress. The Company was granted a royal charter, with exclusive right to occupy the regions between 34° and 38°, or from Cape Fear to southern Maryland. The Virginia Company, like the East

India Company, was a commercial organization. The first ship-load of emigrants numbered one hundred and five, of whom forty-eight were classed as 'gentlemen,' while there were unhappily only twelve laborers, and very few mechanics. The voyage occupied four months, from January 1 to April 26, 1607. They sailed up the broad river Powhatan, which they re-named the James, in honor of the King, and founded Jamestown, on a low and swampy peninsula, at the mouth of the Chickahominy. This was in direct violation of their instructions, "neither must you plant in a low and moist place, because it will prove unhealthful." The colonists paid dearly for their rashness; marsh fevers, with careless regimen, decimated their ranks; and in six months fifty men, or one-half the colony, had died.

The red man, too, was offended by the coming of the white man. After the first wild surprise, and the terror of fire-arms were recovered from, the savages began their endeavors to get rid of the unwelcome guests. Crafty and cunning, blood-thirsty and cruel, they cut off straggling parties in ambush, and finally killed three hundred and forty-seven settlers in one day by a concerted massacre, after the infant colony had grown to some two thousand souls. Women and children alike were slaughtered without mercy. Days of sore trial, and nights of fear and distress succeeded to the brilliant hopes of the early emigrants. Provisions often failed, what corn they got from the Indians was quickly consumed, and famine stared them in the face. Too many of the colony were shiftless adventurers, unaccustomed and unwilling to work, and the fruitful soil, ready to yield luxuriant crops, remained largely untilled. The hardy and resolute Captain John Smith, tired of the idle company that surrounded him, set out on an expedition of discovery, and visited Powhatan, the emperor of the Virginia tribes, at Werowocomoco. Later, he sailed up the Potomac river, and it is supposed, rather than proven, saw the site of the present District of Columbia.

So much interest attaches to the long controversy over John Smith's claims to honor and credence as pioneer and historian, that I may be pardoned for briefing some of the points involved.

Until recently, all histories of Virginia have been built upon Smith's early narratives, the writers simply repeating one another. His romantic history was accepted as unquestioned, until modern criticism took hold of it, and applied searching analysis to its many improbabilities. The story of his rescue from a bloody death by Pocahontas has been printed in hundreds of volumes, and has even been perpetuated in a grotesque sculpture by Capellano in the rotunda at Washington—a harrowing example of the barbaric art that prevails in yonder Capitol. This story is wholly unsupported by any contemporaneous evidence. Not one of the early chroniclers of Virginia—Wingfield, Spelman, Bullock, Jones, Beverly—alludes to it. Smith himself published two books on Virginia soon after the alleged rescue, the 'True Relation' in 1608, and the 'Map of Virginia' in 1612, in which he tells of his treatment by Powhatan, but not a word of any contemplated massacre. His first recorded statement of it was in a letter eight years after to Queen Anne, in 1616, when he briefly said she had saved his life. This was expanded in his 'Generall Historie,' 1624, sixteen years after the event, into the detailed romance of the two great stones with Captain Smith dragged and laid out upon them, the savages standing ready with clubs to beat out his brains, and Pocahontas getting his head in her arms, and laying her own head upon his to save him from death. Smith's other works, moreover, abound in marvellous tales of his prowess and escapes in Africa and Asia, where a fair Turkish princess also saves his life. The least that can be said in judging of the strange tale is that it is not proven. Among the historical writers who discredit it are Neill, Deane, Alexander Brown, Henry Adams, Bancroft, Lodge, Eggleston, Charles Dudley Warner, Gay, Palfrey, and Doyle. On the other hand, among the modern writers who credit it are W. W. Henry, Howison, Bruce, Arber, and John Fiske.

It may, indeed, be thought that the discredit of John Smith has recently been carried too far. The reverse swing of the pendulum of historic judgment may have done injustice to one who must ever remain a notable figure in American history. Captain John Smith was an egotist and a braggart, but he was a

great deal more. He was possessed of ardor, courage, penetration, industry and perseverance. Had he remained longer in the colony (for his whole service in Virginia covered only two and a-half years, from twenty-eight to thirty years of his age) he might have made a much greater record. As it was, he did more for the struggling colony in its first two years than any other man, and with less means. He explored, with cool daring, amid tribes of hostile savages, the James river, the Chickahominy, and the Potomac. He made the first map of Virginia worthy of the name, a map, considering the obstacles in the way, and the non-existing data, of surprising accuracy. He had the sense to despise the gold fever, and the abortive aims of his fellow-adventurers, and to devote himself to practical utilities with his utmost energy. His sagacity made him deal with the cunning and treacherous savages with more success than any others. In his short term of the presidency of the colony, he built defences, foraged successfully for supplies of corn in the starving time, and required lazy vagabonds to work. He was surrounded by dissensions and difficulties of every kind. The absurd ordinance of the London Virginia Company, that the colonists should share all in common, ended in the idlers and the shirks sponging upon the community. Then, as now, communism meant that the industrious and the capable should labor to support the indolent and the shiftless. If John Smith, in his many writings, sometimes boasted more than other men, he had also done more. Men are rare who can be trusted to write their own biography. Let us have charity for poor John Smith, vain though he may have been, as we behold him vanishing, all blackened with powder, from the Virginia for which he had done so much, bearing with stout heart the heavy 'white man's burden.'

As years rolled on, there came a steady influx of emigrants to Virginia. Colony after colony crossed the sea, until, about 1620, there were landed some eleven hundred annually. In Hotten's 'Original Lists of Persons of Quality, Emigrants,' etc., London, 1874, the only extensive published record of early emigrants to America, are some fifteen thousand names. But among the multitude of eager searchers who daily haunt our

libraries in quest of the missing link that shall connect them with British ancestors, scarcely one in a hundred ever finds it. Out of the hundreds of ship loads of early emigrants, many kept no records, and of many more the records are lost. For the purposes of the genealogist, in most cases, the coming of the white man was in vain.

The progress of the colony in the arts of peace was steady and great. In 1649 there were eleven mills to grind corn and six public breweries. Iron and bricks were manufactured in large quantities. The colony was hampered in its foreign commerce by the narrow and odious navigation laws of England, which prohibited her colonies from trading with any other nation, thus cutting off a lucrative trade which might have made all countries tributary to Virginia's great staple, tobacco.

In 1670 the peace of the colony was disturbed by the great number of desperate villains sent over from the prisons of England, and the Council of Virginia ordered that no vessel should be allowed "to bring in any jaile-birds after January next." Negro slavery was introduced as early as 1619, by importation from Africa, and continued a growing evil, demoralizing to a certain degree both races, though the profits of slave labor insured its perpetuation.

That one may form an intelligent judgment of the country and period that we contemplate, there should be brought into view a distinct idea of the natural features of Virginia. The country was held for hundreds of miles by barbarous tribes of aborigines, forming a loose confederacy, each under its own Werowance, or chief, but subject to the powerful king, Powhatan. The Virginia Company's grant extended about two hundred and forty miles north and south, with no defined limit westward. Its territory was washed by four noble tide-water rivers, the James, the York, the Rappahannock and the Potomac, each having many tributaries. The ample Chesapeake Bay, full of convenient and safe harbors, with good anchorage open to commerce from one end of the year to the other, supplied a coast line of a hundred and fifty miles. The magnificent harbor of Hampton Roads could float all the navies of the world. The soil, covered mostly by vast primeval forests, was of such



variety and fertility as to produce almost every kind of plant requisite for the benefit of man. "The vesture of the Earth," says Strachey, "doth manifestly prove the nature of the soyle in most places to be lusty and very rich. There are pines infinite, especially by the sea coast." The early settlers soon introduced all varieties of fruits and vegetables indigenous to England, which, added to the staple agricultural products native to Virginia—Indian corn, sweet potatoes, grapes, melons, etc., soon loaded the tables of the inhabitants with viands in rich profusion. Wild cherries, currants, mulberries, raspberries, blackberries and strawberries of delicate flavor abounded, and the woods were prolific of chestnuts, chinkapins, hazel nuts, peanuts and walnuts. The forests were endless groves of stately trees, oak, pine, maple, hemlock, walnut, ash, chestnut, sassafras and poplar. Early voyagers tell of the sweet aromatic odors blowing off the shore from the forests of balsam pines. The rich and varied flora of the country loaded the summer air with fragrance, the wild bees laid their stores of honey in the woods, the native song-birds filled the air with melody.

The climate, midway between the extremes of heat and cold, was genial and wholesome, save in low and marshy regions, and cattle, sheep, and swine could be kept in most winter seasons in the open air. "I believe," says Beverly (1705) "it is as healthy a country as any under heaven; but the extraordinary pleasantness of the weather, and plenty of the fruit lead people into many temptations. If one impartially considers all the advantages of this country, as nature made it, he must allow it to be as fine a place as any in the universe."

For animal food the Virginians found all which the most epeptic Britons had on their tables, and in addition wild bears, opossums, rabbits and squirrels. The waters, both fresh and salt, literally swarmed with fish, the toothsome shad, the delicate rock fish, the multitudinous herring, the lively bass, the immense sturgeon, with crabs and oysters in inexhaustible shoals along the bays and rivers. Of the feathered tribes were wild turkeys, pigeons, partridges, and water-fowl in clouds, the delicious canvas-back ducks feeding on the wild celery of the bays and inlets. Quaint old Alsop, describing the Eastern

shore on the Chesapeake Bay, says the water-fowl "arrive in millionous multitudes about the middle of September, and take their winged farewell about the midst of March." "There be wild turkeys extream large," wrote Dr. Clayton to the Royal Society in 1688, and he gives their weight at fifty to sixty pounds each.

Tobacco, the great indigenous staple of Virginia, grew luxuriantly in her soil, became to her planters a great source of wealth, a world-monopoly for more than a century, and supplied a currency and a measure of value.

With their material wants supplied thus bountifully by all the kingdoms of nature, the Virginia planters of later years formed a class of men who lived generously and entertained handsomely. Says the historian Beverly: "the gentry pretend to have their victuals drest and served up as nicely as if they were in London." Indeed, the intercourse between Virginia and the old country was by no means infrequent. Visits to relatives abroad, or from those abroad to their friends in America, were of constant occurrence. The social intercourse at home was intimate and lively. Daily, almost, the gentlemen and ladies of the rural gentry would mount their horses (for carriages were but little used) and ride three, five, ten or more miles to visit neighbors, dining together and returning in the evening. Every house was a house of entertainment, for hotels were almost unknown. Any decent stranger was sure of welcome. There were frequent card-parties, horse-races, shooting-matches, athletic sports (like quoits, wrestling, fencing and running) river-parties, hunting-meets, and riding-matches. The tables of well-to-do citizens were always supplied with malt liquors, wines, brandy or rum. The favorite wine was Madeira, though claret, port and Sauterne were not uncommon. A generous, not to say profuse, style of living prevailed, and 'old-fashioned Virginia hospitality' was a term daily illustrated in a community where George Washington records that his family did not once sit down to dinner alone for twenty years.

Dress and manners partook largely of the style and habits of cultivated people in Europe at the period. The Rev. Hugh Jones records that at Williamsburg, the early capital, "may be

seen a great number of handsome, well-dressed, compleat gentlemen." Knee-breeches, silken hose, and shoe-buckles of shining silver were prevalent, and velvet was the favorite wear for gentlemen's gala dress. Lace ruffles and snow-white cravats set off a costume, which, if not more sensible than that now in vogue, was at least more picturesque.

With their large leisure, it may be thought that Virginia gentlemen of a century ago were prone to idleness. Nothing could be farther from the truth, as regards the leading men among them. They were busy with much felling of trees, fencing of grounds, plantation cares, with land surveys and building improvements, with law-suits, with roads and bridges, with local elections and church business, with school arrangements, with family provisions, and with correspondence at home and abroad. The worm-fence, made of rough rails, laid zig-zag fashion, became known the country over as the Virginia fence.

The prevalent idea that intelligence was at a low ebb in early Virginia must yield to authentic facts. In spite of the oft-quoted dictum of the narrow-minded Governor Berkeley—"I thank God there are no free schools nor printing," it is a fact that the first free school founded in America was in Virginia (1622); in 1693 William and Mary College was established, and elementary schools were common; in 1736 a newspaper was successfully established at Williamsburg; and in 1748 education was made compulsory by legislative act in case of parental neglect. Ninety-four percent of the inhabitants in Norfolk county could write, as shown by the marriage bonds on record. Private libraries, too, were common in many Virginia homes. In fact, the progenitors of such men as Washington, Jefferson, Mason, Madison and others, were far from wanting in intellectual attainments.

The historian Jones records of the Virginia colony in 1724, that there were very few poor people and no beggars therein. The planters, and even the negroes, "spoke good English, without idiom or tone." He adds that the citizens generally wore good clothes, had "comely, handsome persons," and good manners and address. "The climate," said he, "makes them bright, and of excellent sense."

It is not singular that we find, scattered through the literature of the 17th and 18th centuries, numerous encomiums upon Virginia. Says the quaint historian Beverly: "Here people enjoy all the benefits of a warm sun, and by their shady trees are protected from its inconvenience. Here all their senses are entertained with an endless succession of native pleasures." The chronicler of Newport's voyage wrote that Virginia might "claim the prerogative over the most pleasant places in the world." Edward Williams wrote, in 1650, "the melancholiest eye in the world cannot look upon it without contentment, nor content himself without admiration." Hugh Jones records: "Virginia is esteemed one of the most valuable gems in the crown of Great Britain." In England the newly-found virgin land excited a wide-spread interest, reflected by numerous allusions in dramatic and poetic literature. Spenser dedicated his *Faerie Queen* (1590) to "Elizabeth, Queen of England, Ireland, France and Virginia." At a later period, Thomas Neals was made by royal patent 'Postmaster-General of Virginia and other parts of North America.' Arthur Barlowe wrote: "The soil is the most plentiful, sweet, fruitful and wholesome of all the world." Another writer speaks enthusiastically of "the dear strand of Virginia, earth's only paradise." The early historian Hamor (1615) tells of the "goodlie rivers, no where else to be paralleled," and he says, there were "wilde pigeons in winter beyond number or imagination, so thicke that they have even shadowed the skie." Another adds "there are infinite hogges in heards all over the woods." Ralph Lane says: "We have discovered the main to be the goodliest soil under the cope of heaven." Captain John Smith wrote: "Heaven and earth never agreed better to frame a place for man's habitation."

Thomas Hariot's 'Brief and True Report of the New-Found Land in Virginia,' 1588, was the first published account, but between this and 1700, more than thirty distinct books and pamphlets respecting Virginia were published, though a complete Virginia bibliography is still to seek. Beverly's Virginia, within two years of its appearance in 1705, was translated into French, and three times reprinted at Paris and Amsterdam. For more than a century before Washington's time, a constant

succession of British ships brought colonists to Virginia, and though many returned, dissatisfied with the limited means for amassing wealth, or the absence of advantages to which they had been accustomed, the country grew more and more populous continually.

#### MARYLAND.

The story of Maryland's first settlement by the white man is familiar. Under King Charles's charter of 1632, Caecilius Calvert, 2d Lord Baltimore, fitted out an expedition of about "two hundred gentlemen and their servants," who embarked with his brother, Leonard Calvert, as governor of the colony. They landed in Chesapeake Bay in March, 1634, and sailing up the Potomac, founded the town of St. Marys about twelve miles from its mouth.

Father Andrew White, the pious Catholic missionary, who sailed with this colonial expedition, and whose name is held in honor to this day, labored for years among the Patuxent, Piscataway and Patapsco Indians. He narrates in simple Latin the conversion of many savages, including the Queen of Patuxent, the King of the Anacostans and the Queen of Port Tobacco. He tells how Governor Calvert visited "a village which is called Potomac, a name derived from the river," which he describes thus: "a larger or more beautiful river I have never seen. The Thames, compared with it, can scarcely be considered a rivulet." The good father extols the excellence of the native preparations of Indian corn—"quæm 'pone' et 'omini' appellatur."

I cannot dwell upon the history of Maryland as a colony, but will come to some characteristic features of those parts of the state adjacent to Washington, in the latter part of the last century.

At Upper Marlborough, county seat of Prince George, and only sixteen miles from Washington, there was a grand assembly room, where balls were held and plays acted. Here people flocked to see the races, which lasted a week, winding up with a grand ball, the dancing being kept up till near morning, to the music of two or three fiddles and a clarionet or flute.

The houses of the town were all crowded by visitors from Georgetown, Alexandria, Baltimore and the whole country around. The best of manners prevailed and no disorder nor intoxication was tolerated.

The second theater in the United States was opened at Annapolis in 1752, by an excellent troupe, known as 'the Company of Comedians from Virginia,' where they had played at Williamsburg the same year, and who played at Annapolis and Upper Marlborough for more than twenty years. New York had plays only two years earlier, in 1750, and Philadelphia in 1749. The French abbé Robin, who travelled in Maryland in 1781, records that there was "more wealth and luxury in Annapolis than in any other city which I have visited in America." Indeed, the style of living among prosperous citizens was of a kind which may be characterized as generous and even profuse. The gentlemen wore velvet coats, knee-breeches, swords, lace ruffles, wigs, cocked hats laced with gold or silver, and snuff-boxes. The ladies were dressed in silks, satins, lace and brocade; they frizzed and rouged, and both sexes wore powdered hair. Brissot, the French traveller, in 1790 tells us that the ladies' dress was "of the most brilliant silks, gauzes, hats and borrowed hair." On their heads were pyramids of towering turbans, to which the odious and sometimes intolerable theater hat of to-day, with its fortification of an aviary or conservatory, destructive of human vision and peace of mind, presents a too close analogy. But few jewels were worn, for they were not common in that age. In the country, women wore bonnets called 'calashes,' the front stiffened with cane, and projecting twelve or fifteen inches from the face horizontally. These were described, no doubt correctly, as the height of ugliness.

In those days, horse-races abounded, and cock-fights were common diversions, while fine old Virginia gentlemen sometimes staked their negroes on the result. Everybody was fond of field sports, and even the clergy joined in the chase. Horses were so common that no one ever thought of walking to any distance. Most roads were merely bridle-paths. Ladies rode to the chase or to church on horseback, and went to balls in the evenings, mounted on side-saddles, with scarlet riding habits

tied over their white satin dresses. The men of Maryland and Virginia were like centaurs, who lived in the saddle, and thought nothing of pursuing a fox-chase thirty miles, through two or three counties. Even the grave and sedate George Washington would set off fox-hunting at five o'clock on a frosty morning, with a party of youngsters, or oversee the hauling of a seine of shad in the Potomac, at the head of a gang of yelling negroes. Such severe training in out-door life gave vigor and endurance to the physical system, and made the Maryland Continentals the flower of the Revolutionary armies.

The houses of those days were always surrounded with ample grounds, and even in the cities such a thing as a block of houses was unknown. The old Maryland term 'manor' was applied to the country estates, which always had a mansion with ample porch in front, where the members of the family sat in fine weather for air and shade, with a wide hall running through the house for ventilation. Large estates had their own mills for grinding flour and meal, meat-house, corn-house, hen-house, and many servants' outbuildings, and even the smallest farm-houses had a smoke-house for curing the domestic pork and beef. Within, there reigned a cheerful hospitality. The huge yawning chimney ate up untold cords of wood (for coal was then unknown) and in summer tea was served *al fresco* on the lawn. Cool tankards of sangaree or lemon-punch stood invitingly in the hall, and in the cellar was a cask of Burgundy, and often a pipe of Madeira. West India rum, however, was the favorite beverage of the less wealthy class, because it was cheap, and that was bought by the puncheon. The tables were supplied with a bountiful variety of viands to tempt the palate. At breakfast, there were huge mounds of muffins, hot corn pone, plates of Maryland biscuit, steaming pots of coffee and tea, pigs' trotters and venison steak, fresh fish, or succulent oysters, or soft-shell crabs. The dinner-table rejoiced in great joints of beef or mutton, roast goose and cider apple-sauce, stewed rabbits, wild turkey, roast pig or opossum, and often boiled corned beef, pork and cabbage, with sweet potatoes, juicy succotash, and other vegetables, and dessert of plum-pudding and pumpkin pies. You will concur with me that the eating and drinking were somewhat hearty.

Guests were numerous, and so open was the hospitality, that no house was ever considered full, though each room (and they were large) had half-a-dozen or more of guests; and it was the custom to serve all with mint-juleps in summer, and hot rum or whiskey in winter, upon rising in the morning. People from the North or from Europe called the style of living very extravagant. In fact, many old families kept up a hospitality so expensive that they were almost ruined by it, and farms were mortgaged recklessly to keep up appearances.

Both in Maryland and Virginia, nothing was more striking than the gallantry and deference shown by men of all classes toward the fairer sex. The unanimous sentiment of the people stood for the honor of man, and the virtue of woman; and every offence against either was quickly resented.

The legal interest was six percent on money loans, and eight percent on tobacco loans; but many were compelled to borrow at usury, even as high as twenty-four percent a year. The ruinous expedient of issuing irredeemable paper money (that delusion and snare of inexperienced states and nations) was more than once resorted to, with the always certain result of speculation, collapse, and heavy loss to the people. In the scarcity of gold and silver, tobacco, the one product of the land which had a sure commercial value, became the currency, and was made a legal-tender in 1733; one of the few instances in which the remedy was better than the disease. The whole financial fabric of Maryland and Virginia rested upon tobacco. The colonial governors' salaries were paid in tobacco. The doctor's bill was settled by so many pounds of tobacco. The attorney's fee was fixed at 100 pounds of tobacco in minor cases, and 200 pounds in important ones. All day-laborers' and servants' wages were paid in tobacco. The Virginia Company, in 1621, sent over one widow and eleven maids for wives, requiring that "every man that marries them give one hundred and twenty weight of best leaf tobacco for each of them," to pay charges. Judges and jurymen alike were paid in tobacco. The clergy-tax was forty pounds of tobacco for every citizen, so that his very religion and his hope of heaven was measured by tobacco.

So far was the ever-growing planting of tobacco carried, year



after year, that nearly all the rich virgin lands of Maryland and Virginia were exhausted and ruined by it. Most of the pine-grown and shrub-covered thickets that surround Washington today, represent worn-out and abandoned tobacco fields, on both sides of the Potomac. A century ago, the huge hogsheads of tobacco were rolled to market for many miles, each rigged with tongue and axle, and propelled up hill or held back down hill, by negroes, mules and oxen.

The first white man authentically known to have set foot on the soil of the District of Columbia was Captain Henry Fleet, an English mariner and trader. He made an expedition up the Potomac in 1632, to buy beaver furs from the Indians, whose language he knew, having been much among them in Virginia. He anchored six miles below the Falls of the Potomac, where he got three hundred weight of beaver from the Nacostines, or Anacostian tribe, whose name is perpetuated in the Eastern branch of the Potomac. Fleet thus describes the region:

“This place, beyond all question, is the most pleasant and healthful place, in all this country, and most convenient for habitation; the air temperate in summer, and not violent in winter. It aboundeth with all manner of fish. And as for deer, bears, buffaloes, turkeys, the woods do swarm with them, and the soil is exceedingly fertile. \* \* \* The 27th of June I manned my shallop and went up with the flood, the tide rising about four feet in height at this place. We had not rowed above three miles, when one might hear the falls to roar, about six miles distant, by which it appears that the river is separated with rocks, but only in that one place, for beyond is a fair river.”

This Henry Fleet was a member of the Maryland House of Assembly in 1638, and of the Virginia House of Burgesses in 1652. He lived for a time near the mouth of the Potomac, at a place still known as Fleet's Point.

#### RELIGIOUS INTERESTS.

What of the religion of those who built up the region in which we live? All records attest that the earliest settlers were

zealous observers of religious rites. At their first setting foot on the shores of the great Bay of Chesapeake, the pioneers of 1607 planted a cross, and baptized the point Cape Henry. Maryland was consecrated to Christ at St. Marys by the planting of a cross, in which Catholics and Protestants participated. On laying out the site of Jamestown, one of the earliest buildings to go up was a church. Nearly every vessel from England bore one or more clergymen. When the council that governed the little colony had quarreled and made up their differences, they partook together of the communion, in token of reconciliation.

But the laws first adopted for the government of the colony show more clearly what severity of religious zeal pervaded the polity of the time. In the 'Lawes and Orders, Divine, Politique, and Martial, for the Colony in Virginia,' printed in 1612, is this stringent provision :

"That no man blaspheme God's holy name upon paine of death. That no man speake impiously or maliciously against the holy and blessed Trinitie or against the knowne Articles of the Christian faith, upon paine of death.

"Every man and woman duly twice a day upon the first towing of the bell shall upon the working daies reparaire unto the church, to hear divine Service, upon pain of losing his or her dayes allowance for the first omission, for the second to be whipt, and for the third to be condemned to the Gallies for six Moneths."

And even in Maryland, so loudly praised for freedom of opinion in religion, this worse than Draconian code was enacted in 1649, in 'an Act concerning Religion.'

"Be it ordered and enacted by the right honorable Cecilius, lord baron of Baltimore, with the advice and consent of this General Assembly, that whatsoever person within this province shall blaspheme God, that is, curse him, or shall deny our Saviour Jesus Christ to be the Sonne of God, or shall deny the Holy Trinity, the father, Sonne, and holy Ghost, or the Godhead of any of the said Three persons of the Trinity, or the Unity of the Godhead, or shall utter any reproachfull speeches, words, or language, concerning the said Holy Trinity, or any

of the said three persons thereof, shal be punished with death, and confiscation of all his land and goods to the Lord Proprietor and his heires.”

This act proceeds to provide that if any one shall disturb or molest any person professing to believe in Jesus Christ, for or in respect of his religion, or the free exercise thereof, such offender shall pay treble damages to the person so wronged or molested, besides the sum of twenty shillings sterling in money, one-half to the lord proprietary, and the other half to the party so wronged or molested.

Thus we find this so-called ‘act of toleration’ which punished by fine any one who interfered with another’s free exercise of his religion, also punished with death any one who preferred to doubt the doctrine of the Trinity, or the Godhead of Christ. It gave religious freedom with one hand, and took it away with the other. Need we wonder that it was called by some ‘a cursed intolerable toleration’?

But these statutes were too barbarous to be executed, and no one was put to death in either colony under them; showing how much men were better than their laws, and more liberal than their creeds. When we shudder at finding in the Virginia code of 1612, the penalty of death ordained for fifty different offences, we are reminded that far more trifling offences were then punished by death in England, where the 16th and 17th centuries witnessed multitudes of bloody beheadings, hangings, and burnings at the stake. We who live in the full blaze of the light that is poured upon the radiant path of human progress may thank God that the ages are gone when men were murdered for their beliefs, their misbeliefs, or their unbeliefs.

But was there no persecution for religion’s sake in colonial days? History records that in 1663 two Quaker women were flogged, under Virginia laws, thirty-two lashes each, with a nine-corded whip, every stroke of which drew blood. The same year the Virginia Assembly enacted that any separatists from the Church of England, assembled for worship, should be fined two hundred pounds of tobacco, and for the third offense should be banished from the colony. The creed and the forms of the Church of England were established as the sole tolerated religion. Peo-

ple who refused to have their children baptized were fined two thousand pounds<sup>7</sup> of tobacco. Any master of a ship who brought in a Quaker was fined five thousand pounds of tobacco. George Wilson, a Quaker preacher, writes in 1662, "from that dirty dungeon in Jamestown" where he was imprisoned for his belief. In 1723, blasphemy was punished by boring through the tongue which had offended. In 1756 every man was taxed forty pounds of tobacco annually for the benefit of the clergy, and one hundred percent was added to all taxes to be paid by any Catholic. In 1662 Quakers were fined twenty pounds for absenting themselves from church, and no non-conformist could teach religion under pain of banishment. Most of these infamous laws survived until Thomas Jefferson's Virginia 'Act for establishing religious freedom,' passed in 1785, abolished the last relic of the barbarism of the dark ages.

#### DISTRICT OF COLUMBIA.

In more modern days, church observances appear to have been general, though not, as formerly, compulsory. In Georgetown, which was founded in 1751, a Presbyterian church was built in 1792, and enlarged by subscription in 1802, when President Jefferson contributed seventy-five dollars to that object. In 1792 the first Catholic church in Georgetown (now Trinity Church) was founded. The first Presbyterian church in Washington was founded as early as 1795, with Rev. John Breckenridge as pastor. It first met in a carpenter shop, used for building the President's house. As illustrating the liberal tendency of the time, it is recorded that at Georgetown the Bridge Street Presbyterian Church was occupied together by Baptists, Methodists and Episcopalians, who celebrated the communion service along with the Presbyterians.

From the earliest Washington newspaper, published from 1796 to 1798, the 'Washington Gazette,' of which the only known file is preserved in the Library of Congress, one learns curious particulars of the beginning of things in this District a century ago. A nail factory was started in 1796 at Greenleaf's Point, and a hat factory is advertised as an auspicious novelty.

William Cranch, afterwards Judge of the District Court, advertised for "a sober, industrious woman who understands housework. Good wages will be paid. N. B. No objection will be made as to color." As this notice stood for six weeks, free labor must have been scarce in Washington. J. V. Thomas, bookseller, advertises book-binding in all its branches. Lund Washington, postmaster of the city, brother of the President, advertises the Washington letters uncalled for. A runaway negro is advertised at a reward of eight dollars, rather cheap for a human being held in absolute fee simple. Rude woodcuts, depicting a negro running, with stick and bundle, abound. The Sheriff of Prince George County advertises frequently runaway slaves in custody, who will be sold to pay charges, unless their owners take them away. The editor records the finishing of twenty houses, begun by Robert Morris and J. Nicholson, which those gentlemen celebrated by treating a few acquaintances, the architect and workmen, some two hundred in number, to a barbecue on the spot. "We do not recollect ever to have seen a greater appearance of social glee on a similar occasion." These houses stood on South Capitol street, corner of G street. Blodget's hotel and his lotteries were the butt of many gibes. "We understand that Mr. Blodget draws 100 tickets per week; now, as the wheel contains 50,000 tickets, the lottery will be drawing ten years. We, therefore, advise all holding tickets to mention them in their wills, as they may become important possessions for the good of their heirs." Again: "Wanted.—A number of patient sportsmen to purchase the unsold tickets in Washington Lottery, No. 2. Gentlemen of fortune would be preferred." And again: "At Philadelphia the tickets in Blodget's lottery are held at one dollar, at par; but at Georgetown, where information is better, they may be got at under par, and on a long credit." This notable 'Washington Lottery, No. 2,' was first schemed in December, 1794, and the criticisms here cited appeared in 1796. The lottery prospectus was headed: 'For Improvement of the National Capital,' and read: "It is hoped that the friends to a National University and the other National objects may continue to favor the design."

## CITY OF WASHINGTON.

The Gazette printed June 25th, 1796, a proclamation by President Washington, setting forth that the requirement of building all houses in Washington of brick or stone, and not less than thirty-five feet in height, had impeded the settlement of the city by mechanics and others, and would therefore be suspended until A. D. 1800. The Commissioners of the District made frequent advertisements of public auction sales of Washington lots, at one-third cash, and one and two years credit for the remainder; sales to be continued until they had raised a sum sufficient to complete the public buildings.

The paper contained many advertisements of hotels. The Capitol Hill tavern announced—"A shuffle-board and nine-pin alley are ready for those inclined to amuse themselves." William Tunnecliff, whose tavern was located on Capitol Hill, in square 925, corner of Pennsylvania Avenue southeast and Ninth Street, announced "stabling for horses, and lodging for gentlemen or ladies," at his Eastern Branch hotel.

The first dramatic performances in Washington of which I find record were held in 1801, in Blodget's unfinished hotel, near the site of the former Post-Office Department, Seventh and F Streets. Rough boards were put in as temporary seats for the audience at the play.

In 1805, there were seven hundred houses and three market houses in Washington; while in 1800, five years earlier, there were only forty-seven brick, and one hundred and nineteen frame houses completed in the city, after eight years possession by the government.

One of the most notable characters in the life and history of early Washington was Thomas Law. He was of a distinguished English family, being a son of the Bishop of Carlisle, and one of his brothers being Edward Law, Lord Ellenborough, who became Lord Chief Justice of England. Thomas Law went early in life to India, where he amassed a large fortune, and, being a liberal in politics, he came to America to spend it. This he succeeded in doing in the embryo Washington, where he invested most of his estate, buying some five hundred lots,

and building a block of houses near Greenleaf's Point, in southwest Washington, which are still standing. He also built the three large mansions in one block, at New Jersey Avenue and C Street, southeast, so long occupied by the Coast Survey, and which is now the Hotel Varnum. He married the beautiful Miss Elizabeth Parke Custis, a grand-daughter of Mrs. Martha Washington, but separated from her after some years of married life. The late Dr. Brodhead, who was his neighbor for many years, told me that Mr. Law had a very slow, imperturbable utterance. One morning, while sitting at breakfast, his negro waiter announced to him—"Massa Thomas, Missus Law died last night." "The-hell-she-did?—pass-the-po-ta-toes," was his only reply.

The English traveller, Thomas Twining, who had been, like Mr. Law, an East India resident, visited him at Washington in 1796, and remarked upon the seclusion in which he had chosen to bury his distinguished talents. "I could not but be surprised," said he, "at the plan of life he had chosen. The clearing of ground, and building of small houses, amongst the woods of the Potomac" seemed to him a most uncongenial occupation for such a man as Law.

The Duke de la Rochefoucauld-Liancourt stayed with Law during his visit to 'Federal City,' and, says he—"I could not felicitate Mr. Law on the speculation which induced him to purchase lots in the new city, and thought he might have made a more prudent and fortunate use of his great property." "His fortune," he adds, "is superior to the greatest fortunes in America, and he might have lived on his own revenues with splendor. He has wilfully plunged himself into an abyss of cares, and all the contentions of this distracted city, which not only prevent the enjoyment of his fortune, but even endanger it."

Mr. Law was an eccentric specimen of the wealthy Indian nabob, who appeared to others marvellously out of place in the crude wilderness of Washington. His leading qualities were obstinacy and independence. The more money he sunk in building fine residences in places where nobody wanted to reside, the more he resolved to have his own way. His losses in real estate were enormous, but he lived luxuriously, entertaining Eng-

lishmen and other foreigners with profuse hospitality. We read of his driving his chariot and four horses from Baltimore to Washington, with his wife, in 1796. George Washington and his Secretary, Tobias Lear, stayed at Law's house on frequent visits to the Federal City.

Law was one of the chief promoters of the canal lottery, a scheme which must not be confounded with the Washington lotteries of Samuel Blodget. A charter was granted by Maryland in 1795, with Daniel Carroll, Thomas Law, and others as corporators, to build a canal from above Great Falls through Washington City to the Eastern Branch. Into this Mr. Law put much money and time. Procuring from Congress an enabling act authorizing the lottery, in 1812, the Washington Canal Company widely advertised the scheme as a 'National lottery,' and sold many tickets in Virginia, Maryland, and elsewhere.

Mr. Law died July 31, 1834, aged seventy-five years, at his mansion on Capitol Hill. The *National Intelligencer* styled him "one of the oldest, most zealous and enlightened citizens," and said that he had passed an old age clouded by disease and domestic calamity (for all his children had died before him) but "indulging with delight in such hospitality as his narrowed means permitted him to exercise, for his many investments proved anything but lucrative." He wrote at least twelve pamphlets, printed anonymously, chiefly on finance and sound banking. His work, 'Thoughts on Instinctive Impulses,' however, is an ethical and poetical treatise displaying a wide range of speculative thought.

#### DESCRIPTIONS BY EARLY TRAVELERS.

Richard Parkinson, whose tour in America in 1798 to 1800 appeared in two volumes, said that Washington contained only three hundred houses, and he concluded that it was too young a city for a brewery, which he had thought to establish. Thomas Law he found the only man of any considerable monied property in the city. He met General Washington at Mr. Law's, who was "quite sociable," though he adds, "the General went to bed at nine o'clock, as that was his hour."



John Davis, the English schoolmaster who first told the unfounded tale of Jefferson's riding alone to the Capitol to be inaugurated as President, and hitching his horse to the palisades, wrote of Washington in 1802, what may well be believed: "There were no objects to catch the eye but a forlorn pilgrim forcing his way through the grass that overruns the streets, or a cow ruminating on a bank." He says the village was surrounded by "endless and almost impenetrable woods," and drops into poetry upon "the noble river Potomac, on whose banks the proud structures of Washington are to lift their heads."

Francis Baily, President of the Royal Astronomical Society of London, visited here in 1796. He arrived by stage from Baltimore, for which journey four dollars was the fare, and the road was well furnished with good taverns. Georgetown he describes as "a handsome town which will in time lose its name of Georgetown, and adopt the general one of Washington"—a prediction which is now fulfilled. He visited Alexandria, fare seventy-five cents by stage. He praises the view from the capitol as 'extremely delightful,' visits Greenleaf's Point, where twenty or thirty houses were built, and says about a hundred others were scattered over in other places. Most of the streets were cut through the woods, appearing like broad avenues in a park. "In short," says he, "all tends to render it one of the most delightful and pleasant sites for a town I have ever remarked."

In the *Travels of the Duke de la Rochefoucauld-Liancourt*, who spent the years 1795 to 1797 in the United States, and who was a careful observer, is the most extended account of this District and its vicinity in Maryland and Virginia at the period of our review to be met with. He pronounces the plan of the city "both judicious and noble"; but adds that it is in fact the grandeur and magnificence of the plan which renders the conception "no better than a dream." He details at length the speculation in lots, then at its height, in what he always terms 'Federal City'; shows that Robert Morris, with Nicholson and Greenleaf, bought up all that could be had, either from the commissioners or from private owners; that the Morris syndicate (to use a term not then invented) purchased six thousand

lots at \$80 each from the commissioners, and nearly as many more from individuals, the whole purchase being nearly one million dollars; that the bargain was made in 1793, on seven years' time, one-seventh to be paid annually; that they were bound to erect one hundred and twenty brick houses of two stories, within the seven years, but were not to sell any lots before 1796, without a like condition of building on them. This was a stipulation designed, on the part of the commissioners, to improve the city rapidly by settlement, but it proved ineffective.

Thomas Law bought from Morris 445 lots, paying nearly \$300 a lot. Many others bought, but mostly on speculation, for the land fever ran high. The building of the capitol and the President's palace, so-called, excited the hope of a great influx of population. The public prints of Virginia, Baltimore, etc., were filled with exaggerated praises of the new city. The President and the commissioners believed that the ground marked out for the city would soon be filled up, and this led them to enforce a regulation prohibiting houses of wood, or of less than two stories in height.

Samuel Blodget, who had bought a large quantity of lots, devised an ingenious scheme of disposing of them by lottery. The great prize was a handsome fifty-thousand-dollar tavern, yet to be built (for the whole speculation was in the air); the next prizes were three houses to be erected near the Capitol, valued at twenty-five, fifteen, and ten thousand dollars, respectively. The Duke de la Rochefoucauld-Liancourt adds that these lotteries gained a large profit to Mr. Blodget, who, he says, "was the only person not deceived in the transaction."

Messrs. Morris & Co. were not very successful in getting their extensive lot purchases off their hands. People, after admiring the plan of the Federal City in embryo for its beauty and magnificence, began to perceive that it was rather extensive for the actual circumstances of the United States; and that the immense extent of ground would not be so speedily covered with handsome houses as was expected. Every lot holder intrigued to get his neighborhood first improved; hence rivalries and antagonisms became the order of the day. Georgetown owners of

lots declared their property the most eligible, because situated near the principal existing settlement, and boasted of the port of Georgetown and its well-founded commerce, while Washington was a forest and swamp without a harbor. On the other hand, Greenleaf's Point lot owners sang the praises of that situation as the most airy, healthful, and beautiful in the city. Then came the Eastern Branch proprietors, who decried both the Point and Georgetown, and claimed their location as the best, because nearest to the Capitol and most likely to be settled by the members of Congress, when that body should remove here in 1800. Then, in the fourth place, came Capitol Hill speculators in lots, who depreciated all other locations but their own, as too remote from the political center where Congress was to hold its daily sessions.

Our traveller records about a hundred and fifty houses as scattered over the vast surface of the city, each of the four contending quarters having thirty or forty, at great distances from each other. He said few lots had been sold to individuals to be improved, though in 1796 forty houses had been begun by the Morris syndicate, who had pledged their property in advance, and had no money to complete their extensive undertakings. Not a single house had been built as yet, in 1796, on Pennsylvania Avenue between the President's house and the Capitol.

After recording that the commerce of Georgetown had declined from about \$400,000 imports and exports in 1791, to \$189,000 in 1796, a decline he attributes to the diminished production of tobacco and the absorption of the merchants in lot speculations, the Duke concludes his sombre picture of the prospects of Washington by saying that it was idle to imagine that it would arrive at the execution of the tenth part of its plan, before a dissolution of the Union should take place. "Federal City," he says, "will never reach that degree of improvement to render it even a tolerable abode for the kind of persons for whom it was designed." We, who smile over the signal falsification of this dire prediction, should allow that our infant capital, cradled in a wilderness of woods a century ago, offered little enough to countervail the forebodings of failure.

Robert Sutcliff, an intelligent English Quaker, visited Washington in 1804, and wrote: "The situation is one of the most eligible spots for a city that I have ever seen; it bids fair to be one of the most elegant and regularly-built cities in the world." Visiting a family in Alexandria, where a hundred slaves were employed (at least ostensibly), he remarked that the more slaves there were kept about a plantation, the more disorder appeared. He passed through Piscataway to Port Tobacco in Maryland, and found the people mostly black, and the sandy road tracked with feet immoderately large, which he attributed to the slaves going always barefoot. On Sunday, he met fair white girls riding to church on horseback, with a negro boy mounted behind, and jumping off to open gates, while the horse trotted on, and the boy nimbly running after his mistress, jumped up again behind her. At Alexandria, he saw negro girls ten or twelve years of age walking the streets with baskets of fruit and vegetables on their heads, without any clothing whatever.

Another traveller, who came to Washington in 1796, was Thomas Twining. He wished to go from his tavern in Georgetown to his friend Thomas Law's residence at Greenleaf's Point, but could get no conveyance for a whole day. At last a horse was found, and he proceeded in the saddle, through what he terms 'a silent wilderness,' or a thick wood pierced with avenues, toward the south. He remarks of the Americans that they are far more ready in speech than Englishmen, and that they speak the English language with all the volubility of Frenchmen. This characteristic has not apparently failed them in the century since he wrote.

A Swiss, named Charles Pictet, whose two volumes on the United States appeared in 1795, '*Tableaux des États-Unis d'Amérique*,' describes Washington as a city laid out on a plan proportioned to the majesty of the enterprise, and which "will secure to the capital of America advantages which no city before it will have possessed."

Charles W. Janson was in Washington in 1806, and he gave a graphic and far from cheerful account of its aspect, headed 'Failure of the City of Washington.' He wrote "The entrance, or avenues, as they are pompously called, which lead

to the American seat of government, are the worst roads I passed in the country, particularly the mail stage road from Bladensburg to Washington, and from thence to Alexandria. Deep ruts, rocks, and stumps of trees every minute impede your progress, and threaten your limbs with dislocation. Speculation, the life of the American, embraces the design of the new city. Several companies purchased lots and began to build, with an ardor that soon promised a large and populous city. Before they arrived at the attic story, the failure was manifest; and in that state are the walls of many houses begun on a plan of elegance. The President's house, the offices of state, and a little theatre, where an itinerant company repeated the lines of Shakespeare, Otway, and Dryden to empty benches, terminate the view of the Pennsylvania, or Grand Avenue. This is the largest Avenue; in fact I never heard of more than that and the New Jersey Avenue. Except some houses uniformly built, with some public-houses, and here and there a little grog-shop, this boasted Avenue is as much a wilderness as Kentucky. Some half-starved cattle browsing among the bushes present a melancholy spectacle to a stranger, whose expectation has been warmed up by the illusive descriptions of speculative writers. So very thinly is the city peopled, and so little is it frequented, that quails and other birds are constantly shot within a hundred yards of the capitol. Strangers, after viewing the offices of State, are apt to inquire for the city, while they are in its very centre."

Thomas Moore, the Irish poet, who was in Washington in 1804, while Jefferson was President, wrote of

"This embryo capital, where fancy sees  
Squares in morasses, obelisks in trees;  
Which second-sighted seers, ev'n now, adorn  
With shrines unbuilt, and heroes yet unborn,  
Though nought but woods and Jefferson they see,  
Where streets should run and sages ought to be."

On his way hither, the poet wrote from Baltimore: "I have passed the Potomac, the Rappahannock, the Occoquan, the Patapsio (meaning the Patapsco) and many other rivers, with names as barbarous as the inhabitants. The mail takes twelve

passengers, which generally consist of squalling children, stinking negroes, and republicans smoking cigars."

He speaks of Blodget's famous lottery hotel thus: "The hotel is already a ruin: a great part of its roof has fallen in, and the rooms are left to be occupied gratuitously by the miserable Scotch and Irish emigrants. The few ranges of houses which were begun some years ago have remained so long waste and unfinished that they are now for the most part dilapidated."

Gouverneur Morris, who attended Jefferson's inauguration in 1801, records that the road from Washington to Annapolis was so deep in mud that the stage was stalled and stuck fast. It took him ten hours to go the twenty-five miles. Of Washington he wrote: "We only need here houses, cellars, kitchens, scholarly men, amiable women, and a few other such trifles, to possess a perfect city. In a word, this is the best city in the world to live in—in the future." Perhaps the present citizens of Washington will agree with him.

In 1800, John Cotton Smith, a Connecticut member of Congress on his way to attend its first session, Nov. 17, 1800, in the new city, recorded that he dined at Baltimore on canvas-back ducks, which he pronounced a dish of unequalled and exquisite flavor. He found one wing of the Capitol only erected, which, with the President's House, "both constructed with white sandstone, were shining objects in dismal contrast with the scene around them." Not an avenue was visible save one which he calls "a road with two buildings on each side of it, called the New Jersey Avenue." Pennsylvania Avenue was nothing but "a deep morass covered with alder-bushes." He says there appeared to be but two really comfortable habitations in the city, those of Daniel Carroll (whom he calls Dudley Carroll) and of Notley Young. In spite of the unfavorable aspect presented by the city, this Yankee Congressman expresses his admiration for its local position. He extols the view of the majestic river, "the cultivated fields and blue hills of Maryland and Virginia, the whole constituting a prospect of surprising beauty and grandeur."

When Baron von Humboldt returned from his scientific expedition in Central and South America, in 1804, he visited Washington, and was taken to Capitol Hill to enjoy the prospect.

After a careful survey of the surrounding scenery, he said to his companions—"Gentlemen, I have never seen a more beautiful near panorama in all my travels." This was told me by the late William W. Corcoran, who died in 1888, at the age of ninety.

The oft-told story of the location of the National Capitol at Washington is too familiar, in its main outlines, to justify repetition here. It enters into every book about our city, and was made the subject of a separate publication, 'The Founding of Washington City,' forming No. 17 of the Maryland Historical Society's Fund Publications, prepared by the present writer. I shall here brief a mere outline of the salient facts, with some allusions which are less generally known.

When the first Congress under the Constitution met at New York in 1789, that body was embarrassed by the claims of many cities, and the offers of various States, to provide a permanent seat of government. Trenton, Philadelphia, Carlisle, Germantown, Lancaster, York, Harrisburg, Reading, Wilmington and Baltimore all were eager to receive the new government with open arms. The debates in the House of Representatives (for none of those in the Senate are reported) were long and sometimes acrimonious. Suffice it to say, that after many locations had been successively defeated (Germantown, Pa., having been once selected, but reconsidered) the site on the Potomac was carried July 9, 1790, by a majority of only two votes in the Senate, and three votes in the House. Those votes, moreover, could not have been obtained, had North Carolina not come into the Union before the decision, casting her vote for the southern location.

The prolonged struggle over a question which excited so many passions, interests and prejudices, attests at once, in its settlement, the wisdom and moderation of our fathers, and the prodigious power of compromise in human affairs. Philadelphia was placated by receiving the boon of the temporary seat of government from 1791 to 1800. Other northern votes were secured by pledging enough southern votes for the National assumption of state debts to carry that favorite measure of the creditor States. As nearly all legislation is the fruit of compromise in some form, as the earliest American Confederation

in 1778 was a compromise, so was the founding here of the National Capital a compromise, and the adoption of the Constitution of the United States was the greatest compromise of all.

It is a noteworthy fact that this act of Congress for establishing a permanent seat of government, adopted after so long and serious a division of opinion, fixed absolutely no definite place for the site of the capital city. It gave the President of the United States the sole power to select any site on the river Potomac, between the mouth of the Eastern Branch (or Anacostia) and the mouth of the Conococheague, or about seven miles from Hagerstown, Maryland, which is over one hundred miles, following the windings of the river, from the present capital. It was in the power of Washington, under the provisions of this act, to have founded the National Capital at Harpers Ferry, fifty miles west of Baltimore, instead of at a place forty miles south of it. Indeed, a contemporary letter of Oliver Wolcott says: "In 1800, we go to the Indian place with the long name (meaning Conococheague) on the Potomac."

Washington, however, with that consummate judgment which distinguished his character, selected the only spot in the limits prescribed by Congress which united the advantages of tide-water navigation to the sea, easy access from Baltimore and other cities, and the finest natural sites both for public buildings, and the future wants of a thronging population. The 'magnificent distances,' which were long the theme of almost world-wide ridicule, have been discovered to be none too spacious, since the city has grown from a straggling village into a well-built and finely paved emporium for nearly three hundred thousand inhabitants. While the measurements of the city proper exhibit a total of 6111 acres, no fewer than 3095 acres of this aggregate are in streets, avenues, and public reservations, which leaves about half the surface of the city to private residences and their grounds. It results that there is a far greater proportion of open ground reserved from buildings in Washington than in any other large city, and this secures most important sanitary advantages to its inhabitants.

This is no place for any description of a capital so often described. But it is a notable fact in its history that the felicity



of the site, with the rival pretensions of other cities, should have forestalled any removal of the capital at times when that chronic discontent, which sways the temper of men and of nations broke out against the established seat of government. These criticisms give an amusing and sometimes grotesque coloring to the letters and journals of some early members of Congress, and ambassadors from foreign nations, in the earlier decades of our century. But these and later discontents have been allayed, we may hope permanently, by the extraordinary natural advantages of the site, growing more and more evident every year; and by the magnificent civic progress of the last quarter of a century, during which Washington has been advanced to the first rank among cities in public buildings, museums, libraries, thoroughfares, cleanliness, private residences, and all the arts of life.



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DESCRIPTION OF A NEW GENUS AND TWENTY  
NEW SPECIES OF FOSSIL CYCADEAN TRUNKS  
FROM THE JURASSIC OF WYOMING.

BY LESTER F. WARD.

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DISCOVERY AND HISTORY.

A CONSIDERABLE number of fossil cycadean trunks have been obtained from the Jurassic of Wyoming. The locality is in what are called the Freezeout Hills of Carbon County, twenty-five miles nearly due north of Medicine Bow.

The history of the discovery of these fossil trunks only dates back to 1898. The first intimation that I had of it was contained in a telegram from Prof. O. C. Marsh, dated July 15, 1898, as follows: "Have two small cycads, apparently new, from a new Wyoming locality; will send them by express if you can use them in your report." The 'report' alluded to is the description of the Black Hills cycads in the Nineteenth Annual Report of the U. S. Geological Survey (Pt. II, pp. 594-641, pl. lxi-clvii), which had gone to the printer before the telegram was received. As the new locality is not in the Black Hills it

would not have been appropriate to include the Wyoming cycads in that paper, and I so informed Professor Marsh.

Professor Marsh promptly made public all the information he had on this subject in the 'Postscript' to his paper on 'The Jurassic Formation on the Atlantic Coast—Supplement' which he had read before the National Academy of Sciences on November 18, 1897. This 'Supplement' with the 'Postscript' appeared in the American Journal of Science for August, 1898 (4th Ser., Vol. VI, pp. 105-115), and also in Science of August 5, 1898 (NS., Vol. VIII, pp. 145-154).

The next reminder I had of the existence of these vegetable fossils was through Dr. F. H. Knowlton, who had received a letter from Professor Wilbur C. Knight, State Geologist of Wyoming, dated September 3, 1898, in which he said: "Recently my assistant made a very rich find of Jurassic cycads. Would you care to describe the species, or possibly several species? I have some fine ones. One on my desk is 8×6×12 inches or larger."

Dr. Knowlton showed me this letter and, knowing that it referred to the same locality as that from which Professor Marsh had obtained his specimens, I immediately wrote to Professor Knight and offered to describe the specimens if he could find a way of placing them in my hands. As a result a negotiation was entered into with the authorities of the United States National Museum as to conditions on which the material would be received, but it was not until the 16th of March, 1899, that the collection finally arrived.

#### STRATIGRAPHIC POSITION.

In a letter from Professor Knight, dated October 18, 1898, in answer to questions I had asked him relative to the age of the beds, he says:

"There is no question as to the horizon of the find, it is in the Jurassic fresh water beds, and near the bottom. In the locality where this bed has been opened there is a typical Jurassic exposure, and the fresh water and marine beds can be sectioned to a foot. I have not visited the cycad beds yet but I am well acquainted with the locality and have made rough sections many times. In my opinion it is a very excellent find and is

well worth a careful study. I am at the present time making a special study of the Jurassic of Wyoming contemplating a monograph on the subject as soon as it is possible to complete the work. If you wish I can go to the field and give you an absolute section of the bed."

In another letter dated November 1, 1898, he makes the following more specific statement:

"A section through the locality will be about as follows:

Triassic red sandstone, 1000 feet.

Lower Jurassic (marine), 200 feet.

Upper Jurassic (fresh water), 225 feet.

Dakota conglomerate, from 50 to 200 feet.

Your Black Hills section reminds me of the Big Horn Basin country where I found beds that I could not place in the Dakota. In no instance in the section given have I detected any non-conformability, although I anticipate that such exists between the Jurassic and Dakota."

I spent the latter part of November of that year at the Yale Museum describing the new material that Professor Marsh had acquired since my visit in June. This included the two specimens received from Mr. W. H. Reed from the Jurassic of Wyoming and I took as full notes on them as possible. It was apparent at a glance that they had nothing to do with the Black Hills cycads, and that they were very different from anything that I had seen either in this country or in Europe. In some respects they resembled the specimens from the Purbeck beds of the Isle of Portland, especially the small ones that I saw there in 1894, and of which I obtained 20 specimens for the U. S. National Museum. This, however, had less to do with their botanical than with their mineralogical character—their light color, soft ashly constitution, and especially their obviously partially calcareous nature.

#### PERSONAL FIELD WORK.

I naturally had a great curiosity to visit these beds and study their geological position, and I was so fortunate as to make an arrangement with Professor Knight to meet him on September 1st, 1899, at Laramie, Wyoming, and have his company and guidance to the locality. We proceeded to Medicine Bow, where he had an outfit in readiness to take us to the Freezeout

Hills. The University of Wyoming had a cabin erected in the center of the Dinosaur area and only half a mile from the cycad bed. Several days were spent there and I devoted most of my time to a search for cycads and to a thorough investigation of the geological character and position of the strata holding these interesting remains.

Professor Knight was entirely correct in the above statement in his letter to me that the cycad beds are in the Jurassic fresh water formation. This deposit is nearly 200 feet thick and the cycad bed lies a little below the middle of it. The cycads occur on a ridge of disintegrated sandstone rock, having a grayish color with a reddish-brown tint. It was possible, however, to follow the bed around the northern slope of the hill to the east, where it was distinctly exposed as a ledge about ten feet in thickness of coarse, reddish-brown, crossed-bedded sandstone, with streaks formed by small white calcareous flecks, interbedded with the sand; which, however, are sometimes much larger, giving the rock somewhat the appearance of a conglomerate.

On the hills to the north of the cabin, across the valley, it crops out in great clearness and is considerably thicker. Everywhere it is full of silicified wood, but cycads were only found in the one particular locality described, which has an east and west extension of some 1000 feet and a north and south width near the top of the northern slope of the ridge of about 150 feet. A student, Mr. Charles Gilmore, of the University of Wyoming, who had been for some time at the cabin working out the Dinosaur bones, and who had rediscovered Mr. Reed's cycad locality, had obtained several additional trunks and sent them to Medicine Bow, where, without my knowledge, they were stored at the time we passed through and which, at the present writing, I have not yet seen; but I understand they are soon to be sent to the National Museum. As soon as we began work in the locality fragments were found and it was soon apparent that many other specimens were buried in the ground only a very short distance from the surface. A careful scanning of the entire area revealed small projections of such as actually reached the surface and they were easily dug out, resulting in the discovery of several good specimens. I spent one forenoon with a mat-

tock hunting for others that were wholly buried and succeeded in exhuming two or three more. All the specimens collected by us were packed up by Mr. Charles Schuchert, who was with the party and remained after I left, and these were shipped with his other collections to the National Museum where they now are. I have not had time to study them or to ascertain whether they include any additional species to those described in this paper, but as others are on their way and as there is a prospect of more extensive excavation and the discovery of many more, all this may be left for a future paper.

The section of the Freezeout Hills immediately to the east of the cycad bed and including the ledges formed by the stratum in which they occur was carefully measured. It is a characteristic section since it extends from the Red Beds at the bottom of the valley to the Cretaceous which caps the hill and is supposed to represent the Dakota group, although such an examination of it as I was able to make led me to suspect that it is the equivalent of the Lower Cretaceous of the Black Hills, possibly extending, in some places, to the true Dakota group of Meek and Hayden.

The following is the section :

Lower Cretaceous capping the hill.....	50 feet.
Base of Cretaceous to top of cycad bed .....	100 "
Thickness of cycad bed .....	10 "
Bottom of cycad bed to top of Marine Jurassic.....	80 "
Thickness of Marine Jurassic to bottom of valley on Red Beds .....	<u>115</u> "
Total exposure .....	355 "

This section leaves no doubt of the Jurassic age of the cycad bed and at the same time fixes its position in the fresh water Jurassic with sufficient exactness for all practical purposes.

#### LABORATORY PREPARATION.

The collection received from Professor Knight consisted of 83 specimens of cycads and three specimens of silicified wood. The specimens of cycads bore the numbers 500.1 to 500.83, and those of the wood 500.85 to 500.87, of the Museum of the

School of Mines of the University of Wyoming, at Laramie, Wyoming. They are for the most part fragments, but there are a few entire trunks. The three largest, Nos. 500.1, 500.2, and 500.65, though all present, are each broken in two pieces which fit perfectly together. In a number of cases complementary parts had been detected and unfortunately for their convenient study, glued together. In others such complements had been recognized and given the same number. It was obvious, however, that many fragments that belong together had not been identified, and much time was spent in finding and joining these counterparts. This study ultimately resulted in finding about twenty-five such cases. In addition to these there are a number which, although they do not actually fit together, nevertheless evidently belong to the same trunk, the structure being continuous and explicable on the assumption of the loss of intermediate portions. Putting these two classes together, the number of independent trunks and fragments is reduced to 61. In several cases more than two fragments belong together, for example, in three cases there are three, and in two cases there are five separately numbered pieces of the same trunk. A large proportion of the specimens were covered on the side on which they lay in the field by an incrustation of lime. This completely obscured the structure and it was necessary to remove it. This was the case with many of the Black Hills cycads, but it presented no serious difficulty beyond the labor and expense of placing the trunks in a vat of hydrochloric acid and leaving them there until the lime was removed, the pure silica of those trunks being wholly unaffected by the process. But, as already remarked, the Jurassic trunks, although mainly silicified, contain calcareous matter, and the acid unavoidably etches the surface somewhat. If this had been all it would have been a comparatively small matter. The worst difficulty arises from the fact that the oxidation of the specimens turns the parts affected by the acid black or dull brown, and thereby more or less obscures the markings of the surface on which the different organs normally have a different shade of color, which brings them out distinctly. After the acid bath, although the lime is removed and the surface little eaten



or injured, all the organs have this uniform black or brown color. It is, however, fortunate that while this interferes seriously with an ordinary macroscopic examination, the application of a lens removes the obscurity to a considerable degree, and in photographing the specimens it is observed that the dark surfaces come out almost as clearly as the light or variegated ones.

Besides the lime incrustations on the under surface there was usually a coating of lichens on the surface which lay uppermost, and this, where it existed, was quite as fatal to an examination of the parts thus concealed as the coating of lime. This, though somewhat more difficult to remove, yields to a strong alkali which has no effect upon the underlying structures.

The cleaning of the specimens by both the processes employed was undertaken as soon as possible after the collection had been unpacked and I commenced the systematic study of the trunks almost at once, thoroughly noting and recording the characters and peculiarities of every specimen and of all parts of each, and by the end of May, 1899, I had completed this part of the work. I have compiled tables of the characters and the subdivisions into specific groups has been based mainly upon such characters. Notwithstanding considerable sameness among these characters it is possible to classify them, and there seems no doubt that could their foliage and reproductive organs be known the cycadean flora of the Jurassic of Wyoming would be represented by a considerable number of species if not of genera, although it would be rash to assert that the lines would be drawn in all cases where we must draw them here.

The most marked feature that struck me on first casual inspection of these trunks, aside from their relatively small size, light color, and soft calcareous structure, was the frequency of a sort of smooth, to the naked eye, structureless, dull, uniform, covering that invests their outer surfaces and cuts off the view of the normal organs of the armor. A closer examination revealed the fact that this was not an occasional condition, but the normal state of these cycads, and that the cases in which this outer coating is wanting represent the abnormal state. It further became clear that there really are no cases in which it is naturally

absent, and that its absence is always due to some external influence acting upon the surface which has removed it. There is an abundance of proof of this, and most of the specimens show parts over which the external coating still adheres and other parts where it is absent. The latter usually reveal the nature of the agency that has removed the coating, whether a sudden and violent concussion, a gradual erosion, or a process of weathering. The contact of the outer layer with the surface of the armor proper is always marked by a clear plane of separation, and usually by an open structure or even a partially void space. This becomes a natural plane of cleavage, and almost any influence will cause the outer coating to scale off like the outer bark of a tree.

In the specimens of the Yale Museum this outer coating had almost entirely disappeared, though not absolutely, so that the phenomenon did not specially strike me, and I only noted that the surfaces were obscure in places. Through the kindness of Dr. C. E. Beecher, these specimens were sent to me for further examination and comparison with those of the large collection from Mr. Knight. Some of the important results of this comparison will be noted later on, but it is sufficient to state here that they form no exception or anomaly, but are simply part and parcel of the general lot.

#### GENERIC CHARACTERS OF FOSSIL CYCADEAN TRUNKS.

Generic characters, with the exception of Bennettites, which is identical with *Cycadeoidea* except in the accident that seeds have been discovered in the spadices, have generally been based on the shape of the trunk and on the character of the armor, *i. e.*, of the remains of the foliar organs still adhering to the trunk in the fossil state. The former of these characters have proved of less constancy, and in cases where the latter class of characters is distinctive authors have not hesitated to ignore variations in the former, as, *e. g.*, *Cycadeoidea gigantea* of Seward, a tall cylindrical trunk wholly different in form from other species of that genus. I was obliged to do the same with *C. excelsa* and *C. jennyana*.

The second class of characters is relatively constant and diag-

nostic, and to show the differences in the different genera I will reproduce the descriptions of different authors of these generic characters, translating where necessary :

**Bucklandia** : scarred-areolate by the scars of the spadices, scales, and petioles (Carruthers).

**Yatesia** : covered by the scales and persistent bases of the petioles (Carruthers).

**Williamsonia** : scarred-areolate by the markings of the deciduous petioles (Carruthers).

**Bennettites** : covered with the persistent bases of the petioles (Carruthers).

**Mantellia** : same as Bennettites (Carruthers. This was Brongniart's name of *Cycadeoidea* which Carruthers adopted).

**Raumeria** : densely covered or scarred by the persistent bases of the petioles and stipule-shaped, connate scales (Carruthers).

**Fittonia** : covered by the scales and persistent, large, geniculate bases of the petioles (Carruthers).

**Crossozamia** : covered by the short, subimbricate bases of the petioles (Carruthers).

**Clatharia** : marked by transverse rhombic or irregularly pentagonal and hexagonal scars of leaves truncated above the base (Carruthers).

**Cycadeoidea** : enveloped by the basilar remains of the leaves, rhomboidal in cross-section (Schimper).<sup>1</sup>

**Bolbopodium** : completely enveloped by the disjointed rhombic leaf bases of different lengths (Saporta).

**Cylindropodium** : leaf bases short, densely crowded, with rhombic, convex scars (Saporta).

**Clathropodium** : leaf bases long-rhombic or elliptical in cross-section (Saporta).

#### THE NEW GENUS CYCADELLA.

The peculiar outer coating or second armor of the Jurassic cycads of Wyoming obviously constitutes a good generic character. At the same time, as is seen by the above descriptions, it is wholly different from that of any other genus of cycadean trunks, and it is therefore necessary to regard it as a new genus, altogether different in its most essential generic characters from any other. From the general small size of these trunks, espe-

<sup>1</sup> Buckland's description was not compact.

cially when compared with the giant forms of the Black Hills, I have concluded to call this new genus *Cycadella*.

Although a macroscopic examination is sufficient to show this generic distinction, still it does not immediately indicate the true nature of this supplementary envelop. I was at first disposed to think that it consisted of matted leaves. I observed that the leaf bases were always present, filling the scars, and sometimes projecting somewhat above the general surface, and I did not know but that expanded portions of them might have also persisted and been rolled and packed against the trunks in the process of entombment in a manner to produce the observed effect. But a strong glass failed to bring out the difference on the surface that would be expected if such had been the case: striations, folds, leaf margins, etc. Moreover, the fractured margins often showed the darker leaf bases coming out to the surface of the true armor, but never continuing across the line of separation and mingling with the tissue of the outer layer, which is sometimes more than a centimeter in thickness.

Since, aside from the reproductive organs, less abundant than in the Cretaceous cycads, the armor consists of nothing else than the leaf bases and the ramentum that is attached to them and constitutes the walls, this last must have furnished the covering which forms the outer coat. It has been observed that these fine scales or hairs are always the most certain to be preserved, and whatever the degree of imperfection, in the state of preservation in other respects, the walls are usually intact. This accounts for the large number of trunks that consist of these walls penetrated to a great depth by the rhombic or triangular cavities, looking like petrified honeycomb or sponges. This is a most fortunate circumstance, since otherwise we should in such cases have nothing but the woody cylinder of the trunk, and would be entirely incapable of determining the true nature of these objects.

This special susceptibility to petrification on the part of the ramentum explains the presence of the external covering of the Wyoming Jurassic cycads, since it seems actually to consist of a matted mass of these ramentaceous hairs, which in some way developed so luxuriantly upon the sides of the petioles as to push

out beyond the surface and roll over the spaces formerly occupied by the leaves and fruits. It seems necessary to assume that this occurred long after the fall of the leaves, and, indeed, this latter doubtless took place much as it does in living cycads, the leaves always forming a crown to the trunk and falling away as the trunk elongates, leaving only their persistent bases to form a false bark. These are not wholly dead, but manifest vegetative activity and doubtless have some physiological function. The development of copious ramentaceous hairs would form a protection to the trunk both from cold and from violence.

Something analogous to this may be seen in living cycads and in tree-ferns, also in some palms, and a similar function is sometimes performed in other ways, as by the coat of wax on the wax palms. At any rate we are confronted with the fact that *Cycadella* developed an exuberant growth of fine scales or hairs from the bases of its old petioles below the apex, which formed a woolly or mossy covering of considerable thickness, sufficient when tightly appressed to the trunk and petrified there to form a layer 5-15mm thick all over the fossil trunks.

As already remarked, there is usually a clean line of separation between the armor proper and this outer covering, but if the latter consists of ramentum there must be points at which it crossed this boundary and reappeared in the superficial layer. Such points are not easy to find in the collection, but the fractured surfaces of a few specimens reveal the process of transition in a more or less imperfect way. Such specimens were carefully searched out and the most promising cases were sectioned and the surfaces polished. Slides were also made and the whole process is as fully illustrated as the nature of the material will permit.

#### SYSTEMATIC DESCRIPTION OF THE GENUS AND SPECIES.

The following is the description of the new genus *Cycadella* and the species distinguished in the collections examined:

Genus **CYCADELLA** new genus.

Pl. XIV.

Trunks relatively small, bulbous, subspheroidal, or subconical, variously compressed, encased in a layer 5-15mm thick of dense tis-

sue consisting of the chaffy ramentum exuberantly developed from the leaf bases and extruded from the armor, massed and matted in the fossil state so as to form a thick outer covering to the trunk; leaf bases always filling the scars, occasionally caught in the meshes of the outer coating, but normally truncated below and constituting with the ramentum walls a dense armor 1-5cm thick; otherwise as in *Cycadeoidea*.

Pl. XIV merely illustrates the nature of the ramentaceous chaff and the great length that it attains, but it would be obviously impossible to show the full length with a power of 90 diameters. The manner in which the chaffy hairs protrude from the armor and pour over the surface of the trunk upon which they lie in mats of wavy lines is shown on Pls. XIX and XX, illustrating *Cycadella knowltoniana*. The phenomena will be more fully described under that species.

I am indebted to Dr. F. H. Knowlton for the drawings of Pl. XIV, made from slides of several species under the compound microscope. For further details see description of that plate.

#### CYCADELLA REEDII n. sp.

##### Pl. XV.

Trunks small (8-12cm high, 6-16cm in diameter), subspheroidal or subconical, unbranched, usually more or less laterally compressed, the axis oblique; rock substance rather soft, light colored, of low specific gravity; organs of the armor ascending; leaf scars arranged in rows around the trunk nearly at right angles to the axis, subrhombic, 15-20mm wide, 6-10mm high; leaf bases porous; walls 1-3mm thick, hard and fine-grained, often flinty, usually white and somewhat striate; reproductive organs very obscure; armor 1-3cm thick, separated from the axis by a definite line; wood 2-3cm thick; cortical parenchyma 1-2cm thick; fibrous zone divided into two or three rings of fine, more or less distinctly radiate structure; medulla 2-4cm in diameter, nearly circular, consisting of fine-grained homogeneous tissue.

To this species are referred five of the specimens. One of these which is taken as the type is the more complete of the two originally sent to Professor Marsh by Mr. W. H. Reed for whom the species is named. It is No. 127 of the Yale Collection. The other specimens are Nos. 500.6, 500.10, 500.19, and 500.29 of the Museum of the State University of Wyoming. The Yale specimen is larger than any of the others, weighing 2.04 kilograms, while No. 10 is the smallest

trunk in either collection and weighs only 0.37 kilogram. No. 500.6 weighs 1.48, No. 500.19, 1.56, and No. 500.29, 1.67 kilograms.

Pl. XV represents the best side of the Yale specimen with the eccentric medulla projecting.

CYCADELLA BEECHERIANA n. sp.

Pl. XVI.

Trunk cylindrical, contracted at base and summit, somewhat laterally compressed, unbranched, 35cm high, 18×22cm in diameter; rock substance soft, generally light colored with darker stripes and spots strongly contrasting, of low specific gravity; organs of the armor horizontal; phyllotaxy concealed by the outer coating of ramentum; leaf scars subrhombic or somewhat elliptical, 15–20mm wide, 5–10mm high; leaf bases dark colored, punctate; walls about 5mm thick, firm, white, sometimes with a median line; reproductive organs well developed, somewhat raised above the general surface, elliptical in cross-sections, 2×3cm in diameter, surrounded by subrhombic bract scars in several rows, the central portion heterogeneous and more or less crystallized; armor 3–4cm thick, joining the axis by an irregular line; wood 3–4cm thick; cortical parenchyma 1–2cm thick; fibrous zone 2cm thick not differentiated into rings, firm and dark colored; medulla mostly wanting in the only specimen known, the preserved remains flinty and white.

Of this species there has been thus far found less than half of one trunk. The upper two thirds of this consists of the fragment No. 128 of the Yale collection. When I studied this fragment in November, 1898, it was all in once piece, but subsequently broke into two nearly equal pieces by an oblique transverse fracture, and a small lump came out of the lower one of these pieces. While studying the larger collection at Washington in June, 1899, I felt the need of again seeing the two Yale specimens in order to correlate them with the rest, and at my request Dr. C. E. Beecher kindly sent them to me for the purpose. As soon as I saw this fragment I at once recognized its resemblance to a smaller fragment of the Knight collection, No. 500.54, which I had been unable to class with any of the rest. On confronting them it was found that No. 500.54 of the Wyoming collection fitted perfectly on the lower end of No. 128 of the Yale collection, thus nearly completing it in that direction, but still leaving a small part of the base unrepresented. Thus restored the specimen represents nearly half of the original trunk, which was split down quite

evenly from summit to base on a longitudinal plane a trifle on one side of the center. On the fractured surface thus presented the internal characters are exposed with great clearness.

As a partial recognition of the interest taken by Dr. Beecher in the subject of cycads in general and in the Wyoming specimens in particular I dedicate this species to him.

The Yale specimen weighs 3.18 and the Knight specimen 1.45 kilograms.

Pl. XVI represents the inner fractured surface of the specimen as restored, the lines separating all four of the pieces being distinctly visible.

### CYCADELLA WYOMINGENSIS n. sp.

#### Pl. XVII.

Trunks relatively large (25–30cm high, 15–25cm in diameter), short-conical or slightly contracted at the base, more or less laterally compressed, unbranched or with a few projecting secondary axes; rock substance hard and fine-grained, generally light colored but with varying shades, of medium specific gravity; organs of the armor slightly ascending; rows of scars from left to right making an angle with the axis of  $70^{\circ}$ – $80^{\circ}$ , those from right to left, of  $45^{\circ}$ ; leaf scars subrhombic, 15–20mm wide, 8–12mm high; leaf bases relatively dark, affected with black or sometimes white tubular punctations; walls 2–4 mm. thick, light colored and striate but without any proper commissure; reproductive organs few but often well developed, sometimes projecting or passing through the outer coating, elliptical in cross-section,  $2 \times 3$ cm in diameter, surrounded by mostly obscure rather large involucreal bract scars of variable shape, the central portion solid but heterogeneous in structure; armor 3–6cm thick, joined to the axis by a definite but usually irregular, sometimes scalloped line; wood 3–4 cm thick; cortical parenchyma 10–15mm thick; fibrous zone 1–2 cm thick, usually consisting of two rings, one or both radiate in structure, the medullary rays often distinct; medulla 5–10cm in diameter, the cross-section elliptical in the compressed specimens, of a nearly homogeneous fine-grained structure.

This species includes some of the handsomest specimens in the collection, having about a medium size, and therefore fairly representative of the Jurassic cycads. Nos. 500.3, 500.14, and 500.15 are nearly perfect trunks. The rest are fragments. Nos. 500.7 and 500.20 are somewhat thin segments bounded by transverse fractures, and almost certainly belong to the same trunk at different elevations. No.



500.26 may be a lower segment of the same trunk, but if so it must have been contracted at the base, as is the case with No. 500.3. Nos. 500.8 and 500.67 fit each other and the former, which was shattered when received, has come in three pieces. It represents a section between two oblique but chiefly vertical fractures. No. 500.52, a thick somewhat cubical piece, almost certainly belongs to No. 500.8 as shown by the identical structure of its principal fracture.

The weights of the specimens are as follows:

No. 500.3,	11.03 kilograms.	
“ 500.7,	2.41	“
“ 500.8,	1.28	“
“ 500.14,	12.00	“
“ 500.15,	8.89	“
“ 500.20,	3.57	“
“ 500.26,	4.00	“
“ 500.52,	1.13	“
“ 500.67,	0.40	“

In Pl. XVII, which is a side view of No. 500.14, the distinction between the parts covered with the ramentaceous cortex on the right and those from which this has peeled off on the left, with the exposed edge of this layer, are clearly brought out.

### CYCADELLA KNOWLTONIANA n. sp.

Pls. XVIII, XIX and XX.

Trunks of medium size (25cm in diameter), cylindrical, bearing a few small secondary axes; rock soft, light colored without, dark and variegated within; organs of the armor horizontal; leaf scars sub-rhombic, 8-12mm wide, 4-6mm high; leaf bases relatively dark, punctate with minute, white-walled tubes; walls thick, sometimes 5mm, soft, white on their outer edges, brown within as shown on the fractures, contrasting strongly with the nearly black leaf bases, the ramentaceous hairs very distinct, showing their mode of origin in the petioles and their passage from the armor into the outer coating which they form, to a thickness in places of nearly 2cm; reproductive organs few but distinct, usually raised, 16×25mm in diameter, surrounded by two or more rows of narrow involucre bract scars, the bracts distinctly traceable in longitudinal section to their origin in the receptacle from which also proceed the essential organs in an advanced stage of decay and mineralization; armor 3-4cm thick, joined to the axis by a very irregular but somewhat definite line, the petioles emerging from different depths as projections of the wood substance; wood 2-3cm thick, very imperfectly differentiated into two zones, the inner wall,

exposed in one specimen, showing large scars of the medullary rays, consisting of elongated alternating depressions, 10-15mm long, 5-8mm wide, each with a raised point or cushion above the middle; medulla 4cm in diameter, hard, fine-grained, and homogeneous.

This species consists of Nos. 500.62 and 500.76, which seem to belong to the same trunk but are not exactly contiguous. They probably belong end on end, No. 500.62 being the upper segment and reaching nearly to the apex of the trunk, while No. 500.76 falls considerably short of reaching the base. The trunk probably had a height of about 20cm. No. 500.62 has lost the medulla, thus exposing the inner wall of the woody axis as described. Both specimens are nearly covered without by the coating of ramentum and the transverse fractures reveal its nature better than in any other specimens in the collection. One of these surfaces (the upper fracture of No. 500.76) has been cut across and polished, and microscopic slides prepared from the region which most clearly shows the transition of the ramentum to the outer investiture (see Pl. XIV). This polished surface was photographed natural size and also enlarged four times linear, and the most instructive portions of the enlarged view have been selected to illustrate the behavior of the ramentaceous chaff in forming the external layer.

On account of the great interest taken by Dr. F. H. Knowlton in the question of the true nature of this peculiar generic character, the material assistance he has rendered me in preparing and examining microscopic slides illustrating it, and the fact that the most successful of these investigations have been made on specimens of this species, I have thought it a proper recognition of his services that the species should bear his name.

The weight of No. 500.62 is 1.22, and that of No. 500.76 (before cutting) 1.39 kilograms.

Pl. XVIII, Fig. 2, and Pls. XIX and XX, illustrate the instructive specimen No. 500.76. The polished surface of the upper transverse fracture, from which the microscopic slides were taken, is represented by Pl. XVIII, Fig. 2. The figure is somewhat enlarged and even here the origin of the ramentum from the sides of the leaf bases is distinctly visible without a lens. The line dividing the armor from the outer layer is clear and a good general idea of the nature of the latter can be gained from this view. The irregular attachment of the armor to the axis is also well shown.

Pls. XIX and XX represent two areas of the polished upper transverse plane enlarged four diameters. An inspection of Pl. XVIII, Fig. 2, shows that there is a short interval near the center of the specimen over

which, for some reason, there is no outer layer, to the left of which it extends entirely to the margin, and on the right of which it fills a deep depression in the surface. Pl. XIX includes the greater part of the portion on the left where this layer is present, and Pl. XX covers the area on the right. All the characters, generic and specific, are admirably brought out in these two enlarged areas, especially the nature of the ramentum outside of the armor, and its wavy, crinkled character as determined by the irregularities of the surface and the unknown agencies that compressed it from without and packed in down against the trunk. In several places portions of leaf bases and perhaps of reproductive organs, detached from the armor and caught, as it were, in the meshes of chaff, can be seen lodged in the outer coat. These show their normal vascular structure under the compound microscope. Owing to inequalities of pressure and unexplained conditions the long strands of matted chaff are differentiated into bands of different color and density that lie parallel to one another and zigzag across the exposed cross-sections of the investing layer. Near the left margin of Pl. XX there is a region where one of the petioles is clearly seen to cross the boundary line between the armor and the ramentaceous covering, and the chaff that developed from its left side can also be traced across this boundary and out into the outer layer. This is particularly instructive from the point of view of the origin of the latter. Upon the whole these several illustrations afford a tolerably clear idea of the character of this remarkable group of extinct plants.

#### CYCADELLA COMPRESSA n. sp.

Trunks small (10-20cm high, with major diameter 12-15cm), originally conical, all much compressed laterally or sometimes vertically or obliquely, unbranched; rock soft, light colored, of low specific gravity; organs of the armor tightly appressed to the trunk for the most part upwardly, obscuring their arrangement; leaf scars subrhombic, where normal 15-20mm wide and 8-12mm high; leaf bases soft, rough or porous; walls 1-2mm thick, soft sandy or decayed and depressed, light colored or yellowish; reproductive organs few and obscure, sometimes slightly elevated, elliptical in cross-section, 12 x 20mm in diameter, with or without visible bract scars, the central portion obscure; armor very variable in thickness (5-25mm), joined to the axis by a definite but more or less irregular line; wood 2cm thick; cortical parenchyma 1cm thick; fibrous zone 1cm thick, not differentiated; medulla in laterally compressed specimens a thin slab 5mm

thick and 7cm long, in vertically compressed specimens circular, 2cm in diameter.

This species embraces six much flattened specimens, viz., Nos. 500.4, 500.18, 500.22, 500.35, 500.68, and 500.69. Of these Nos. 500.4, 500.18, and 500.35 are nearly complete trunks, No. 500.18 being vertically or somewhat obliquely compressed. All the rest are laterally compressed. Nos. 500.22, 500.68, and 500.69 may all belong to the same trunk, the last two especially resembling each other, but none of them are contiguous. They all bear a general resemblance to one or other of the species already described but, aside from their great compression and small size, not specific characters in themselves, there are numberless features which forbid their union with any of these.

The weights are as follows :

No.	500.4,	1.11	kilograms.
"	500.18,	1.14	"
"	500.22,	0.79	"
"	500.35,	0.88	"
"	500.68,	0.59	"
"	500.69,	0.56	"

### CYCADELLA JURASSICA n. sp.

Trunks rather small (10–15cm high, 10–20cm in diameter), very irregular in shape, more or less compressed in various directions and distorted, often much branched with several primary axes, sometimes with secondary axes only, the branches usually terminating in regular buds; rock substance soft except where excessively mineralized, light ash colored with dark, sharply contrasting stripes and spots, usually of low specific gravity; organs of the armor mostly ascending and adjusted to the axes of the branches; phyllotaxy not generally traceable except in secondary arrangement around certain branches; leaf scars subrhombic or somewhat elliptical, 15–20mm wide, 8–12mm high; leaf bases dark and affected with white fistular punctations; walls 2–4mm thick, soft-sandy, white or yellowish, striate, often with a median groove, depression, or crack; reproductive organs somewhat rare, often well-developed, either flush with the surface or raised above it, elliptical in cross-section, variable in size, 15–30mm in diameter, surrounded by large triangular bract scars, the central portion solid and marked by the scars of the essential organs; armor 4–6cm thick, joined to the axis by an uneven, more or less definite line; wood 2–3cm thick; cortical parenchyma 1–2cm thick; fibrous zone 1–2cm

thick, sometimes in 2 rings with radiate structure; medulla 3-6cm in diameter, fine-grained and homogeneous.

This species is one of the most common in the Jurassic of Wyoming and is typical of the smaller branching forms. It embraces Nos. 500.5, 500.23, 500.30, 500.36, 500.38, 500.41, 500.49, 500.70, 500.77, 500.78, 500.80, and 500.82. Nos. 500.49 and 500.77 fit together, and No. 500.41 evidently belongs to the same trunk. A small piece has become detached from No. 500.49. Nos. 500.78 and 500.82 also fit together, and No. 500.70 seems to form a cap to this small trunk, but a portion is lost between them. The rest are all single. Nos. 500.5 and 500.23 are practically complete trunks. Nos. 500.36 and 500.38 are parts of two of the largest trunks of the species, and No. 500.30 is over half of another nearly as large. They are all very handsome specimens, presenting the regular mottled striped or spotted appearance due to contrast between the dark leaf bases and the light colored walls. No. 500.23 is nearly unbranched and is anomalous in several respects. It may represent a different species, but cannot be identified with any other specific group.

The weights of the specimens is as follows:

No. 500.5,	2.41 kilograms.
" 500.23,	1.05 "
" 500.30,	2.30 "
" 500.36,	3.43 "
" 500.38,	3.32 "
" 500.41,	0.37 "
" 500.49,	1.84 "
" 500.70,	0.56 "
" 500.77,	1.14 "
" 500.78,	0.79 "
" 500.80,	0.79 "
" 500.82,	0.62 "

#### CYCADELLA NODOSA n. sp.

Trunks small (8-14cm high, 10-20cm in diameter), ellipsoidal or conical, somewhat laterally compressed or otherwise distorted, covered with small secondary axes forming prominences or protuberances and giving the specimens a kotty or gnarly appearance; rock hard, light ash colored or brown on weathered surfaces, black within, of medium specific gravity; organs of the armor generally horizontal; leaf scars subrhombic, 15-20mm wide, 5-10mm high; leaf bases punctate with small white tubes; walls 1-3mm thick, firm, light colored, striate, sometimes with a median groove or line; reproductive organs few, obscure, simulating the secondary axes, surrounded by large subrhombic

involucral bract scars in several rows passing into leaf scars, central portion solid, heterogeneous; armor 2-4cm thick, joined to the axis by a definite line; wood 2-4cm thick; cortical parenchyma 1cm thick; fibrous zone 1-3cm thick, consisting of two or three rings, the outer ones showing radiate structure; medulla either circular and 4cm in diameter or elliptical in cross-section, the lesser diameter 2-4cm and the greater 3-8cm.

After considerable hesitation I have decided to group together seven of the specimens under this name, although, from different states of preservation and degrees of compression, they present a somewhat varied aspect. They all agree, however, in the one leading character of being more or less densely covered with small protruding secondary axes which greatly obscure and distort all other characters. I name the species from this character, using the word *nodosa* in its primary and more correct sense of *knotty* or *full of knots*, and not in the secondary and less correct sense which most naturalists give it of *jointed*, which should properly be expressed by the Latin word *articulatus*.

The specimens referred to this species, with their weights are as follows:

No. 500.9,	2.41 kilograms.
“ 500.11,	1.14 “
“ 500.12,	0.87 “
“ 500.17,	2.55 “
“ 500.21,	2.12 “
“ 500.47,	2.35 “
“ 500.48,	1.25 “

With the exception of No. 500.21, these are all nearly perfect trunks. That one seems to be only the upper part of a trunk larger than the rest, but it is impossible to decide how much more there was below this, and in fact the base may not have been far away. In that case it would have had a low, vertically flattened form, which is different from the rest. No. 500.9 is considerably larger than the others and has fewer branches, but it cannot be referred to any other group. Nos. 500.11, 500.12, and 500.48 are all smaller and have about the same general facies. I would make Nos. 500.17 and 500.47 the types of this species. They are very similar in all respects and display the specific characters to good advantage. They are much less distorted by pressure than the other specimens.

#### CYCADELLA CIRRATA n. sp.

Trunks of medium size, short-cylindrical, rounded at the summit, somewhat laterally compressed, unbranched; rock rather hard, drab

on the weathered surfaces, dark within with white stripes, of medium specific gravity; organs of the armor ascending, especially above the middle, towards the summit, as seen on the fractured surfaces, curving first upward and then gracefully outward in continuation of the clearly marked strands from the interior of the axis; leaf scars subelliptical or subrhombic, 12-15mm wide, 5-6mm high; leaf bases hard, dark and porous; walls 3-5mm thick, hard and smooth, light colored or nearly white; reproductive organs few and obscure; armor 3-5cm thick, irregularly joined to the axis; woody zone 2cm thick, undifferentiated, medulla 2-3cm in diameter, black, striped and blotched with white flinty patches.

This species includes the specimens numbered 500.42, 500.46, 500.59, 500.71, and 500.75, but they all probably belong to the same trunk. No. 500.46 matches No. 500.42 and No. 500.75 matches No. 500.46 by a narrow facet, with the loss of intervening chips. No. 500.71 has exactly the same markings as No. 500.42 on the side opposite No. 500.46. These markings are too definite and peculiar to recur, and amount to a proof of identity, although a thin plate between has disappeared. No. 500.59 is evidently the downward continuation of No. 500.42. On one side there is almost complete continuity, but a large triangular piece is wanting on the other side.

The weights of the pieces are as follows:

No. 500.42,	1.53 kilograms.
“ 500.46,	0.57 “
“ 500.59,	1.11 “
“ 500.71,	0.28 “
“ 500.75,	0.70 “

After all are put together we still probably have less than half the original trunk.

#### CYCADELLA EXOGENA n. sp.

Trunks small or of medium size (12-20cm high, 8-20cm in diameter), ellipsoidal, somewhat compressed laterally or (in one specimen) vertically, unbranched; rock hard and fine-grained, light colored on the weathered surfaces, dark within, variegated with brown or white stripes or spots, of medium specific gravity; organs of the armor horizontal; rows of scars making an angle of 50° with the axis in both directions (traceable only in one specimen); leaf scars subrhombic, 12-20mm wide, 6-9mm high; leaf bases hard, fine in structure, punctate or porous; walls 1-3mm thick, soft-sandy, and more or less decayed, light colored, sunken between the leaf bases, striate or wrinkled, sometimes with a median line or commissure; reproductive organs

mostly concealed, well developed, generally projecting,  $15 \times 25$  mm in diameter, surrounded by narrow bract scars, the central portion solid and showing the scars of floral organs; armor 3–5 cm thick, definitely but irregularly joined to the axis, the leaf bases penetrating to different depths; wood 2–3 cm thick, clearly exposed on longitudinal and transverse sections; cortical parenchyma 1 cm thick, irregular on its outer, even on its inner face; fibrous zone consisting of three very definite exogenous rings of wood, the outer 5 mm thick, the middle one 2 mm thick, and the inner one 1 cm thick, all with radiate structure, the medullary rays visible across the entire zone, the inner wall of which is scalloped by the rounded inner edges of definite woody wedges, 8 mm wide, and the sharp reëntrant angles between them; medulla when circular 4 cm in diameter, when elliptical  $3 \times 5$  cm, in one specimen  $5 \times 7$  cm in diameter.

This species is represented by 7 different numbers in the collection, but Nos. 500.13 and 500.72, Nos. 500.40 and 500.73, and Nos. 500.53 and 500.61, each match and complement each other. No. 500.37 is larger than the rest and represents most of the lower part of a trunk. With the exception of Nos. 500.53 and 500.61 all the specimens so closely resemble one another that the suspicion arises that they may all belong to the upper part of No. 500.37. But a careful examination negatives this view, and it seems necessary to suppose that they represent at least two different trunks. The combination Nos. 500.44 and 500.73 may be a part of the same trunk as No. 500.37, but the combination Nos. 500.13 and 500.72 must be distinct, as it forms nearly half of a trunk of different shape with the large mamillary terminal bud and a small portion of the base, which show that this trunk was low and vertically compressed if at all.

The combination Nos. 500.53 and 500.61 constitute more than two thirds of a handsome little trunk broken longitudinally through the center of the axis, and one of the halves transversely above the middle, the fractures being as clear and perfect as if sawn. This specimen shows the internal structure more perfectly than any other in the collection, especially the three exogenous rings of wood as described.

The weights of the specimens are as follows:

No. 500.13,	1.08 kilograms.
“ 500.37,	2.41 “
“ 500.44,	1.25 “
“ 500.53,	1.64 “
“ 500.61,	1.16 “
“ 500.72,	0.59 “
“ 500.73,	0.65 “



## CYCADELLA RAMENTOSA n. sp.

Trunks rather large (15–25cm high, 2–25cm in diameter), cylindrical or subellipsoidal, somewhat compressed laterally or vertically, mostly unbranched; rock hard and much mineralized within, dark brown on the surface, the fractured surfaces variegated with black and white, more or less flinty or chalcedonized; specific gravity above the mean; organs of the armor horizontal or radiating from an equatorial zone; leaf scars subelliptical, 10–15mm wide, 6–9mm high, hard, dark, rough, punctate with white, tubular pores; walls 1–3mm thick, firm and smooth, light colored or yellowish, sunk below the leaf bases, with a median line or groove; reproductive organs few, mostly concealed by the ramentum coating, where exposed well developed, raised above the leaf bases, mostly elliptical and  $15 \times 20$ mm in diameter, enclosed in an involucre of narrowly rhombic bracts visible in transverse and longitudinal section, central portions well shown on fractured surfaces, the interior mostly decayed and somewhat crystallized; armor 4–6cm thick, attached to the axis by an irregular, somewhat scalloped surface; wood 3cm thick, undifferentiated; medulla elliptical in cross-section  $3 \times 5$ cm in diameter.

This species includes ten numbers of Professor Knight's collection, but probably only represents three trunks, since five of these fragments (Nos. 500.40, 500.43, 500.45, 500.66, and 500.81) all fit together and may be built up into a single specimen representing nearly half of one trunk, and Nos. 500.50 and 500.60 also match, forming about one third of another. Nos. 500.39 and 500.55 do not exactly match, but so closely resemble each other that the amount and character of the part lost can be determined with considerable certainty. They cannot well belong to either of the other combinations. No. 500.39, is the next most important specimen in the collection in furnishing the generic characters, and slides illustrating them have been prepared from it.

No. 500.34 is a small apical portion of a trunk of the same type and may well have formed the top of No. 500.39 and the lost piece that belonged with it, but there was a short interval between them, as they do not exactly match.

The weights of the several fragments in the order of the numbers are as follows:

No. 500.34,	1.02 kilograms.
“ 500.39,	2.41 “
“ 500.40,	2.04 “
“ 500.43,	1.50 “
“ 500.45,	1.64 “

No. 500.50,	2.55 kilograms.
“ 500.55,	1.70 “
“ 500.60,	1.53 “
“ 500.66,	2.33 “
“ 500.81,	0.68 “

The large combination, therefore, has a total weight 8.19 kilograms, and Nos. 500.50 and 500.60 together weigh 4.08 kilograms.

The specific name is not meant to imply that there is anything exceptional in the ramentum of this species, although most of the specimens have a well developed outer coating of it, but some of the fractures afford fine examples and the detailed study of the generic characters has chiefly been made on this species and *C. knowltoniana*.

#### CYCADELLA FERRUGINEA n. sp.

Trunk small (18cm high, 9×22cm in diameter), ovoid, laterally compressed, unbranched; rock hard, rust-colored without, striped and spotted with the same in the interior, of medium specific gravity; organs of the armor horizontal at the middle, descending below and erect at the summit; leaf scars subelliptical, 10mm wide, 5mm high; leaf bases fine-grained, not porous nor punctate; walls 2–3mm thick, soft, rust-colored, with a median groove; reproductive organs much obscured, sometimes raised, elliptical, 15×20mm in diameter, surrounded by thin obscure involucre bract scars, the central portion only clearly shown on the fractured surfaces, heterogeneous and much altered by mineralization; armor 2–3cm thick, irregularly joined to the axis; wood 1cm thick; cortical parenchyma 5mm thick; fibrous zone 5mm thick, not clearly differentiated into rings, but longitudinally striate, parallel to the axis of the trunk; medulla a thin slab visible only on the narrow edge where it is 1cm thick, apparently 4–5cm wide.

This species includes the two fragments Nos. 500.51 and 500.74, exactly alike in all their characters and certainly belonging to the same trunk. The fracture in both cases is longitudinal in the direction of the minor axis, starting in obliquely near the top and becoming vertical near the middle. In No. 500.51 this vertical direction continues to near the base and then runs out on the same side it went in. In No. 500.74 it describes a sort of curve, cutting in to near the center and out again at a still sharper angle long before it reaches the base. The true base and summit are therefore lost in both specimens. There is one point at which the two pieces probably are contiguous, though the surface of contact is not large enough to demonstrate this.

No. 500.51 weighs 1.36 and No. 500.74, 0.81 kilograms, total 2.17 kilograms.

Named from the ferruginous or rusty color peculiar to these specimens.

#### CYCADELLA CONTRACTA n. sp.

Trunks of small or medium size (height not known, 15–25cm in diameter), probably conical above, strongly contracted at the base, laterally compressed, more or less branched; rock hard and fine-grained, of a nearly uniform drab color or dull reddish on the outer surface, of medium specific gravity; organs of the armor ascending at their origin, curving outward and becoming horizontal or declined; rows of scars (traceable in one specimen) from left to right forming an angle of 40° with the axis, those from right to left 55°; leaf scars subrhombic, 12–20mm wide, 6–12mm high; leaf bases of uniform color, punctate with white tubular pores; walls 1–3mm thick, rather soft, depressed, striate, with a median line or crack; reproductive organs imperfectly developed, somewhat raised, 15 × 22mm in diameter, surrounded by large bract scars passing into leaf scars, central portion solid, roughened, warty; armor about 3cm thick; wood 1–3cm thick, differentiated in one specimen, the outer zone 5mm thick, the inner 1cm, longitudinally striate; medulla 15–30mm in diameter, hard, fine-grained, and homogeneous.

The specimens constituting this species are Nos. 500.56, 500.57, 500.58 and 500.79. With the exception of the last their general resemblance is obvious, which probably accounts for the contiguity in the numbers. No. 500.79 is probably a thin segment from much higher on the same trunk as No. 500.56, where the size and shape had considerably changed, but the same structure persists. Nos. 500.57 and 500.58 are portions of the lower end of two different trunks.

The weights of the several fragments in the order of the numbers are as follows:

No. 500.56, 1.13 kilograms.  
 “ 500.57, 1.25 “  
 “ 500.58, 1.92 “  
 “ 500.79, 0.76. “

The specific name refers to the contracted base.

#### CYCADELLA GRAVIS n. sp.

Trunk small (12cm high, 8 × 13cm in diameter), conical-flattened, rounded at the summit, laterally compressed, unbranched; rock very hard, coarse-grained, of a gray color and very high specific gravity;

organs of the armor upwardly appressed, especially on one side; rows of scars from left to right making an angle of  $35^\circ$ , those from right to left of  $50^\circ$  with the axis; scars subrhombic, 18–22mm wide, 8–10mm high; leaf bases on the sides of the specimen appressed to the trunk but exposed at their summits and on their lower sides, the keel distinct, rough or honeycombed on the exposed ends, but on fresh fractures fine in structure and white-punctate with small narrowly elliptical, white pores appearing as short white lines; vascular bundles faintly visible forming a row part way round the petiole on the side next the trunk; walls 1–2mm thick, striate with alternating light and dark lines; reproductive organs few, poorly developed, sometimes raised,  $2 \times 3$ cm in diameter, the interior porous or heterogeneous; armor 2cm thick, joined to the axis by a definite line of appreciable thickness (libro-cambium layer); wood 2cm thick; cortical parenchyma 1cm thick, of coarse structure; fibrous zone 1cm thick, consisting of two rings of equal thickness separated by a light colored band, the structure radially disposed; medulla  $2 \times 6$ cm in diameter, hard and coarse with white punctuations or variously shaped markings.

This small specimen, No. 500.63 of the collection, is so totally different from all the rest that it was necessary to regard it as constituting a species by itself. It weighs 1.5 kilograms and has the highest specific gravity observed, feeling almost like heavy spar, whence the specific name.

#### CYCADELLA VERRUCOSA n. sp.

Trunks large (30–40cm high, 20–30cm in larger diameter), obovate, contracted at the base, much laterally compressed, unbranched or with a few small secondary axes; rock hard and fine at least in the interior, light colored or brown on weathered surfaces, dark or black on freshly exposed ones, of medium specific gravity; organs of the armor horizontal; leaf scars subrhombic, 15–20mm wide, 7–10mm high; leaf bases hard, rough or porous, with a raised ridge near the margin indicating the position of the vascular bundles which are themselves sometimes visible in the form of pits; walls 2–5mm thick, hard and somewhat porous, light colored with darker striae; reproductive organs numerous, well developed, prominently projecting in the form of large warty protuberances distorting the arrangement of the leaves, elliptical in cross-section,  $20 \times 30$ mm in diameter, surrounded by large narrowly subrhombic bract scars in several rows passing into leaf scars, central portions heterogeneous, marked by the scars of the essential organs; armor 2–5cm thick, clearly but irregularly joined to

the axis; woody zone 15mm thick, not differentiated; medulla a thin slab 3-6cm thick, 15cm wide, of a fine uniform structure resembling the white iron ore of the Potomac beds of Maryland.

Nos. 500.27, 500.32, and 500.64 are referred to this species. The last is anomalous and shows relatively few of the characters, but it has the same shape. The fruits are little elevated but otherwise this leading character holds for it. No. 500.27 is probably the top of the same trunk as No. 500.32, but there is an interval between them, and they have been subjected to different conditions since they became fossilized. On a casual view, therefore, they do not seem so closely to resemble each other as they do when carefully inspected. They are then found to have almost exactly the same width, thickness, and general form, so that it is easy to see which sides correspond. All the characters also agree except that the fruiting axes are more prominent on No. 500.32, representing the lower portion. This is partly due to the fact that this specimen has suffered more from erosion, and, owing to the greater hardness of these organs, they are made to stand out more conspicuously. It was the appearance thus produced that suggested the specific name.

No. 500.27 weighs 5.19, No. 500.32, 8.31, and No. 500.64, 4.68 kilograms.

#### CYCADELLA JEJUNA n. sp.

Trunks of medium size (18cm high, 7-12cm in lesser, and 16-20cm in greater diameter), ovoid or subconical, laterally compressed, unbranched; rock hard, gray on weathered surfaces, drab in the interior, black on fresh exposures, with rather high specific gravity; organs of the armor horizontal; rows of scars forming an angle in either direction of  $45^{\circ}$ - $50^{\circ}$ ; leaf scars subrhombic, 15-20mm wide, 7-9mm high; leaf bases hard and firm, rough on the exposed ends; walls 2-4mm thick, light colored and contrasting with the leaf bases, sometimes with a median ridge; reproductive organs few and poorly preserved; armor 2-4cm thick, joined to the axis by a clear line; wood 15-20mm thick; outer zone 5mm thick, traversed by rays or vessels; inner zone consisting of two rings, the outer 5mm thick with fine radiate structure showing medullary rays and woody wedges, the inner 5-10mm thick of a less definite structure; medulla elliptical in cross-section, lesser diameter 2-3cm, greater 3cm, homogeneous.

The two specimens Nos. 500.28 and 500.31, which I have brought together here, have at first view very little to mark them or interest the student, but while they differ essentially from all others in the col-

lection, they resemble each other in all the main points. No. 500.28 is smaller and more compressed, and is mostly black on the outer surface, but the outer coating has pretty much entirely disappeared and the leaf scars are clearly exposed. The fracture at the base also reveals some very definite internal structure. No. 500.31 shows much less but so far as visible the characters are the same. The former weighs 2.33 and the latter 3.97 kilograms. The specific name refers to the somewhat negative and meager character of the specimens.

#### CYCADELLA CONCINNA n. sp.

Trunk small (12cm high, 14×15cm in diameter), irregularly and obliquely short-conical, somewhat vertically compressed, unbranched, broad at the concave base, terminating in an imperfect bud; rock soft on the surface, harder within, dark colored or bluish except a light weathered area, the specific gravity above the normal; organs of the armor at right angles to the oblique axis; rows of scars from left to right making an angle with the axis of 75°–80°, those from right to left of 30°–40°; leaf scars narrowly subrhombic, very small, 12–13mm wide, 3–5mm high; leaf bases dark, firm but porous; walls 3–5mm thick, of denser structure than the leaves, lighter colored, sometimes with darker stripes; reproductive organs doubtful and practically wanting; armor 2cm thick, joined to the axis by a definite line; wood 2cm thick, undifferentiated; medulla elliptical, 3×6cm thick, smooth and homogeneous.

It has been necessary to regard the nearly perfect, compact, and rather handsome little trunk No. 500.16 as constituting a species by itself, and it is much to be hoped that other specimens of the same may be found. It weighs 2.18 kilograms.

#### CYCADELLA CREPIDARIA n. sp.

Trunk small, elliptical in cross-section, much vertically compressed, having the form, when inverted, of a shoe or moccasin, having a height (thickness) of 7cm, a width (lesser diameter) of 12cm, and a length (greater diameter) of 19cm, with two lateral axes nearly at right angles to the primary axis, the terminal bud forming a large raised area, the base projecting downward in a rounded protuberance; rock soft and coarse-grained, dark brown or nearly black, bluish within, of low specific gravity; organs of the armor mostly appressed or concealed; leaf scars where visible distorted and abnormal in shape, subelliptical, 12–15mm wide, 4–5mm high; leaf bases coarse and

homogeneous in texture; walls 1–3mm thick, relatively hard and light colored; reproductive organs few, abortive or immature; thickness of armor unknown; wood 3cm thick; outer zone 1cm thick, coarse; inner zone 2cm thick, finer and longitudinally striate; medulla elliptical, 3 × 5cm in diameter, coarse and homogeneous.

No. 500.83 of Professor Knight's collection, which constitutes the species, is in all respects a unique specimen, and notwithstanding its apparent deformity there is evidence that this is by no means wholly due to external agencies. The position in which the trunk grew no doubt had much to do with this, but it probably represents a dwarf, flat, branching species, all the members of which would present most of these peculiarities. When inverted and laid on its back, the terminal bud down and the base uppermost, it has much the shape of a broad low wooden shoe or sandal, the thicker end representing the heel and the thin flattened end, which is a sort of terminal bud of one of the lateral branches, representing the toe—a comparison which suggested the specific name.

It weighs 1.45 kilograms.

#### CYCADELLA GELIDA n. sp.

Trunks rather large and relatively tall (the largest of the specimens 39cm high, 12 × 20cm in diameter), subcylindrical, slightly diminishing from base to summit, laterally compressed, having a few secondary axes, terminating in a large conical bud, the base projecting; rock of medium hardness and specific gravity, light brown on weathered surfaces, nearly black within and on freshly exposed portions; organs of the armor slightly ascending; rows of scars from left to right making an angle with the axis of 45°, those from right to left of 50°; leaf scars subrhombic, 20–25mm wide, 8–12mm high; leaf bases rough and punctate; walls 1–2mm thick, friable, white, with a median line or crack; reproductive organs well developed, usually raised or projecting, elliptical in cross-section, 2 × 3cm in diameter or larger, the involucre bracts not visible, the central portions solid and amorphous; armor 1–3cm thick, joined to the axis by a more or less definite line, all within it a black undifferentiated mass of cherty and apparently structureless matter which tends to crack into cubes or flake off.

The large fine specimen, No. 500.1, scarcely injured by being broken in two by an obliquely transverse fracture near the base, was at first supposed to be altogether unique, but in my efforts to correlate the fragment No. 500.24 of a considerably smaller trunk I found that it

had scarcely any affinities except with this, and upon a thorough comparison of all the characters I am convinced that it belongs to the same species. That specimen was broken into three unequal pieces but mended with glue before sending. A small flake or cap numbered 500.25, from the light weathered surface of some trunk, having a coarse black structure on the fractured side, resembles No. 500.24 more than any other specimen, but does not exactly fit its broken summit. Rather than leave it wholly unassigned I assume that it belongs here.

No. 500.1 weighs 12.56, No. 500.24, 2.52, and No. 500.25, 0.11 kilograms.

The specific name has a vague reference to the Freezeout Hills in which the beds occur.

#### CYCADELLA CARBONENSIS n. sp.

Trunk of maximum size (39cm high,  $21 \times 39$ cm in diameter), subglobular, both laterally and vertically compressed, the principal axis oblique to the plane of compression, having numerous secondary axes forming large short branches or rounded elevations interspersed with smaller ones, the primary axis terminating in a well developed bud, the base occupied by a circular concavity; rock of medium hardness and specific gravity, nearly black, considerably mineralized in the interior; organs of the armor radiating from an equatorial zone; phyllotaxy not traceable; leaf scars subrhombic, rhombic, or irregular in shape, 30mm wide, 15mm high; leaf bases rough and porous; walls 2-3mm thick, firm, and definitely bounded, longitudinally striate with raised white lines, median line higher than the rest; reproductive organs numerous but not well developed, of two kinds, large and small, the former difficult to distinguish from secondary axes, all usually more or less elevated, but occasionally depressed or decayed so as to leave a shallow concavity, elliptical in cross-section, the larger ones  $3 \times 5$ cm in diameter, the smaller about half as large, the former class surrounded by faintly visible large subrhombic involucreal bract scars simulating and passing into leaf scars, the central portions solid and heterogeneous; armor 4-5cm thick, its junction with the axis obscure; woody zone 4-5cm thick, undifferentiated; medulla nearly circular, 5-6cm in diameter, smooth and homogeneous in structure.

The largest specimen in the collection, No. 500.2, weighing 37.69 kilograms, is unique also in its form and a considerable number of other characters, and has to form a species by itself. I name it for



Carbon County in which, the locality for all the specimens is located. It constitutes an almost complete trunk, but came in two nearly equal pieces, the fracture passing through the narrowest dimension, through the center of the apex, down the back and lower side and emerging at the center of the basal concavity along a nearly even plane. Unfortunately the interior thus exposed shows scarcely any structure.

CYCADELLA KNIGHTII n. sp.

Pl. XXI.

Trunks very large (30-40cm high, 19×28cm in diameter), sub-ellipsoidal, somewhat laterally compressed, unbranched, depressed at the summit; axis eccentric; rock hard, somewhat mineralized, dark colored or nearly black, of high specific gravity; organs of the armor horizontal; rows of scars from left to right forming an angle of 45° with the axis, those from right to left of 70°; leaf scars subrhombic or subelliptical, 18-20mm wide, 8-12mm high; leaf bases hard, punctate; walls 3-5mm thick, hard, striate, with or without a median groove; reproductive organs few, poorly developed, flush with the surface or slightly raised, elliptical in cross-section, 2×3cm in diameter, surrounded by large subrhombic involucre bract scars passing into leaf scars, the central portion solid and showing the scars of the floral organs; armor 4-6cm thick, obscurely attached to the axis; woody zone 3-4cm thick, undifferentiated; medulla 6×10cm in diameter, difficult to distinguish from the woody zone, hard, and black with flinty or crystalline areas.

The next largest specimen in the collection and probably the finest from the standpoint of symmetry and general appearance is No. 500.65. It came in two pieces of unequal size caused by a transverse fracture below the middle. The larger piece weighs 15.48 and the smaller 9.8 kilograms, making the total weight 25.28 kilograms. There was one other specimen, viz., No. 500.33, which so closely resembles this that it is impossible to separate it. It consists of considerably over half of the lower portion of a somewhat smaller trunk, having the base perfect and a nearly horizontal transverse fracture across the trunk above. This weighs 8.87 kilograms.

I take great pleasure in dedicating this fine species of *Cycadella* to Prof. Wilbur C. Knight, State Geologist of Wyoming, through whose enterprise the collection was made and who has so generously placed it in my hands for elaboration.

Pl. XXI represents the best preserved side of No. 500.65.

The following is a list of the twenty species of *Cycadella* in the order in which they have been described:

1. *Cycadella reedii*.
2. *Cycadella beecheriana*.
3. *Cycadella wyomingensis*.
4. *Cycadella knowltoniana*.
5. *Cycadella compressa*.
6. *Cycadella jurassica*.
7. *Cycadella nodosa*.
8. *Cycadella cirrata*.
9. *Cycadella exogena*.
10. *Cycadella ramentosa*.
11. *Cycadella ferruginea*.
12. *Cycadella contracta*.
13. *Cycadella gravis*.
14. *Cycadella verrucosa*.
15. *Cycadella jejuna*.
16. *Cycadella concinna*.
17. *Cycadella crepidaria*.
18. *Cycadella gelida*.
19. *Cycadella carbonensis*.
20. *Cycadella knightii*.

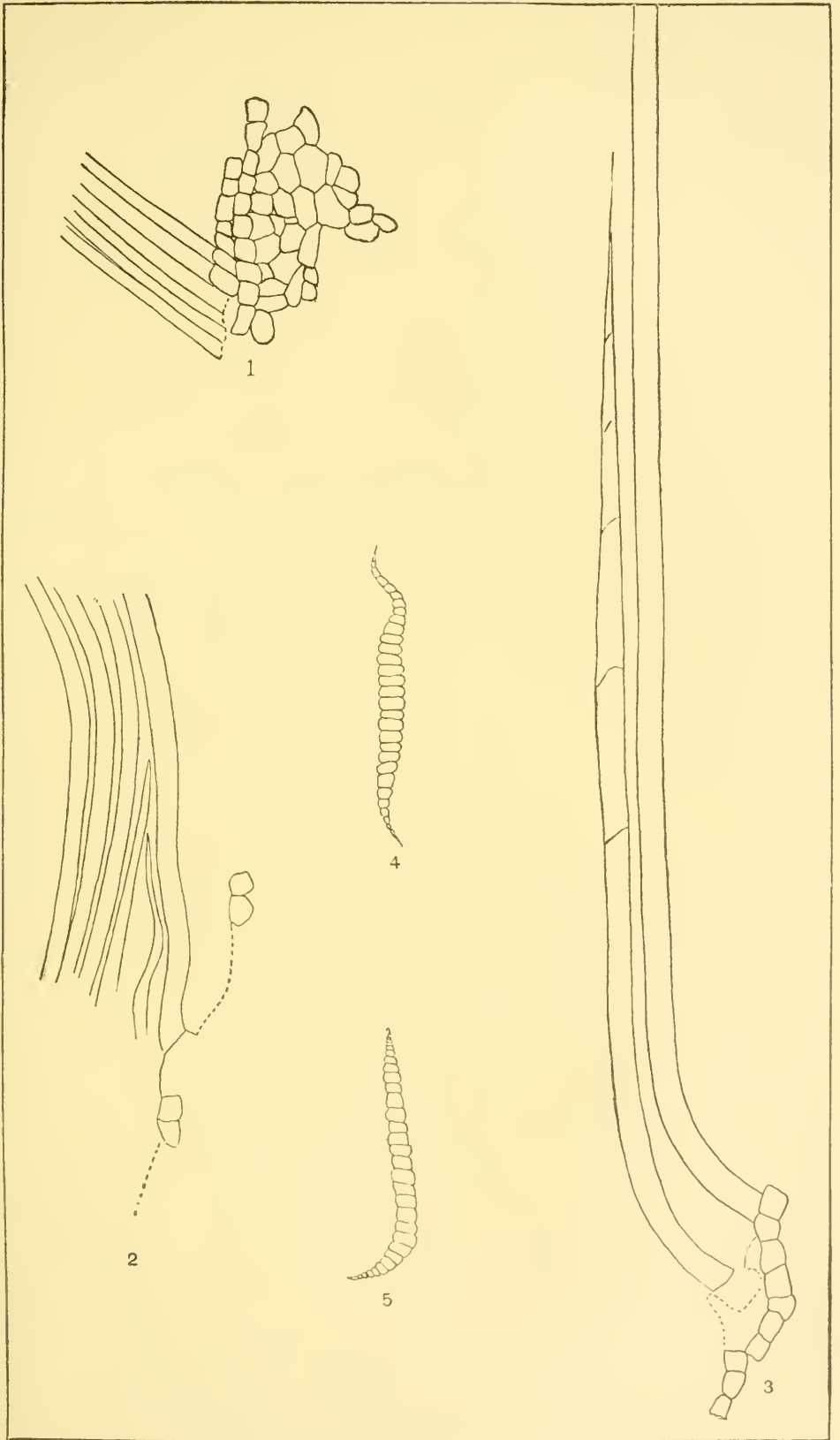
The order can scarcely be called a classification. There is, however, something in common in the first twelve, viz., their general light color and calcareous structure, while the last seven are darker, coarser grained, and less calcareous. *C. gravis* and *C. verrucosa* are intermediate in these respects, but the former differs in its high specific gravity. These distinctions all relate rather to the mineral than to the vegetable character, and although there is always some connection between them as arising out of differences of structure, still it can scarcely be called a systematic grouping. The strictly botanical characters traverse these more conspicuous ones in such a manner that it is impossible to arrange the species according to both, and it was considered more satisfactory upon the whole not to attempt any finer classification until the internal structure can be studied, which should be done and promises most interesting results.



PLATE XIV.

Illustrations of the nature of the ramentaceous investiture of the genus  
*Cycadella*.

- Figs. 1. Epidermal cells of a petiole giving origin to the ramentaceous chaff.  
2. Ramentum as seen between two leaf bases within the armor.  
3. Illustration of the relative great length of the chaffy hairs, which might be traced much farther. The one on the left is cut obliquely, showing the parallel cells.  
4, 5. Cross sections of the chaff showing their flat, sharp-edged, multi-cellular character.



Ramentaceous investiture of the genus *Cycadella* Ward.





PLATE XV.

*Cycadella reedii* n. sp.

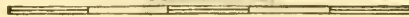
View of the best preserved side of No. 127 of the Yale collection,  
including the eccentric base.

(288)





CENTIMETERS



*Cycadella reedii*, sp. nov.





PLATE XVI.

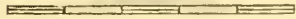
*Cycadella bcecheriana* n. sp.

Fractured surface of No. 128 of the Yale collection (three upper pieces) and No. 500.54 of the Museum of the University of Wyoming (lower piece).

(290)



CENTIMETERS



*Cycadella beecheriana*, sp. nov.





PLATE XVII.

*Cycadella wyomingensis* n. sp.

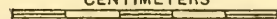
View of one of the sides of No. 500.14 of the Museum of the University of Wyoming, showing portions of the surface from which the outer coat has been scaled off.

(292)





CENTIMETERS



*Cycadella wyomingensis*, sp. nov.





PLATE XVIII.

*Cycadella knowltoniana* n. sp.

- Fig. 1. View of the lower transverse fracture of No. 500.62 of the Museum of the University of Wyoming, showing the leaf bases and walls in longitudinal section overlain by the outer coating.
2. View of the polished surface of the upper transverse fracture of No. 500.76, somewhat enlarged, showing the attachment of the armor to the axis, the leaf bases emitting the ramentaceous chaff to form the walls and outer layer.

(294)

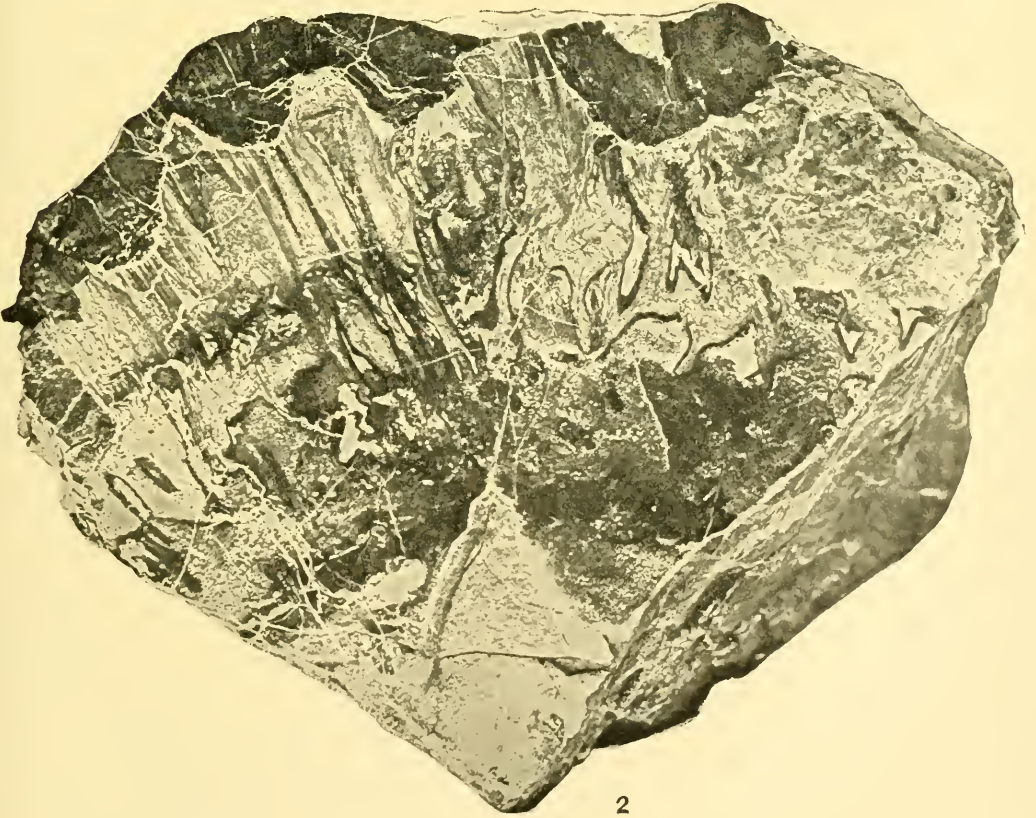
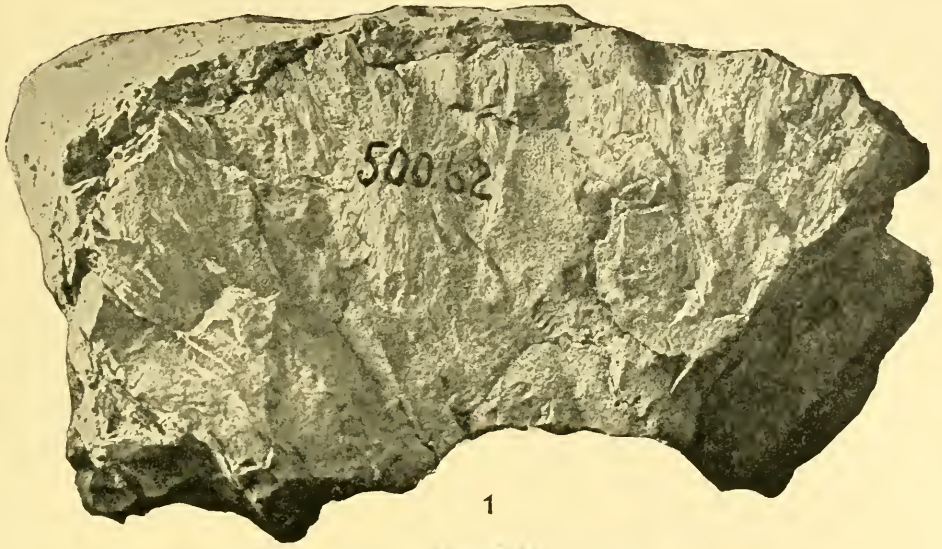






PLATE XIX.

*Cycadella knowltoniana* n. sp.

View of an area of the polished transverse surface of the upper end of No. 500.76 of the Museum of the University of Wyoming, taken from the left side of the specimen (see Pl. XVIII, fig. 2) and enlarged four diameters.

(296)





*Cycadella knowltoniana*





PLATE XX.

*Cycadella knowltoniana* n. sp.

View of an area of the polished transverse surface of the upper end of No. 500.76 of the Museum of the University of Wyoming, taken from the right side of the specimen (see Pl. XVIII, fig. 2) and enlarged four diameters.

(298)



*Cycadella knowltoniana*





PLATE XXI.

*Cycadella knightii* n. sp.

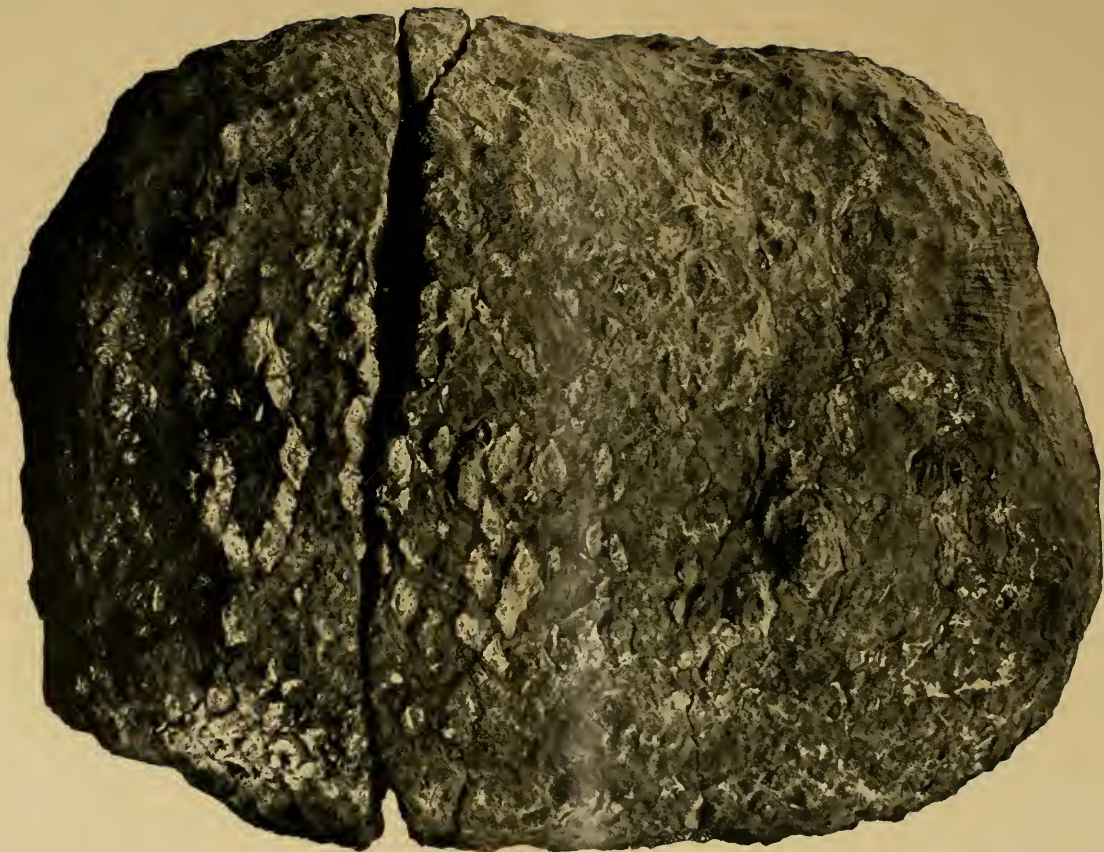
Side view of No. 500.65 of the Museum of the University of Wyoming.

(300)









*Cycadella knightii*, sp. nov.



PROCEEDINGS  
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WASHINGTON ACADEMY OF SCIENCES

VOL. I, PP. 301-339.

FEBRUARY 14, 1900.

LOWER CAMBRIAN TERRANE IN THE ATLANTIC PROVINCE.

BY CHARLES D. WALCOTT.

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INTRODUCTION.

SINCE the publication of the correlation memoir on the Cambrian, in 1891,<sup>1</sup> a number of articles by Mr. G. F. Matthew have appeared from time to time advocating the dropping of the term Middle Cambrian and using the two terms Upper Cambrian and Lower Cambrian, the Lower Cambrian to include the Middle Cambrian (Paradoxides beds) and strata containing the subjacent 'Protolenus' fauna, which was regarded as the equivalent of the Olenellus fauna.<sup>2</sup> Mr. Matthew was led to advocate this division of the Cambrian largely by reason of his failure to find the Olenellus<sup>3</sup> fauna in the 'Basal or

<sup>1</sup> Bull. U. S. Geol. Survey, No. 81.

<sup>2</sup> Matthew, G. F., The Protolenus Fauna: Trans. N. Y. Acad. Sci., Vol. XIV, 1895, p. 103; A New Cambrian Trilobite: Bull. Nat. Hist. Soc. New Brunswick, No. XVII, 1899, p. 142; Studies on Cambrian Faunas, No. 4: Trans. Roy. Soc. Canada, 2d ser., Vol. V, 1899, Sec. IV, p. 8; Preliminary Notice of the Etcheminian Fauna of Cape Breton: Bull. Nat. Hist. Soc. New Brunswick, Vol. IV, 1899, pp. 198-208.

<sup>3</sup> Am. Jour. Sci., 3d ser., 1889, Vol. XXXVII, pp. 374-392; Vol. XXXVIII, pp. 29-42.

Etcheminian' series of New Brunswick and Newfoundland, and because he gave much more consideration to the results of theoretic biologic studies than to the already established stratigraphic succession of the faunas; and this was carried still further when the Lower Cambrian (Olenellus zone) of the Atlantic Province was referred to a pre-Cambrian Paleozoic terrane.<sup>1</sup>

The name *Olenellus* is here used in the general sense given it by me in 1888 at the Geological Congress in London. The species *O. bröggeri* has been referred to the genus *Holmia*, but it still remains in the Mesonacidæ, a family of trilobites confined, so far as known, to the Lower Cambrian fauna. No attempt will be made in this article to discuss the faunas of the Cambrian or their biologic relations, my object being to show their stratigraphic relations and succession. The genus *Protolenus* appears to occur stratigraphically between the *Olenellus* and *Paradoxides* horizons, and it is probable that it will be found associated with *Olenellus* below and with *Paradoxides* or *Olenoides* above when we come to know more of the Cambrian faunas.

In the broad generalizations on the Cambrian system published in 1891 there are many partial and tentative conclusions, but the main points of the classification are fully outlined. Many pages are devoted to unsolved problems. One of those for Newfoundland was stated as follows:<sup>2</sup>

The determination of the relation of the Cambrian rocks of St. Marys and Trinity Bays to the basal conglomerate in the Manuels Brook section, to ascertain if a series of Cambrian strata occurs between the lowest recognized Cambrian of Conception Bay and Manuels Brook and the pre-Cambrian rocks of Trinity and St. Marys Bays, as thought by the Newfoundland geologists. If such a series be found its fauna should be carefully collected and studied with reference to its being basal Cambrian or pre-Cambrian.

A problem for New Brunswick<sup>3</sup> reads:

The clearer identification of the Lower Cambrian or Olenel-

<sup>1</sup> A Paleozoic Terrane Beneath the Cambrian: *Annals N. Y. Acad. Sci.*, Vol. XII, pp. 41-56.

<sup>2</sup> *Bull. U. S. Geol. Survey*, No. 81, p. 380.

<sup>3</sup> *Loc. cit.*, p. 381.

lus zone and its exact stratigraphic relations to the Paradoxides zone.

Mr. Matthew took up both the above-stated problems and personally examined the sections and collected fossils. His conclusions differed so radically from what appeared to me to be the correct interpretation of the record as found elsewhere that I decided to study the problems in the field, and prove or disprove them. The result, while not all that I could wish for in fossils from the Lower Cambrian of New Brunswick, I think establishes the Lower Cambrian (or *Olenellus* zone) in the Atlantic Coast Province as distinct, stratigraphically, from the Middle Cambrian (or Paradoxides zone), as outlined by me in 1889.<sup>1</sup> The Lower Cambrian formations of the Peninsula of Avalon were then referred to the 'Terra Nova' terrane.

In the correlation bulletin of 1891 the following (p. 304) classification of the formations of the Upper, Middle and Lower Cambrian was adopted.<sup>2</sup>

The basal series of Matthew on Hanford Brook was referred to the Lower Cambrian under the name Hanford. In the text<sup>3</sup> reference is made to the red and green beds of the northwest side of Trinity Bay, as follows:

Beneath the conglomerate beds of Manuels Brook and between them and the subjacent Archean gneiss, there is, according to Messrs. Murray and Howley, a series of red and green sandstones, conglomerates, and massive sandstone strata, which, according to their tabulated section, have a thickness of 1800 feet. They are exposed on the north side of Trinity Bay and partially on St. Marys Bay. I think we should have more data before deciding that this series of 1800 feet is really subjacent to the Manuels Brook conglomerate; although it is extremely probable that such is the case, judging from the character of the Trinity Bay and Conception Bay sections.

Mr. Matthew has shown very clearly that the Smith Sound-Trinity Bay pre-Paradoxides strata are the stratigraphic equivalent of the basal series beneath the St. John quartzite in the

<sup>1</sup> Stratigraphic Position of the *Olenellus* Fauna in North America and Europe: *Am. Jour. Sci.*, 3d ser., Vol. XXXVII, pp. 374-392; Vol. XXXVIII, pp. 29-42.

<sup>2</sup> *Loc. cit.*, p. 360.

<sup>3</sup> *Loc. cit.*, p. 261.

*Classification of the Formations.*

		Lower Calciferous.	Lower portion of the Calciferous sandrock of New York and Canada; Lower Magnesian limestone of Wisconsin, Missouri, etc.
Cambrian.	Upper Cambrian.	Potsdam.	<p style="text-align: center;"><i>Type.</i></p> <p>Sandstones of the north and east sides of the Adirondack Mountains of New York and adjoining parts of Canada.</p> <p style="text-align: center;"><i>Correlated.</i></p> <p>Limestones of the south side of the Adirondacks and Dutchess County, New York, and an unknown portion of the limestones of the 'Marble Belt' of western Vermont.</p> <p>Shales of Tennessee (Knox), Georgia, and Alabama (Connasauga).</p> <p>Sandstones of the Upper Mississippi Valley (St. Croix), South Dakota, Wyoming, Montana, and Colorado.</p> <p>Sandstones and calcareous beds of northern Arizona (Tonto) and central Texas (Katemcy).</p> <p>Limestones and shales of Nevada (Hamburg), Idaho, and Montana (Gallatin).</p> <p>Black shales of the upper portion of the New Brunswick and Cape Breton Island sections.</p> <p>Shales and sandstones of Conception Bay, Newfoundland (Belle Isle).</p>
	Middle Cambrian.	Acadian.	<p style="text-align: center;"><i>Type.</i></p> <p>Shales and slates of eastern Massachusetts (Brain-tree), New Brunswick (St. John), and eastern Newfoundland (Avalon).</p> <p style="text-align: center;"><i>Correlated.</i></p> <p>Limestones of Dutchess County, New York (Stissing), and central portions of Tennessee and Alabama sections (Coosa).</p> <p>Limestones of central Nevada and British Columbia (Mount Stephen).</p>
	Lower Cambrian.	Georgian.	<p style="text-align: center;"><i>Type.</i></p> <p>Shales and limestones of western Vermont (Georgia) and Red Sandrock.</p> <p style="text-align: center;"><i>Correlated.</i></p> <p>Quartzite of western slope of Green Mountains ('Granular Quartz') and Appalachian Range of Pennsylvania, Virginia, Tennessee (Chilhowee), Georgia, and Alabama.</p> <p>Shales with interbedded limestones and roofing slates of southern Vermont, New York, and south to Alabama.</p> <p>Limestone, sandstone, and shales of Straits of Belle Isle (Labrador), northwest coast of Newfoundland and peninsula of Avalon (Placentia).</p> <p>Basal series of Hanford Brook Section, Caton's Island, etc., New Brunswick (Hanford).</p> <p>Shales and limestones of eastern and southeastern Massachusetts (Attleborough).</p> <p>Lower portion of Eureka and Highland Ranges, Nevada (Prospect).</p> <p>Portion of Wasatch Cambrian section (Cottonwood).</p> <p>Base of Castle Mountain limestone, British Columbia (Castle Mountain).</p>



Hanford Brook section of New Brunswick. As my study in 1899 began with the Smith Sound section, and it was there that the *Olenellus* fauna was found in the central portion of the 'Paleozoic terrane beneath the Cambrian,' that section will first be noticed. Other sections of the Cambrian rocks of southeastern Newfoundland will next be taken up, before the New Brunswick Cambrian rocks are considered.

Mr. S. Ward Loper accompanied me, to aid in collecting fossils. Mr. J. P. Howley, Government Geologist of Newfoundland, joined us a few days after our arrival in Smith Sound. From his intimate knowledge of localities of Cambrian rocks, acquired when making the geologic map of the Peninsula of Avalon, Mr. Howley was able to guide us quickly to the best sections and exposures about Trinity Bay. Except for his help it would have been impossible, in the month at our disposal, to overcome the physical obstacles of fog, snow, rain and storm, and accomplish the object of the trip. We found the sections published in the *Geology of Newfoundland* to be essentially correct, and were so fortunate as to establish the stratigraphic succession from the Middle Cambrian down through the Lower Cambrian and Upper Algonkian to the Signal Hill sandstone of the Avalon series of the Algonkian. Mr. Howley studied certain problems in which he was interested, while I investigated the problems connected with the Cambrian succession of strata and faunas.

#### DESCRIPTION OF SECTIONS.

##### NORTHWEST SIDE OF TRINITY BAY.

*Smith Sound Section.*—On the northern shore of Smith Sound, east and west of Smith Point, the Cambrian rocks are well exposed along the shore. At Broad Cove, west of the point, the transition beds between the Upper Cambrian (*Olenian*) and the Middle Cambrian (*Paradoxidian*) are concealed by the drift at the head of the cove. West of the cove the fissile and arenaceous shales of the Upper Cambrian are well exposed and contain *Olenus*. On the eastern side of Broad Cove the Middle Cambrian is exposed. The measured section begins with the dark argillaceous shales, and is as follows:

*Middle Cambrian, downward.*—

- |  | Feet. |
|--|-------|
| 1a. Dark, argillaceous shales, with fragments of <i>Paradoxides</i> in the upper portion. At 45 feet down the <i>Paradoxides</i> are abundant; also <i>Acrothele</i> , <i>Obolus</i> (L.) <i>ferrugineus</i> , <i>Ptychoparia</i> , etc. At 110 feet down a 4-inch band of pinkish limestone carrying fragments of trilobites occurs. A roll in the strata comes in at this point and continues for a considerable distance along the shore. It starts between the two east wharves at Broad Cove, and extends some distance east of the eastern point of Broad Cove ..... | 110   |
| 1b. Below the limestone greenish shale extends downward to a layer of reddish argillaceous shale 20 feet in thickness...<br>No recognizable fossils were found in this bed.  | 80    |
| 1c. Pinkish nodular limestone in several layers, interbedded in reddish shale.....<br>Fossils: <i>Paradoxides</i> (undet.), <i>Ptychoparia</i> .   | 4     |
| 1d. Reddish-purple argillaceous shales with interbedded greenish-colored bands.....<br>This band of shales corresponds stratigraphically to the <i>Protolenus</i> zone of the Hanford Brook section of New Brunswick. A basalt dike cuts through the shales a few feet above their base. On the weathered surface it has the appearance of a massive sandstone. It is 3 feet 4 inches in thickness, is vertical, and the dip of its cleavage planes is almost coincident with the dip of the shales.   | 135   |
| 1e. Nodular limestones. A pinkish layer 4 inches thick contains at base numerous fragments of trilobites and appears to be made up of a conglomerate formed of fragments of pinkish-colored limestone and purple shale, and dark iron- or manganese-stained nodules resembling a <i>Stromatoporoid</i> -like growth, and a few small quartz pebbles.   |       |

The entire stratum is as follows:

	Inches.	
Dark, nodular limestone.....	25	
Purplish-colored shale.....	2	
Pinkish limestone.....	2	
Brick-red shale.....	3	
Pinkish conglomerate ? limestone.....	4	3

At the point of exposure on the shore this band is faulted down 15 feet to the west. It is exposed near the top of the bank on the eastern side of the fault, where its dip is lower than on the western side.

The stratum 1e is taken as the base of the Middle Cambrian (*Paradoxidian*). It is the horizon indicated by Mr. Matthew in his diagrammatic section as the base of the

Cambrian, and corresponds in stratigraphic position to the St. John quartzite of the New Brunswick Cambrian.

One observes no difference, in either strike or dip, between the shales beneath this band of nodular limestone and conglomerate and the shales above it until one passes to the east of the fault-line that cuts through and breaks the band a few feet above the water's edge.

*Lower Cambrian* (Etcheminian of Matthew).—

	Feet.
2a. Reddish-purple argillaceous shale with greenish shales in bands at irregular intervals and a massive band of greenish shale near the base.....	284
Dip near base 20° to 23° W.	
At 110 feet from the summit fragments of a large undetermined trilobite were noted. On the south side of Smith Sound, at Britannia Cove, <i>Olenellus</i> ( <i>H.</i> ) <i>bröggeri</i> occurs at a horizon corresponding to 140 feet below the summit of the stratum.	
Near the base of 2a the following fossils were found:	
<i>Obolella atlantica</i>	
<i>Hyalithes</i> sp.	
<i>Orthotheca</i> sp.	
<i>Microdiscus</i> sp. undet.	
<i>Olenellus</i> ( <i>Holmia</i> ) <i>bröggeri</i>	
<i>Solenopleura?</i> <i>bombifrons?</i>	
	Inches.
2b. Greenish-colored arenaceous limestone, passing into an intraformational conglomerate formed of nodules of pinkish limestone mixed with fine sand and carrying numbers of fragments of trilobites .....	16
Pinkish-colored nodular limestones .....	8
Fossils: Fragments of trilobites and a small brachiopod.	
	Feet.
2c. Reddish-purple to brick-red argillaceous shale.....	56
The following fossils occur in the central and lower portions of this band:	
<i>Obolella atlantica</i>	
<i>Microdiscus bellimarginatus</i> S. & F.	
<i>Microdiscus</i> n. sp.	
<i>Olenellus</i> ( <i>Holmia</i> ) <i>bröggeri</i>	
<i>Zacanthoides</i> sp. undet.	
<i>Agraulos</i> sp.	
<i>Micmacca walcotti</i>	
2d. Brick-red and pinkish nodular limestone in layers varying from 3 feet to 6 inches in thickness.....	27

This is one of the most important horizons in the Lower Cambrian of Newfoundland (Smith Point limestone). It is very persistent about Trinity Bay, and it occurs, although much thinner, at various exposures in Conception, St. Marys and Placentia Bays. The upper 24 feet at Smith Point is practically solid limestone layers. The lower layer of limestone, 1 foot in thickness, is separated by 2 feet of reddish shale in which 3 inches of limestone occurs.

## Fossils:

In the upper 6 inches of the top layer of limestone numerous fragments of *Olenellus* (*H.*) *bröggeri* and *Solenopleura* ? occur. About 3 feet below this, in the next bed of limestone, immense numbers of *Hyolithes princeps* are found in association with the fauna that marks this limestone band wherever it is found. The following species were collected in a few hours:

*Iphidea labradorica* (*Kutorgina granulata* M.)

*Fordilla troyensis*

*Scenella reticulata* ?

*Randomia aurora*

*Helenia bella*

*Orthotheca pugeo*

*Hyolithes princeps*

*Coleoloides typicalis*

*Hyolithellus micans* ?

	Feet.
2e. Green argillaceous shale.....	23
2f. Massive stratum of nodular limestone, divided into 18 inches of a pinkish limestone, and 3 feet of purple to a pink, mixed with purple argillaceous shale.....	4½

## Fossils:

*Coleoloides typicalis*.

2g. Green argillaceous shale in massive bands, with numerous small pinkish limestone nodules scattered irregularly on the line of bedding. At 51 feet from the base the limestone nodules increase in number and size, and form the greater part of a layer 2 feet in thickness. Above this the reddish-purple and green shales occur in bands varying in thickness.....	62
--	----

## Fossils:

*Hyolithes rugosus* Matt. ?

*Coleoloides*

*Urotheca pervetus* Matt.

Crustacean, n. g., n. sp.

- Feet.
- 2h. Reddish-purple, argillaceous shales, with irregularly distributed bands of nodular limestone of varying thickness. A layer of nodular limestone 42 feet from the summit has 12 inches of pinkish and reddish-purple limestone above, with 10 inches of greenish limestone below. In both layers numerous tubes of *Coleoloides* occur. At 66 feet below the summit a second band of nodular limestone 20 inches in thickness occurs. Thin layers of nodular limestone occur both above and below the two thicker bands mentioned..... 136
- 2i. Green argillaceous shale, with a few thin layers of purple shale, also scattered layers of pinkish-colored, nodular limestone ..... 30½

Fossils :

Annelid trails are abundant in some portions of the greenish-colored shales.

- 2j. Reddish-purple shale, with layers of greenish- and pinkish-colored limestone nodules scattered irregularly on the line of bedding. The nodular limestones are usually from 2 to 4 inches in thickness, but at 60 feet from the top a layer 12 inches thick occurs..... 185

The section is here cut off by the drift coming down to the water's edge.

The nodular limestones of the Smith Point section are one of the most noticeable features of the lower portion of the section. Plate XXII illustrates narrow bands of nodules about 350 feet below the massive nodular limestone of Smith Point, which is beautifully shown on plates XXIII and XXIV. The only fossils found in the lower part of the section except annelid trails occur in the nodules. The bedding planes of the shale in the slate quarries on Smith Sound are clearly indicated, at nearly right angles to the cleavage, by the lines of scars left by the nodules, as is shown by plate XXV.

*Base of Cambrian in Smith and Random Sounds.*—The base of the Cambrian is exposed at the slate quarries east of Tilton Head, on the north side of Smith Sound, in the synclinal basin formed of the Avalon and subjacent Cambrian rocks. The section, however, is not here complete. On the south side of Smith Sound, near Britannia Cove, the Smith Point limestone, carrying *Hyalithes*, etc., is well exposed, and 220 feet above it, in the green shales, *Olenellus (H.) bröggeri* was found. Below, the limestone beds are much broken. Crossing Random Island from Britannia Cove to the north shore of Random Sound, one finds a much more complete section,

east of Hickmans Harbor Point. At Hickmans Harbor Point the Signal Hill conglomerate of the Avalon series is well exposed, and above, to the eastward, the Random terrane. The summit of the latter is very beautifully shown at the slate quarries about half a mile east of Hickmans Point, where the strike of the upper bed of the Random sandstone is N. 50° E., dip 70° S.E. Immediately on this band of reddish-tinted sandstone there is a thin layer of conglomeratic limestone that forms the basal bed of the Cambrian. (Plate XXVI.)

*Random Sound Section, upward.*—

- |  |         |
|--|---------|
|  | Inches. |
| 1a. Conglomerate formed of small pebbles of the subjacent Random rocks, and small quartz grains and pebbles, all cemented together by a fine calcareous sandy matrix. Often there is scarcely a trace of calcareous matter ..... | 6       |

Fossils:

Slender tubes of *Coleoloides* and fragments suggesting *Archæocyathus*.

- |  |         |
|--|---------|
|  | Feet.   |
| 1b. Reddish-purple sandstones capped by coarse-grained grayish-purple sandstone 6 inches thick ..... | 3       |
|  | Inches. |
| 1c. Pinkish-colored limestone with <i>Coleoloides</i> .....  | 6       |
|  | Feet.   |
| 1d. Reddish-purple argillaceous shale .....  | 10      |
| 1e. Purple to pink, hard, irregular, arenaceous limestone.....                                       | 1½      |

Fossils:

*Coleoloides*, and sections of what appears to be a small *Obolella*-like shell.

- |  |     |
|--|-----|
| 1f. Green and reddish-purple argillaceous shale in broad bands. At 140 feet up nodular limestone appears, and at 170 feet a band of pinkish-colored limestone 6 inches thick with <i>Coleoloides</i> ..... | 171 |
|--|-----|

A change of dip and overturn occurs here, which breaks the section and cuts out probably 100 feet or more of the shales. Estimated..... 100

- |  |    |
|--|----|
| 1g. Green argillaceous shale.....                            | 42 |
| 1h. Reddish-purple argillaceous shale.....                   | 98 |
| 1i. Greenish argillaceous shale .....                        | 84 |
| 1j. Pinkish-colored, massive-bedded, nodular limestone ..... | 6  |

Fossils:

*Hyolithes princeps*, *Coleoloides typicalis*, also numerous fragments of small *Hyolithes*, of which, owing to the cleavage of the limestone, it was impossible to get good specimens.

1k. Reddish-purple and green argillaceous slates, cleaned so as to make a good roofing slate, at Bryant's quarries about 1 mile east of Hickmans Point. The estimated thickness of this slate in the syncline is over 200 feet. 200 +  
 The total thickness of the section up to the Hyolithes limestone is over 500 feet, which, with the 369 feet above the limestone at Smith Point, gives a total thickness of fully 900 feet for the Lower Cambrian on the western side of Trinity Bay.

*Fosters Point Section.*—At Fosters Point, on the southeastern end of Random Island, the Smith Point (Hyolithes) limestone is well shown. The strata are nearly vertical and are cut by dykes of greenstone. This distributed condition extends upward in the section nearly to the *Paradoxides davisii* bed, where the dip is more regular. The Olenus horizon was found at an estimated distance of 200 feet above the Paradoxides zone, where Olenus is associated with several species of Ostracods. Above this there are nearly 1000 feet of shales and interbedded sandstones, much like the lower portion of the Great Belle and Kelley Island section of Conception Bay.

SOUTHEAST SIDE OF TRINITY BAY.

*Hearts Delight Section.*—On the south side of Hearts Delight Harbor the sandstones of the Algonkian Random terrane, beneath the Cambrian, dip to the northwest at about 75°, the Cambrian conglomerate and shales above having the same strike and dip.

*Lower Cambrian, upward.*— Inches.

1a. Conglomerate formed of bits of Random gray sandstones, fragments of reddish sandstone, dark sandy shales, quartz pebbles, etc., with a calcareous sandstone matrix, 3 to 8 inches thick.

This conglomerate is spread over the irregular upper surface of the Random sandstone. It is slightly calcareous in places, and looks very much like the basal bed of the Random Sound Lower Cambrian. The best section of it on the east side of Trinity Bay is exposed on Hopeall Hill, at the entrance of Hopeall Harbor, about 8 miles south of Hearts Delight.

At Spread Eagle Point, opposite Dildo, the basal conglomerate is from 24 to 30 inches in thickness, with thin, irregular layers of limestone in the upper portion that contain immense numbers of *Coleoloides* and a small *Obolella*-like shell.....

	Feet.
1b. Greenish sandy and argillaceous shale. At 14 feet large, slightly calcareous oval nodules occur, and at 49 feet a thin band of nodular limestone.....	75
1c. Brick-red argillaceous shales, with irregularly arranged bands of calcareous nodules.....	41
Fossils:	
<i>Coleoloides</i> , and slender tubes of <i>Hyolithes</i> , suggesting <i>Hyolithes communis</i> .	
1d. Greenish argillaceous shales, with larger and more numerous calcareous nodules than in 1c.....	38
The nodules form almost solid layers in some places.	
<i>Coleoloides</i> occurs abundantly in the calcareous nodules.	
1e. Massive-bedded, pinkish-colored limestone, with many nodular, dark, small concretions, suggesting <i>Stromatopora</i> .....	28
Fossils:	
Fragments of fossils occur all the way through this band. <i>Coleoloides</i> and a slender <i>Hyolithes</i> , fragments of <i>Olenellus</i> , and <i>Agraulos</i> ? were recognized. At Hearts Delight Point, to the north, <i>Olenellus</i> ( <i>H.</i> ) <i>bröggeri</i> was found in the upper layer, corresponding to the upper layer of the Smith Point limestone.	
1f. Reddish argillaceous shales, with thin bands of pinkish limestone.....	79
Fossils:	
Twelve feet from the base a band of limestone 6 inches in thickness occurs, carrying numerous fragments of fossils, including the genera <i>Coleoloides</i> , <i>Olenellus</i> , and <i>Agraulos</i> ?.	
1g. Alternating bands of reddish and greenish shale, with calcareous nodules .....	145
1h. Greenish arenaceous shales.....	127
1i. Pinkish and reddish nodular limestone..... 1 ft. 6 in.	
Reddish shale .....	4
Pinkish-colored nodular limestone.....	2
	7½
1j. Greenish arenaceous shale.....	42
1k. Reddish arenaceous shale.....	21
1l. Pinkish-colored limestone 12 inches in thickness where first met with, but thickening on the strike to 4 to 5 feet, where there is a well-marked conglomerate near the bottom, formed of rolled pinkish- and greenish-colored limestone pebbles. Both pebbles and matrix are filled with fragments of trilobites and <i>Coleoloides</i> .....	5
Among the fossils were recognized <i>Obolella</i> ?, <i>Hyolithes</i> , <i>Microdiscus</i> , and <i>Solenopleura</i> .	



It is probably representative of the conglomerate 1c at base of the Middle Cambrian of the Smith Sound section. Above this the greenish shales extend a considerable distance, but they are broken and more or less covered by drift.

*Summary of Hearts Delight Harbor Section, downward.*—

	Feet.
From Middle Cambrian conglomerate 1l to Hyolithes limestone.....	330
Hyolithes limestone.....	28
Hyolithes limestone to base.....	155

*Dildo Harbor Section.*—At the point on the south side of Dildo Harbor the lower portion of the Cambrian section is exposed, where it rests on the sandstones of the Random terrane. The Smith Point limestone is much broken up. In one of the upper beds *Coleoloides typicalis*, numerous sections of *Hyolithes*, and fragments of trilobites, including *Olenellus*, were noted.

CONCEPTION BAY.

*Manuels Brook Section.*—At Manuels Brook, above the railroad bridge, the ledges of gneiss that form the bed of the river were referred to the Laurentian by Mr. Alexander Murray.<sup>1</sup> The examinations made by me in 1899, in company with Mr. J. P. Howley, proved that this gneiss is intrusive in the lower portion of the 'Huronian' of Murray, or the Avalon series as then described.<sup>2</sup> The gneiss at this point formed a headland in the early Cambrian sea, about which the waves gathered a coarse conglomerate, which now forms several beds, aggregating 35 feet in thickness, at the base of the Cambrian. A few miles to the southwest, at Red Rock Point, Chapel Cove, near Holyrood Point (see page 317), the basal bed of the Cambrian is a fine-grained sandstone 6 feet in thickness, resting on altered basalt that cuts through the Random terrane of the Avalon series. Immediately southwest of Manuels, along the line of the railway track, the basal beds of the Cambrian are exposed for a distance of 2 miles or more, sometimes as conglomerate with purple shales above, at other times as nodular limestones interbedded in the reddish-purple shales with greenish shales above.

<sup>1</sup> Map of the Peninsula of Avalon, 1881.

<sup>2</sup> Bull. Geol. Soc. Am., Vol. X, p. 218.

Just southwest of the landing platform at Manuels Station green shales occur in a hollow on the upper surface of a bed of eruptive rock that appears to have been injected along the contact of the Cambrian and pre-Cambrian, and to have broken the succession of the strata. Both the conglomerate and portions of the shales appear to be locally cut out by faults. Blocks of pinkish-colored limestone are bedded in the eruptive rock, that were evidently broken off near by, as layers of a limestone occur within a short distance, farther along the track. In the green shales mentioned immense numbers of fragments of a large trilobite occur, which Mr. Matthew has named *Metadoxides manuelensis*.<sup>1</sup> To the northwest of this outcrop, in a field across the railway track and road, green shales of the higher horizon occur, in which fragments of *Olenellus (H.) bröggeri* were found. A little distance beyond the hand-car house earthy nodular limestones are exposed. These limestones, when decomposed, afford very fine specimens of a number of species of Lower Cambrian fossils. Among those noted were: *Obolella atlantica*, *Solenopleura ? bombifrons ?* *Microdiscus helena*, *Parmophorella rugosa*, *Olenellus (H.) bröggeri*. There were also in one of the layers immense numbers of *Hyalolithes*. In a layer capping this earthy limestone band a large number of heads of *Solenopleura ? harveyi* and *S. ? howleyi* were found, along with an unusually long species of *Orthotheca*. Below this band of limestone a reddish-purple, argillaceous shale occurs, in which many fragments of *Olenellus (H.) bröggeri* and *Agraulos ?* were found. A short distance beyond this the basal conglomerate outcrops, and resting directly on it a layer of pinkish limestone, corresponding in its contained fauna with the Smith Point (*Hyalolithes*) limestone of the Smith Sound section. In this layer of limestone the following species were found: *Helcunia bella*, *Hyalolithes impar*, *H. princeps*, *H. quadricostatus*, *H. similis*, *H. terranovicus*, *Hyalolithellus micans*, *Coleoloides typicalis*.

The reddish-purple shale occurs again in a cutting about one and one-half miles southwest of Manuels Station, where entire specimens of *Olenellus (H.) bröggeri* and *Agraulos ?* were found. At a point one-half mile beyond this, beside the railroad track,

<sup>1</sup> Bull. Nat. Hist. Soc. New Brunswick, No. XVII, p. 137.

layers of nodular limestone occur, aggregating several feet in thickness. The contained fauna is of the same character as that in the Topsail Head limestone. The species noted were: *Iphidea labradorica*, *Parmophorella rugosa*, *Colcoloides typicalis*, *Microdiscus helena*, and numerous fragments of *Olenellus* (*H.*) *bröggeri*.

At Lawrence Pond, about 6 miles southwest of Manuels, a layer of gray limestone, just above the highly altered Conception slates of the Avalon series, was found to be very fossiliferous. The species noted are: *Scenella reticulata*, *Parmophorella rugosa*, *Straparollina remota*, *Hyolithes*?, *Colcoloides typicalis*, *Hyolithellus micans*, *Fordilla troyensis*.

Above this limestone the reddish-purple slates carry the same fauna as along the railroad near Manuels. The stratigraphic succession of the strata at Manuels and along the railway to the southwest, shows that the Smith Point (*Hyolithes*) limestone occurs immediately on the conglomerate, and above it the reddish-purple argillaceous shales, earthy limestone, etc., containing the *Olenellus* (*H.*) *bröggeri* fauna. The limestone was found in place near Manuels Station, but at several other localities it appeared to be absent.

*Base of the Middle Cambrian in the Manuels Brook Section.*—On the southwest side of Manuels Brook, a short distance below the falls and 45 feet up in the section above the basal conglomerate, there is a stratum that corresponds in character to the basal conglomerate of the Middle Cambrian or Paradoxides zone of the Smith Sound section. It is a ferruginous, semi-conglomeratic, earthy limestone, with nodules of red hematite in the upper portion, and irregular concretions, or pebbles it may be, of pinkish limestone, in which fragments of *Olenellus* and *Agraulos* were found. In places it is a solid layer, 18 inches in thickness, and in other localities it breaks up into two or three layers. Above this semi-conglomeratic stratum green argillaceous shales in massive beds extend upward with a thickness of 170 feet. Several layers of manganese occur in the lower portion, but no traces of fossils were found.<sup>1</sup>

<sup>1</sup> In the 'Manuels Brook' section of 1888, mention is made of the finding of the head of an *Olenellus* and fragments of *Agraulos* or *Ptychoparia* near the

Stratigraphically this shale occupies the position of the *Protolenus* beds of the Hanford Brook section of New Brunswick. The next stratum above is formed of two layers of impure,

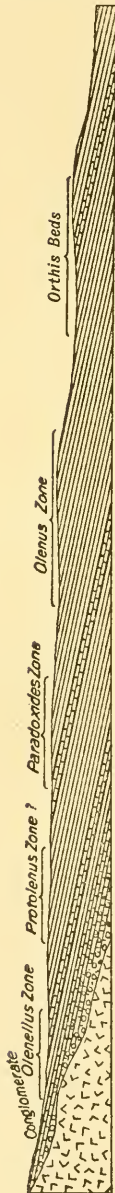


FIG. 9. Diagrammatic section of Cambrian rocks on Manuels Brook, showing relative position of the *Olenellus*, *Protolenus*, *Paradoxides*, and *Orthis* zones.

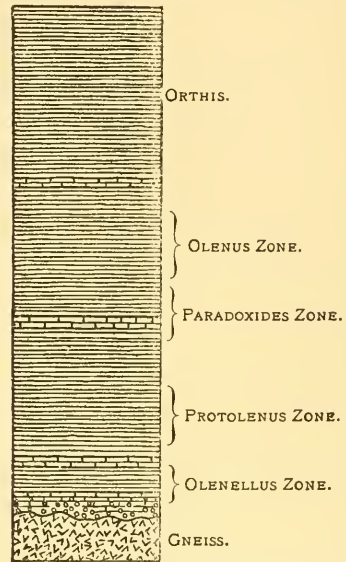


FIG. 10. Diagrammatic vertical section of the Cambrian formations on Manuels Brook.

earthy, pinkish-colored limestone, separated by 10 inches of greenish shale. In the limestone numerous fragments of *Paradoxides* occur. This limestone is the base of the great *Paradoxides* zone, and corresponds in position to a similar limestone in the Smith Sound section.

base of the green shales. At the time this section was measured the cliffs and banks were heavily wooded, and I now think that the shales found in the outcrop higher up the slope were beneath the conglomerate limestone. A comparison also shows differences in the measured thickness of the beds, which arise largely from the better opportunity offered for measuring this section in 1899, owing to the fresh exposures made by the landslides, resulting from the clearing off of the timber.

In the shales just above the limestone the *Paradoxides* fauna is largely developed. It extends up through 66 feet of shale and interbedded limestone to the base of the Upper Cambrian or Olenus zone. Six feet above the thickest band of limestone, in which *Paradoxides davidis* occurs, there is a thin layer of calcareous conglomerate, varying from 2 to 6 inches in thickness. It contains many dark argillaceous concretions, also pebbles of a reddish siliceous rock. This narrow band of conglomerate is found on both sides of the river, and it is taken as the base of the Upper Cambrian. Of the fauna occurring below it one species of *Agnostus* and one brachiopod, *Obolus* (*Lingulella*) *ferrugineus*, pass up into the Olenus fauna.

The relative positions of the subfaunas of the Cambrian fauna are indicated by figures 9 and 10.

*Chapel Cove Section.*—Holyrood Point, Conception Bay, Newfoundland.

*Lower Cambrian, downward.*—

	Feet.
1a. Reddish-purple shale, with numerous layers of nodular limestone, some of them 18 inches in thickness.....	28
Fossils:	
<i>Agnostus?</i> sp. undet.	
<i>Olenellus</i> ( <i>H.</i> ) <i>bröggeri</i>	
<i>Agraulos strenuus</i>	
<i>Agraulos</i> sp. undet.	
1b. Green argillaceous shale, with bands of pinkish nodular limestone in the upper 20 feet.....	156
Fossils:	
Numerous fragments of the slender tubes of <i>Coleoloides</i> were noticed in the limestone nodules.	
1c. Pinkish and reddish-purple-colored nodular limestone in two beds, 24 inches and 12 inches .....	3
Fossils:	
Fragments of trilobites were abundant, but no specimens were obtained that could be identified.	
1d. Reddish-purple argillaceous shales, with scattered nodules of greenish and pinkish limestone.....	22
Strike N. 50° W. mag., dip 45° SE.	
Fossils:	
<i>Iphidea labradorica</i>	
<i>Obolella atlantica</i>	
<i>Olenellus</i> ( <i>H.</i> ) <i>bröggeri</i>	
<i>Solenopleura?</i> <i>bombifrons?</i>	
2. Pinkish quartzitic sandstone.....	6

*Algonkian Random Terrane.*—The sandstones of the Random terrane are considerably broken and disturbed, and capped by a highly altered greenstone, which appears to have been deposited and eroded prior to the deposition of the basal Cambrian sandstone.

CAMBRIAN SECTIONS OF NEW BRUNSWICK AND CAPE BRETON.

Mr. Matthew has so fully described in many papers the formations of the Cambrian system in New Brunswick, and their contained faunas, that it appeared almost unnecessary to re-examine them. It was mainly on account of his statement that a great unconformity exists between the 'Etcheminian' and the 'St. John quartzite' at the base of the Middle Cambrian that I was led to study the sections at St. John and on Hanford Brook. Mr. Matthew gave me all assistance possible and guided me to the localities where the best outcrops of strata could be found. He has done a great deal of earnest, thorough work, and I regret that I am obliged to differ from him in the interpretation of the Lower Paleozoic section in New Brunswick and Newfoundland.

In the city of St. John the examination of the outcrops led me to the conclusion (*a*) that the Lower Cambrian strata beneath the St. John quartzite had been deposited on and against an irregular, uneven shore line, (*b*) that the sands of the St. John quartzite had been spread conformably over the beds of the Lower Cambrian ('Etcheminian'), (*c*) that where the pre-Cambrian (Algonkian) rocks projected above the Cambrian beds, or formed the shore lines, the St. John quartzite conformably overlapped the reddish-purple and greenish-colored arenaceous-micaeous shales and thin-bedded sandstones of the Lower Cambrian ('Etcheminian') and came in unconformable contact with the Algonkian rocks.

The basal bed of the St. John quartzite was formed of a clear white sand, no traces of the subjacent Lower Cambrian or Algonkian rocks appearing in it in the outcrops that I have examined. It is only in the layers 30 feet or more above the base that white quartz pebbles, over a half inch in diameter, begin to

appear. The St. John quartzite was evidently formed from a well-washed white quartzitic sand that was spread quickly and evenly over the Lower Cambrian sediments. The currents of water loaded with sand undoubtedly eroded to a slight degree the subjacent Lower Cambrian deposits, but in the only section where I saw the actual contact there was no evidence of this. Mr. Matthew speaks of the great erosion of the Lower Cambrian 'Etcheminian' prior to the deposition of the St. John quartzite, citing as proof the absence of the Lower Cambrian beds beneath the quartzite. It does not appear that he considered the possibility that the Lower Cambrian sediments might never have been deposited over the areas he mentions, and that the Middle Cambrian 'St. John' sediments covered the 'Etcheminian' and overlapped on the Algonkian. Exactly the same conditions prevailed about Trinity and Conception Bays, Newfoundland, where, with a fixed datum line in the Smith Point (Hyalithes) limestone, we found from 30 feet of strata in one locality to 400 feet in another between the Hyalithes limestone and the subjacent Algonkian rocks. At St. John, New Brunswick, the quartzite is close down on the Algonkian. At Hanford Brook 1040 feet of Lower Cambrian beds occur between them. Mr. Matthew's view is that the 1040 feet of the Hanford Brook section were nearly and in some places completely eroded off the St. John City area before the deposition of the Cambrian, not that they were never deposited.

In the St. John basin the strata are more or less disturbed and tilted at angles varying from  $10^{\circ}$  to vertical. As usual under such conditions, there is more or less displacement between the massive unyielding stratum of quartzite and the softer more yielding shales above and below. Even if there is no break a decided difference in dip may occur only a few feet away from the more unyielding stratum. The behavior of strata under such conditions is beautifully shown at several points in the Lower Cambrian of the Hanford Brook section. It is only on the evidence of well exposed contacts (such as that at the head of Seely street) that conformity or unconformity can be established between the harder stratum and the more easily flexed shales.

*Seely Street Section.*—The section exposed at the head of Seely Street, beside the Park road, is as follows. The pre-Cambrian Algonkian rocks have an uneven surface where the basal beds of the Cambrian rest against them.

<i>Lower Cambrian, upward.</i> —		Feet.
1a.	Dark reddish-brown, fine conglomerate and sandstone, with reddish and green, hard arenaceous shale. The conglomerate contains small quartz pebbles and bits of the subjacent Algonkian siliceous beds .....	12
	Strike N. 40° mag., dip. 70° S. E.	
1b.	Space concealed. From the abundant débris in the soil as exposed in a cutting beside the road the section here is formed of reddish-purple and green sandy shales.....	85
1c.	Reddish-purple and greenish arenaceous-micaceous shales and thin-bedded sandstone.....	52

*Middle Cambrian.*—

- |     |   |       |
|-----|---|-------|
| 2a. | Light-gray, fine-grained, quartzitic sandstone in thick layers. The grains of sand become coarser in the upper part of section and a layer of white quartz pebble conglomerate occurs near the summit.....  | 40-45 |
|     | Strike at base N. 55° E. mag., dip 70° S. E.  |       |
| 2b. | Arenaceous and argillaceous, greenish-colored shales and thin-bedded sandstones, passing above into dark argillaceous shales. About 25 feet above the base the <i>Paradoxides</i> fauna appears in great abundance. For further details of the section of the St. John Cambrian rocks see Mr. Matthew's papers. |       |

It will be noted that the strike of the basal Lower Cambrian bed 1a is N. 40°, while that of the St. John quartzite is N. 55° E. This does not indicate an unconformity, as the change of strike occurs in the beds below; the shales just beneath the quartzite are conformable to the quartzite.

*Hanford Brook Section, St. John County, New Brunswick.*—The Middle Cambrian portion of the Hanford Brook section as exposed at McAfee's saw mill, on the south bank of the brook below the mill, is as follows:

<i>Middle Cambrian, downward.</i> —		Feet.
1a.	Greenish-colored argillaceous shales with abundant remains of <i>Paradoxides</i> and other forms of the <i>Paradoxides</i> fauna .....	30+
1b.	Massive calcareo-argillaceous layer carrying the <i>Paradoxides lamellatus</i> fauna .....	3
	Strike E. and W., dip 45° N.	



	Feet.
2a. Gray sandstone and greenish arenaceous and argillaceous shale.....	34
Very few traces of fossils were found in this bed. It is the horizon of fauna b <sub>4</sub> and b <sub>5</sub> of Matthew.	
2b. Greenish argillaceous shale with a layer of sandstone 8 inches thick, and, a little below, another layer of sandstone 4 feet in thickness. The sandstones are very hard, fine-grained, and with fossiliferous phosphatic nodules near the bottom.....	10
Fossils:	
This horizon carries the <i>Protolenus</i> fauna, fauna b <sub>3</sub> of Matthew.	
2c. Fine-grained, dark-gray, arenaceous argillites in layers 10 to 20 inches in thickness, that break up on exposure into irregular shaly layers.....	16
Strike E. and W., dip 25° N.	
Fossils:	
<i>Protolenus</i> fauna, b <sub>2</sub> of Matthew. About midway of the subdivision there is a layer of greenish-gray, fine-grained sandstone 14 inches in thickness, in which numerous small phosphatic nodules occur in the lower 3 inches, with many fragments of fossils.	
2d. Dark-green to grayish-green, fine-grained, compact, hard sandstone.....	18
Fossils:	
Fauna b <sub>1</sub> of Matthew.	
3. Light-gray to white quartzitic sandstone in massive layers, the upper portion passing into greenish-tinted quartzitic sandstone.....	30+

The section from the quartzite downward for a distance of nearly 300 feet on the surface is entirely concealed. The highest beds of the subjacent Lower Cambrian are exposed at the upper end of the mill pond, where they have a strike of N. 60° E., dip 20° N. W.

*Lower Cambrian, downward.—*

	Feet.
1a. Estimated thickness concealed beneath the 'St. John quartzite'.....	136
1b. Massive-bedded, dark-purplish-colored arenaceous shales and sandstones. Toward the lower portion a few calcareous nodules appear in the shales .....	320
Strike in upper beds, N. 60° E., dip 20° N.W. In beds 215 feet below summit, strike N. 70° E., dip averaging 20°-25° N.W.	

- |  | Feet. |
|--|-------|
| 1c. Reddish and greenish arenaceous and argillaceous shales and thin-bedded sandstones, with a few thin interbedded calcareous sandstones .....  | 30    |
| Strike N. 65° E, dip 35° to 40° N.W.   |       |
| Fossils:   |       |
| In a thin reddish-brown, slightly calcareous sandstone occur great numbers of a slender species of <i>Hyalithes</i> that resembles <i>H. communis</i> . Just below it I noted, in a hard, very fine-grained, compact sandstone, specimens of <i>Coleoloides</i> like <i>C. typicalis</i> and a large <i>Iphidea labradorica</i> ? This appears to be the horizon of the <i>Hyalithes</i> limestone fauna of the Smith Sound section of Newfoundland. Unfortunately the sediments are of a type in which fossils are rarely found well preserved. |       |
| 2. Reddish-purple conglomerate in fine sandstone matrix. White quartz and reddish and greenish siliceous pebbles occur, some of which are from 2 to 6 inches in diameter. Strike N. 65° E., dip 40° N. W.  | 31    |
| 3. Reddish-purple to grayish-purple, fine-grained sandstones, passing below into flaggy gray and greenish-gray micaceous sandstone, interbedded with thick layers of sandstone.....  | 395   |
| About 120 feet down a few layers of white quartz pebbles appear in the dark sandstone, and at 175 feet down broad annelid trails were seen on the smooth surface of a thick layer of sandstone.  |       |
| The dip decreases from 40° at the top to 30°, and then 25° at the base, where the strike is N. 55° E.  |       |
| At this point the upper beds of the basal conglomerate outcrop on the south side of the brook, but they are cut off a few feet down by a fault that brings up some of the beds of No. 3 of the section, and possibly No. 1c. On the north side of the brook a syncline and fault expose a considerable portion of No. 3 of the section. Up the brook the basal quartzite appears again beneath the sandstone of No. 3, from which it extends nearly to the contact with dark, pyroclastic, andesitic rocks of the Algonkian.                     |       |
| 4. Rather coarse siliceous, massive-bedded conglomerate, formed of white quartz, jaspery, reddish- and greenish-colored pebbles. The upper 8 feet has a light-gray color that passes below to a purplish tint.....   | 128   |
| Total of Lower Cambrian .....  |       |
|  | 1040  |

The contact with the Algonkian rocks is not seen, the base of the conglomerate being considered as near the last angular boulders of

the conglomerate seen in the bank, a little distance below the outcrop of Algonkian rocks.<sup>1</sup>

*Cape Breton Section.*—The most recent publication of Mr. Matthew on the subject of the Etcheminian fauna appeared in December, 1899.<sup>2</sup> Therein he states:

The physical conditions and history of the Etcheminian deposits in Cape Breton are very closely parallel to those in New Brunswick. . . . These sections show *no Lower Cambrian*, nor have the faunas of this part of the system (Paradoxides and Protolenus) been recognized in Cape Breton. The fauna which is found in the lowest sandstones and shales above the basal conglomerate of the Cambrian appears to be Upper Cambrian. . . . It is therefore more reasonable to expect a discordance of strata in this region between the Cambrian and the Etcheminian than in the region of New Brunswick where the Lower Cambrian is present.

The fauna found in the beds identified as Etcheminian is mainly brachiopods, and appears to me to be of a Middle Cambrian character, such as occurs in the beds above the St. John quartzite in the Hanford Brook section.

Two diagrammatic sections are given to show the supposed relations of the Etcheminian and the superjacent Upper Cambrian rocks. The fauna and Fig. 2 of the section strongly suggest that the so-called Etcheminian is Middle Cambrian and that the Lower Cambrian and the Etcheminian are absent in

<sup>1</sup> Mr. Matthew refers to the section on Hanford Brook in the following papers :

On a Basal Series of Cambrian Rocks in Acadia : Can. Rec. Sci., Vol. III, 1888, p. 27. Estimated section of Basal series 1200 feet thick ; notes occurrence of fossils.

On Cambrian Organisms in Acadia : Trans. Roy. Soc. Can., Jan. 1889, Vol. VII, 1890, Sec. IV, pp. 138, 139. Republishes section of 1888, and gives a diagrammatic figure of section and sketch map, calling the Basal series 'Etcheminian.'

List of Fossils : Bull. Nat. Hist. Soc., New Brunswick, No. 10, 1892. 'Basal Series of Rocks or Etcheminian Stage.' Abstract of section published in 1888.

The Protolenus Fauna : Trans. N. Y. Acad. Sci., Vol. XIV, 1895, p. 108. Diagrammatic section of Etcheminian on Hanford Brook.

A Paleozoic Terrane Beneath the Cambrian : Annals N. Y. Acad. Sci., Vol. XII, 1899, p. 44. Introduces section figure published in 1895.

<sup>2</sup> Preliminary Notice of the Etcheminian Fauna of Cape Breton: Bull. Nat. Hist. Soc. New Brunswick, Vol. IV, 1899, pp. 198-208.

this region, or are beneath the beds containing the fauna described by Mr. Matthew.

UNCONFORMITY AT BASE OF ST. JOHN GROUP AND EQUIVALENT HORIZON IN NEWFOUNDLAND.

Almost from the beginning of his studies of the Cambrian rocks about St. John, New Brunswick, Mr. Matthew inferred that there was an unconformity between the St. John quartzite and the subjacent red, green, and gray shales and sandstones that occur in the vicinity of St. John and in Long Reach Valley. In 1888<sup>1</sup> he based the unconformity on the variation in thickness of these lower deposits; and from the descriptions given by Mr. Alexander Murray of the red, green, and gray slates and sandstones below the Paradoxides-bearing shales of Trinity, St. Marys, and Placentia Bays, Newfoundland, he inferred that they were also unconformably beneath the Paradoxides beds. He says:<sup>2</sup>

The conglomerate at Manuel Brook, Conception Bay, and the sandstones elsewhere at a corresponding horizon, appear to mark the break between this series and the higher part of the Cambrian rocks in Newfoundland.

In a paper read in 1889<sup>3</sup> he says:

The Basal series in Acadia, though unconformable to the St. John group, is closely related to it in its distribution.

In a later paper presented to the New York Academy of Sciences in 1895, when speaking of the 'Etcheminian' series, he says:<sup>4</sup>

In New Brunswick there is a definite base of conglomerate to this series, but in Newfoundland the base has not been shown. *Olenellus* having been found in Newfoundland above this series, the series is there clearly pre-Cambrian.<sup>5</sup>

No authority is given for the statement that *Olenellus* has been found above the 'Etcheminian' series.

<sup>1</sup> On a Basal Series of Cambrian Rocks in Acadia: Canadian Record of Science, Vol. III, No. 1, 1888, p. 22, 23.

<sup>2</sup> Loc. cit., p. 23.

<sup>3</sup> On Cambrian Organisms in Acadia: Trans. Roy. Soc. Canada, 1889 (published in 1890), Vol. VII, Sec. IV, p. 137.

<sup>4</sup> The Protolenus Fauna: Trans. N. Y. Acad. Sci., Vol. XIV, 1895, pp. 101-153.

<sup>5</sup> Loc. cit., p. 105.

In 1899 Mr. Matthew presents the same arguments as in 1888, to the effect that the strata between the St. John group and the crystalline rocks (Huronian, etc.) are of varying thickness and often absent altogether. From this he infers that the 'Etcheminian' rocks were removed by erosion prior to the deposition of the rocks of the St. John group.<sup>1</sup>

In the description of the 'Eopalæozoic' rocks of Smith Sound, N. F., Mr. Matthew states that the strata of the higher terrane have a greater dip than those of the lower (Etcheminian). A diagrammatic figure of a section is introduced, showing the exact position of the unconformity. The conglomerate at the base of the Cambrian is described in detail and explanations are given of its probable source.<sup>2</sup> He concludes from a hasty examination of the section on Manuels Brook, that the Etcheminian was eroded prior to the deposition of the Cambrian. He adds:

It is plain, therefore, that the Etcheminian terrane was entirely eroded at Manuels Brook before the first member of the Cambrian was laid down, though perhaps the harder calcareous masses remained to contribute to the boulders in the conglomerate. This is parallel to the conditions in New Brunswick on the Kennebecasis River, except that there are no limestones or remains of them in that valley, and the Etcheminian is entirely wanting.<sup>3</sup>

*Hanford Brook.*—During the summer of 1899 I visited Hanford Brook and studied with great interest the geologic structure and stratigraphic succession of the strata referred to the 'Etcheminian' and the St. John terranes. I found that the unconformity on Hanford Brook, shown by Mr. Matthew, between the basal St. John quartzite, Middle Cambrian, and the subjacent Lower Cambrian ('Etcheminian') was based on the difference in strike and dip of the Paradoxides and Protolenus beds of the Middle Cambrian and the highest exposed beds of the Lower Cambrian ('Etcheminian'). The two formations do not come in contact, an interval of nearly 300 feet separating them. The lowest beds of the St. John quartzite at Hanford Brook have nearly the same strike and dip as the highest beds

<sup>1</sup> A Paleozoic Terrane beneath the Cambrian: *Annals N. Y. Acad. Sci.*, Vol. XII, 1899, No. 2, pp. 41-56.

<sup>2</sup> *Loc. cit.*, pp. 47-50.

<sup>3</sup> *Loc. cit.*, p. 52.

of the Lower Cambrian ('Etcheminian'). The latter, at the head of the mill-pond, on the north side, strike N. 60° E., and dip 20° N.W. On the southeast side of the mill-pond the strike is N. 50° E., dip 25° N.W. Then comes a gap of 300 feet before the white quartzites of the St. John group are seen. These, on the north side of the pond, strike N. 50° E., dip 30° N.W. On the south side of the pond the dip is increased to 35°. The quartzites may be traced for some distance both north and south of the pond on the same general strike. Within a few feet of the first outcrop on the south side of the pond, at the angle where the pond narrows as it approaches the dam, beds of quartzite a little higher in the section than those striking N.

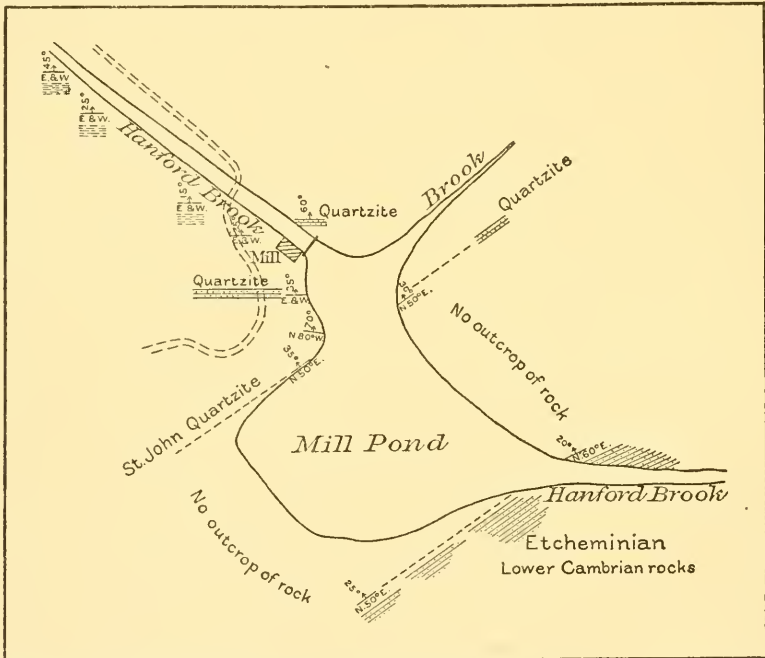


FIG. 11. Diagrammatic sketch of Hanford Brook and mill-pond, showing the relations of the St. John quartzite to the Hanford formation.

50° E. are curved so as to have a strike of N. 80° W., dip 70° N. A few feet farther west the strike is east and west, with a dip of 35°. This, a little west of the mill, is reduced to 15°. On the north side of the mill-dam the quartzites strike east and west,

with a dip of  $60^{\circ}$  N. If these beds continue down the brook they must come directly in contact with the central portion of the *Protolenus* beds of the St. John terrane.

The strikes and dips mentioned are shown in the accompanying diagrammatic sketch, Fig. 11. They illustrate the irregularities occurring within the St. John quartzite at the base of the Middle Cambrian and the fact that the supposed unconformity at the base of the St. John quartzite is a break or split within that formation and not below it. There does not appear to be any evidence for a safe conclusion that there is an unconformity between the Lower Cambrian Hanford formation and the Middle Cambrian St. John quartzite.

*City of St. John.*—At the head of Seely street, beside the Park road, in the city of St. John, the pre-Cambrian (Algonkian) rocks have an uneven surface where the basal beds of the Hanford formation rest against them with a strongly marked unconformity. Passing up through about 150 feet of thickness of the 'Etcheminian' Hanford terrane, we find the basal bed of the St. John quartzite resting conformably on the shales and thin-bedded sandstones of the Hanford terrane. There is no evidence whatever of any unconformity at this point.

*Catons Island.*—I also examined the contact of the two formations on the east side of Catons Island, Long Reach. Here the purplish-colored sandstones are conformable in strike and dip with the St. John quartzite.

*Conclusions.*—The presence of a quartzitic sandstone of the character of the St. John quartzite is not in itself proof of any decided unconformity. It indicates a decided change in sedimentation and the derivation of material from some other source of supply, but such a phenomenon may occur in the midst of a terrane where the fauna is the same above and below the quartzite. This is well illustrated in the Eureka district of Nevada, where the Eureka quartzite, 300 feet in thickness, occurs in mid-Trenton, the limestones below and the limestones above the quartzite carrying the same species of the Trenton fauna.

Judging from the character of the St. John quartzite as I have seen it, and the description given of it at other localities by Mr. Matthew, I think that the sand of which it is formed came

from a considerable distance, and from a source of supply quite different from that which furnished the sands of the Lower Cambrian and the sediments above the St. John quartzite in the Middle Cambrian.

Mr. Matthew's argument for the presence of a great unconformity beneath the St. John quartzite was primarily based on the variation in thickness of the strata of the Hanford 'Etcheminian' terrane. In the sections about St. John the St. John quartzite sometimes rests on the pre-Paleozoic strata, and in other localities a relatively thin section of the Hanford terrane is intercalated. At Hanford Brook the Hanford terrane is more than 1000 feet in thickness, while in the near-by Kennebecasis valley it is entirely absent. Mr. Matthew conceived the view that the non-presence of the Hanford 'Etcheminian' terrane was owing to its removal by erosion prior to the deposition of the St. John quartzite. It may have been that when the Lower Cambrian sea began to deposit sediments in this region the topography of the sea bottom was very irregular and that the sediments were deposited on an uneven surface of Algonkian rocks. There does not seem to be any evidence of erosion, either in the presence of débris in the basal beds of the St. John quartzite or in an irregularly eroded surface of the Hanford terrane. On the contrary, there is every evidence of the overlap of the various beds of the Hanford terrane on the subjacent Algonkian rocks.

From the character of the sediments of the Hanford series it is evident that they were deposited on a gradually subsiding surface. The lowest basal beds are conglomerates, followed by finer sands, and again by beds of conglomerate and coarse sandstones at intervals throughout the terrane. As the land subsided the sediments gradually overlapped on the lower portions of the topography, finally reaching a height of 1000 or more feet above the horizon at which the basal beds were deposited. In shallow waters only a thin layer of the sediments accumulated. When the sands of the St. John quartzite were distributed over this series there may have been a slight erosion by the currents distributing the sand, but there would not necessarily be any marked unconformity between the two terranes.

It seems to me that the view that the variation in thickness of



the strata of the Hanford terrane beneath the quartzite results from non-deposition is more satisfactory than the view that the strata were originally deposited and subsequently removed by erosion.

*Unconformable Overlap of Cambrian in Newfoundland.*— Various Cambrian sections on Trinity and Conception Bays prove that the outlines of the bays existed in Algonkian time, and that the Cambrian sediments were deposited within and about the bays on an uneven surface of Algonkian rocks. In some instances the contact between the Cambrian and the Algonkian shows the same dip and strike, but in other instances, as at Manuels Brook and other points on Conception Bay, there is a great unconformity between the two.

I do not think that the Cambrian rocks were extensively eroded at any period during their deposition. In every section examined where there was no disturbance of the strata by intrusive rocks there was conformity throughout the Cambrian section.

Taking the massive Smith Point Hyolithes limestone as the datum line, the following sections show the thickness to the point of contact with the subjacent Algonkian Random terrane:

	Feet.
Smith Sound (no contact).....	441+
Random Sound (contact) .....	516+
Hearts Delight (contact).....	155
Spread Eagle Point (contact), est.....	100
Manuels Brook (contact).....	35

Mr. Matthew, in his diagrammatic figure of a section of the Eopaleozoic at Smith Sound,<sup>1</sup> indicates an unconformity between the Etcheminian and the Cambrian 'Protolenian' horizon. Mr. Howley and I studied this portion of the section very carefully and we failed to find any evidence of an unconformity. There is a conglomerate, as described by Mr. Matthew, but it is of an intraformational character, such as occurs in the Cambrian at other localities and horizons in Newfoundland. This conglomerate serves well to mark the base of the Middle Cambrian. At the point of exposure on the shore there is a vertical fault cutting

<sup>1</sup> Loc. cit., Fig. 3, p. 48.

the conglomerate, very near the water's edge, which has thrown the conglomerate bed 15 feet to the west. On climbing up the bank we found the conglomerate on the eastern side of the fault, where its dip is lower than on the western side. At low tide a contact was found between the conglomerate and the shales beneath, which showed that they were conformable. It was also found that the shales and conglomerates on the eastern side of the fault, in the cliff, were conformable both above and below the conglomerate. The unconformity noticed by Mr. Matthew in his section is the difference in the dip on two sides of a fault caused by the displacement accompanying it. This bed of conglomerate was found at the same horizon in other localities. In every case there was no unconformity in either strike or dip between the shales below and those above. This is particularly well shown in the Cambrian section on the south side of Hearts Delight Harbor, Trinity Bay.

Mr. Matthew's placing the base of the Cambrian at the St. John quartzite and at the conglomerate in the Smith Sound section was logical when he assumed that the subjacent strata should be referred to a pre-Cambrian terrane. The change in sedimentation is so apparent that it was unnecessary to seek to establish a marked unconformity to sustain the view that it was the natural boundary line between two systems of strata. He established, however, the break in sediments that affords probably the best line of demarkation between the Middle and Lower Cambrian that is known to exist on the North American continent.

Mr. Matthew correlates the Lower Cambrian Hanford beds of Manuels Brook with the Protolenus beds of New Brunswick, and considers them as unconformably above the 'Etcheminian' of the Smith Sound section. As about Trinity Bay and in New Brunswick, all of the conditions exhibited at Manuels and about the head of Conception Bay go to prove that the sea bed was very uneven, and that any conclusions as to a general unconformity at the base of the Middle Cambrian on account of the absence or presence of certain beds must be based on the evidence of overlap of the various layers on the pre-Cambrian shore-line rather than on the supposition that there was a general

erosion of still older Cambrian beds prior to the deposition of the sediments now forming the base of the section at Manuels and vicinity. At one point the basal bed may be the Smith Point *Hyalolithes* limestone resting on the conglomerate, and at another point not far away a shale 50 feet, more or less, above or below that limestone. Ten miles away, at Red Rock Point, the basal conglomerate is absent; a reddish-purple shale rests on a band of fine-grained quartzitic sandstone, with a succession of shales and limestones above for 200 feet, in which the *Olenellus (H.) bröggeri* fauna occurs. It is to be noted that at this point a massive bed of limestone, 170 feet above the base, apparently represents the Smith Point *Hyalolithes* limestone; and it must be recalled in this connection that there are no nodular limestones above the Smith Point *Hyalolithes* limestone in the Smith Sound section, but that the nodular limestones occur in the reddish-purple shales beneath that band of limestone. That the section between the *Hyalolithes* limestone and the base of the Middle Cambrian is so thin at Manuels may be owing to the elevation of the sea bed at this point after the deposition of the limestone, or possibly to a fault that cuts out more or less of the shales. Certain it is that the intervening beds found on Trinity Bay are not present. This fact, and the *Protolenus*-like aspect of the fauna, misled Mr. Matthew as to the true stratigraphic position of the fauna, as it is now known from the unbroken Smith Sound section.

#### LOWER CAMBRIAN FAUNA.

Mr. Matthew makes the following observations on the fossils in the Basal series. In 1888 attention was called to the occurrence of several forms, and reference was made to the 'Lower Cambrian series' as containing vestiges of organic forms.<sup>1</sup> Two years later a measured section of the 'Basal Etcheminian' series was published, with an account of the fossils found at various horizons in the 1200 feet of estimated thickness of the series. As no subsequent account is given of this fauna, the

<sup>1</sup> On a Basal Series of Cambrian Rocks in Acadia: Canadian Rec. Sci., Vol. III, 1888, p. 27.

most important portions of Mr. Matthew's notes are copied in full.<sup>1</sup>

About one hundred feet or more above the horizon where Psammichnites appears, separated from it by a conglomerate, indications of the Olenellus fauna show themselves. These consist of *Volborthella* (a chambered cell resembling an Orthoceras), the cystidean genus *Platysolenites*, Pander, and a large *Obolus*, allied to *Michwitzia* (formerly *Obolus*? or *Lingula*?) *monilifera* Linns, of the Eophyton sandstone of Sweden and the upper part of the "Blue Clay" of Russia. Some of the layers in this part of the series abound in soft green grains similar to the glauconite grains of the Cambrian rocks in Russia. The paste enveloping them is red.

I have remarked above that the Basal series affords indications of the fauna which accompanies the trilobite genus *Olenellus* and its kindred genus *Mesonacis*, but indications of a similar fauna are also found in the two lowest bands of the St. John group. (Loc. cit., p. 140.)

In summing up the facts bearing on the comparative age of this part of the Cambrian rocks in Acadia we get no aid from the typical genera of this horizon, *Olenellus* and *Mesonacis*, but the Acadian rocks contain other genera of this faunas which serve to fix their age with a certain degree of accuracy. Some of these genera, however, are such as may have a wider range of existence in time than the trilobites, and, therefore, are not of the same homotaxial value. The trilobites that do occur are not so definitive as some others. (Loc. cit., p. 143.)

In 1892 a section is given as 'Basal Series of Rocks or Etcheminian Stage,' but no fossils are mentioned except as faunas that occur in two divisions.<sup>2</sup>

In his admirable essay on the *Protolenus* fauna Mr. Matthew mentions the occurrence of protozoans, brachiopods, echinoderms? and mollusks, and worm furrows and trails in the Etcheminian. He says:

No fauna of trilobites has yet been found below this sandstone (at base of St. John Group). Here, then, should be drawn the line between Cambrian and pre-Cambrian.<sup>3</sup>

He states that the 'Protolenus' fauna *found above* the

<sup>1</sup> On Cambrian Organisms in Acadia: Trans. Roy. Soc. Canada, Vol. VII, 1889 (published 1890), p. 138.

<sup>2</sup> List of Fossils: Bull. Nat. Hist. Soc. New Brunswick, No. X, p. 1.

<sup>3</sup> The Protolenus Fauna: Trans. New York Acad. Sci., Vol. XIV, 1895 series, p. 103.

'Etcheminian' is more primitive and more pelagic than the *Olenellus* fauna. He speculates as to whether the two faunas were contemporary, and remarks that his conjectures are based "on our *present knowledge* of its (*Protolenus* fauna) constitution and peculiarities. Possibly further knowledge may make it necessary to modify these remarks in some particulars, but the fauna is now so well shown by the numerous species pertaining to it, that these modifications cannot essentially change its aspect, or obliterate its peculiar and essential characters."<sup>1</sup>

In 1899 he concluded, from the evidence known to him, that the 'Etcheminian' fauna is distinct from the Cambrian faunas.

The uniformity of conditions attending the depositions of the Etcheminian terrane throughout the Atlantic Coast province of the Cambrian is surprising, and points to a quiescent period of long continuance during which the *Hyolithidæ* and *Capulidæ* developed so as to become the dominant types of the animal world, while the *Brachiopods*, the *Lamellibranchs* and the other *Gasteropods* still were puny and insignificant. The crustacea, so far as we know, were represented only by one *Phyllocarid*, and the trilobites so far have not been recognized at all.<sup>2</sup>

This was followed by a paper on the Etcheminian fauna of Newfoundland, giving a description of new genera and species, and a brief summary, as follows :

The peculiarities of this fauna as distinguished from the Cambrian are the following :

1. Great preponderance of the tube worms (*Hyolithidæ*, etc.).
2. Absence or rarity of trilobites.
3. Minuteness of the *Gasteropods* except *Patellidæ*.
4. Minuteness of the *Brachiopods*.
5. Minuteness of the *Crustaceans*.

The two special types of the Etcheminian fauna are, among the *Hyolithidæ* *Orthotheca bayonet*, and among the *Gasteropoda* *Randomia aurora*. The minuteness of the *Lamellibranchs* is not peculiar to the Etcheminian, as the Cambrian species are not much larger.<sup>3</sup>

This last paper was soon followed by a more detailed description of the genera and species of the 'Etcheminian' fauna, with

<sup>1</sup>Loc. cit., p. 153.

<sup>2</sup>Paleozoic Terrane Beneath the Cambrian: *Annals New York Acad. Sci.*, Vol. XII, 1899, pp. 52-54.

<sup>3</sup>*Bull. Nat. Hist. Soc. New Brunswick*, Vol. IV, 1899, p. 195.

illustrations.<sup>1</sup> In the same brochure Mr. Matthew has included the following species of the Lower Cambrian 'Etcheminian' fauna, supposing them to occur in strata which he refers to the superjacent Cambrian: *Hyolithes hatthewayi*, *Microdiscus bellimarginatus*, *Agraulos*<sup>2</sup> (*Strenuella*) *strenuus* var., *A. (S.) attleboroughensis* var., *Micmacca walcotti*, *M. angimargo*, *Avalonia plana*, *Protolenus howleyi*, *Metadoxides magnificus*.<sup>2</sup>

On some pieces of pinkish-colored limestone taken from the upper surface of the conglomerate at Manuels Brook last summer I found the following association of fossils:

*Helena bella* (*H. granulata* Matthew)

*Hyolithes princeps*

*H. quadricostatus*

*H. similis*

*H. terranovicus*

*Coleoloides typicalis*

*Olenellus (Holmei) bröggeri*

This fauna is typical of the Smith Sound section, with the exception of *O. (H.) bröggeri*, which occurs, however, at Smith Point in the upper 6 inches of the limestone series, some six feet above the typical (Etcheminian) fauna as outlined by Matthew in his paper on 'A Paleozoic Terrane Beneath the Cambrian.'<sup>3</sup>

As soon as I can secure the necessary time, I shall undertake a review of all work done on the Lower Cambrian fauna since 1890, in connection with the study of a large amount of new material collected from various localities in North America.

#### OLENELLUS FAUNA.

Considering the 'Etcheminian' to be pre-Cambrian, and the Protolenus fauna to extend down close to the St. John quartzite, Mr. Matthew frequently refers to the probable position of the Olenellus fauna. In 1889 he considered it a pre-Para-

<sup>1</sup> The Etcheminian Fauna of Smith Sound, Newfoundland: Trans. Roy. Soc. Can., Vol. V, Sec. IV, 1899, pp. 97-123.

<sup>2</sup> Fragments of Cambrian Faunas of Newfoundland: loc. cit., pp. 67-95.

<sup>3</sup> Ann. N. Y. Acad. Sci., Vol. XII, pp. 52-54.

doxides fauna,<sup>1</sup> but in 1895, when speaking of the Manuels Brook conglomerate and sandstones, he says:<sup>2</sup>

No fauna of trilobites has yet been found below this sandstone. Here, then, should be drawn the line between Cambrian and pre-Cambrian.

Above this limit there have thus far been found on the Atlantic coast of America the following trilobite faunas:

Upper Cambrian... { Peltura fauna.  
Olenus fauna.

Lower Cambrian... { Paradoxides fauna.  
Olenellus fauna.

He further concludes that the Protolenus fauna is in this region more primitive than the Olenellus fauna, but conjectures that it may have been contemporary with the latter elsewhere.<sup>3</sup>

In 1897 Mr. Matthew contends that the presence of *Dorypyge* in the 'Hastings Cove fauna' establishes a strong connection with the Olenellus fauna, and that, from the established succession of Cambrian faunas in Lower Cambrian beds in Scandinavia, Wales, and elsewhere in Eastern Canada, "we are therefore compelled to assume that the Hastings Cove fauna is as recent as the Upper Paradoxides beds."<sup>4</sup>

In speaking of Olenellus in reviewing 'Billings's Primordial Fossils of Vermont and Labrador,' Mr. Matthew says:<sup>5</sup>

The other Primordial form described by Billings therein were the two Olenelli, *O. Thompsoni* and *O. Vermontana*, two Salterellas, and Plantæ, Protozoa and Brachipoda. From the following remarks it will be seen that in the opinion of the writer the study of Billings's types has thrown considerable light on the geological horizon of Olenellus, and appear to link this genus with the Middle rather than the Lowest Cambrian.

It is only just to Prof. Jules Marcou to say that this is the position which he has contended for as the true age of Olenellus, determined by him from a study of the geology in the vicinity of Swanton, Vt., and Point Levis, near Quebec. I think he

<sup>1</sup> On the Classification of Cambrian Rocks in Acadia: Can. Rec. Sci., Vol. IV, 1889, pp. 303, 304.

<sup>2</sup> The Protolenus Fauna: Trans. N. Y. Acad. Sci., Vol. XIV, 1895, p. 103.

<sup>3</sup> Loc. cit., p. 152.

<sup>4</sup> Studies of Cambrian Faunas: Trans. Roy. Soc. Can., 2d Ser. Vol. II, Sec. IV, p. 193.

<sup>5</sup> Loc. cit., pp. 194, 195.

is the only American geologist who has held rigidly to this view : or at least the only one who has contended actively against Mr. Walcott's reference of this fauna to a position below that of Paradoxides.

Arguing from biologic relations, Mr. Matthew classifies the Atlantic North American Cambrian as follows :<sup>1</sup>

ATLANTIC NORTH AMERICA.

Upper Cambrian...	{	Dictyonema fauna.
		Peltura fauna.
		Olenus fauna.
Lower Cambrian...	{	Paradoxides fauna.
		Newfoundland species described in this article.
		Protolenus fauna.

In the final paper, establishing the ' Etcheminian ' as pre-Cambrian, he says, in speaking of the strata carrying the Olenellus fauna at Manuels Brook :<sup>2</sup>

Dana has said that " if strata should be found containing no Trilobites, but only Worms, the lower types of Brachiopods, Ostracods among the Crustaceans, and other inferior species, a place in the Cambrian would properly be made for it."<sup>3</sup> To the author it appears that while a place might, for convenience, be found in the Cambrian for such a fauna, it would not be " properly found " if we regard its biological significance. To assign such a fauna to the Cambrian would be to ignore the importance of the trilobites in distinguishing from each other the several life-zones of the Cambrian system ; we would not recognize as Cambrian a varied fauna from which the trilobites were absent.

Of the Olenellus fauna as it occurs at North Attleborough, Mass., we read :

As the trilobites all have continuous eyelobes, and the species *Microdiscus bellicinctus* is common to this locality and the Protolenus zone in Newfoundland, it is evident that this fauna is Protolenian. The group of trilobites to which the above *Microdiscus* belongs, have a series of tubercles along the an-

<sup>1</sup> A New Cambrian Trilobite : Bull. Nat. Hist. Soc. New Brunswick, No. XVII, 1899, p. 142.

<sup>2</sup> A Paleozoic Terrane Beneath the Cambrian : Annals N. Y. Acad. Sci., Vol. XII, 1899, pp. 52-54.

<sup>3</sup> Manual of Geology, 4th ed., pp. 487-488.



terior marginal fold, which has a functional meaning. Though not found at St. John, these trilobites are evidently characteristic of the Protolenus fauna series; they occur with it at Attleborough and Conception Bay; but they are also a common constituent of the Cambrian fauna at Troy, N. Y.; it seems therefore highly probable that the Troy fauna in part at least, belongs to the Protolenus zone, but with considerable variation from the typical facies. The fauna is found in its integrity only in the areas over which the Etcheminian fauna is known to be spread.<sup>1</sup>

The latest expression of his views of the Olenellus fauna 'in the west of America' is that it is linked with Upper Cambrian faunas rather than Lower.<sup>2</sup>

Of Olenellus as he restricts it he says:

To us therefore it seems that the appearance of Olenellus (sens. strict.)<sup>3</sup> in the Cambrian Faunas of America marks the irruption of a new group of forms that ousted the typical fauna of Paradoxides, which may be considered to have reached its culminating point in the faunas of *P. Tessini* and *P. Davidis*. These would be the conditions in Atlantic North America. Further west the Olenellus Fauna appears in most places to have invaded continental areas, as it is preceded by beds of quartzite and sandstone; and hence all the earlier Cambrian including the Protolenus and Paradoxides Zones exhibit no faunas in those regions.<sup>4</sup>

As against all the above-quoted and many other arguments, I can only state:

(a) That the Olenellus fauna in Newfoundland occurs 420 feet beneath the Paradoxides fauna, in the heart of the Lower Cambrian 'Etcheminian.'

(b) That fragments of the fauna are found 460-480 feet below the Protolenus fauna in the 'Etcheminian' of the Hanford Brook section of New Brunswick.

(c) That in the undisturbed, unbroken Highland Range section of Nevada the Olenellus fauna is 4450 feet below the Upper Cambrian fauna, and that the Olenoides (*Dorypyge* fauna of

<sup>1</sup> Loc. cit., p. 55.

<sup>2</sup> Fragments of the Cambrian Faunas of Newfoundland: Trans. Roy. Soc. Can., 2d ser., Vol. V, 1899, Sec. IV, p. 68.

<sup>3</sup> "As represented in *O. thompsoni*, *O. gilberti*, *O. iddingsi*, *O. lapworthi*, and *O. reticulatus*." Annals N. Y. Acad. Sci., Vol. XII, 1899, p. 55.

<sup>4</sup> Fragments of the Cambrian Faunas of Newfoundland: Trans. Roy. Soc. Can., 2d. ser., Vol. V, 1899, Sec. IV, p. 69.

Matthew) is 3000 feet below the horizon of the Upper Cambrian fauna and 1450 feet above the horizon of the *Olenellus gilberti* fauna.

(d) That in the southern Appalachians the *Olenellus* fauna occurs more than 7000 feet below the highest Cambrian fauna known in that region, and fully 2000 feet below a typical *Olenoides* fauna.

To the geologist the position of the *Olenellus* fauna is well assured. Theoretic biology may question the facts of stratigraphy, but, as many paleontologists have learned in the past, it is dangerous to base broad generalizations on the relatively small amount of biologic data available from the older Paleozoic strata.

It may not be out of place to call attention to the range of the *Olenellus* fauna at the locality where the types of the genus were first found, at Parker's quarry, township of Georgia, Vermont. The base of the section is at the western face of the cliff overlooking the level that reaches to the shore of Lake Champlain. Here the massive magnesian limestones have a low dip to the southeast. The section continues without a stratigraphic break to the Georgia shales at Parker's quarry, where *O. thompsoni* occurs in association with *O. (Masoniacis) vermontana*. At a point 970 feet below this horizon I found, in 1895, heads of a species of *Olenellus* associated with *Obolella crassa*. From the fact that *Olenellus* (?) *asaphoides* is associated with the latter at Troy, N. Y., it may be that the heads found represent that species. In any event this section clearly proves that representatives of *Olenellus* have a range of over a thousand feet at the typical locality of the genus in Vermont.<sup>1</sup>

#### NOMENCLATURE.

Mr. Matthew proposed the term 'Etcheminian' for a pre-Cambrian Paleozoic terrane which I think has been shown to be equivalent to the Lower Cambrian terrane of the classification established in 1888 for which the term Georgian was adopted. The term 'Etcheminian' was proposed for a distinct system of rocks corresponding in classification to the order of Cambrian,

<sup>1</sup> For a detailed description of this section see Bull. U. S. Geol. Survey, No. 81, pp. 278, 279.

Ordovician, Silurian, etc. It appears to be inapplicable for such use, as it is equivalent to Georgian. For the Lower Cambrian formation on Hanford Brook the best name is Hanford, as that is the typical locality where the terrane may be studied. It was applied to the formation in 1891.<sup>1</sup> For the Lower Cambrian of Newfoundland the local name Placentia was used in 1891. In 1889 Terra Nova was used in the same sense as Mr. Matthew uses Etcheminian.<sup>2</sup> Both names are unnecessary, as Georgian includes all the Lower Cambrian terranes and formations.

The term St. John should be limited to a definite formation or group of formations. We now have the St. John quartzite, St. John shales and St. John group. It has long been applied to the St. John terrane, and I think should be used in the broad sense. If this is done the basal quartzite should receive a local name, as well as the shales above. The quartzite might be called the Seely quartzite, from the fine exposure on Seely street in the city of St. John, and the shales the Ratcliff formation, from the typical locality on Ratcliff's mill stream.

#### CONCLUSIONS.

(a) The 'Etcheminian' terrane of Matthew is of Lower Cambrian age.

(b) The *Olenellus* fauna is older than the *Paradoxides* and *Protolenus* faunas of the Middle Cambrian.

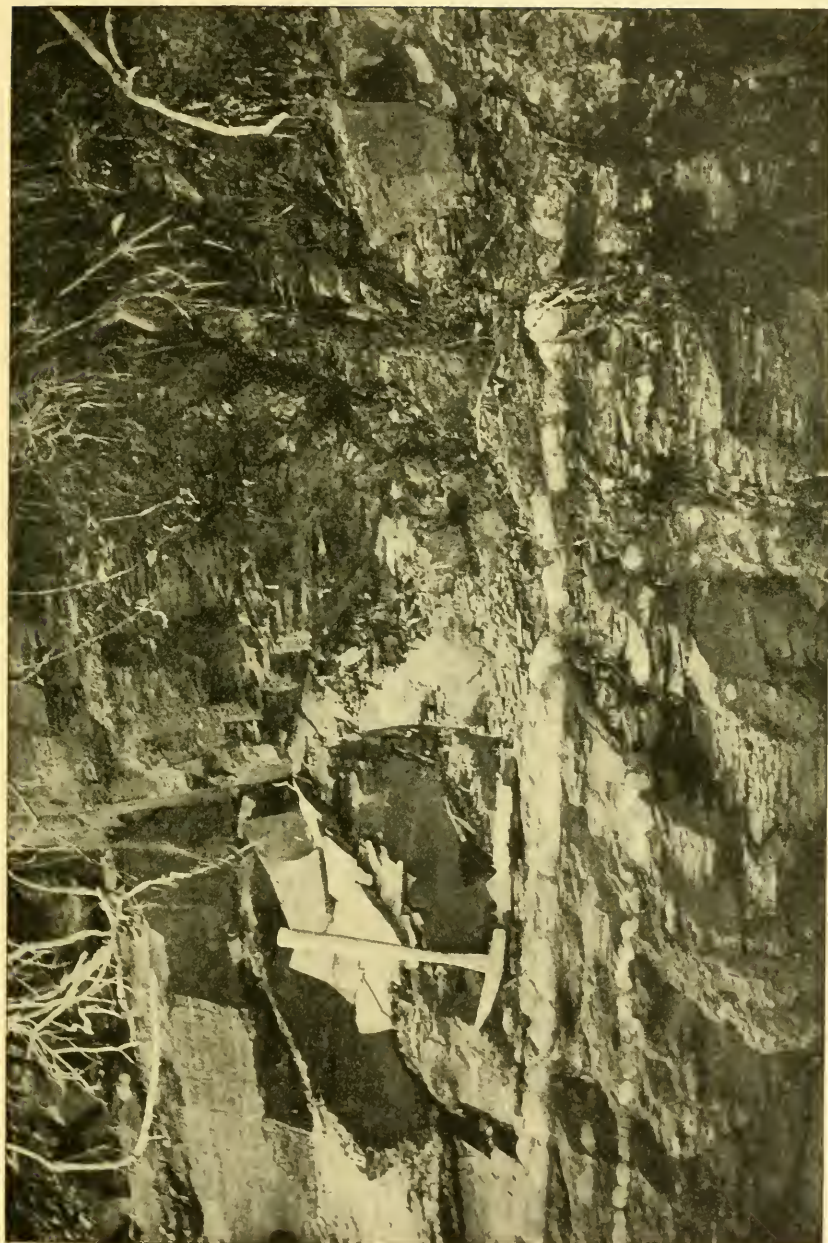
(c) The Cambrian section of the Atlantic Province<sup>3</sup> of North America includes the Lower, Middle, and Upper Cambrian divisions as defined by me in 1891.

Bull. U. S. Geol. Survey, No. 81, p. 360.

<sup>2</sup> Amer. Jour. Sci., 3d ser., Vol. XXXVII, p. 383.

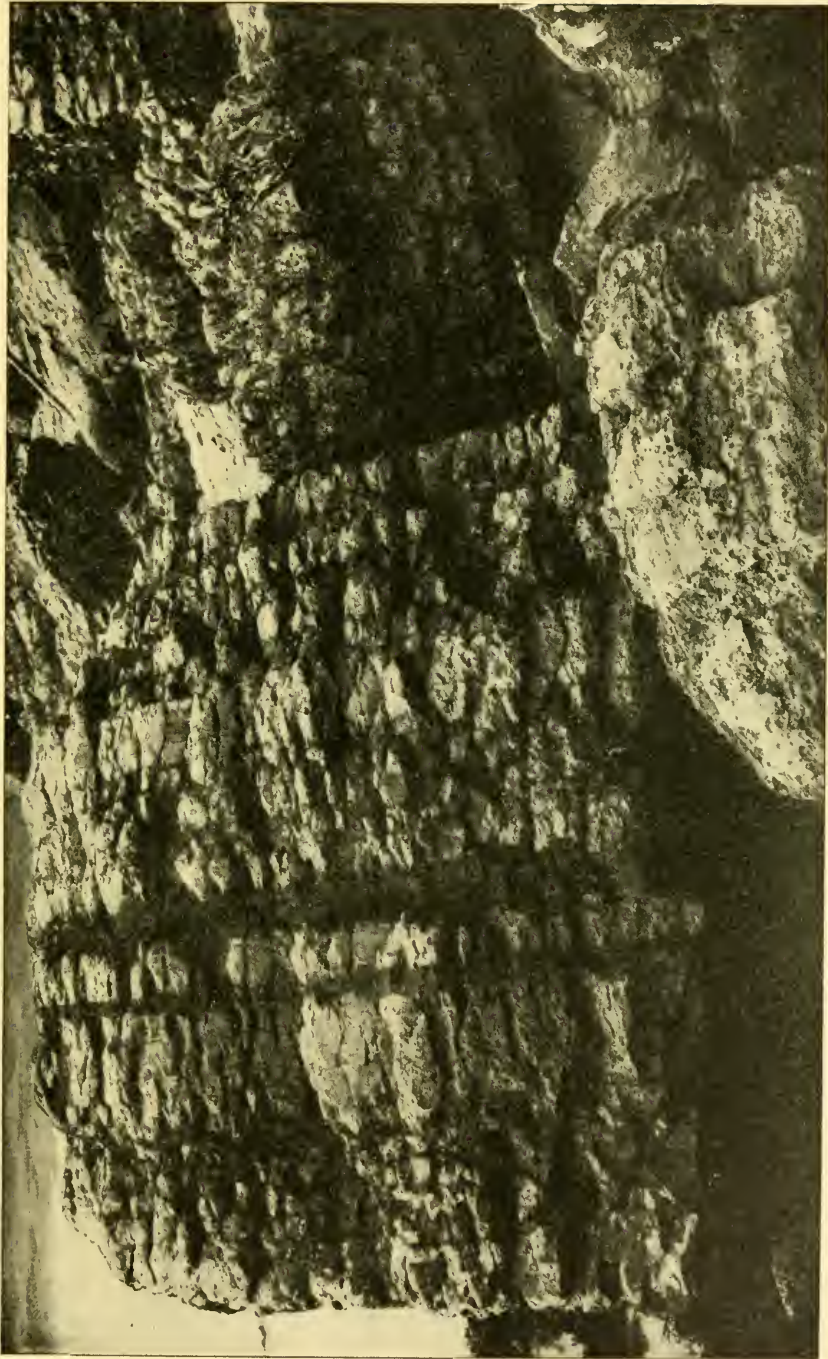
<sup>3</sup> I do not think it is necessary to discuss the Cambrian rocks of Massachusetts. Once the typical 'Etcheminian' is shown to be of Lower Cambrian age, all correlated formations go with it.





Nodular limestone in shales beneath Smith Point limestone, Smith Sound, N. F. Photo C. D. W.

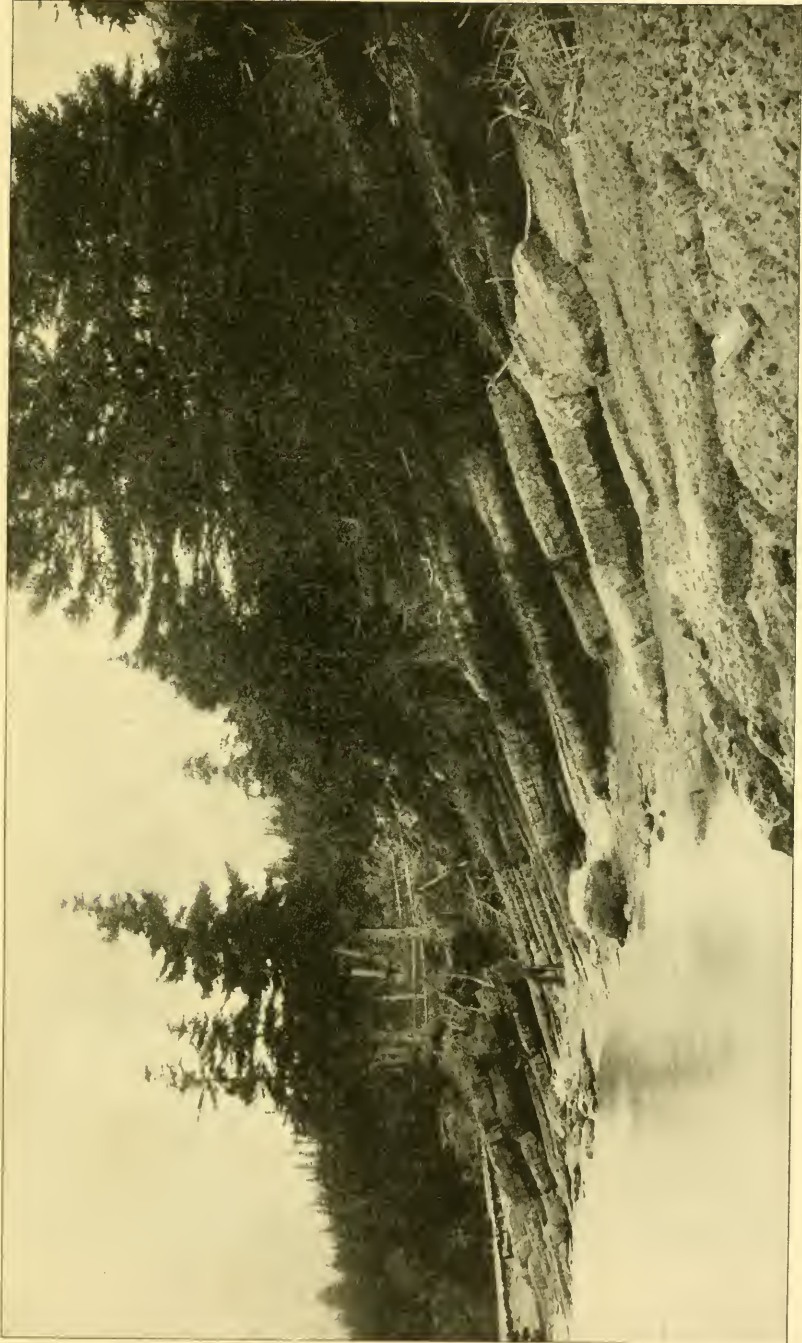




Characteristic appearance of the massive, weathered layers of the Smith Point limestone, Smith Sound, N. F. Photo C. D. W.

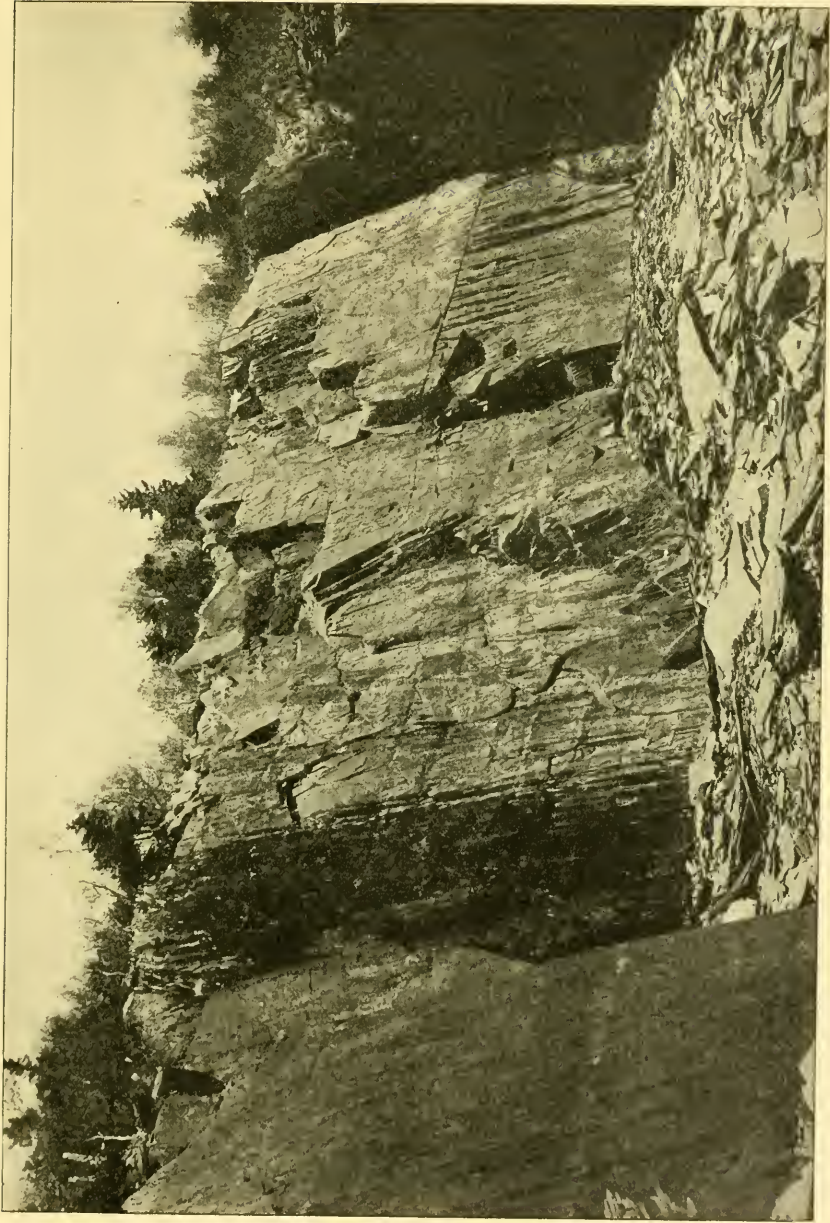






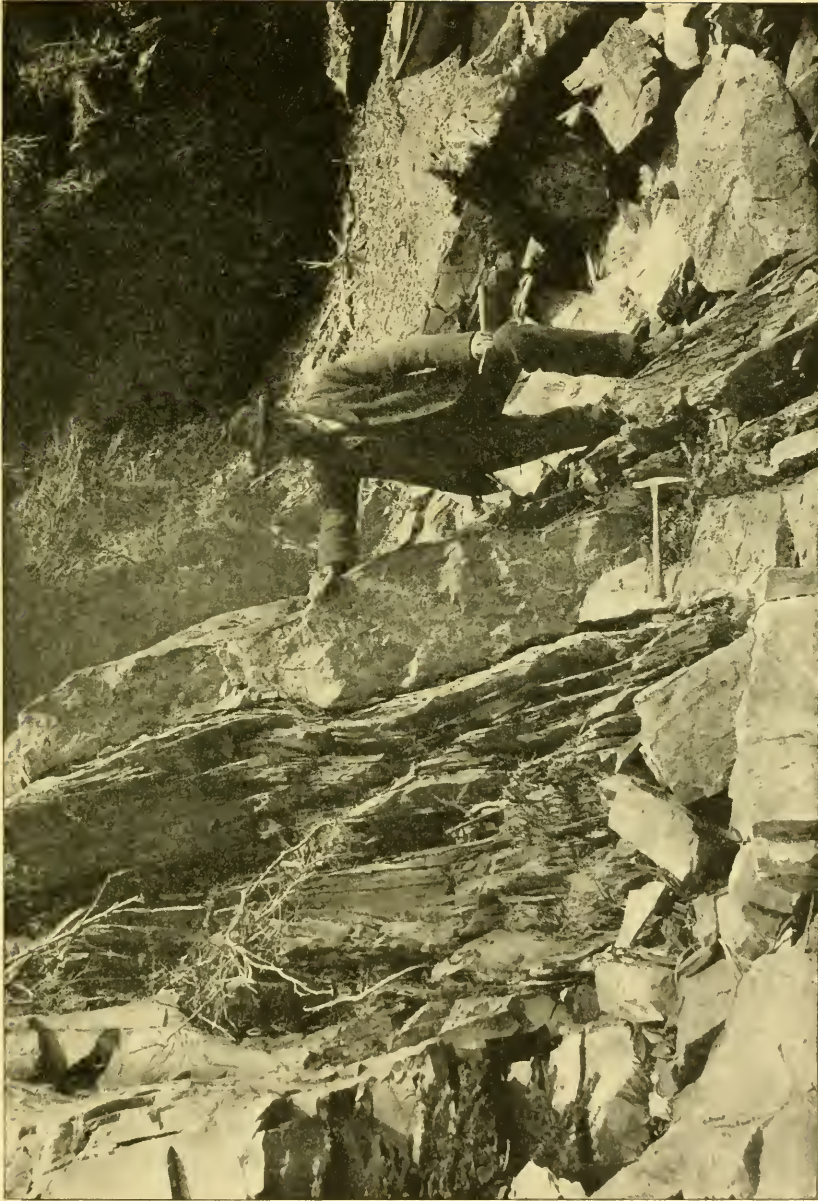
Smith Point limestone as exposed on Smith Sound, N. F. The *Olenellus* fauna occurs in the upper beds. Photo C. D. W.





Cleaved Cambrian shales, Currie quarries, Smith Sound. The bedding is shown by the lines of nodules. Photo C. D. W.





Contact of Cambrian with Random terrane of the Algonkian. Mr. J. P. Howley is standing on Cambrian and resting his hand on upper layer of Algonkian. Photo C. D. W.



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