SMITHSONIAN

CONTRIBUTIONS TO KNOWLEDGE.

VOL. VI.

EVERY MAN IS A VALUABLE MEMBER OF SOCIETY, WHO, BY HIS OBSERVATIONS, RESEARCHES, AND EXPERIMENTS, PROCURES KNOWLEDGE FOR MEN.—SMITHSON.

CITY OF WASHINGTON:
PUBLISHED BY THE SMITHSONIAN INSTITUTION.
MDCCCLIV.

ADVERTISEMENT.

THIS volume forms the sixth of a series, composed of original memoirs on different branches of knowledge, published at the expense, and under the direction, of the Smithsonian Institution. The publication of this series forms part of a general plan adopted for carrying into effect the benevolent intentions of JAMES SMITHSON, Esq., of England. This gentleman left his property in trust to the United States of America, to found, at Washington, an institution which should bear his own name, and have for its objects the "*increase* and *diffusion* of knowledge among men." This trust was accepted by the Government of the United States, and an Act of Congress was passed August 10, 1846, constituting the President and the other principal executive officers of the general government, the Chief-Justice of the Supreme Court, the Mayor of Washington, and such other persons as they might elect honorary members, an establishment under the name of the "SMITHSONIAN INSTITUTION FOR THE INCREASE AND DIFFUSION OF KNOWLEDGE AMONG MEN." The members and honorary members of this establishment are to hold stated and special meetings for the supervision of the affairs of the Institution, and for the advice and instruction of a Board of Regents, to whom the financial and other affairs are intrusted.

The Board of Regents consists of three members *ex officio* of the establishment, namely, the Vice-President of the United States, the Chief-Justice of the Supreme Court, and the Mayor of Washington, together with twelve other members, three of whom are appointed by the Senate from its own body, three by the House of Representatives from its members, and six persons appointed by a joint resolution of both houses. To this Board is given the power of electing a Secretary and other officers, for conducting the active operations of the Institution.

To carry into effect the purposes of the testator, the plan of organization should evidently embrace two objects: one, the increase of knowledge by the addition of new truths to the existing stock; the other, the diffusion of knowledge, thus increased, among men. No restriction is made in favor of any kind of knowledge; and, hence, each branch is entitled to, and should receive, a share of attention.

The Act of Congress, establishing the Institution, directs, as a part of the plan of organization, the formation of a Library, a Museum, and a Gallery of Art, together with provisions for physical research and popular lectures, while it leaves to the Regents the power of adopting such other parts of an organization as they may deem best suited to promote the objects of the bequest.

After much deliberation, the Regents resolved to divide the annual income into two equal parts—one part to be devoted to the increase and diffusion of knowledge by means of original research and publications—the other half of the income to be applied in accordance with the requirements of the Act of Congress, to the gradual formation of a Library, a Museum, and a Gallery of Art.

The following are the details of the two parts of the general plan of organization provisionally adopted at the meeting of the Regents, Dec. 8, 1847.

DETAILS OF THE FIRST PART OF THE PLAN.

I. To increase Knowledge.—*It is proposed to stimulate research, by offering rewards for original memoirs on all subjects of investigation.*

1. The memoirs thus obtained, to be published in a series of volumes, in a quarto form, and entitled "Smithsonian Contributions to Knowledge."

2. No memoir, on subjects of physical science, to be accepted for publication, which does not furnish a positive addition to human knowledge, resting on original research; and all unverified speculations to be rejected.

3. Each memoir presented to the Institution, to be submitted for examination to a commission of persons of reputation for learning in the branch to which the memoir pertains; and to be accepted for publication only in case the report of this commission is favorable.

4. The commission to be chosen by the officers of the Institution, and the name of the author, as far as practicable, concealed, unless a favorable decision be made.

5. The volumes of the memoirs to be exchanged for the Transactions of literary and scientific societies, and copies to be given to all the colleges, and principal libraries, in this country. One part of the remaining copies may be offered for sale; and the other carefully preserved, to form complete sets of the work, to supply the demand from new institutions.

6. An abstract, or popular account, of the contents of these memoirs to be given to the public, through the annual report of the Regents to Congress.

II. To INCREASE KNOWLEDGE.—*It is also proposed to appropriate a portion of the income, annually, to special objects of research, under the direction of suitable persons.*

1. The objects, and the amount appropriated, to be recommended by counsellors of the Institution.

2. Appropriations in different years to different objects; so that, in course of time, each branch of knowledge may receive a share.

3. The results obtained from these appropriations to be published, with the memoirs before mentioned, in the volumes of the Smithsonian Contributions to Knowledge.

4. Examples of objects for which appropriations may be made:—

(1.) System of extended meteorological observations for solving the problem of American storms.

(2.) Explorations in descriptive natural history, and geological, mathematical, and topographical surveys, to collect materials for the formation of a Physical Atlas of the United States.

(3.) Solution of experimental problems, such as a new determination of the weight of the earth, of the velocity of electricity, and of light; chemical analyses of soils and plants; collection and publication of articles of science, accumulated in the offices of Government.

(4.) Institution of statistical inquiries with reference to physical, moral, and political subjects.

(5.) Historical researches, and accurate surveys of places celebrated in American history.

(6.) Ethnological researches, particularly with reference to the different races of men in North America; also explorations, and accurate surveys, of the mounds and other remains of the ancient people of our country.

I. To DIFFUSE KNOWLEDGE.—*It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge not strictly professional.*

1. Some of these reports may be published annually, others at longer intervals, as the income of the Institution or the changes in the branches of knowledge may indicate.

2. The reports are to be prepared by collaborators, eminent in the different branches of knowledge.

3. Each collaborator to be furnished with the journals and publications, domestic and foreign, necessary to the compilation of his report; to be paid a certain sum for his labors, and to be named on the title-page of the report.

4. The reports to be published in separate parts, so that persons interested in a particular branch, can procure the parts relating to it, without purchasing the whole.

5. These reports may be presented to Congress, for partial distribution, the remaining copies to be given to literary and scientific institutions, and sold to individuals for a moderate price.

The following are some of the subjects which may be embraced in the reports:—

I. PHYSICAL CLASS.

1. Physics, including astronomy, natural philosophy, chemistry, and meteorology.
2. Natural history, including botany, zoology, geology, &c.
3. Agriculture.
4. Application of science to arts.

II. MORAL AND POLITICAL CLASS.

5. Ethnology, including particular history, comparative philology, antiquities, &c.
6. Statistics and political economy.
7. Mental and moral philosophy.
8. A survey of the political events of the world; penal reform, &c.

III. LITERATURE AND THE FINE ARTS.

9. Modern literature.
10. The fine arts, and their application to the useful arts.
11. Bibliography.
12. Obituary notices of distinguished individuals.

II. To diffuse Knowledge.—*It is proposed to publish occasionally separate treatises on subjects of general interest.*

1. These treatises may occasionally consist of valuable memoirs translated from foreign languages, or of articles prepared under the direction of the Institution, or procured by offering premiums for the best exposition of a given subject.

2. The treatises to be submitted to a commission of competent judges, previous to their publication.

DETAILS OF THE SECOND PART OF THE PLAN OF ORGANIZATION.

This part contemplates the formation of a Library, a Museum, and a Gallery of Art.

1. To carry out the plan before described, a library will be required, consisting, 1st, of a complete collection of the transactions and proceedings of all the learned societies in the world; 2d, of the more important current periodical publications, and other works necessary in preparing the periodical reports.

2. The Institution should make special collections, particularly of objects to verify its own publications. Also a collection of instruments of research in all branches of experimental science.

3. With reference to the collection of books, other than those mentioned above, catalogues of all the different libraries in the United States should be procured, in order that the valuable books first purchased may be such as are not to be found elsewhere in the United States.

4. Also catalogues of memoirs, and of books in foreign libraries, and other materials, should be collected, for rendering the Institution a centre of bibliographical knowledge, whence the student may be directed to any work which he may require.

5. It is believed that the collections in natural history will increase by donation, as rapidly as the income of the Institution can make provision for their reception; and, therefore, it will seldom be necessary to purchase any article of this kind.

6. Attempts should be made to procure for the gallery of art, casts of the most celebrated articles of ancient and modern sculpture.

7. The arts may be encouraged by providing a room, free of expense, for the exhibition of the objects of the Art-Union, and other similar societies.

8. A small appropriation should annually be made for models of antiquity, such as those of the remains of ancient temples, &c.

9. The Secretary and his assistants, during the session of Congress, will be required to illustrate new discoveries in science, and to exhibit new objects of art; distinguished individuals should also be invited to give lectures on subjects of general interest.

In accordance with the rules adopted in the programme of organization, each memoir in this volume has been favorably reported on by a Commission appointed for its examination. It is however impossible, in most cases, to verify the statements of an author; and, therefore, neither the Commission nor the Institution can be responsible for more than the general character of a memoir.

The following rules have been adopted for the distribution of the quarto volumes of the Smithsonian Contributions:—

1. They are to be presented to all learned societies which publish Transactions, and give copies of these, in exchange, to the Institution.

2. Also, to all foreign libraries of the first class, provided they give in exchange their catalogues or other publications, or an equivalent from their duplicate volumes.

3. To all the colleges in actual operation in this country, provided they furnish, in return, meteorological observations, catalogues of their libraries and of their students, and all other publications issued by them relative to their organization and history.

4. To all States and Territories, provided there be given, in return, copies of all documents published under their authority.

5. To all incorporated public libraries in this country, not included in either of the foregoing classes, now containing more than 7000 volumes; and to smaller libraries, where a whole State or large district would be otherwise unsupplied.

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SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

PLANTÆ FRÉMONTIANÆ;

OR,

DESCRIPTIONS OF PLANTS COLLECTED BY COL. J. C. FRÉMONT IN CALIFORNIA.

BY

JOHN TORREY, F.L.S.

[ACCEPTED FOR PUBLICATION, SEPTEMBER, 1850.]

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TO WHICH THIS PAPER HAS BEEN REFERRED.

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DESCRIPTIONS

OF

SOME NEW PLANTS

COLLECTED BY

COLONEL J. C. FRÉMONT, IN CALIFORNIA.*

THE important services rendered to science by that distinguished traveller, Colonel Frémont, are known to all who have read the reports of his hazardous journeys. He has not only made valuable additions to the geographical knowledge of our remote possessions, but has greatly increased our acquaintance with the geology and natural history of the regions which he explored. His First Expedition was made in the year 1842, and terminated at the Rocky Mountains. He examined the celebrated South Pass, and ascended the highest mountain of the Wind River Chain, now called Frémont's Peak. The party moved so rapidly (travelling from the frontier of Missouri to the Mountains and returning in the short space of four months) that much time could not be given to botany. Nevertheless, a collection of 350 species of plants was made, of which I gave an account in a Botanical Appendix to his first Report. The Second Expedition of Colonel Frémont, that of 1843 and 1844, embraced not only much of the ground which he had previously explored, but extensive regions of Oregon and California. In this journey, he made large collections in places never before visited by a botanist; but, unfortunately, a great portion of them was lost. In the gorges of the Sierra Nevada, a mule loaded with some bales of botanical specimens gathered in a thousand miles of travel, fell from a precipice into a deep chasm, from whence they could not be recovered. A large part of the remaining collection was destroyed, on the return of the Expedition, by the great flood of the Kansas river. Some of the new and more interesting plants that were rescued from destruction, were published in the Botanical Appendix to Colonel Frémont's Report of his Second Expedition.

* An Abstract of this memoir was read before the American Association for the Advancement of Science, at its meeting held in New Haven, August, 1850, and published in the volume of its Proceedings.

Very large collections were also made in his Third Expedition in 1845 and the two following years; but again, notwithstanding every precaution, some valuable packages were destroyed by the numerous and unavoidable mishaps of such a hazardous journey. Very few of the new genera and species that were saved have as yet been published, excepting several of the Compositæ, by Dr. Gray, in order that the priority of their discovery might be secured for Colonel Frémont. There was still another journey to California made by that zealous traveller; the disastrous one commenced late in the year 1848. Even in this he gleaned a few plants, which, with all his other botanical collections, he kindly placed at my disposal. I had hoped that arrangements would have been made by the Government for the publication of a general account of the Botany of California; but as there is no immediate prospect of such a work being undertaken, I have prepared this memoir on some of the more interesting new genera discovered by Colonel Frémont. The drawings of the accompanying plates were made by Mr. Isaac Sprague, of Cambridge, Massachusetts, who ranks among the most eminent botanical draughtsmen of our day.

SPRAGUEA. Nov. Gen.

Calyx disepalus, persistens; sepalis suborbiculatis, basi cordatis, emarginatis, membranaceis, patentibus. Corollæ petala 4, æstivatio imbricata, libera, duobus exterioribus sepalis alternantibus, interioribus sepalis oppositis. Stamina 3, petalis opposita. Ovarium uniloculare. Ovula 8–10, basilaria. Stylus filiformis, apice trifidus; lobis intus stigmatosis. Capsula membranacea, compressa, unilocularis, bivalvis. Semina 2–5, lenticulari-compressa, nigra, nitida, estrophiolata.—Herba Californica, perennis, glabra; caulibus 1–5, scapiformibus, e caudice brevi ortis, remote squamosis; floribus confertis scorpioideo-spicatis; spicis pluribus, aphyllis, umbellatis, terminalibus.

SPRAGUEA UMBELLATA. Tab. I.

Hab.—Forks of the Nozah river, in the foot-hills of the Sierra Nevada of Northern California. In flower and fruit, May 22. Other specimens, not ticketed, were in the collection, perhaps obtained on the same ground a little earlier in the season.

The root of this remarkable plant is short and tapering, soon dividing into a tuft of thick fleshy fibres. The caudex is short and thick, throwing up from its summit from one to five or six simple scape-like branches, which are from three inches to a span high, and somewhat diverging. All the proper leaves are situated at the crown of the caudex, forming a dense rosulate cluster. They are from an inch to nearly two inches in length, of a fleshy consistence, obovate-spatulate, with a long tapering base, obtuse, and perfectly entire. The scapes are furnished with several lanceolate distant scales, which are scarious on the margin. Spikes six to twelve in a terminal spreading umbel, at first conspicuously scorpioid, and gradually unfolding from the base upwards. The peduncles are about half an inch long, and the ovate bracts at their base form an involucrum. Flowers closely imbricated, on short pedicels. The calyx consists of two persistent hyaline sepals, which are right and left of the axis; they are nearly orbicular, emarginate, undulate on the margin, obscurely veined, and of a pale rose-color, except the broad green midrib. Petals four, obovate, rose-color, much shorter than the calyx, two of them nearly opposite the sepals, the others alternate with them, gelatinous-colliquescent after flowering, as in many other Portulacaceæ, and in a withered state, remaining attached to the summit of the young fruit like an indusium. The stamens are constantly but three, and are inserted opposite three of the petals; the fourth (belonging to a lateral petal) wanting: filaments longer than the petals: anthers ovate, fixed by the middle, two-celled, opening longitudinally. The ovary is globose-ovoid, much compressed, one-celled, and contains from eight to ten ovules, on conspicuous stalks, which arise from a basilar placenta. Style slender, as long as the stamens, undivided; the stigma minute and three-lobed. Capsule membranaceous, much compressed, two-valved; the valves parallel with the persistent sepals. Seeds lenticular, black and shining, with a crustaceous testa. Embryo hippocrepiform, embracing mealy albumen.

This remarkable plant undoubtedly belongs to the family of the Portulacaceæ; and, judging from the description, it seems to be a near ally of the Chilian genus Monocosmia of Fenzl. In the latter, however, there is but a single stamen; the ovules are only from two to four in number; the style is very short as well as two-cleft, and the habit is different.

I have dedicated this genus to Mr. Isaac Sprague, of Cambridge, Massachusetts, so well known as a botanical draughtsman, and especially for the admirable illustrations of the Genera of the Plants of the United States, by himself and Dr. Gray.

FRÉMONTIA. Nov. Gen.

Calyx basi tribracteatus, patenti-campanulatus, quinque-partitus, subpetaloideus basi foveolatus æstivatione quincuncialis. Corolla nulla. Stamina quinque: filamenta vix ad medium monadelpha: antheræ oblongo-lineares, biloculares, subanfractuosæ, extrorsæ; loculis longitudinaliter dehiscentibus. Ovarium quadri-quinque-loculare: ovula in loculis plurima, biseriatim inserta, horizontalia, anatropa: stylus filiformis, subincurvus: stigma indivisum, acutiusculum. Capsula*

* Just as this memoir was sent to press I received from the Rev. Mr. A. Fitch a collection of plants which he obtained while acting as a missionary in California. In his extensive travels through that country he availed himself of favorable opportunities of collecting botanical specimens, which from time to time he placed at my disposal. In the last parcel, which he brought home himself, I was greatly pleased to find the Frémontia. I am now able to describe the fruit of this rare plant, but unfortunately the only capsule that was received had shed its seeds, the characters of which I have given from the verbal description of Mr. Fitch.

ovata, turgida, plerumque quinquelocularis, loculicide dehiscens, pilis rigidis stellatis dense vestita; loculis polyspermis. "Semina ovata, glabra."—Frutex Californicus, stellato-pubescens; foliis alternis cordatis, lobatis; stipulis nullis vel caducis; pedunculis oppositifoliis unifloris; floribus amplis flavis.

FRÉMONTIA CALIFORNICA. TAB. II.

HAB.—Sources of the Sacramento, in the northern part of the Sierra Nevada of California. Also hill-sides, Mariposa county, especially near the gold works of the Merced Company; flowering in May.—Rev. Mr. A. Fitch.

A beautiful shrub, usually from three to four feet high, but occasionally reaching a height of ten feet, and having very much the appearance of an ordinary fig-tree. The bark is of a brownish gray color; the wood is hard, and apparently of slow growth. Most of the leaves and flowers are produced at the extremity of very short lateral branches or spurs. The former are petiolate, roundish in outline, from three fourths of an inch to an inch, or sometimes even three inches, in diameter,* three to seven-lobed; the lobes entire, or crenate-toothed, of a thick (and when old of a somewhat coriaceous) texture, green and sparsely stellate-pubescent on the upper surface, ferruginous-tomentose underneath; the petioles from four to six lines long. In the specimens from Mariposa county, the leaves of the young shoots are less deeply and more numerously lobed. The peduncles are about as long as the petioles, stout, straight or somewhat recurved. Immediately under each flower, and closely applied to the calyx, are three small lanceolate bracts. The calyx is sulphur-yellow widely campanulate, about an inch and a quarter in diameter, deeply five-parted; the segments roundish-obovate, and usually with a short abrupt point, or sometimes mucronate. Externally the calyx is sparsely stellate-pubescent, and on the inside at the base it is densely villous. The stamens are equal, shorter than the calyx, and opposite to its segments: the filaments are glabrous, the upper half filiform, spreading and distinct; the lower part united into a tube which embraces the ovary and nearly conceals it: the anthers are about three lines long, extrorse, adnate, tortuous, and incurved at each end. In the bud they are four-celled, but only two-celled in the expanded flower; the cells are distinct and open longitudinally their whole length. Under the microscope the pollen appears triangular-globose and reticulated. The ovary is ovoid, and densely clothed with short conical hairs or processes. It is usually five-celled;† each cell containing eight or ten horizontal anatropous ovules: the style is about one third longer than the stamens, and gradually tapers towards the summit, where it terminates in a minute undivided stigma. The capsule is about as large as that of Hibiscus Syriacus, and is closely covered with short stiff reddish stellate hairs; a portion of the calyx remaining at its base. At maturity it splits loculicidally nearly

* The plate of Fremontia was engraved and printed before the specimens with larger leaves were obtained.

† Only four cells are represented in the plate, and no more were found in the flowers first examined.

to the base into five valves. Only two or three seeds ripen in each cell; and these are smooth, resembling those of the Ochra.

This genus is a near ally of the celebrated Cheirostemon of Humboldt, the Hand-tree of Mexico. The latter differs, however, in the form and texture of the calyx, the lobes of which are deciduous; in the much longer stamineal column and secund mucronate free portion of the filaments; in the straight parallel anther-cells, and in some other characters of less importance.

The genus Cheirostemon has long been regarded as an anomalous member of the order Bombaceæ, which by many botanists is reduced to a tribe of Sterculiaceæ. It differs, as does also Frémontia, from the rest of the tribe in the apetalous flowers, imbricated calyx, and definite stamens; characters which, in this family, are of sufficient value to constitute a distinct division, which may be called Frémontieæ. The genus Ochroma of Swartz, another anomalous Bombacea, has some resemblance to Cheirostemon, as Kunth noticed many years ago, especially in its five-lobed stamineal crown and in the subimbricated calyx; but in most other respects it resembles its congeners.

Those Bombaceæ which have the stamineal tube five-cleft at the summit, with each segment bearing two anthers, may be regarded as composed of ten stamens, the filaments of which are monadelphous below and pentadelphous above; the upper portions of the filaments being united in pairs, with (usually) one-celled anthers. This view may be taken of Fremontia as well as of Cheirostemon.

In my memoir on Batis, published in the present volume, I have given the reason for relinquishing the former genus Frémontia, and my intention of bestowing the name on a new plant from California, first detected by the distinguished traveller himself, whose valuable services to North American Botany it is thus intended to commemorate.

LIBOCEDRUS. Endl.

Libocedrus Endl. Synops. Conif. p. 42; Gen. Pl. Suppl. IV. pars 2, No. 1794.
Thuyæ species auct.

LIBOCEDRUS DECURRENS. Tab. III.

L. ramulis compressis subancipitis; foliis late ovatis breviter acuminatis apice serrulatis longe decurrentibus, lateralibus carinatis, facialibus planis; strobilis ovato-oblongis erectis; squamis infra apicem spina tuberculiformi recurva auctis, superioribus multo majoribus; seminibus bialatis, ala altera maxima.

Hab.—Upper waters of the Sacramento, particularly from lat. 38° 40′ to about 41° N. lat., where it was also found (without fruit) by the botanists of the United States Exploring Expedition, and by Dr. G. W. Hulse.

A noble tree, sometimes attaining a height of 120 or even 140 feet; and a trunk of seven feet in diameter is not uncommon. It rises from 80 to 100 feet without a limb. The leaves are four-ranked, as usual in this genus, very small, and closely imbricated; their bases prolonged downward and contracted, with strongly-marked longitudinal lines where the two exterior overlap the two interior ones. In the younger branchlets, the decurrent bases are from two to three times longer than their diameter, and in the older ones, about four times longer. None of the leaves are acerose. The two interior of each joint are marked on the face with a slight depression, beneath which there is often a small obscure gland, although none appears externally. The staminiferous aments terminate the branchlets. They are ovoid-oblong, and from two to three lines in length. The stamens are from twelve to fourteen, four-ranked; the connective produced into a suborbicular excentrically peltate scale, and bearing on its under surface about four oblong anther-cells, which open longitudinally. The seminiferous aments are nearly an inch in length, ovate-oblong, and consist of four scales, of which the two exterior are very short, the two interior rounded externally, with the flattened septum-like axis prolonged between them, and equalling them in length; all the scales mucronate with a short recurved point below the tip. Beneath each interior scale are two seeds. These are furnished with two very unequal wings.

This tree much resembles Callitris quadrivalvis in its foliage. It has probably been confounded by some botanists with Thuya gigantea of Nuttall, from which, however, it can be distinguished by the foliage alone; the long decurrent bases of the leaves being characteristic of the Libocedrus. Endlicher has described three other species of this genus, all of which are natives of South America and New Zealand. Our L. decurrens is most nearly related to L. Chilensis *Endl.* (Thuya Chilensis *Hook. Lond. Jour. Bot.* 2. p. 199. t. 4.)

COLEOGYNE. Nov. Gen.

Calyx basi bibracteolatus, coriaceus, petaloideus, quadrisepalus; sepalis basi connatis persistentibus. Corolla nulla. Stamina numerosa; filamentis ima basi disci tubæformi inserta. Ovarium uniovulatum, uniloculare, tuba disci inclusum: ovulum hemitropum: stylus lateralis, filiformis, intus longitudinaliter stigmatosus. Fructus . . . —Frutex Californicus, ramosissimus, rigidus; ramulis sæpe subspinescentibus; foliis parvulis, oblongis, crassis, oppositis, confertis, brevissime petiolatis; lamina decidua, stipulis cum petiolo minutissimo persistentibus; floribus solitariis, terminalibus, basi bracteis trifidis suffulti.

COLEOGYNE RAMOSISSIMA. Tab. IV.

Hab. Sources of the Mohave and Virgin Rivers, tributaries of the Colorado of the West, in the mountains of Southern California. Flowering in April and May.

A shrub with the aspect of Krameria, five to six feet high, and clothed with a grayish bark; the branches spreading, short, crowded, and mostly opposite.

Leaves crowded toward the summit of short, spur-like branches, which often become spiny, appearing fasciculate, but truly opposite. They are oblong, on very short pedicles, from five to eight lines long, rather obtuse, tapering at the base, very thick and coriaceous, marked with five longitudinal ribs on the upper surface, but flattish underneath, clothed with appressed hairs, which are fixed by the middle. The stipules are minute and scale-like, partly adherent to the short and persistent petiole, from which the lamina of the leaf falls away, their minute points giving to the spurs a squarrose appearance. The flowers are about half an inch in diameter, terminal, solitary, on short stalks, and are subtended by two (or sometimes four) trifid bracts which resemble the ordinary leaves, except that the points of the stipules are more strongly produced, and the articulated lamina is much smaller. The persistent sepals are ovate or obovate, coriaceous, somewhat united at the base, obtuse or mucronate at the summit, spreading, one or more of them rarely furnished with a single lateral tooth. Externally they are hairy like the leaves, but glabrous and yellowish on the inner surface; the two outer are flat, the two inner obvolute or half equitant. There are from thirty to forty stamens, which are about as long as the calyx: the filaments slender, distinct, except at the base, where they are confluent with a singular sheath which encloses the pistil: anthers oblong-cordate, introrse, two-celled, opening longitudinally. Pollen very minute, obtusely triangular. The sheath arises from the base of the calyx, and is about the length of the stamens. It gradually tapers from below upwards, and is somewhat five-toothed at the summit. The pistil is solitary and simple; the ovary sessile and oblong: style lateral, arising from a little below the middle of the ovary, tortuous, exserted, very villous, the upper third compressed, somewhat recurved, and stigmatose on one side. Ovule single in all the specimens examined, hemitropous on a very short funiculus, which is inserted opposite the origin of the style. Ripe fruit unknown: probably an achenium. In a partially mature state the seed appeared to be destitute of albumen, and the broad flat cotyledons could be distinctly seen. The radicle is erect.

It is difficult to refer this puzzling genus with certainty to any natural order hitherto indicated. Its nearest affinities are doubtless with Rosaceæ, and with the suborder Chrysobalaneæ; from which it differs in its opposite leaves, persistent stipules, lateral stigma, and solitary ovules, as well as in habit. One undoubted genus of this suborder, and three anomalous genera referred here by most botanists, are apetalous. In several others, the filaments are united at the base; in two or three there are lateral or interior sterile filaments; and in Trilepisium there is a tube between stamens and pistils, as well as a solitary ovule. The sheath or tube may be regarded as belonging to the andrœcium either by the deduplication of the interior stamens, or as consisting of the monadelphous filaments of an abortive inner series of stamens.

Coleogyne also resembles some of the proper Rosaceæ with solitary carpels; especially those of the Tribe Dryadeæ, *Torr. & Gr.* In its elongated lateral stigma, it is like Purshia. To Cliffortia, it is allied in its foliage and stipules, as well as in other respects. Finally, we are inclined to place this new genus in Rosaceæ, between Chrysobalaneæ and Dryadeæ; although it is more nearly related to the former than to the latter. The opposite leaves, which are so closely approximated that I was not aware of their true arrangement until the engraving of the plant was finished, are not found in any other Rosaceæ, so far as I know.

EMPLECTOCLADUS, Nov. Gen.

Calyx obconico-campanulatus; tubo ad faucem nudo haud contracto; limbo æqualiter quinquepartito, persistente. Petala 5, erecto-patentia. Stamina 10–13, biserialia. Pistilla 1–2 (plerumque solitaria) unilocularia: ovula 2, collateralia, pendula. Stylus brevissimus, crassus, subobliquus: stigma capitatum. Fructus . . . — Frutex Californicus, ramosissimus; ramis rigidis, patentibus, subspinescentibus; foliis minutis, spathulatis, e gemmis subglobosis quasi fasciculatis; stipulis minutis deciduis; floribus subsolitariis, sessilibus, terminalibus, parvulis.

EMPLECTOCLADUS FASCICULATUS. Tab. V.

Hab.—Sierra Nevada of California; probably in the southern part of the range.

A shrub, with numerous widely spreading branches, which have a knobbed appearance from the short rounded buds or spurs; the bark smooth and of an olive color. The leaves are crowded on the spurs, three to four lines long, cuneate-spatulate, obtuse, sessile, of a thick and somewhat coriaceous texture, flat, marked with a single nerve underneath, sparsely hirsute with mostly deciduous hairs, and furnished with minute scarious stipules. The flowers are mostly solitary, surrounded by the closely set leaves, and are scarcely more than a fourth of an inch in diameter. Externally the calyx is glabrous, but woolly inside; the teeth short and obtuse. The petals are apparently white, ovate-oblong, obtuse, about one line and a half long, and are destitute of a claw. There are usually about eleven stamens, the slender filaments of which are inserted in two rows near the summit of the calyx-tube, the superior or exterior ones being about as long as the petals: anthers subglobose-didymous, introrse; the cells distinct, opening longitudinally Pollen obtusely triangular (as is also the case in Adenostoma and many other Rosaceæ). Pistils usually solitary, but sometimes in pairs, seated at the bottom of the calyx, and free from it. The ovary is ovoid, abruptly contracted above into a very short and somewhat oblique style, which is terminated by a depressed-capitate stigma. There are two ovules, which are anatropous, and suspended from the summit of the cell opposite the style. Nothing is yet known of the ripe fruit.

The only specimens of this plant brought by Colonel Frémont had unfortunately lost their labels, so that we have no certain information as to its precise station, and of the size which it attains. Neither, for want of the fruit, can we determine its nearest affinities. It is probable, however, that the genus belongs to the Tribe Dryadeæ. In many respects it resembles Adenostoma of that tribe, but it differs in the even calyx without glands* in the throat; in being almost destitute of a style, as well as in the mode of inflorescence, the form of the ovary, &c. There may also be considerable difference in the fruit, as the appearance of the ovary seems to indicate. The generic name is derived from Ἐμπλεκτος, *entangled*, and κλάδος, *a branch*.

CHAMÆBATIA, Benth. Plant. Hartw. p. 308.†

Calycis tubus turbinato-campanulatus; limbus persistens, laciniis 5 æstivatione valvatis. Petala 5. Stamina numerosa, pluriseriata, ad faucem calycis inserta. Ovarium in fundo calycis unicum, erectum, liberum: stylus ex apice ovarii erectus, latere interiore fere ad medium fissus et stigmatifer. Ovula 2, erecta, anatropa. Achenium siccum, calyce subinclusum. Semen unicum erectum.—Frutex Californicus, ramosissimus; foliis tripinnatisectis, segmentis ultimis confertis numerosissimis; stipulis lineari-lanceolatis; floribus cymosis albis.

CHAMÆBATIA FOLIOLOSA, Benth. l. c. Tab. VI.

Hab.—Higher parts of the Sierra Nevada, as well as on the sides of the foothills; in great abundance: Colonel Frémont. Mountains of the Sacramento: Mr. Hartweg and Mr. Shelton.

A shrub, growing from two to three feet high, of agreeable balsamic odor, with very smooth bark, and numerous upright branches; the young twigs clothed with a glandularly pubescent epidermis, which easily separates. The leaves are broadly ovate in outline, about two inches long, tripinnately dissected; the ultimate segments oval and obtuse, scarcely half a line long, hispidulous-pubescent, each tipped with a minute gland. Stipules minute, adnate to the petiole. The cymes are four–five-flowered, and terminate the young shoots: each pedicel is subtended by a foliaceous bract, which is toothed or pinnatifid. The flowers are about three fourths of an inch in diameter. Externally the calyx is glandularly pubescent, and the inside of the tube is densely woolly. The petals are white, obovate, emarginate, with a very short claw. There are fifty or more stamens, the filaments of which are inserted in several series in the throat of the calyx. The pollen is obtusely triangular. The ovary is ovoid; one-celled, with two

* The so-called glands in the throat of Adenostoma are only lobes of the free margin of the disk.

† The plant on which this genus was founded was first discovered by Colonel Frémont, in his second expedition, while traversing the Sierra Nevada and other parts of California, early in the year 1844, as well as in his third expedition. His specimens were too imperfect for description. It was afterwards found in good condition, but without mature fruit, by the well known and zealous botanical collector, Mr. Hartweg. Mr. Bentham kindly offered me the privilege of describing this fine new genus, but I thought the right fairly belonged to him, as he first determined its character and affinities. I have but little to add to the accurate description which he has given of it in his Plantæ Hartwegianæ.

collateral and erect ovules, which arise from the base of the cell: style as long as the stamens, nearly straight, and with a longitudinal stigmatose fissure or groove on the inside (as in Cercocarpus). Achenium oblong, compressed, almost wholly enclosed in the persistent and membranaceous calyx, apiculate with the base of the style. The seed is erect, with amygdaloid cotyledons, and a short inferior radicle.

The foliage of this plant is so different from that of most other Rosaceæ, that it was at first sight taken for a Mimosa or Acacia. It clearly belongs to the subtribe Cercocarpeæ, *Torr. & Gr.*,* although it differs in its valvate calyx. The æstivation of Cercocarpus is difficult to determine, as the calyx is open in the very young flower-bud, and the teeth are very short; it seems, however, to be imbricated. The characters of the subtribe Eudryadeæ must be altered, for the calyx in Cowania (described by Don, Endlicher, and Zuccarini as valvate) is certainly imbricate in all the species. Dr. Englemann noticed this character in his genus Greggia† (which is Cowania plicata, *Don*, and C. purpurea, *Zucc.*)‡ There will be nothing therefore to distinguish the subtribes, as they now stand, but the number of ovaries in the flower, which being a character of no great importance, they may be united; and then Cowania will stand next to Purshia, to which it is very nearly allied in habit.

CARPENTERIA, Nov. Gen.

Calycis tubo late hemisphærico, basi ovarii adnato; limbo 5–6–(rarius 7–) partito, laciniis valvatis persistentibus. Petala 5–6, orbiculari-obovata, æstivatione convoluta. Stamina numerosa: filamenta filiformia. Styli in unicum coadunati, brevi: stigmata 5–7, lineari-oblonga, distincta. Capsula (nisi basi) libera, 5–7, locularis, loculicide dehiscens: placentæ subglobosæ, intra loculos projectæ, polyspermæ. Semina divergentia, oblonga; testa utrinque laxa, reticulata, ad hilum crenata.—Frutex Californicus; foliis oppositis integerrimis; floribus magnis, albis, in cymis racemosis simplicibus terminalibus dispositis.

CARPENTERIA CALIFORNICA. Tab. VII.

Hab.—Sierra Nevada of California, probably on the head waters of the San Joachin.

A shrub, with upright dichotomous branches, and a loose grayish bark, which

* Flora of North America, 1. p. 426.

† Bot. Append. to Wislizenus's Tour in Northern Mexico, p. 114.

‡ A remarkable new species of Cowania, with entire linear leaves (C. ericæfolia, *Torr.*), has very recently been found on the Rio Grande, by Dr. Parry of the Mexican Boundary Commission. It will be described in the appendix to the second part of Dr. Gray's Plantæ Wrightianæ, now in press, and soon to be published.

is disposed to separate in plates. Leaves from two to three inches long, elliptical-oblong, gradually tapering at the base into a petiole, the margins (when dry) narrowly revolute, glabrous above, densely and minutely tomentose underneath, and with scattered appressed hairs. These hairs are muricate-scabrous, as in Philadelphus, Decumaria, Deutzia, and Jamesia. Stipules wanting. The cyme is on a long straight peduncle, and is from five to seven-flowered. The pedicels are from an inch and a half to two inches and a half in length. They are furnished at the base with oblong foliaceous bracts, which resemble the leaves, but are smaller; and about half an inch below the flower, there is a pair of subulate bracteoles. The (fructiferous) calyx is very obtuse and almost truncate at the base, tomentose externally, with the segments ovate, acute, entire, and spreading. The petals are white, about three fourths of an inch long, nearly orbicular, and alternate with the segments of the calyx. There are fifty or more stamens, which are inserted with the petals at the base of the free portion of the calyx: the filaments are slender, shorter than the petals, glabrous, and furnished with subglobose, two-celled, didymous anthers, which open longitudinally. The pollen is subglobose and simple. The ovary was destroyed by insects in the withered flowers that were found with the specimens. The styles are combined, and the oblong stigmas are free. Capsule broadly ovoid-conical, crowned with the united styles; the thin exocarp finally separating from the coriaceous endocarp, and persistent at the base, so as to resemble accessory valves. The endocarp opens longitudinally on the back. The placentæ are large, subglobose from a narrow base, projecting into the cavity of the cells, and covered with very numerous seeds, which radiate in all directions. The seeds are oblong, anatropous; the reticulated testa a little produced at each end, but not enough to form a wing, crenate at the hilar extremity. Nucleus oblong, nearly as long as the seed. The embryo is in the axis of fleshy albumen, which it nearly equals in length; with ovate plano-convex cotyledons, and a cylindrical thick radicle.

The only specimens of this plant brought home by Colonel Frémont, were in fruit; but I found attached to them a few withered and imperfect flowers. These materials, however, were sufficient to show the essential characters of nearly all the organs. The genus is very near Philadelphus: which differs, however, in the usually tetramerous flowers, in the calyx adhering to the greater part of the ovary and fruit, in the form of the placentæ, and in the seeds being strongly imbricated and pendulous, as well as fimbriate at the hilum. In very old fruit of Philadelphus, especially after it has been exposed to the action of frost, the exocarp separates as in this genus, but not in such regular valves. The same character exists also in Decumaria.

This genus is named in memory of my excellent departed friend, the late Professor Carpenter of Louisiana, who for many years laboriously and successfully investigated the Botany of his native State, but who was suddenly arrested in his career, while preparing an account of his researches.

HYMENOCLEA, Torr. & Gray.

Hymenoclea, Torr. & Gray, in Emory. Rep. p. 143 (sine char.); Gray, Pl. Fendl. p. 79.

Capitula monoica, homogama, glomerato-spicata. Mas. Involucrum Franseriæ, 5–6—lobum, 15–20—florum. Receptaculum parvum, paleis scariosis unguiculatis obovato-dilatatis vel spathulatis onustum. Corolla cyathiformis, quinquedentata. Antheræ conniventes, vix connatæ, appendicula deltoidea inflexa superatæ. Stylus apice radiato-pencillatus. Fem. Involucrum fructiferum obovoideum seu fusiformi-clavatum, coriaceum, clausum, uniloculare, apice in rostrum tubiforme superne scariosum pervium desinens, extus squamis 9–12 magnis scariosis persistentibus, aut spiraliter imbricatis, aut univerticillatis, insigniter alatum.—Frutices Neo-Mexicani, Texani, et Californici, in aridis salinis vigentes, ramosissimi, glabrati, foliosi; foliis alternis filiformibus, inferioribus pinnato-triquinquepartitis, summis integerrimis; capitulis axillaribus et terminalibus.—Gray, Pl. Fendl. l. c.

HYMENOCLEA SALSOLA, Torr. & Gray, l. c. Tab. VIII.

H. involucro fructifero strobiliformi squamas a basi ad apicem spiraliter dispositas suborbiculares undique gerente.

Hab.—Sandy saline uplands, near the Mohave River, Southern California; flowering in August.

This singular plant, looking, when in fruit, so much like one of the Chenopodiaceæ, is a stout shrub, attaining the height of about two feet, with numerous branches which are invested with a loose and pale bark. The leaves are mostly entire, from one to two inches long, and scarcely a line wide, semiterete (when dry), paler, and somewhat hoary underneath. Only the lower ones are from three to five parted. In the axils of the leaves, along the upper branches are clustered the sessile little heads of flowers. The staminate heads are hemispherical, and consist of a somewhat hairy involucre of five obtuse, undulate or crenate lobes, enclosing from fifteen to twenty minute flowers, which contain not even the rudiment of an ovary. The corolla is glabrous and five-lobed. The chaff, which is nearly as long as the corolla, is obovate or oblong, with a long and narrow claw. Although destitute of an ovary, the flower contains a slender filiform style, which at length projects through the included tube of anthers, and is furnished with a capitate pencillate stigma. The fructiferous involucre is the most conspicuous part of the plant. It is about one third of an inch in diameter, of an obovoid form, and is surrounded, in a spiral manner, with usually about ten broad spreading winglike scales of a silvery color. The scales are thickened and indurated at the base. The achenium is of a dark purple color, and is completely enclosed in the coriaceous body of the involucre. It is tipped with the long and persistent style, which is much exserted through the tubular rostrum.

The only specimens of this plant which I have ever seen, were collected by Colonel Frémont, in the place above mentioned. Afterwards another species of the same genus was discovered by Major Emory on the Gila River, and is briefly noticed in the Botanical Appendix to his Report, under the name of H. monogyra, *Torr. & Gray*. The same plant has since been found in California by Colonel Frémont; at Ojito, in New Mexico, by the late Dr. Gregg; and in Texas by Mr. Charles Wright. It is described by Dr. Gray, in his Plantæ Fendlerianæ, p. 79. In my specimens of *H. monogyra* from the Gila, the scales in several of the fructiferous involucra are broad, and not contracted at the base. The sterile heads are rather smaller than in *H. Salsola*, and the chaff is spatulate.

This genus is very nearly allied to Franseria, but differs in the remarkable winglike scales of the fructiferous involucre, as well as in habit. Perhaps the following interesting plant, found by Colonel Frémont on his return from California in 1849, may unite Franseria and Hymenoclea.

FRANSERIA.

Franseria deltoidea (sp. nov.): caule erecto suffruticoso glabriusculo; foliis deltoideis indivisis eroso-denticulatis subtus dealbatis; involucris fœmineis subglobosis bilocellatis bifloris; squamis lanceolatis breviter spinescentibus, margine submembranaceis, exterioribus latioribus.

Hab.—On the Gila River, Southern California: collected by Colonel Frémont, in returning from his fourth journey. Found also by Dr. C. C. Parry, on the same river.

Stem apparently suffrutescent, with slender angular branches, which are clothed with a deciduous pubescence. The leaves are deltoid, or deltoid-ovate, scarcely an inch long, obtuse or subcordate at the base, irregularly erose-toothed, tomentose on both sides, almost white underneath, except the reticulated veins. The heads are not larger than a small pea, and are disposed in racemose spikes, which are about two inches long. The sterile ones are pedicellate, with the involucre pubescent, 5–6-toothed, and about fifteen-flowered. Corolla of the sterile flowers tubular-infundibuliform and glabrous; the bracteole or chaff at its base broadly ligulate. The fertile involucre is sessile; the base surrounded with imbricated broadly ovate membranaceous mucronate bracts, which are crenulate on the margin; scales numerous, membranaceous on the margin, terminating in a sharp stout scabrous spine, which is often a little curved or uncinate at the tip. Styles filiform and obtuse.

* Journ. of the Acad. Sc. Philad. n. ser. vol. 1. p. 172.

A remarkable species, partaking of the character both of Hymenoclea and Franseria. There is a transition from the broad and somewhat membranaceous bracts at the base of the fertile head, to the lower scales of the involucre, and from these, with a broad base and spiny top, to the narrow prickles that occur in many species of Franseria.

A genuine and apparently new species of the latter genus occurs among the plants collected in California by Colonel Frémont. It belongs to the section Centrolæna of De Candolle, and may be thus characterized.

Franseria albicaulis: frutescens, incano-pubescens; foliis bipinnatifidis, laciniis oblongis vel lineari-oblongis obtusis integris vel pauci-dentatis; capitulis dense spicato-racemosis; involucro masculo 8-dentato, fructifero biloculari aculeis lanceolato-subulatis rigidis incurvis armato.

Hab.—Southern California, probably on the Gila: Colonel Frémont. It was also found, without flower or fruit, by Major Emory, on the sandhills of the Gila; and is the plant referred to in my botanical appendix to his Report, as an apparently new species of Ambrosia.

A shrub with numerous branches, which are clothed with a short whitish pubescence. The leaves are about an inch long, grayish pubescent on both sides, and pinnately or bipinnately divided; the narrow ultimate segments being from one to three lines in length. The heads are about the size of a small pea, and are disposed in close leafless spiked racemes. Some of the racemes are wholly staminate; others have fertile heads intermixed. Sterile heads on short pedicels, with the involucre obtusely 7–8-toothed. The chaff is filiform and bearded. Corolla five-toothed. The fructiferous involucres are globose, and thickly covered with rather rigid, compressed, curved prickles, which are slightly roughened, and about as long as the semidiameter of the involucre.

This species is near F. dumosa *Gray*, described in my Botanical Appendix to Frémont's Second Report; but it differs in the more divided leaves, and in the rigid, nearly glabrous, curved, and larger scales of the involucre.

AMPHIPAPPUS, Torr. & Gray.

Capitulum plerumque sexflorum, heterogamum; nempe flore radii unico ligulato, femineo, fertili, et floribus disci quinque, tubulosis, hermaphroditis, sed sterilibus. Involucrum obovoideum, squamis septem ad novem, subæqualibus, concavis, subcarinatis, appresso-imbricatis. Receptaculum angustum, subalveolatum. Ligula brevis, obovata, discum vix superans: corolla disci e tubo gracili infundibuliformis, limbo profunde quinquefido. Styli rami breves Linosyridis; appendiculo ovato-deltoideo superati. Achenium radii oblongum, compressum, villosum, pappo uniseriali paleaceo (e squamellis pluribus setaceis varie modo concretis) achenio dimidio breviore superatum. Achenia disci infertilia, turbinata, pappo piloso uniseriali elongato instructa; setis rigidulis, tortuosis, denticulatis, valde inæqualibus, interdum subramosis.—Frutex Californicus, ramosissimus; foliis alternis, brevibus, obovato-spathulatis, integerrimis, subsessilibus; capitulis dense corymbosis; floribus aureis.*

* Amphipappus, Torr. & Gray, in Bost. Journ. Nat. Hist. 5. p. 4.

AMPHIPAPPUS FRÉMONTII, *Torr. & Gray, l. c.* TAB. IX.

HAB.—Interior of California, in the mountains between 35° and 36° of North latitude; particularly on the Mohave River and other tributaries of the Colorado: flowering in April.

A smoothish shrub, growing about a foot and a half high, with numerous slender, whitish, corymbose branches. The leaves are from half an inch to three fourths of an inch long, nearly glabrous, of a rather thick texture, mucronate at the tip, and tapering at the base into a short petiole. The flowers are yellow, in numerous heads, which are three or four lines long, in clusters of from three to five each, and disposed in somewhat naked corymbs. The involucres are nearly glabrous; and the oblong obtuse scales are of a pale straw color. There is but a solitary ray-flower, the ligule of which is obovate, entire, and about one third as long as the involucre. Its achenium is villous, and crowned with a paleaceous pappus of five or six scales, which are deeply cut into several unequal subulate segments, or rather consist of bristles variously united. The disk flowers are usually five in number, infundibuliform, with a slender tube, 5-cleft; the segments revolute. Stamens at length exserted; the anthers furnished with a subulate appendage at the tip. The achenia of the disk are apparently always infertile, though containing a large and well formed ovule. They are crowned with a setose pappus which is nearly as long as the corolla. Its bristles are usually very tortuous, and sometimes forked or rather united in pairs, at the base.

This rare Composita belongs to the subtribe Asterineæ of the tribe Astereæ, and to the division Chrysocomeæ. It resembles in many respects Solidago, particularly the sections Euthamia and Chrysoma of that genus, from which it differs in the involucre and in the dimorphous pappus. In its involucre and general habit it more nearly resembles Guttierrezia, and might be referred to that genus were it not for the truly pilose or setose pappus of the disk-flowers.

SARCODES, Nov. Gen.

Calyx quinquesepalus, marcescens; sepalis concavis, basi vix gibbosis. Corolla campanulata, persistens, quinquelobata; lobis ovatis, erectis. Stamina 10, hypogyna: filamenta subulato-filiformia: antheræ oblongæ, biloculares, didymæ, fere ad basim introrsum affixæ; loculis sacculæformibus, apice oblique truncatis, foramine amplo hiantibus. Ovarium hemisphæricum, quinquelobatum, quinqueloculare; loculis multiovulatis. Ovula horizontalia, anatropa. Stylus elongato-columnaris: stigma capitatum, subquinquelobum. Discus nullus. Capsula depresso-globosa, subquinqueloba, quinquelocularis. Semina numerosissima, ovata, aptera; testa reticulata. Embryo in basi albuminis, minutissimus, indivisus.—Herba Californica, carnosa, rubra; caule simplici, squamis carnosis vestito, in spicam conferte bracteatam desinens; floribus pedicellatis.

SARCODES SANGUINEA, Tab. X.

Hab.—Valley of the Sacramento; the precise locality not recorded, but probably on the Yuba River.

A very interesting plant, belonging to the small group of Monotropeæ. It is of a fleshy texture and blood-red color. The stems are apparently clustered, and spring from a thick coralloid root. They are from six to ten inches high, perfectly simple, and clothed with long erect scales, which are broader below, and gradually become narrower above, where they pass into bracts. The lowest scales are broadly ovate and clasping, very thick, and of a firmer texture than the others: upper ones an inch or two inches long, and two or three lines wide, rather obtuse, ciliate on the margin. The flowers are numerous (from 30 to 50), about as large as in *Hypopithys lanuginosa*, and occupy the upper half of the stem, each subtended and partly concealed by a long bract. All of them are decandrous. Peduncles of the lower flowers are nearly an inch long; of the upper flowers much shorter. The calyx is composed of five appressed, oblong, obtuse, glandularly pubescent sepals, which are imbricated in æstivation. The corolla is about one third larger than the calyx, monopetalous, obtusely five-lobed, without gibbosities at the base, and glabrous. The stamens are hardly more than half the length of the corolla, and arise from its base: the glabrous filaments are somewhat flattened. The anthers are attached to the filament by the back towards the base. They are about two lines long, and consist of two oblong, tubular, saccate cells, which in the bud are erect,* and almost or quite divided into two loculi. Each cell is obliquely truncated at the apex, where it opens by a large hole. The pollen is simple, very minute, and somewhat hemispherical. The ovary is distinctly five-lobed, and with as many cells, into which protrude the large placentæ, covered with innumerable oblong anatropous ovules. The style is erect, stout, about the length

* The anthers of Schweinitzia, while in the flower-bud, are singularly turned to one side at a right angle, so that one cell stands directly over the other. Even in the expanded flower, they do not become perfectly erect. My friend, Dr. Gray, in his admirable description of this genus (*Chloris Bor.-Amer.* p. 17), gives me credit for adopting, in my Flora of the Northern and Middle States, published in 1824, the true view of the position of the anthers of Pyrola. It was in the Flora of New York (1843) that I corrected the error: in the former work the prevailing view was given.

of the filaments, and terminates in a capitate, slightly five-lobed stigma. The capsule is similar in form to the ovary, only larger. It is of a chartaceous texture, and apparently opens by chinks at the margin of the valves, which do not separate from the axis. Seeds covering the large two-lobed placentæ, ovoid, obtuse at the base; the reticulated testa covering closely the nucleus, except at the apex, where it is produced into a short, conical, oblique appendage. The embryo is exceedingly minute, obovoid, undivided, and situated near the base of fleshy and oily albumen, with the radicle pointing to the hilum.

This genus is intermediate between Hypopithys and Schweinitzia. Like the former, it has a long style; but it differs from it in the gamopetalous corolla, the two-celled biporose anthers, close testa, &c. Schweinitzia, which has a similar corolla, differs in its short thick style, and in the form as well as the insertion of the anthers.

There can be no doubt respecting the position of the embryo in this genus and in Pterospora. After much patient dissection, I have obtained it repeatedly in both genera. The ripe seeds of Monotropa and Hypopithys I have not examined, but they have anatropous ovules, and therefore the radicle must be next the hilum. Lindley and De Candolle, however, state that the embryo is situated at the *apex* of the albumen; but this I am convinced is a mistake. As, therefore, all the genera of this group but one have two-celled anthers, there would seem to be nothing to distinguish Monotropeæ from Pyroleæ, except the parasitic habit, the want of verdure, and the erect position of the anthers in the flower bud. There is, however, a leafless species of Pyrola which serves as a connecting link between them; and I have already alluded to the half turning of the anthers in the unexpanded flowers of Schweinitzia. In comparing these groups, there is still another character which, I believe, has been hitherto overlooked. Some years ago,* I remarked that the pollen in all the Ericaceæ that I had examined was compound, consisting of three or four united spherules, as in Epacridaceæ. At that time, I had only looked at the pollen of the Ericeæ proper, and the Vaccineæ. Afterwards, I found that, in Monotropeæ, the pollen is simple; while, in Pyroleæ, it is compound, consisting usually of three united grains; but these are not so easily observed as in the suborders just noticed.

The genus Galax, which was first referred to Ericaceæ by Michaux,† and afterwards to a separate tribe of Pyrolaceæ by De Candolle, ought, perhaps, to be the type of an order, or at least of a suborder. It is remarkable for its monadelphous stamens and truly one-celled anthers. From genuine Pyroleæ it differs besides in its simple pollen, wingless seeds, and cylindrical, axile, divided embryo. According to Sir J. E. Smith,‡ it was referred by Mr. Dryander to Saxifragaceæ; and the late Prof. D. Don placed it in his heterogeneous order Galacineæ, which was characterized so as to include Francoa.

Endlicher enumerates among Pyroleæ the little known genus Shortia,§ although Dr. Gray gives no opinion of its affinities, merely observing, that it has the habit

* Flora of the State of New York, i. p. 229.

† Michx. Fl. Bor.-Am. ii. p. 48.

‡ Grammar of Botany, p. 164.

§ Gray in Sill. Amer. Jour. 42, p. 48.

of Pyrola and the foliage of Galax. It seems to be more nearly related to the latter than to the former. Until, however, the flowers of this plant (of which only a single specimen, in fruit, is extant) are obtained, it will be impossible to determine its place in the system with certainty.

Of the five genera and seven species that constitute the suborder Monotropeæ, so far as at present known, four of the genera and five of the species are peculiar to North America.

Several of the species have a very wide range, both in latitude and longitude. Monotropa uniflora* occurs from Canada to Florida, and from the Atlantic to the Pacific coasts. On the western side of the continent it seems to be confined to Oregon. Hypopithys lanuginosa is spread almost as widely. H. multiflora, if it be really indigenous to North America, has not been found within the limits of the United States. The rare Schweinitzia is a somewhat southern genus, never having been observed in a higher latitude than Baltimore; while Pterospora is exclusively northern, the State of New York being its limit to the south, although it has been found as far west as the Cascade Mountains of Oregon. Sarcodes is wholly a Californian genus.

* *Monotropa Morisoniana* is certainly nothing but *M. uniflora*, in which the flower is always erect after fertilization.

EXPLANATIONS OF THE PLATES.

PLATE I. SPRAGUEA UMBELLATA, PAGE 4.

FIG. 1. Plan of the flower.
2. A flower, magnified.
3. One of the sepals, magnified.
4. A petal, more magnified.
5. A stamen, seen in front, magnified.
6. The pistil, showing a longitudinal section of the ovary, more magnified.
7. A ripe dehiscent capsule, with the persistent sepals, equally magnified.
8. A seed, highly magnified.
9. Longitudinal section of the same.

PLATE II. FRÉMONTIA CALIFORNICA, PAGE 6.

FIG. 1. Plan of the flower. The ovary should have been represented as 5-celled.
2. The andrœcium, magnified.
3. An anther, with the free portion of its filament magnified; front view.
4. The same; side view.
5. Transverse section of an anther, showing the two loculi of each cell.
6. Pistil, considerably magnified.
7. Longitudinal section of a flower, only part of the calyx remaining, equally magnified.
8. An ovule, more highly magnified.
9. One of the stellate hairs, highly magnified.

Plate III. LIBOCEDRUS DECURRENS, page 7.

Fig. 1. A branch bearing male aments, of the natural size.
2. Portion of the same, magnified.
3. A branch bearing mature fertile aments, of the natural size.
4. An anther, seen from the inside, magnified.
5. The same seen from the outside.
6. A mature cone, of the natural size.
7. A seed, slightly magnified.
8. Vertical section of the same, more magnified.
9. The embryo separated, and still more magnified.

Plate IV. COLEOGYNE RAMOSISSIMA, page 8.

Fig. 1. Plan of the flower.
2. A flower-bud, magnified.
3. A bract, equally magnified.
4. An expanded flower, moderately magnified.
5. A stamen, front view, more magnified.
6. The same, seen from behind.
7. A flower laid open longitudinally, magnified.
8. The pistil, equally magnified.
9. A leaf, magnified.
10. One of the centrally fixed hairs.

Plate V. EMPLECTOCLADUS FASCICULATUS, page 10.

Fig. 1. A flower, on its short branch or spur, magnified.
2. The same laid open, and more magnified.
3. A petal, magnified.
4. A stamen, back view, equally magnified.
5. Front view of the same.
6. A grain of pollen, highly magnified.
7. Pistil, moderately magnified.
8. Longitudinal section of the same.
9. An ovule, more magnified.

Plate VI. CHAMÆBATIA FOLIOLOSA, page 11.

Fig. 1. A flower, magnified.
2. The same laid open longitudinally, more magnified.
3. A stamen, front view, more magnified.
4. The same, back view.
5. The fruit enclosed in the calyx, magnified.
6. Longitudinal section of the same, somewhat more magnified.

Plate VII. CARPENTERIA CALIFORNICA. Tab. VII., page 13.

Fig. 1. A petal of the natural size.
2. Front view of a stamen.
3. Back view of the same.
4. A capsule, with the persistent calyx, showing the manner in which the exocarp separates: slightly magnified.
5. Longitudinal section of a capsule, exposing one of the placentæ, more magnified.
6. Transverse section of the same. The notches in the margin indicate the lines of dehiscence of the exocarp.
7. A separate cell, or carpel, after the removal of the exocarp.
8. A seed, highly magnified.
9. Longitudinal section of the same, equally magnified.
10. Embryo, still more highly magnified.

Plate VIII. HYMENOCLEA SALSOLA, page 14.

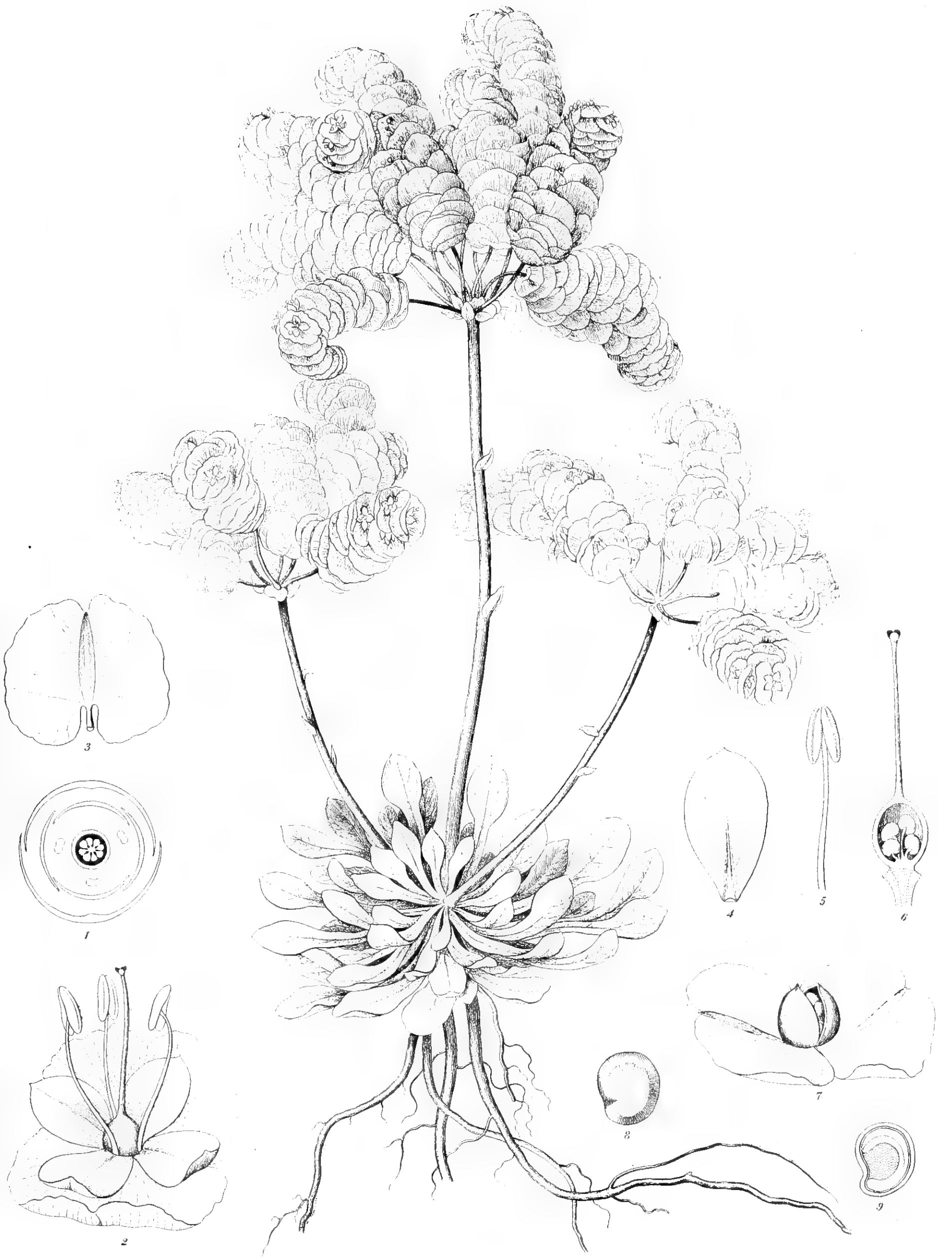
Fig. 1. A staminate head, moderately magnified.
2. The involucre of the same, with a single staminate flower, and the chaff at its base.
3. A staminate flower laid open.
4. One of the stamens, considerably magnified.
5. Style and stigma of the sterile flower.
6. Fructiferous involucre, magnified four or five times.
7. The same, cut open longitudinally, showing the enclosed achenium and the seed.
8. Transverse section of the fructiferous involucre.
9. An achenium, with its persistent styles.
10. The embryo.

Plate IX. AMPHIPAPPUS FRÉMONTII, page 17.

Fig. 1. A head of flowers, magnified.
2. The ray-flower, more magnified.
3. Pappus of the same, laid open, highly magnified.
4. A disk-flower, moderately magnified.
5. Pappus of the same, highly magnified.
6. Branches of the style, showing the stigmatic lines.

Plate X. SARCODES SANGUINEA, page 18.

Fig. 1. Plan of the flower.
2. A flower, moderately magnified.
3. Front view of a stamen.
4. The same, seen from the inside; the anther cut transversely to exhibit its two cells: both more magnified than fig. 1.
5. Vertical section of a magnified flower, showing all the organs in their relative situations.
6. The pistil, with one of the stamens, magnified.
7. Transverse section of the ovary.
8. An ovule, highly magnified.
9. A ripe seed, more magnified.
10. Vertical section of the same.
11. The embryo detached, very highly magnified.



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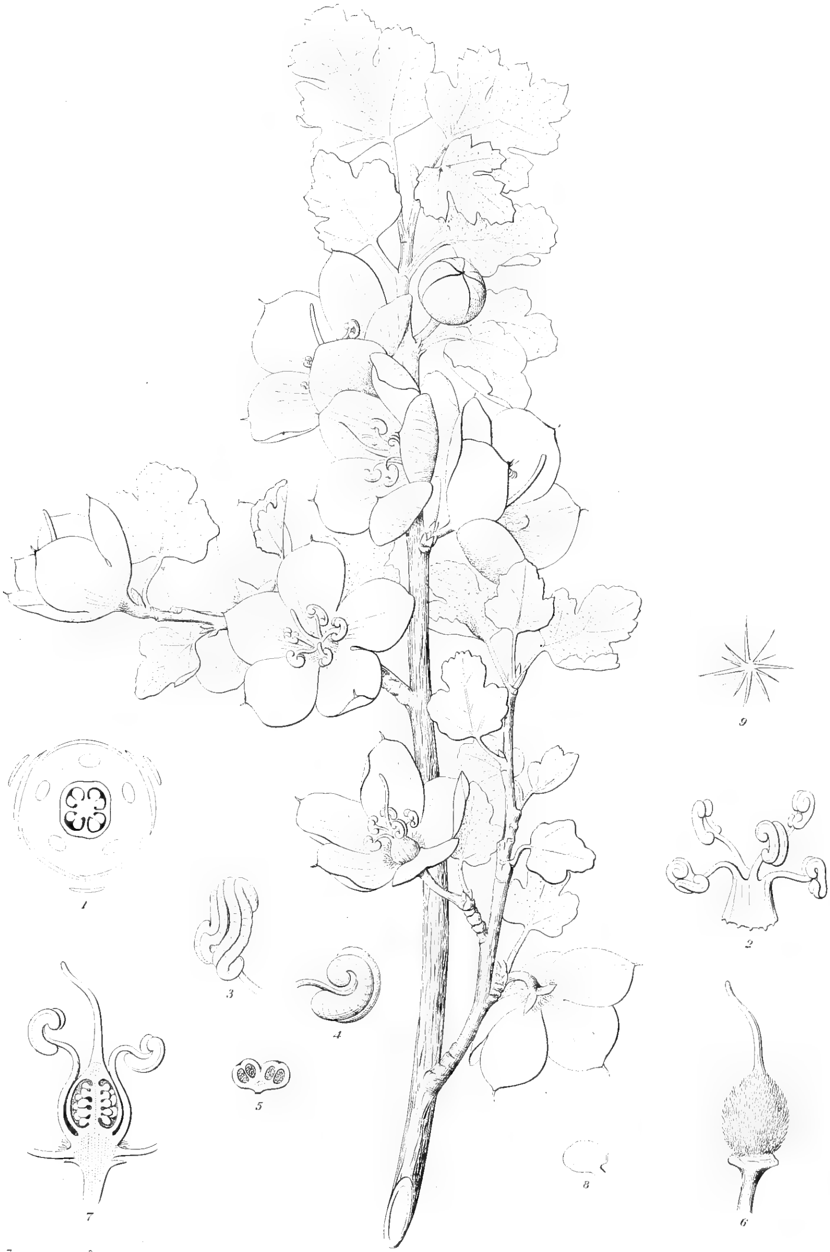

FREMONTIA CALIFORNICA.

PL. III

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LIBOCEDRUS DECURRENS.

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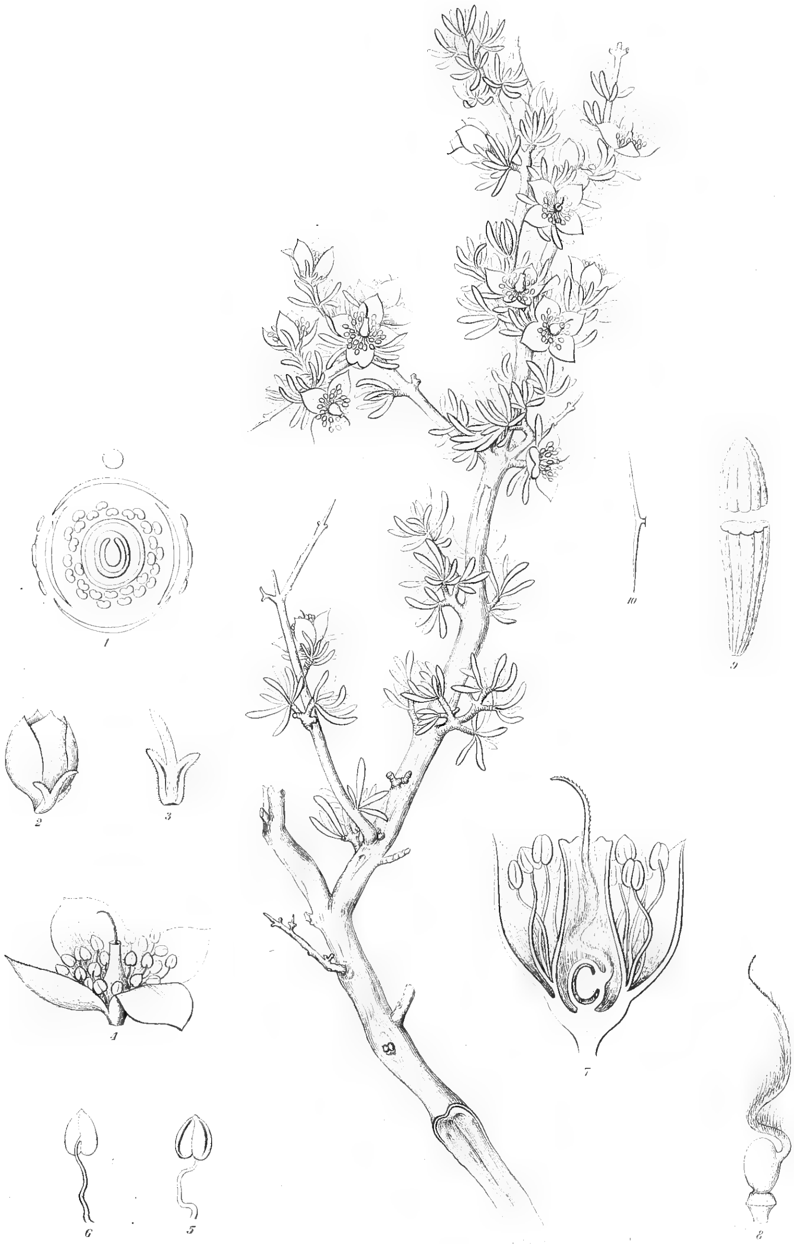
PL. IV



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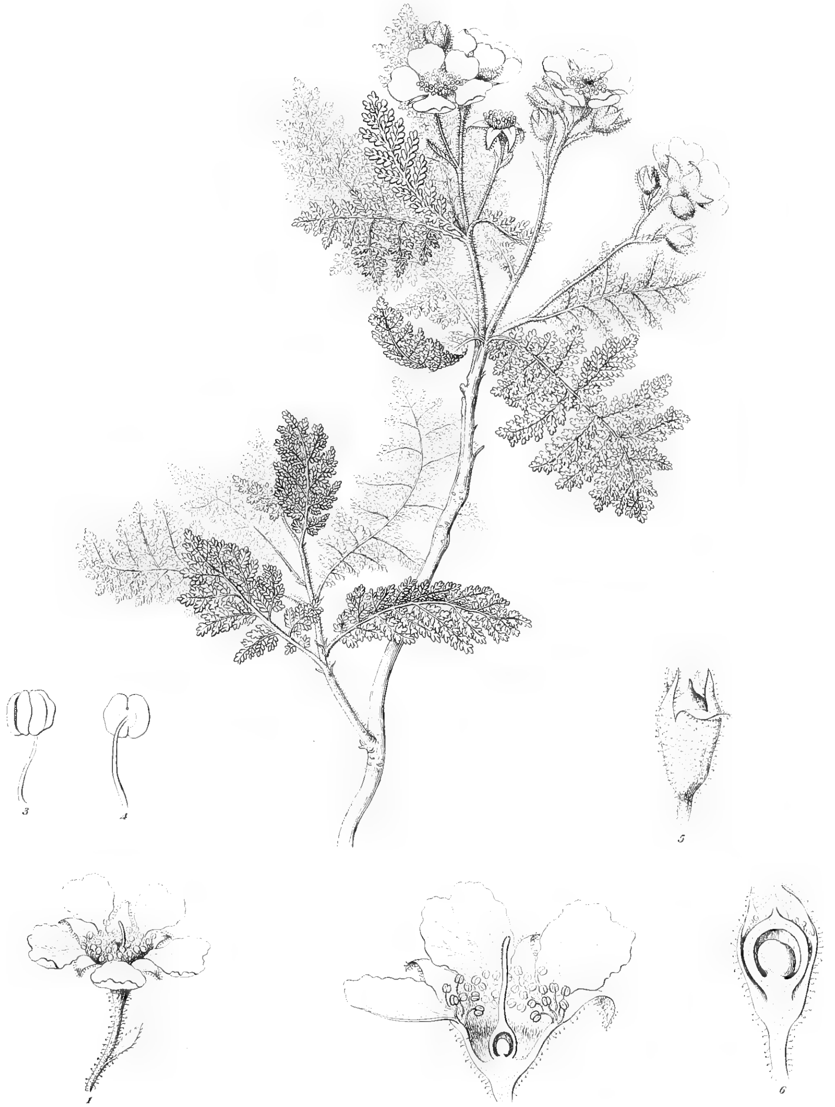
COLEOGYNE RAMOSISSIMA.

EMPLECTOCLADUS FASCICULATUS.



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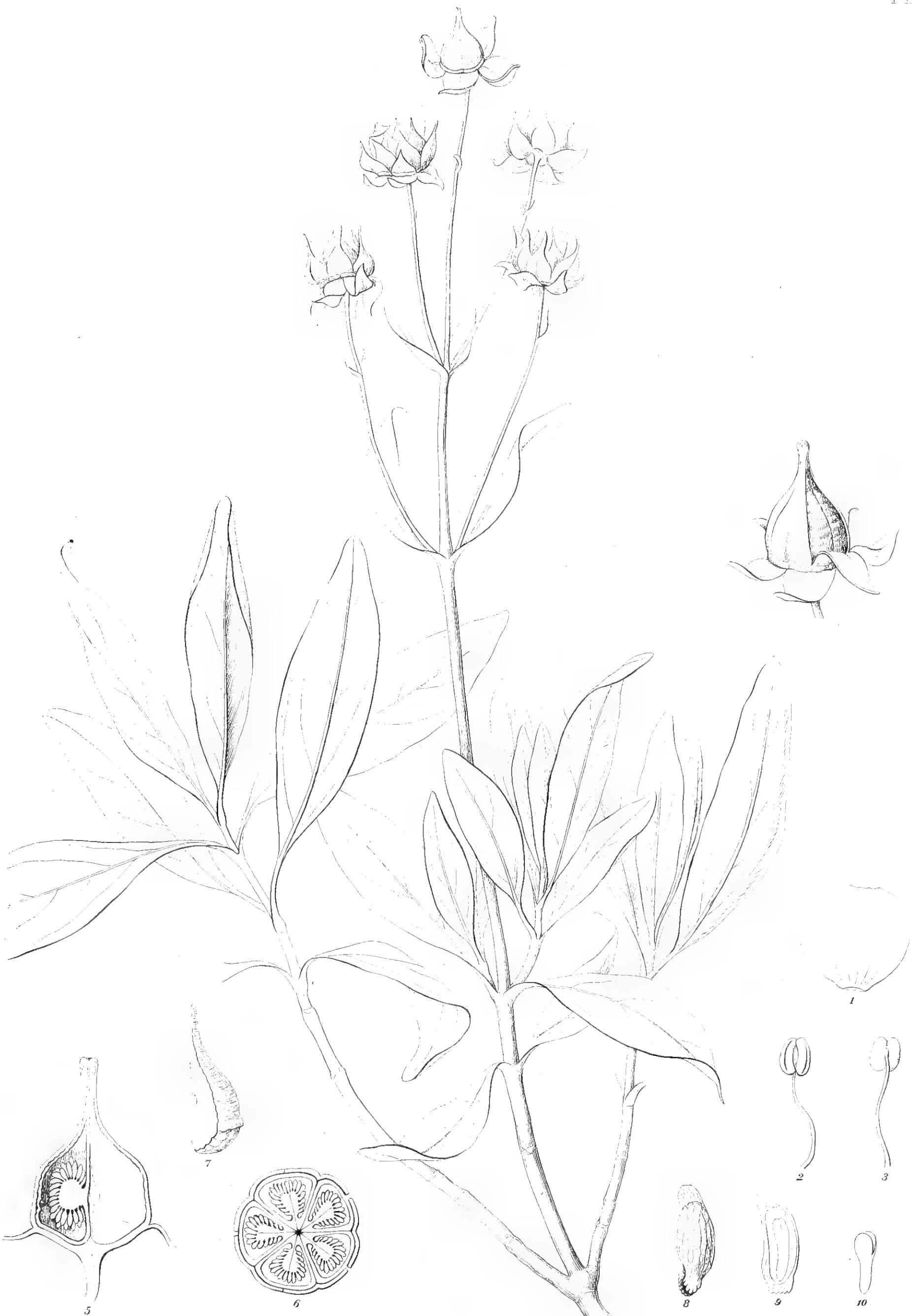
CHAMÆBATIA FOLIOLOSA



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CARPENTERIA CALIFORNICA.

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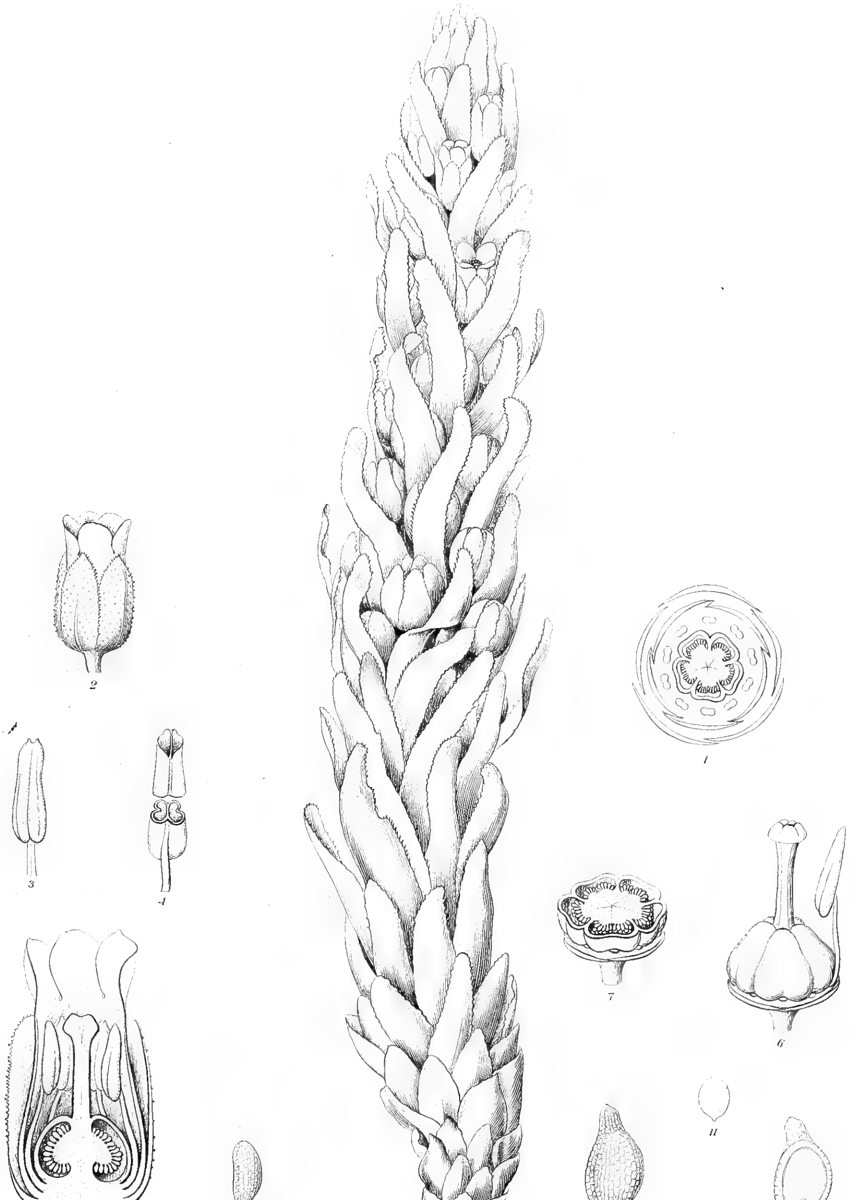
HYMENOCLEA SALSOLA

Engraved by J. Prestele.

Lith. of Wm. Endicott & Co. N York.

AMPHIPAPPUS FREMONTII



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SARCODES SANGUINEA.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

OBSERVATIONS

ON THE

BATIS MARITIMA

OF LINNÆUS.

BY

JOHN TORREY, F.L.S.

[ACCEPTED FOR PUBLICATION, SEPTEMBER, 1850.]

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

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OBSERVATIONS

ON THE

BATIS MARITIMA OF LINNÆUS.

BY JOHN TORREY, F.L.S.

THE Batis maritima is a common maritime shrubby plant of the West India Islands and the neighboring parts of the continent; but it is surprising that no correct description of its flowers and fruit has hitherto been published, nor has its place in the Natural system been satisfactorily determined. Lindley says, "that British botanists should be ignorant of the structure of one of the commonest plants in one of the oldest colonies is certainly a thing not to be proud of."*

The plant appears to have been first noticed, more than one hundred and fifty years ago, by Sloane, in his Catalogue of the Plants of Jamaica,† and afterwards in his history of that island,‡ under the name of *Kali fruticosum coniferum, flore albo.* He gives no description of the plant, except what is contained in this phrase, and merely adds one or two observations respecting its uses.

In 1756, P. Browne, in his Civil and Natural History of Jamaica,§ first gave this plant its present generic name; and his description is very good, considering the time when it was published.

Linnæus briefly characterized the genus in the second edition of his Species Plantarum (1763),‖ but he gave no additional information respecting it, and seems to have drawn his description entirely from Browne. The only habitat that he records is Jamaica.

In the Stirpium Americanarum Historia of Jacquin, published in 1763,¶ is a good description (except of the male flowers and the fruit), with a rude figure of the plant. There is another figure of it in the Plant. Amer. Pict.,** of the same author, a scarce work, without date, which I have never been able to find. It seems to be a later edition of the Historia, with more numerous and colored plates.

* Hook. Lond. Jour. Bot. 4, p. 1.
† Page 50 (1696).
‡ I. p. 144 (1707).
§ History of Jamaica, i. p. 356.
‖ P. 1451.
¶ P. 261, t. 40, f. 4.
** P. 246.

The small volume of Jacquin, entitled Selectarum Stirpium Americanarum Historia, published in 1788, contains only the text of the larger work of 1763, with references to the colored plates. The description of Batis is not altered.

Lamark's figure of Batis* seems to be a copy of Jacquin's, already cited.

Swartz, in his Observationes Botanicæ (1781), gives a detailed character of the plant, which is, in some respects, more accurate than that of Jacquin; but he, too, has overlooked the petals; and the fertile flowers as well as the fruit are imperfectly described.

Jussieu, in his Genera Plantarum,† has drawn the character of the genus from Browne and Jacquin, and seems to have been unacquainted with the plant. He left it among his *genera incertæ sedis.*

Willdenow‡ and Persoon§ copy the short description of Linnæus, and add nothing to our previous knowledge of the plant.

In 1814, appeared the extensive Flora Jamaicensis, by John Lunan. His description of Batis is very full,‖ but is wholly taken from Jacquin, with some additions from Browne, and he makes no conjecture as to its affinities.

Kunth notices the plant in his Nova Genera et Species, and places it among Chenopodiaceæ.¶

Sprengel, in 1826,** referred it, doubtfully, to Coniferæ. In his Genera Plantarum (1830) it stands without a reference to the Natural order.

Bartling, four years later, leaves it, without a remark, among his undetermined genera.††

Even so late as 1840, Endlicher seems to have had no better materials for the character of Batis in his Genera Plantarum‡‡ than the description of Jacquin; which he has copied, with only slight alterations. In doing so, however, he has made two verbal mistakes, viz.: "ovarium *acutum*" for "ovarium *obtusum;*" and perigonium *decumbens*" for "*disrumpens.*" Like Bartling and Jussieu, he does not assign the genus a place in the Natural system.

The only important addition to our knowledge of this interesting plant, since the time of Jacquin, is given by Lindley, in his remarks on the genus Sarcobatus of Nees, in the fourth volume of Hooker's London Journal of Botany.§§ He correctly describes the structure of the fruit, and rendered it probable (for his specimens were not mature) that what had been regarded as seeds by former botanists, were only the empty and easily separable carpels; the plant rarely perfecting its seeds.

Several years ago, the Batis was detected at Tampa Bay, in East Florida, by that zealous botanist, Dr. M. C. Leavenworth, late of the United States Army, who has contributed so much to our knowledge of Southern plants. It was shortly afterwards found by Mr. J. Blodgett, on Key West Island. From this gentleman, I lately received ripe and perfect specimens, preserved in alcohol. Dr. Chapman has also sent me excellent dried specimens of both male and female plants from

* Illustr. des Gen. t. 806. † P. 443 (1789). ‡ Sp. pl. 4, p. 735 (1807).
§ Synops. 2, p. 613 (1807). ‖ 2, p. 137. ¶ 2, p. 193 (1816), and Synops. 1, p. 479.
** Syst. Veg. 3, p. 901. †† Ordin. Nat. Plant., p. 426 (1830).
‡‡ No. 6844, p. 1327. §§ P. 1 (1845).

East Florida. With these ample materials, I am able to give a more complete description of the plant than has yet appeared, and to determine, with considerable certainty, its place in the Natural system.

BATIS, *P. Browne, Hist. Jamaic.* 1, *p.* 356.

Flores dioici, in spicas conico-oblongas quadrifariam dispositis. MAS. Flores distincti. Bracteæ lato-cordatæ, obtusæ, vel brevissime acuminatæ, concavæ, integræ, persistentes, arcte appressæ. Calyx disepalus; sepalis in cyathulam compressam truncatam sub-bilabiatam coalitis, bracteæ subæqualibus. Petala 4, subunguiculata ; limbo subrhomboideo. Stamina 4, petalis alternantia, exserta : filamenta subulata, glabra : antheræ oblongæ, incumbentes, versatiles ; loculis distinctis introrsim longitudinaliter dehiscentibus. Pollinis granula minutissima, simplicia, spherica. FEM. Flores in spicam carnosam coaliti. Bracteæ ut in mare, deciduæ, duobus infimis connatis. Calyx et corolla desunt. Ovaria inter se et cum basi bractearum coalita, quadrilocularia. Ovula in loculis solitaria, e basi erecta, anatropa. Stylus nullus: stigma capitato-subbilobum. Pericarpia 8–12, quadrilocularia, in syncarpium ovoideo-conicum tuberculosum carnosum coalita; loculis monospermis: endocarpium coriaceum. Semina oblonga, erecta, rectiuscula : testa tenui, membranacea. Embryo exalbuminosus semine conformis: cotyledones carnosæ, oblongæ, compressæ: radicula brevis, hilo proxima.—Frutex Antillanus, et vicinæ Continentis, littoralis ; caulibus prostratis ramosissimis ; foliis oppositis, exstipulatis, oblongo-linearibus, basi attenuatis, succulentis, supra planis, subtus convexis ; spicis solitariis, sessilibus, viridibus.

BATIS MARITIMA, Linn. TAB. XI.

B. MARITIMA, Linn. Sp. Pl., p. 1451 ; Jacq. Stirp. Amer., p. 261, t. 40, f. 4 ; Plant. Amer. Pict., t. 246 ; Select. Stirp. Amer., p. 335 ; Swartz, Obs. Bot. p. 373 ; Willd. Spec. Plant. 4, p. 735 ; Pers. Synops. 2, p. 613 ; Lunan, Hort. Jamaic. 2, p. 137 ; Kunth, Nov. Plant. Gen. et Spec. 2, p. 193 ; Synops. 1, p. 479 ; Spreng. Syst. Veget. 3, p. 901.

B. maritima erecta ramosa, foliis succulentis subcylindricis, P. Browne, Hist. Jamaic. 1, p. 356.

Kali fruticosum coniferum, etc., Sloane, Catal. Jamaic., p. 50 ; Hist. Jamaic., p. 144.

HAB.—On the sea shore, and the margin of lagoons; flowering nearly all the year. Tampa Bay, East Florida : Dr. Leavenworth. Southern Florida : Dr. Chapman. Key West : Mr. J. Blodgett. Also in Jamaica, Cuba, and other of the West India Islands; and on the neighboring parts of the Continent.

Within the limits of the United States, this plant has been found only in the stations here noticed. It is probable that Tampa Bay, the latitude of which is about 33°, is the northern limit of its range.

In Carthagena, and some other places where it abounds, the plant is burned for the sake of an impure carbonate of soda contained in its ashes. It is also used for pickles.

The plant is commonly prostrate, with numerous branches, which spread on the ground to the extent of three or four feet. Every part of it is quite glabrous, and of a strong saline taste. The leaves are opposite, about an inch in length, oblong-linear, narrowed downwards, and very fleshy. They are flattish above and rounded underneath, and are without stipules. The staminate and pistillate flowers are on different individuals, and both kinds are disposed in dense, oblong, four-rowed spikes, which are solitary and sessile in the axils of the leaves. They are about one third or a quarter of an inch long. In the staminate spikes there are from twelve to sixteen flowers, each subtended by a roundish or broadly cordate and somewhat persistent scale or bract. The calyx is a little cup, consisting of two sepals, which are anterior and posterior with respect to the axis, and are united below the middle. The cup is compressed and somewhat two-lipped; the lower lip slightly cucullate and cristate transversely just below the margin. There are four unguiculate white petals, with the limb rhombic-ovate, erose-denticulate on the margin, and abruptly narrowed at the base into a claw which is nearly as long as the limb. Alternating with the petals, and about equal to them in length, are four stamens. The filaments are subulate and glabrous; the anthers yellow, oblong, fixed by the middle, two-celled, introrse, with a longitudinal dehiscence. The pollen is simple and spherical. There is no trace of a pistil. The fertile spikes are seldom more than eight or ten-flowered, and are furnished with bracts similar to those of the sterile flowers, but which are much more caducous. There are no floral envelopes, nor even rudimentary stamens. The ovaries of all the flowers in one spike grow together, except at their upper part, and perhaps the bases of the bracts are united with them. Each ovary is four-celled, in all my specimens, but there are five and six cells represented in the figure of Lindley.* In each cell there is a single anatropous ovule, which is supported on a long stalk that rises from the base. There is no style, and the thick, capitate, pubescent stigma is slightly two-lobed. The fruit is half an inch or more in length, and is composed of from eight to twelve drupaceous pericarps, which are united into an oblong, obtuse, fleshy, tuberculate head. Each pericarp is four-celled, with a single seed in each cell. The endocarp is tough and coriaceous. Until its nature was determined by Lindley, it had always been mistaken for the testa. The seed is oblong and nearly straight, erect, with a thin and membranaceous testa, and is destitute of albumen. The embryo is conformed to the seed, with fleshy oblong cotyledons, and a short, somewhat oblique radicle which is placed next the hilum.

Only a single species of Batis is known. Lindley has ascertained that the East Indian shrubs referred to this genus by Roxburgh and Wallich have no affinity with

* Vegetable Kingdom, p. 286.

Batis, and that they belong to Urticaceæ, being near allies of Morus. He also states* that, in the herbarium of Sir William Hooker, there is a Texan plant, in a state too young for examination, which may be a second species of this genus.

The Batis (?) vermicularis of Hooker† is my former Frémontia,‡ a Chenopodiaceous plant, which I described several years ago as a new genus, without being aware at the time that it had shortly before been published by Nees, under the name of Sarcobatus.§ That plant has strangely been omitted by M. Moquin, in his recent and most excellent elaboration of the Chenopodiaceæ, in De Candolle's Prodromus. In Frémont's Reports (both of which M. Moquin has consulted and quoted), it was fully described and figured, with analyses of the fertile flowers and fruit; and was clearly shown to belong to that family. He must also have seen specimens of it in Sir William Hooker's Herbarium.

From the history of Batis already given, it is seen that very discordant opinions have been entertained by botanists as to its affinities. Although Jussieu, Bartling, Endlicher, and others have allowed it to remain among "*genera incertæ sedis*;" some have been inclined, more on account of its habit than from any correct views of its structure, to place it among Chenopodiaceæ. To Coniferæ, where it was referred by Sprengel, it has no resemblance whatever. Martius‖ arranged it between Podostemaceæ and Salicaceæ, but without giving any reasons for so doing; and, moreover, he has indicated it (without a character) as the type of a proper Order. The station assigned to it by Meisner¶ is immediately after Urticaceæ, probably from the remarks of Lindley, to which allusion has already been made.

Lindley, in his latest work,** placed it, until better known, in the Euphorbial Alliance; and, with much sagacity, conjectured that it might belong to Empetraceæ; at the end of which he has appended it. With that Order it agrees in its diœcious flowers, definite stamens, several-celled ovary, erect anatropous ovules, drupe-like fruit, and inferior radicle. It differs, however, in habit; in the want of imbricated scaly sepals or bracts; in the presence of a true corolla; and, especially, in the seed being destitute of albumen.

Considering the importance of most of the distinctive characters, it seems most probable that Batis should be regarded as constituting a proper natural Order, and that its station should be in the immediate vicinity of Empetraceæ.

* Vegetable Kingdom, p. 286.

† Flora Boreali-Americana, 2, p. 128.

‡ Botanical Appendix to Col. Frémont's Report of his First Exped. (1843), p. 95; and Second Report (1845), p. 317, t. 3.

§ This genus was first described in a Botanical Appendix to Prince Maximilian's Travels in North America, a rare and costly work, of which an English translation was published in 1843. In the Botanische Zeitung for 1844, Dr. Seubert published a description of the plant, with a figure (p. 753, t. 7); but he did not determine its place in the Natural System. As Nees's name has the priority, I have dedicated to Colonel Frémont another and very remarkable Californian plant, of which there is a description and figure in an earlier memoir of this volume.

‖ Conspectus, p. 13.

¶ Plantæ Vasculares, p. 349.

** The Vegetable Kingdom, p. 286 (1846).

Since the preceding memoir was written and prepared for press, I have received from Dr. C. C. Parry, who was attached to the Mexican Boundary Commission as Botanical Assistant to Major Emory, a specimen of a Batis, which he found in a salt marsh, near San Diego, California. The only specimen brought away by Dr. Parry is a male. It differs from the common Batis in its much broader and considerably shorter leaves, and in the staminate flowers being furnished with a filiform central organ that resembles an abortive pistil. This last is totally destitute of an ovary, and bears a small stigma-like head, which contains imperfect pollen; so that the body is rather to be regarded as an abortive stamen than a pistil. From these characters, it is probable that the Californian plant is new. The two species may be distinguished by the following diagnosis:—

B. MARITIMA: foliis oblongo-linearibus; floribus masculis sine corpore centrali filiformi.

B. CALIFORNICA: foliis obovato-oblongis; floribus masculis corpore centrali filiformi apice capitato instructis.

EXPLANATION OF THE PLATE.

PLATE XI. BATIS MARITIMA. TAB. XI., PAGE 5.

FIG. 1. A branch, with spikes of male flowers; of the natural size.
2. A branch, with spikes of female flowers; also of the natural size.
3. A male spike, magnified.
4. Longitudinal section of the same, more highly magnified.
5. One of the bracts, magnified.
6. Plan of the male flower.
7. A male flower, unexpanded and magnified.
8. The same, without the calyx, and expanded.
9. Front view of a stamen, magnified.
10. Back view of the same, also magnified.

FIG. 11. A spike of female flowers, moderately enlarged.
12. One of the bracts, more magnified.
13. Longitudinal section of the same.
14. Transverse section of the female spike.
15. An ovule, highly magnified.
16. The fruit, of the natural size.
17. Longitudinal section of the same.
18. A portion of the same, pretty highly magnified.
19. Transverse section of the fruit, less magnified.
20. A seed, magnified.
21. The embryo, equally magnified.

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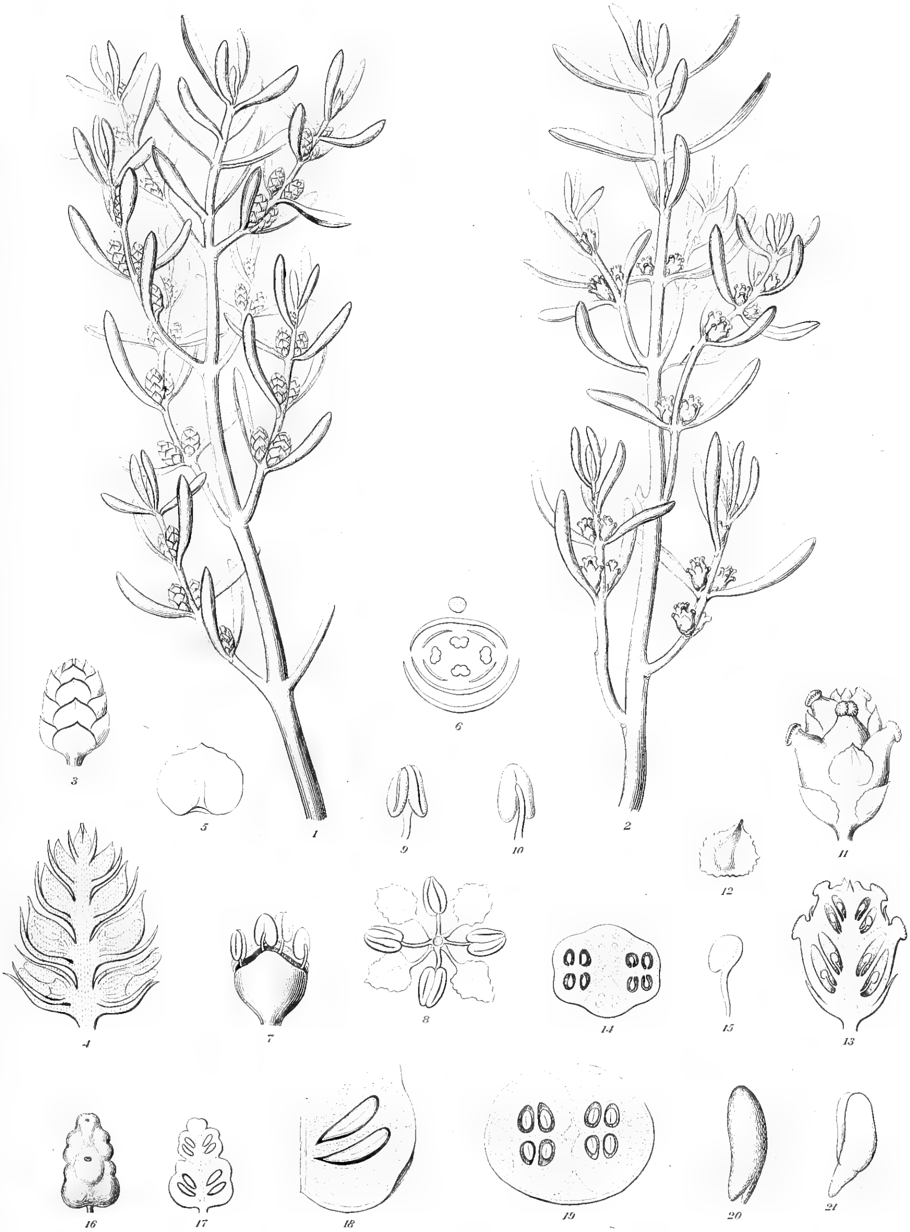

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BATIS MARITIMA.

ON THE

DARLINGTONIA CALIFORNICA,

A NEW PITCHER-PLANT,

FROM NORTHERN CALIFORNIA.

BY JOHN TORREY, F.L.S.

[ACCEPTED FOR PUBLICATION, SEPTEMBER, 1850.]

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

PROF. A. GRAY.

JOHN CAREY, ESQ.

JOSEPH HENRY, *Secretary S. I.*

ON THE

DARLINGTONIA CALIFORNICA,

A NEW PITCHER-PLANT,

FROM NORTHERN CALIFORNIA.

BY JOHN TORREY, F.L.S.

This new Pitcher-plant was first detected by Mr. J. D. Brackenridge, Assistant-Botanist to the United States' Exploring Expedition, under Captain Wilkes, while passing overland from Oregon to San Francisco, in the year 1842. He found it in a marsh, bordering a small tributary of the Upper Sacramento, a few miles south of Shasta Peak. Owing to the lateness of the season (it was October), the flowers had passed; and not even a seed vessel was found, but only the leaves and tall scapes, with the remains of a single capsule. The leaves, however, were so peculiar, that no doubt was entertained of the plant being either a Sarracenia, or a near ally of that genus. Without the flowers, nothing further could be determined respecting it; but from the bracteate scape and deeply parted lamina or appendage of the leaves, it seemed more probable that it was distinct from Sarracenia. Long had I been hoping to receive the plant in a more complete state, when it was at last brought to me by my friend, Dr. G. W. Hulse, of New Orleans, who found it in flower in May, 1851, in the same region, and perhaps in the very spot where it was discovered many years before by Mr. Brackenridge. The plant proves to be generically distinct from Sarracenia, as well as from the genus Heliamphora of Bentham; and I take great pleasure in dedicating it to my highly esteemed friend Dr. William Darlington, of West Chester, in Pennsylvania, whose valuable botanical works have contributed so largely to the scientific reputation of our country. The genus dedicated to this veteran botanist by De Candolle has been reduced to a section of Desmanthus by

Bentham; and a Californian plant, on imperfect specimens of which, I had recently indicated a genus under this name, proves to be only a species of Styrax.* The following are the characters of the new genus:—

DARLINGTONIA, Nov. Gen.

Calyx ebracteolatus, 5-sepalus; sepalis distinctis subpetaloideis. Corolla 5-sepala; petalis latissime unguiculatis; lamina ovata ungue multo minore. Stamina 12–15, uniserialia; filamentis brevibus subulatis; antheris oblongo-linearibus; loculis inæqualibus. Ovarium turbinatum, 5-loculare, 5-lobatum; apice dilatatum concavum. Stylus brevis, columnaris, 5-fidus; laciniis linearibus, divergentibus, apice intus stigmatosis. Ovula plurima anatropa, placentas dilatatas obtegens. Capsula . . . —Herba perennis, Californica, uliginosa, foliis Sarraceniæ; lamina profunde biloba; lobis divergentibus: scapis unifloris, bracteatis; bracteis infimis distantibus, supremis approximatis imbricatis: flore nutante purpureo.

* Having recently obtained good flowering specimens of this plant, the following description of it is appended:—

STYRAX CALIFORNICUM (*n. sp.*): foliis ovatis utrinque obtusis subcoriaceis integerrimis ramulisque glabriusculis vel subtus minute stellato-tomentosis; racemis terminalibus 2–4-floris; pedicellis flore multo brevioribus incrassatis cum calyce brevissime 6-dentato subtomentosis; corollis sexpartitis; filamentis ad medium usque monadelphis.

HAB.—Upper Sacramento: Col. Frémont. Near the upper crossing of the Sacramento, about lat. 40° 30′: Dr. G. W. Hulse. Foot-hills of the Yuba River: Dr. Stillman. Flowers in March and April.

An upright branching shrub, seldom attaining a height of more than six feet. The leaves vary from an inch to two and a half inches in length, and are more or less broadly ovate in outline. The under surface is paler, and either nearly glabrous or clothed with a close stellate pubescence; on the upper side they are usually quite smooth. The racemes are produced at the extremity of short leafy branches, and are mostly about three-flowered; occasionally the flowers are solitary. The pedicels are from three to six lines long, and are thickened upward. The campanulate calyx is furnished with six very short subulate teeth. Corolla about three fourths of an inch long, nearly white, or slightly cream-color; constantly 6-parted, with oblong-lanceolate rather obtuse segments. Stamens 10–14; the filaments monadelphous to near the middle. Ovary 3-celled, with several ovules in each cell; but the dissepiments soon separate from the walls. Style slender, longer than the stamens; stigma minutely 3-cleft. Immature fruit one-celled, with a single seed.

Of the numerous American species of Styrax only two have been found on the west side of the Continent, as far north as Mexico. This is the most northern species of the genus found in any part of the world. It has a strong resemblance to S. officinale of Southern Europe, from which it is chiefly distinguished by its fewer-flowered racemes, thickened pedicels, and longer stamineal tube. There is a well-marked, unpublished species (S. PLATINIFOLIUM, *Engelm. ined.*, gathered on the Guadaloupe, north of New Braunfels, Texas, by Mr. Lindheimer), the corolla of which is more commonly 6-parted. Its dilated and subcordate leaves are glabrous and shining on both sides.

DARLINGTONIA CALIFORNICA, Tab. XII.

Hab.—Head waters of the Sacramento; Northern California, near Shasta Peak; growing in marshes, and flowering in May. Mr. J. D. Brackenridge, and Dr. G. W. Hulse.

A perennial herb. Root-stock short and thick, producing numerous, stout, dark brown, fibrous roots. Leaves all radical; the adult ones from eighteen inches to two feet or more in length; the petiole or pitcher tubular, gradually tapering downward, and singularly twisted on its axis about half a turn, marked with strong parallel and longitudinal veins which are connected by very slender veinlets. The summit is vaulted, and formed into a sac about the size of a hen's egg, on the under side of which is an oval orifice, about half an inch in diameter, opening into the cavity of the pitcher. The areolæ of the sac, and also of the back of the tube, on the upper part, are discolored (of a dull orange color in the dried specimens), as in Sarracenia variolaris and S. Drummondii. Along the inside of the petiole is a narrow wing, which is single, except at the base, where it separates into two plates that clasp the scape and the base of the superior leaves. The lamina is narrow at the base, and deeply divided into two somewhat unequal widely-spreading lobes, which are oblong-lanceolate, rather acute, bent downwards and often also backwards; the inner (or properly upper) surface very minutely pubescent. The pitcher inside the hood is retrorsely hirsute with short conical hairs; from thence downward it is glabrous; but towards the base it is lined with long slender hairs, also pointing downwards: at the bottom remains of insects were found. Neither these hairs, nor those of the lamina, appeared to be of a secreting character.* The scape is from one to four feet long, flexuous, angular, glabrous, and furnished with sessile clasping straw-colored scales. These scales are foliaceous and alternate; the lower ones distant and lanceolate, the upper more and more approximated and broader, while those near the flower are oblong-ovate and imbricate. They are marked with longitudinal veins, which are forked above. The upper surface is paler than the lower, and under a lens shows minute conical papillæ. The flower, when fully expanded, is nearly two inches in diameter. The calyx consists of five oblong, rather acute sepals, which are of pale straw-color, and are quincuncially imbricated. There are no calyculate bractlets at their base. The corolla is five-petalled, about the length of the calyx, and its æstivation is likewise quincuncial. The petals are oblong, pale purple, marked with deeper reticulated veins, and are apparently not connivent over the pistil. They are furnished with a small ovate, concave lamina, and a very broad, obovate claw, which is two or three times larger than the lamina. Stamens from twelve to fifteen, hypogynous,

* The orifice of the Pitcher, being placed directly under the vaulted summit, cannot receive either rain water or dew; and yet Mr. Brackenridge thinks he found some of the leaves containing water. Still I cannot think the water was secreted by the hairs in the tube. In Sarracenia psittacina the orifice is likewise concealed and protected by the hood, so that the leaf can hardly be said to have any lamina; the arched summit belonging to the petiole, as in Darlingtonia.

inserted in a single series, and partly concealed by the dilated summit of the ovary: filaments short and rather stout: anthers oblong, with the cells very unequal and opening longitudinally, turned by the twisting of the filament so that the cells are anterior and posterior, the smaller cell lying against the ovary. Pollen simple and spherical. The ovary is turbinate, five-celled and somewhat five-lobed, concave and dilated at the summit, so as to exhibit a sort of margin which projects over the stamens: the columnar style is short, and five-cleft at the summit; the narrow segments diverging, and stigmatose at the extremity, on the inside. Ovules very numerous, anatropous, covering the large placentæ, which project into the cells of the ovary. No fruit was found; but, on one of the specimens collected by Mr. Brackenridge, there was a small portion of a capsule, which was evidently five-celled.

From Sarracenia, this genus differs in the calyx not being calyculate; in the form of the petals; in the somewhat definite and uniserial stamens; in the dilated turbinate ovary; and especially in the absence of the large umbrella-shaped summit of the style, which is so conspicuous in the former genus. The forked lamina of the leaf, and the bracteate scapes, are also characters not found in any Sarracenia.

From Heliamphora, it is still more distinct. In that genus, the scapes are several-flowered, and the flowers are destitute both of calyculate bracts and petals; the style is entire and not dilated at the summit, and the ovary is three-celled. The leaves, also, differ in their greatly dilated orifice, in the very small lamina, and in the doubly-winged pitchers.

The geographical distribution of Sarraceniaceæ is worthy of notice. This small order consists of but three genera, which are all exclusively natives of America. The oldest or typical genus is confined to North America; and, of the six species, one only (Sarracenia purpurea) has an extensive range, being found from lat. 48°, north, to Southern Florida, but westward only as far as Ohio; the remaining species being confined to the Southern States. Heliamphora, a genus of a single species, is a native of British Guiana, and has not been found elsewhere. Darlingtonia is the only representative of the order west of the Rocky Mountains, and even there it seems to be extremely rare.

The affinities of Sarraceniaceæ, notwithstanding the discovery of Heliamphora, and now of another genus belonging to the same family, are nearly as obscure as ever. Its resemblance to Nymphæaceæ and Papaveraceæ has been pointed out by several botanists; and Dr. Lindley, without hesitation, places it between the latter order and Ranunculaceæ. A more remote affinity to Droseraceæ has also been indicated; but this, however, is chiefly seen in the structure of the leaf of Dionæa.

The most recent opinion respecting the affinity of Sarraceniaceæ is that of M. Planchon,* who thinks these plants are very closely related to Pyrolaceæ. This acute botanist points out some striking characters in which Sarracenia resembles

* Hooker's London Journal of Botany, 5, p. 252.

the genus Moneses (Pyrola uniflora, *Linn.*); in addition to which, it may be remarked that the seeds of Heliamphora are furnished with a loose winged testa and a minute embryo, as in Pyrolaceæ. Between Moneses and Darlingtonia the comparison may be drawn still more closely: in the floral envelopes and the almost definite stamens, in the structure of the ovary and in the radiating stigmas, as well as in habit, the likeness of our new genus to Moneses is quite remarkable. In many points, too, we may trace in Darlingtonia an approach to Monotropa, of the nearly related family Monotropaceæ. Heliamphora, in its several-flowered scapes, is more like Pyrola. The singular pitchers of Sarraceniaceæ might seem to show a wide difference between the families thus compared, but characters drawn from the abnormal condition of a single organ are not of high importance in determining affinities. In conclusion, I would remark that, while offering a few additional considerations that seem to strengthen the views of M. Planchon, I do not wish to be considered as yet adopting those views. When we obtain the fruit of the Darlingtonia, perhaps it may give us some better knowledge of the place that its family should occupy in the Natural system.

EXPLANATION OF THE PLATE.

PLATE XII. DARLINGTONIA CALIFORNICA, PAGE 5.

FIG. 1. Plan of the flower.
2. A petal, of the natural size.
3. A stamen, considerably magnified.
4. Grains of pollen, highly magnified.
5. Longitudinal section of the ovary, having portions of the floral envelopes, and two of the stamens; considerably magnified.
6. Style and stigmas, more magnified.
7. An ovule, more magnified.
8. Hairs from the inside of the tubular petiole, near its base; highly magnified.
9. Hairs from the hood, just within its orifice; equally magnified.

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APRIL, 1853.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

SYNOPSIS

OF THE

MARINE INVERTEBRATA

OF

GRAND MANAN:

OR THE REGION ABOUT THE MOUTH OF THE BAY OF FUNDY, NEW BRUNSWICK.

BY

WILLIAM STIMPSON.

[ACCEPTED FOR PUBLICATION JANUARY, 1853.]

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

A. A. GOULD, M. D.
PROF. J. D. DANA.

JOSEPH HENRY,
Secretary S. I.

CONTENTS.

MARINE INVERTEBRATA OF GRAND MANAN.

The Island of Grand Manan, the natural history of which this paper is intended to illustrate, is perhaps but little known, geographically, to many who may be readers of this account. It may not be out of place, therefore, to make some remarks on its position. It is more properly an archipelago than an island. The smaller members of the group lie to the east of the largest, which is twenty miles in length, with a general trend north-east and south-west, having an average breadth of nine or ten miles. It lies at the mouth of the Bay of Fundy, about ten miles from the western shore at Campo-bello and Eastport, and thirty from the Nova Scotia shore. It is surrounded on all sides by deep water (a hundred fathoms or more), as might be judged from the character of the shores, which are rocky and precipitous, especially on the western side, where cliffs of a basaltic structure rise perpendicularly to a height of several hundred feet. On the south-eastern side, where there are numerous islands, the shores are low and shelving, composed of Mica-slate having a dip of about 70°. The passages between these islands, worn out by the tides which rush with great velocity through them, are generally very shallow, while a short distance seaward the water becomes as deep as on the western side.

The following paper is intended as a compend of observations made on the marine fauna of this region, during three months' residence in the summer of 1852; and also as a catalogue, which it is hoped will prove nearly complete, of the marine invertebrates found on its shores and in the adjacent waters.

In preparing local faunas, it is desirable that the area included should be as narrowly circumscribed as the inclusion of the requisite variety of station will allow. It is only by the comparison of the results of such examinations, made at a series of *points* along a coast, that an accurate knowledge can be obtained of the distribution of marine animals, and of the effect of external circumstances on their growth, habits, and economy. We can thus ascertain whether a species may inhabit two distant localities without occurring in the intermediate space; and if so, what are the causes of this? Has it been there extirpated by geological changes not affecting the other points? If not, how was its transportation effected? Or, was it originally created in both the distant points? These, and many other questions of the same nature, may be answered in respect to species whose distribution is thus perfectly known. Such investigations will also throw much light on the distinctions of species, which cannot now be derived from their geographical distribution, on account of the loose and general manner in which it is usually recorded. And every practical naturalist knows how much he is aided in defining species, by seeing them in the beauty of life, in their natural condition and associations. So extended a series of observations will, however, require a great number of workers. But these it is hoped will be furnished by the increasing taste for pursuits of this kind in our country. The records of depths and stations may seem trivial in the eyes of some, but upon their accumulation depends the decision of several important questions.

It will be observed that the number of new species described in this paper is quite large. This naturally results from the fact that so few families of our marine invertebrates have yet been investigated. Thus, with the exception of the shells, nearly every species required special study to determine its genus, and whether it was, or was not, identical with some European or Arctic species.

Pelagic animals are particularly abundant at Grand Manan, on account of the proximity of deep water, and by far the greater part of the species were obtained by the use of the dredge. Dredging in this region is attended with dangers, to guard against which some little foresight is necessary. The boat should always be provided with a compass, even in going short distances from land, as the fogs are very thick in summer, and are suddenly formed. The dredger must also keep an eye to windward, as the approach of a fog bank may be generally seen at least some minutes beforehand, so that a course may be taken for home; unless, indeed, he be something of a pilot himself, or have one with him, when he may often continue his operations notwithstanding the obscurity. A "horn," consisting of a *Strombus gigas* with the apex knocked off, should also be provided, to be used when lost in a fog, for, when blown, it will be answered according to the humane custom of this region, by any who may hear it, whether on shore or in boats. In many places, there are patches of rock on the sea-bottom, where the dredge is very liable to be caught. Usually, it may be disengaged by heaving in a portion of the dredge-warp, but this is often not sufficient. The only means then remaining of recovering it is to slack out all the line, while the boat is brought round and run in a direction opposite to the former course. It may even then occur that the dredge remains fixed, so that, on an excursion to these islands, two or three should always be provided.

I must here express my grateful acknowledgements to Professor Agassiz, for the use of his valuable collection of European books and specimens, which he most liberally allowed me, while as his pupil I had the pleasure of his society and the advantages of his instruction. To the officers of the Smithsonian Institution I am also greatly indebted, for affording me every possible assistance in the use of rooms, instruments, books, etc., while this paper was in preparation. I am also indebted to Professor Dana, for his kindness in giving me tracings of the details of many of his new genera of Crustacea, which have materially aided me in the determination of those herein described.

Suites of the original specimens, from which the new species in this paper were described, are deposited in the Museum of the Institution, and in the cabinet of Professor Agassiz, at Cambridge.

Outline figures are given in the plates of some of the most interesting species, especially such as form new genera.

WILLIAM STIMPSON.

SMITHSONIAN INSTITUTION, *February*, 1853.

POLYPI.

ALCYONIDÆ.

ALCYONIUM DIGITATUM, Lin. All the specimens obtained were very small, the largest scarcely an inch in length, and not divided into lobes. Found attached to small pebbles on shelly bottoms in 10–30 fathoms.

ACTINIADÆ.

ACTINIA MARGINATA, Le Sueur, J. A. N. S., i. 172. On rocks at low-water mark, of a very large size.

A. CARNEOLA, St., n. s., Fig. 1. Very small, about four-tenths of an inch in diameter; mouth protruding far upwards on the broad disk, on the edge of which are the tentacula, alternating in two approximated rows, there being eighteen in each row. On the disk, above the base of each of the larger upper tentacula, are two prominent white spots, one above the other; while the lower tentacula have one spot only at their inner bases. This species is of a light flesh or salmon color. It was dredged in 35 fathoms on the Hake Ground, off the north-east shore of Grand Manan. The specimens were attached to dead valves of *Pecten*, and sometimes to the test of *Ascidia callosa*, or to small pebbles.

A. OBTRUNCATA, St., n. s. Body short, with a broad flat disk, on which, between the small mouth and the margin, are placed the tentacula; which are short, very blunt at their extremities, as if cut off, usually equidistant, not very numerous, and arranged alternately in four or five very indistinct rows. Sides smooth and clean, with few porous warts, which can seldom be perceived. Color dark purplish, lighter on the disk, with broad streaks of crimson which meander among the bases of the tentacula. It is found not unfrequently at low-water mark, attached to stones in clear water, but is most abundant in the laminarian zone. It approaches *A. crassicornis*, especially in the arrangement of the tentacula, which are, however, not pointed. It wants also the prominent rim of that species.

A. CORIACEA, (?) Johnst., Brit. Zooph. A few specimens of an *Actinia* were presented to me by H. R. Storer, Esq. (which he took at low water among the outer islands), of a species which I did not myself find. It is conical, with the sides covered with small shells and pebbles, which are secured by the strong wart-like suckers. The tentacula are rather long, and not very numerous. Having never seen it alive, I am by no means certain of the accuracy of the above identification.

A. DIANTHUS, (?) Johnst., Brit. Zooph. A fine specimen, belonging probably to this beautiful species, was dredged in 50 fathoms on the "gravelly bottom," a fishing-ground situated about eight miles off Whitehead. It was unfortunately lost, owing to the roughness of the weather at the time, so that it is not yet accurately determined.

A. SIPUNCULOIDES, St., n. s., Fig. 2. Body greatly elongated, covered with a thin brownish epidermis, with eight narrow longitudinal white lines, dividing the body at the anterior extremity into eight equal lobes when contracted. Tentacula twenty, short, curved, and with blunt extremities. It was found at low-water mark, adhering by its very small base to a large stone, from which it was easily detached. In confinement, it attached itself to the bottom of the glass, but frequently changed its place. Only one specimen was found, from which circumstance the necessary anatomical investigations which would undoubtedly result in the establishment of a new genus for this animal, could not be made.

LUCERNARIADÆ.

LUCERNARIA QUADRICORNIS, Müll. *L. fascicularis*, Johnston, Brit. Zooph., pl. xlv., f. 3–6. The specimen obtained was nearly three inches in length. It was dredged on a bottom of nullipores and sea-collanders (*Agarum*) in four fathoms. It is the first of this interesting genus yet noticed as occurring on our coast.

ACALEPHÆ.

PROLES POLYPOIDEÆ.

CAMPANULARIA SYRINGA, Lam. Johnst., l. c., 110. On *Sertularia polyzonias*, in 25 fathoms, off Duck Island.

LAOMEDEA GELATINOSA, Lamour. Johnst., l. c., pl. xxi., f. 3. This I took from the bottom of the hooker used in my dredging operations. It had reached the height of an inch in less than a month after the bottom of the vessel had been scraped clean.

PLUMULARIA TENERRIMA, St., n. s. Polypidom pinnated, the stem thick, the pinnæ very slender, alternate, with the pyriform cells arranged loosely in a row on their upper surface, pointing alternately to opposite sides. It is common in 25 fathoms, shelly bottom, off the northern point of Duck Island.

P. FALCATA, Lam., An. sans vert., ii. 160. Taken often in 35 fathoms on the Hake Ground.

SERTULARIA ARGENTEA, Ellis. Johnst., l. c., 79. Common in 4–6 fathoms, attached to stones.

S. FILICULA, Ellis. Johnst., l. c., 76. Dredged in 20 fathoms, on shelly bottoms.

S. LATIUSCULA, St., n. s. Pinnæ broad, compressed, attached by a slender base to the main stem; cells crowded, nearly opposite, shaped as in *S. argentea;* vesicles elongated, ovate, with a single strong spine on one side at the extremity. Color brownish. Breadth of pinna, 0.03 inch. Dredged in the laminarian zone.

S. PRODUCTA, St., n. s. Cells opposite, elongated, curving outward, with ovate apertures. Vesicles slender, elongated, subtruncate, and covered with spines at their extremities. It is of a bright silvery color. It differs from *S. margareta*, Hassal, in having more numerous spines at the top of the vesicle, and none on its sides.

S. FALLAX, Johnst., l. c., 73. A few specimens, probably of this species, were taken in deep water.

S. RUGOSA, Lin. Johnst. This species is common in deep water here, and on most parts of our coast, from Massachusetts Bay to the Grand Bank.

S. POLYZONIAS, Johnst., l. c., 61. Many forms occurred at Grand Manan, in from 10 to 40 fathoms, all of which may be referred to this species, as described by Johnston in the second edition of his work. But my own observations upon many specimens, and the consideration of the genera and species of naked-eyed medusæ, the polype forms of which are not yet known, convince me that this species, so called, is in reality a genus, and its varieties true species. The difficulty of identifying our species by the descriptions of European writers in the absence of specimens for comparison, prevents me from naming and describing the forms I have determined.

GRAMMARIA, St. n. g.

Polypidom rectilinear, elongated, cylindrical, composed of aggregated tubes, generally without branches, which, when they occur, are of the same character as that from which they spring. Cells arranged on all sides, in more or less regular and equidistant longitudinal rows, giving a section of the stem a star-like appearance.

G. ROBUSTA, St., n. s., Fig. 3. Cells large, cylindrical, curving outward, equalling in length the diameter of the stem, annulated with one or two lines of growth near their apertures. They are arranged in four or five very regular rows, being alternate in contiguous, and opposite to each other in opposite rows. Color light brown, cells paler and translucent. Dredged not unfrequently in the laminarian zone.

G. GRACILIS, St., n. s. Polypidom slender, with a polished appearance; cells small, elongated, projecting, but curving inward at their extremities, and distant from each other in the very irregular rows. Color dark brown, sometimes black. One specimen only was taken, which occurred in the laminarian zone.

EUDENDRIUM CINGULATUM, St., n. s. Polypidom small, very irregularly branched, somewhat as in *E. rameum*, but not so thickly; branchlets strongly ringed, sometimes throughout their length, always near their origins; polypes small, with long tentacles and broad blunt proboscis. It differs from *E. rameum* in the more numerous rings on the branchlets, and from *E. ramosum* in the mode of branching. Dredged in 20 f., on a shelly bottom off Duck Island.

TUBULARIA INDIVISA, (?) Lin. Johnst., l. c., 48. Found chiefly in the laminarian zone.

T. LARYNX, Ellis. Corall., pl. xvi., f. *b*. Dredged in 25 f., on the Hake Ground.

CORYMORPHA NUTANS, Sars, Beskrivelser og Jagttagelser, etc., 7, pl. i., f. 3. This singular animal has been hitherto found only on the coast of Norway, and among the Orkney Isles. The announcement of its occurrence on our coasts cannot but prove interesting to our marine zoologists, especially as it may be taken in the greatest abundance in some localities here, while it seems a rare animal in Europe. It lives on a sandy bottom, in from 4 to 15 fathoms. Off West Quoddy Head, a hundred or more were taken at a single haul of the dredge. It also occurs in Welch Pool, and near Low Duck Island. I have nothing to add to the description of Forbes and Goodsir, whose observations I have mostly repeated.

ACAULIS, St. n. g.

A. PRIMARIUS, St., n. s., Fig. 4. The remarkable polype for which this name is proposed, which is probably the largest hydroid known, was observed at Grand Manan in two successive stages of development. It was first taken early in August, when it was of a sub-cylindrical form, tapering suddenly to a point at each extremity. At the upper extremity was the mouth, very small, a little below which the tentacula commenced, scattered at first, but gradually increasing in number, and somewhat in size. These tentacula were minute, very short, equalling in length about one-sixth the thickness of the body, with large globular tips. They occupied about two-thirds of the surface of the body; on the remainder below, their places were supplied by the medusa buds, which were crowded, and much larger than the tentacula, although as yet but little developed. The inferior extremity of the body terminated in a short, pointed, fleshy spike, free from appendages, from which exuded a tenacious mucus, by which it adhered to the subaqueous surfaces to which it might be applied. Around the base of this spike, and immediately under the buds, were regularly arranged eight long gracefully-curved cirriform processes, each equalling in length about half that of the body. These appeared from their motions to be in this—the first or free stage of the animal's existence—the locomotive organs.

At a subsequent time, I met with several of these animals which presented a different appearance. The tentacula were larger, especially in the region of the mouth, at the now blunt extremity of the body; and the medusa buds were in an advanced state of development, soon to become free swimming individuals. The inferior appendages had disappeared, and the body was firmly attached by a broad base, and bore much resemblance to one of the ordinary *Corynidæ* deprived of its stalk. In strong contractions, it assumed a shape approaching that of an hourglass. The length of the animal, in this latter stage, was half an inch, the breadth two-tenths. In the earlier stage, the dimensions were one-half these.

It was dredged in the laminarian zone, from 5 to 15 f., attached to various Rhodosperms, as *Ptilota*, *Chondrus*, and *Rhodymenia*. Circumstances did not permit me to ascertain the medusoid form of this polype, although I have my conjecture.

I would here offer, for the judgment of zoologists, the following generalizations to which I have been led by the consideration of two facts exhibited in the characters of the animal above described. First, the basal cirri of the first stage are homologous to the lower or exterior tentacula of *Tubularia*, which I think is evident on comparison of parts. Secondly, these cirri, or tentacula, are deciduous with the growth of the animal, and do not appear in the second stage. Hence we should consider the *Tubulariadæ*, in which they are persistent, as lower in the scale. It might also be considered, as bearing on this question, that the medusæ of *Tubularia* never become free, as in the *Corynidæ*.

It follows, also, from the above, that the species just described, having basal tentacula, is inferior to *Coryne* and its allies, in which they never appear, so that it is correctly classed between that genus and *Tubularia;* and if, as is probable, the single circle of tentacula in the *Sertulariadæ* is homologous with the basal tentacula of *Acaulis* and *Tubularia*, it would follow that that family should stand lowest in the scale. Thus, as will be seen in the arrangement of the hydroids in this paper, it is a reversal only of the series followed in Johnston's work which is proposed, without derangement of the grouping of the families.

HYDRACTINIA ECHINATA, Johnst. *Alcyonium echinatum*, Auct., Gould, Inv. Mass.

CLAVA MULTICORNIS, Johnst. *Coryne squamata*, Müll., etc.

Under these two names are probably included the polype forms of several species of our North Atlantic naked-eyed medusæ.

PROLES MEDUSINÆ.

Among the very numerous species of medusæ observed in this region, the following only were identified. The notices I prepared of new species, owing to the circumstances under which they were observed, are too short for publication.

SARSIA MIRABILIS, Agass., Mem. Am. Acad., 2d ser. iii. 224, pl. iv.

HIPPOCRENE SUPERCILIARIS, Agass., l. c., 250, pl. i.

STAUROPHORA LACINIATA, Agass., l. c., 300, pl. vii.

AURELIA AURITA, Müll., Gould, Inv. Mass.

CYANEA POSTELSII, Gould., Inv. Mass. A *Strobila* of large size, probably the polype form of this *Cyanea*, was taken in various stages of development, in 30 fathoms, on the Hake Ground. It was of a light salmon color, with very long superior tentacula, which it used in walking inverted on the bottom of the sea.

BEROID MEDUSÆ.

PLEUROBRACHIA RHODODACTYLA, Agass., l. c., 313, Part ii., pl. i.

BOLINA ALATA, Agass., l. c., 349, Part ii., pl. vi.

ECHINODERMATA.

CRINOIDEÆ.

Alecto Eschrichtii, Müll. et Trosch. The first specimen of the genus *Alecto* or *Comatula*, so interesting to palæontologists, yet taken on our coast, occurred to me in twenty-five fathoms on a shelly ground near Duck Island. It seemed to be a young individual, although nearly four inches in diameter. It was of a dark green color, dotted with white; the disk grayish, and the dorsal-jointed appendages white. I have compared it with specimens of *A. Eschrichtii* from Greenland, in the collection of Prof. Agassiz, and find differences which may be those of age, since these latter specimens were all ten inches or more in diameter. Under these circumstances, I have hesitated to describe it as new, though it may hereafter be proved so, when more extended comparison shall be possible.

EURYALÆ.

Astrophyton Agassizii, St., *Euryale scutatum*, Gould, Inv. Mass. (non Blainv.). Until within a few years, all the northern species of this singular genus were confounded by zoologists in one. They have now been separated by Müller and Troschel, and the Scandinavian naturalists; four species in northern Europe being known, and one in Greenland, with which I have had opportunities of comparing our species, and find constant differences. The disk of *A. Agassizii* is rather large; the arms divide in two, just beyond their emersion from the disk, and then continue to branch dichotomously till at their extremities the rays are slender roughened twigs, which in preserved specimens are tangled and interlaced in every direction, but in life are usually stretched out to their utmost extension. My largest specimens were thus a foot and a half in diameter when alive, while in a dried state they measure scarce a foot. The disk is quite regularly pentagonal. On its upper surface the ten radiating ribs are narrow, prominent, and provided with numerous small, sharp, small-based warts, which are very irregularly scattered, and which exist also on the marginal ridge which surrounds the disk, except on the concave, which forms a sort of socket for the upper base of the arm. Between the radiating ribs, the disk is soft and membranous, with few scattered granules most numerous in a flat space in the centre. The disk, as well as the arms, is smooth and glabrous below; the mouth comparatively large, with small spines at the entrance, and larger ones within. The arms are flat beneath, with steep sides and convex upper surface. They are covered above with crowded minute granules, like fine oolite, which are arranged in numerous, somewhat irregular transverse rows, and decrease in number on the sides, the lower parts of which are smooth. On the flat under surface the joints are indicated by the pores, which are arranged on each side, in pairs; there being also, just outside of each pore, a row of four small blunt spines. The first pair of pores, however, next the disk, is unprovided with spines. There is also in the angle of each of the bifurcations a single pore without spines.

The characters particularly mentioned in this description are those in which our species most differs from that of Greenland. The arms and prominent parts of the disk are bright yellow, and the depressed or membranous parts of the disk dark brownish.

This species is not uncommon at Grand Manan. It is found in the coralline zone, especially among forests of *Boltenicæ*.

OPHIURIDÆ.

OPHIOLEPIS TENUIS, Ayres, Bost. Proc., iv. 133. Frequent among nullipores below low-water mark.

O. ROBUSTA, Ayres, Bost. Proc., iv. 134. A small graceful species, with flat disk and long slender arms tapering to mere threads. It is always highly colored, usually variegated with red, but sometimes jet black. It varies very much in its proportions, some disks having arms doubling in length those of other disks of the same diameter. It is abundant in the laminarian zone, and sometimes also at low-water mark, on rocky and nullipore bottoms.

O. CILIATA, Müll. et Trosch., Syst. der Asteriden, 91. *O. acufera*, Ag., Proc. Am. Acad., 1851. This species is much larger than the preceding, of a bluish-gray color above, and white below. It is also very different in station, being found only on muddy bottoms and in deep water. I have taken it at a depth of 60 fathoms.

OPHIOPHOLIS SCOLOPENDRICA, M. et T., l. c., 96. *Ophiura aculeata*, Gould, Inv. Mass. Excessively common in the laminarian zone, and also under stones at low water. In this latter station I have found, in August, my largest specimens.

OPHIACANTHA SPINULOSA, M. et T., l. c., 107. A fine purplish-brown species, with long rough spines on the arms, and minute crowded ones on the dorsal surface of the disk. It varies considerably, and has often the aspect of an *Ophiothrix*. It is found sparingly on shelly bottoms in the coralline zone.

Our northern species of *Ophiuridæ* seem yet far from being well determined. One who is so fortunate as to possess very few specimens, soon becomes perfectly satisfied in his own mind as to the specific distinctions, and finds little difficulty in separating them; while one who has some hundreds, can make but slow progress, the perplexity seeming to increase with the number of specimens. I have, I trust, properly defined the limits of our New England species, by the examination of very numerous individuals from many localities, in which determination I have been most aided by the consideration of their habits, and especially of their *association*. The great difficulty now remaining is their identification with those of Northern Europe. So much discrepancy exists in the views of transatlantic naturalists, that a very general reliance only can be placed on their figures and descriptions; and the few specimens which have yet reached this country from Scandinavia and Greenland are still insufficient. So that, although I have mentioned *O. tenuis* and *O. robusta* under the names given them by an American author, I am yet confident that they can be referred to European species when these latter shall be better digested.

ASTERIADÆ.

ASTERACANTHION RUBENS, M. et T., l. c., 17. Specimens a foot or more in diameter are very common just below low-water mark.

A. VIOLACEUS, M. et T., l. c., 16. A purple species about four inches in diameter. The rays are rather narrow, and taper to a point. It is not common in this region.

A. LITTORALIS, St., n. s. Body tumid, rays very broad. Ambulacral spines in two rows, slender, blunt, or even clavate at their tips. Spines on the sides larger than those on the back, but both short, blunt, and showing great uniformity in size and distribution. Its color is always a dark green above, and it never exceeds an inch and a half in diameter. It is very common among the fuci in the middle region of the littoral zone, or even near high-water mark—elsewhere I have never found it.

A. MÜLLERI, Sars., Wiegm. Archiv., x. 169. This remarkable species occurred to me in 30 f., off the northern point of Duck Island. It is of a bright red color above when alive, and may be readily distinguished from all others by the crown surrounding the bases of the spines, which are arranged in distinct rows on the sides of the rays. I have compared our specimens with some sent from Norway by Sars himself.

A. ALBULUS, St., n. s., Fig. 5. Small, depressed, of a uniform cream-color; rays very slender, each with a prominent rounded tuft of spines at its extremity. Ambulacra very broad, with about five rows of slender spines on each side. Back and sides having a remarkably smooth appearance, which is found to result from their being covered with closely set subquadrate tufts of short blunt spines. These tufts are arranged very regularly in rows, which can be traced both longitudinally and transversely. Those of the middle row are more closely set than the others, thus giving each ray the appearance of having a median line.

The number of rays is almost invariably six, one specimen only, out of fifty taken, having five. And what is still more remarkable, four out of five of these had three of the rays much shorter than the others. Some specimens had seven rays. Were it not for the great numbers which I found every day, I should certainly have considered them as the distorted young of some other species. They occurred most frequently among branching nullipores, in 4 or 5 fathoms, on the east side of the islands.

This species is very distinct from any yet described. It may probably form another genus, when the four rows of suckers shall become a family character instead of a generic one.

LINKIA OCULATA, Forbes, Wern. Mem. *Cribella oculata,* Forbes, Brit. Starf. *Asterias spongiosa,* Gould, Desor. Abundant on the rocks about low-water mark.

L. PERTUSA. *Asterias pertusa,* Müll. *Echinaster Eschrichtii,* M. et T. (?) Much larger than the preceding, and with elongated rays, which narrow towards their extremities. The color is also a paler red. Dredged in 30 fathoms, and found also occasionally at low-water mark.

SOLASTER ENDECA, Forbes, l. c. This species is abundant on the rocks at low-water mark in the summer, at some localities, but these are always small, and never more than half grown. The large individuals, some of which are a foot in diameter, are found only in deep water, chiefly in the laminarian zone.

S. PAPPOSA, Forbes, l. c. This species is rare in this region, and small specimens only are found. They usually occur on shelly bottoms in the coralline zone.

PTERASTER MILITARIS, M. et T., l. c., 128. This is perhaps the most remarkable of the *Asteriadæ*, presenting, as it does, the singular phenomenon of a *web* among these lower animals. A soft flexible membrane connects the ambulacral spines, the inner rows transversely, the outer longitudinally; also the spines surrounding the mouth, and those surrounding the large anal pore. In one of my specimens, where this anal pore is widely open, the cavity is distinctly seen to divide into five large channels, corresponding to the five interspaces between the rays. These channels pass underneath, and parallel to, the skin, and, from their action in life, I am inclined to consider their function, at least in part, respiratory. It is perhaps superfluous to say this, when we know that this function is performed by the whole surface of the skin; the webs seeming especially qualified for the office. When, however, we place a living *Pteraster* and a *Holothuria* in the same jar, and see the same action of inhalation and expulsion of water going on at the anal aperture in each, it is difficult to refrain from considering its object the same in both, especially when they are so closely related zoologically.

This starfish has hitherto been observed only in Northern Europe, and in Greenland, where it would seem to be rarely found. At Grand Manan, I took three specimens, all of which occurred in the Hake Bay, in 35 fathoms, shelly bottom.

GONIASTER PHRYGIANA. *Asterias phrygiana*, Parel. *Goniaster equestris*, Agass. *Astrogonium phrygianum*, M. et T., l. c., 52. A large specimen was taken off Duck I., in the coralline zone. It was bright red above, and bright yellow below, being by far the most elegant of our starfishes. The minute vesicles which protrude from the dorsal pores, are short and tipped with black. The eyes are very dark red in color, and the suckers near them are very long and slender, especially a single one just above each eye.

CTENODISCUS CRISPATUS, Dub. et Kor., Skand. Echin., 253. This fine starfish is by no means rare in New England, although not yet noticed by our naturalists. At Grand Manan, it occurred on muddy bottoms in fifty and sixty fathoms.

ECHINIDÆ.

ECHINUS GRANULATUS, Say, Gould., Inv. Mass. The rocky shores of the islands in this region are covered with a zone of *Echini*, extending from the ordinary low-water mark, to a depth of half a fathom. In this zone, these animals are so crowded together that it is impossible in most places to thrust an oar to the bottom without striking some of them. Among them are found several varieties, perhaps species, which an extended investigation only can elucidate. The most common form is of a dark green color, with short blunt spines, the same, in fact, as that found in Mass. Bay, but much larger (three inches in diameter). Among the younger specimens, are found some with very long spines, as in *E. virens*, Dub. et Kor., which it resembles. There are also sometimes found specimens of a bright reddish or purplish color, depressed, and about two inches in diameter; these resemble *E. neglectus*, Forbes, D. et K.

ECHINARACHNIUS ATLANTICUS, Gray. Very common on sandy shores at low water.

HOLOTHURIADÆ.

CUVIERIA FABRICII, Dub. et Kor. *Holothuria squamata*, Gould, Inv. Mass. Small specimens were dredged abundantly among nullipores in five fathoms, and a number of very large ones were found attached to the under surface of large shelving rocks in the fourth subregion of the littoral zone. The largest was four inches in length, while its tentacles had a spread of nearly five inches, and presented a beautiful area of bright red waving plumes.

PSOLUS PHANTAPUS, Jæger. *P. lævigatus*, Ayres, Bost. Proc., iv. 25. Common in forty fathoms, attached to small stones; and occasionally found at low-water mark. These were all small specimens. The large ones seem to live buried among pebbles; thus, at Eastport, one was dug from a depth of six inches in gravel. This measured three inches in length.

OCNUS AYRESII, St., n. s. Completely encased in calcareous matter in the form of polygonal plates somewhat variable in size, but usually equalling in area one-half that of the disk of the sucker. These plates have regular and equal perforations in quincunx, smaller in width than their interspaces. The suckers are stout, and are distributed distantly in five rows, in the three ventral of which they are much larger than in the two dorsal. There are about seven suckers in each row, which are encased in the calcareous plates on their sides. The tentacula are short, and have few blunt branches. The color is white, or pale fawn. Length usually two-tenths of an inch; breadth 0.15 inch. Dredged on shelly bottoms in twenty-five fathoms.

Duben and Koren include the genus *Ocnus* of Forbes in *Cucumaria* (*Pentacta*), and seem to consider the small number of feet or suckers as resulting from the immaturity of the specimens yet examined. But having seen a large number of specimens of the species now proposed as new, none of which exceeded three-tenths of an inch in length, I am led to consider the fewness and large comparative size of the feet as constant; adding to it a character not in Forbes's diagnosis;—the crowded perforated plates, which will always serve to distinguish the species of this genus from young *Pentactæ*, and by which it forms a connecting link between this latter genus and *Psolus*.

PENTACTA FRONDOSA, Jæger. *Cucumaria frondosa*, Forbes, Dub. et Kor. *Botryodactyla grandis*, Ayres, Bost. Proc., iv. 52. *B. affinis*, Ayres, id. 145. Nothing can exceed the profusion in which this species exists in some parts of the islands. It is found just below the ordinary low-water mark on rocky shores, and is, therefore, exposed at spring tides. I have seen areas of several square rods entirely occupied by them. The largest observed was nine inches in length and three wide. They are usually black or dark purple above, and pale brown or yellowish below. Some specimens are of a uniform bright yellow. They always adhere by one side—

that on which the suckers are most developed. They never bury themselves, but are found on the surface of the rocks, and sometimes in chinks or among large pebbles.

THYONIDIUM PRODUCTUM, St. *Orcula punctata,* Agass., Proc. Am. Acad., 1851, (no descr.) *Duasmodactyla producta,* Ayres, l. c., 244. This species is found in deep water, but occurs most frequently under stones, or buried to a slight depth in gravel near low-water mark.

Duben and Koren give in their generic diagnosis of *Thyonidium,* "tentacula 10, quibus interjacent totidem paria tentaculorum triplo breviorum," which character is well marked in this species. In fact, if distinct, it is at least very closely allied to their *T. pellucidum.*

CHIRODOTA LÆVIS, St. *Holothuria lævis,* O. Fabr., F. G., 353. *Synapta coriacea* Agass., Proc. Am. Acad., 1851, ii. 269. *Trochinus pallidus,* Ayres, Bost. Proc., iv. 243. This species is fully and well described by Otho Fabricius, and his account of its habits applies precisely to those of our species, as I have often observed at Grand Manan. It lives in the stony mud of the shores of these islands, buried to a depth of a few inches, usually in a horizontal position. It is found at low water, but is most abundant at a depth of four or five fathoms.

The genus *Trochinus* of Ayres is synonymous with *Chirodota* of Eschscholtz (see Esch., Zoologischer Atlas; also Middendorff, Sibirischer Reise, in which latter work full anatomical figures are given); the *Chirodota* of Forbes (Brit. Starf., 239) being a *Synapta* (see Duben and Koren, Ofvers. af Skand. Echinodermer, 323). Our *Chirodota arenata* must, therefore, form the type of a new genus, for which I would propose the name *Caudina.* It is well described by Mr. Ayres, in Bost. Proc., iv. 143. *Caudina arenata* does not occur in the Bay of Fundy, notwithstanding its abundance on every sandy shore in Massachusetts Bay.

Huxley, in Dr. Sutherland's Journal of Penny's Voyage to Wellington Channel, describes a *Chirodota* which must be closely allied to *C. lævis;* but, if his description be exact, it differs in the number of spokes in the calcareous wheels of the skin.

BRYOZOA.

TUBULIPORA PATINA, Johnst., Brit. Zooph. The species which I consider identical with *T. patina,* notwithstanding some differences, is very common on our whole coast. It is mostly found on seaweeds in shallow water.

T. CRATES, St., n. s. Polypidom generally of large size, suborbicular, sometimes irregularly lobed at the circumference. Cells very slender, curving upward, showing a disposition to linear arrangement, and often rising in circles around cup-shaped depressions, where the tallest (immature) ones have very minute or no apertures. Color white. There is no distinct margin. Diameter often three-fourths of an inch. Found encrusting *Terebratulæ* in deep water.

T. DIVISA, St., n. s., Fig. 6. This species resembles *T. flabellaris*, Johnst., but differs in being much more deeply divided into broad lobes or branches; also in its more erect and elongated cells, which are without transverse wrinkles. Color waxen white; length about three-tenths of an inch. Found on a valve of *Pecten*, taken in the coralline zone to the eastward of the islands.

IDMONEA PRUINOSA, St., n. s., Fig. 7. Polypidom erect at base, the upper branches curving over, so as to be nearly horizontal, with the cell-bearing surface upward. Cells arranged in transverse rows of four or five, closely packed, which rows are arranged along each side of the face of the branch, either alternate or nearly opposite. It is a rather thick and solid species, of a white color, bright and shining. It grows often to a height of one or two inches, and is very distinct from the European species, *I. atlantica*. It was found in considerable numbers in deep water, especially on shelly bottoms.

CRISIA CRIBRARIA, St., n. s., Fig. 8. Polypidom thickly branched, with the cells so crowded as to form often two or three longitudinal rows, in which they are usually opposite. The back of the polypidom is flat, or but slightly convex, presenting an irregularly striate appearance. Color white. Taken in twenty f., east of Duck Island.

C. DENTICULATA, Johnst., Brit. Zooph. On a sponge, taken in ten f., off Cheney's Head.

HIPPOTHOA RUGOSA, St., n. s., Fig. 9. This appears nearest allied to *H. catenularia*, from which it differs in its numerous transverse striæ, or rugosities, and by its somewhat smaller apertures, in each of which a rectangular foramen is observable. It was found widely branched on small pebbles dredged in twenty-five fathoms on shelly bottoms.

LEPRALIA ANNULATA, Johnst. *Cellepora annulata*, O. Fabr., F. G. This differs somewhat from the descriptions, but is probably one of the numerous varieties of the species named. Dredged in deep water, encrusting shells, etc.

L. CANDIDA, St., n. s., Fig. 10. Cells robust, oval, white, coarsely punctate, with small apertures, which are without spines, but have two blunt projections resulting from a sinus, at the top. Dredged on stones in thirty-five f., in the Hake Bay.

L. CRASSISPINA, St., n. s. Cells sub-globular, distinct, crowded, standing obliquely, or sometimes almost erect; with very minute punctures. Aperture large, trumpet-shaped (from a slightly contracted neck), with thickened margin, one stout pointed spine in the middle above, and a long blunt spine at each extremity of the distal margin, which spines are often rough with minute points. Length of each cell one-fortieth of an inch. Color in life pale greenish. Found in small radiating patches on stones and shells from deep water.

L. LABIATA, St., n. s. Ovigerous cells only of this species were observed; and in them the ovarian capsules appeared in the form of a conical chimney on the top of the aperture. The cells were sculptured with irregular distant radiating ridges, commencing at the top of the chimney, and spreading out over the back of the cell. The aperture is sub-oval, truncate behind, and with the distal margin expanded over the cell immediately in front, in the form of a broad lip. Found on small pebbles from deep water.

L. RUBENS, St., n. s., Fig. 11. The cells of this species, as will be seen from the figure, resemble those of *Flustra* more than *Lepralia*, being in straight parallel series, elongated, with small truncate apertures. Color bright vermilion. It is a common species, found in radiated patches encrusting nullipores, etc., in four or five fathoms.

CELLULARIA TERNATA (?), Johnst., Brit. Zooph. Found in twenty f., shelly bottom, in the Hake Bay.

GEMELLARIA DUMOSA, St., n. s. Polypidom white, thick, and bushy, with the branches but slightly diverging. Cells opposite, in pairs, joining each other by the broad dorsal surface, flattened, elongated, broadest at the aperture, which is ovate or sub-panduriform, narrowest behind, and without spines. Each pinna has a chainlike appearance from the constriction at the base of each pair of cells, where it joins the top of the preceding pair. Some of the bunches taken were four inches high. They were all more or less obscured by extraneous substances. It was dredged in ten f., off Cheney's Head, on a coarse, sandy, and somewhat weedy bottom.

FLUSTRA TRUNCATA, Lin. Common in four f., on nullipore bottoms, among the smaller islands.

F. SOLIDA, St., n. s., Fig. 12. Polypidom broad, very thick and solid, of a bright yellowish or cream color. Cells very long and narrow, with broadly truncated apertures. It grows to a height of three or four inches, with the branches three-eighths of an inch broad. Dredged in twenty-five f., off the northern point of Duck Island.

ACEPHALA.

TUNICATA.

Of the compound ascidians only two were observed, and these, for want of proper opportunity, were not sufficiently investigated for specific designation. One was in the form of small glistening pellucid masses, variously lobed, with the aspect of an *Aplidium*. This was common among the nullipores in shallow water. The other was met with in only one instance, in deep water, near Duck Island. It was a mass about two inches in length, encrusting a tuft of *Flustra*, of a bright green color, and very beautiful. It approximated in character the genus *Botrylloides*.

The simple ascidians were numerous and interesting. In addition to those catalogued below, I should mention that in one instance I met with what appeared to be a *Clavellina*, but so mangled by rough usage in the dredge as to be further undistinguishable.

ASCIDIA CALLOSA, St., Bost. Proc., iv. 228. Very abundant on shelly bottoms, affording attachment to many species of zoophytes.

A. TENELLA, St., l. c., 228. In thirty-five f., off Gr. Duck Island.

A. GEOMETRICA, St., l. c., 229. In forty f., off Long Island.

GLANDULA FIBROSA, St., l. c., 230. Dredged in considerable numbers on muddy bottoms in the coralline zone. They appear like hard balls of mud, about the size of an ounce bullet.

G. MOLLIS, St., l. c., 230. In ten f. sand, off Cheney's Head.

CYNTHIA PYRIFORMIS, Rathke. This species I have identified by European examples sent me by M. Sars. They are perfectly the same. It is one of the most beautiful marine productions found in this region, having, in its hard velvety surface, and bright pink blush, precisely the aspect of a blood-peach. In fact, it is called *sea-peach* by the inhabitants. Some of my specimens are three inches in length. It lives in clear water on rocky bottoms among nullipores, sometimes at low-water mark, but usually in four or five fathoms.

C. ECHINATA, St. On rocky bottoms.

BOLTENIA RUBRA, St., l. c., 232. One specimen only of this species was found, on weedy rocks, in four fathoms.

B. RENIFORMIS (?), Macleay. This species is very distinct from the preceding, being uniformly of a fine yellowish-white color, with a smooth velvety surface. It inhabits rocks in deep water, never occurring in less than fourteen fathoms. I am far from certain that it can be referred to *B. reniformis,* but approaches that species more than any of the others mentioned by Macleay in his memoir.

BRACHIOPODA.

TEREBRATULA SEPTENTRIONALIS, Couth. Common.

LAMELLIBRANCHIATA.

ANOMIA EPHIPPIUM, L. Roots of *Laminariæ;* very small.

A. ACULEATA, Gm. Rather common in deep water.

PECTEN MAGELLANICUS, Lam. This species was once taken abundantly in this locality, and used by the inhabitants as food, but seems now rapidly decreasing in numbers. It is now rarely seen alive, though beds of dead shells are often met with at depths of 20 and 30 fathoms, which afford excellent shelter to many marine animals. A few small living specimens were dredged in 10 f. sand, near Duck Island outer ledge.

P. ISLANDICUS, Müll. Distorted specimens are occasionally found under stones at low water, but it usually occurs on shelly bottoms, in 25 to 40 f.

NUCULA PROXIMA, Say. In 4 f. sand, off Duck Island weir.

N. TENUIS, Turt. In from 4 to 40 f. mud.

N. DELPHINODONTA, Migh. 25 f. mud, on the Hake Ground.

LEDA THRACIÆFORMIS, St., N. E. Test. Moll., 9. In 25 f. mud, off Duck Island.

L. SAPOTILLA, St. 10 f., Welch Pool.

L. MYALIS, St. 20 f. mud, off Duck Island.

L. LIMATULA, St. 6 f. mud.

L. TENUISULCATA, St. Common on muddy bottoms.

MYTILUS DECUSSATUS, Mont. Found at low-water mark, attached to the under side of stones by a byssus. Also in 40 f. gravel.

M. CORRUGATUS, St. 35 f. gravel, on the Hake Ground.

M. DISCORS, Lin. Found in nests formed of various marine substances, under stones at low water, and to a depth of 40 f.

M. LEVIGATUS, St. Dead in 35 f. gravel.

M. DISCREPANS, Mont. Common at various depths; sometimes growing very large—one occurred 1¼ in. in length.

M. MODIOLUS, L. This species here inhabits the shores, being seldom found in deep water.

M. EDULIS, L. Very abundant at low-water mark, but usually small.

THYASIRA GOULDII, St. In 4 f. sand, off Duck Island weir; large specimens in 25 f. mud.

CARDITA BOREALIS, Con. Duck Island, at low water under stones, attached by a minute byssus. In deep water it is large and very common.

ASTARTE SULCATA, Flem. Common in deep water on muddy bottoms.

A. QUADRANS, Gould. Occurs very rarely here.

CYPRINA ISLANDICA, Lam. Rarely found.

CARDIUM ISLANDICUM, Linn. Full-grown specimens, dead, are common on nullipore bottoms, in 3 to 6 f.; the young, alive, are dredged in 20 to 40 f. mud.

C. PINNULATUM, Con. In 4 f., coarse sand.

MACTRA PONDEROSA, Phil. Common in sand at low water, buried at a depth of 4 inches.

M. SOLIDISSIMA, Chemn. Found sparingly accompanying *M. ponderosa.*

TELLINA FUSCA, Phil. Inhabits the higher levels of the littoral zone.

T. PROXIMA, Brown. Among nullipores on sandy ground, at low water, and in 4 f.

SOLEN ENSIS, L. At low water, in sand; rare.

THRACIA TRUNCATA, Migh. In 10 f. coarse sand, off Cheney's Head.

T. MYOPSIS, Beck, in Möller's Index Molluscorum Grœnlandiæ. Comparison with specimens of this species from Greenland has convinced me of its identity with my *T. Couthouyi.* I was misled by the inaccuracy of Möller's description, especially in giving "ossiculum nullum." I have observed the ossiculum in several specimens.

T. CONRADI, Couth. Rare.

LYONSIA HYALINA, Con. In 10 f. sand, off Cheney's Head.

PANDORA TRILINEATA, Say. In 5 f. mud.

NEÆRA PELLUCIDA, St., n. s., Fig. 13. Shell small, thin, pale white, subovate, ventricose anteriorly, and contracted posteriorly into a short but distinct rostrum. Beaks small, tumid, and placed a little before the middle. Surface nearly smooth about the beaks, with irregular, distant striæ of growth near the margin, which become sharp and well-marked on the rostrum. Within, smooth and glossy; teeth very minute. Epidermis white, sometimes pale greenish on the beaks, and brownish on the rostrum. Length, .19 inch; height, .12 inch; width, .11 inch.

It is the first of this genus taken on our coast, and resembles the young of *N.*

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cuspidata, F. et H. (*Th. brevirostris*, Brown), more than any other European species. It was taken in 40 f., on a muddy bottom, off Long Island.

Panopæa Norvegica, Lovèn. Taken (dead) in forty f., on the Hake Ground. This is the first instance of its occurrence on the N. E. coast.

Mya truncata, Linn. Found in considerable numbers under stones near low-water mark, at Duck Island.

M. arenaria, L. Common in the coves.

Saxicava rugosa, Lam. Large and common at low water, but small when found in deep water.

S. arctica, Desh. Occurs occasionally in deep water.

Pholas crispata, L. Occurs very rarely.

GASTEROPODA.

PROSOBRANCHIATA.

Dentalium striolatum, St. Very common on muddy bottoms in the coralline zone.

Chiton albus, L. Found among nullipores in 4 f., and occasionally at low water. Those taken in the coralline zone are nearly black.

C. ruber, Linn.

C. marmoreus, O. Fabr. These two species are excessively abundant just below low-water mark, on rocky bottoms, especially on the various species of *Nullipora*. To take a hundred or more in one dredgeful from this ground is by no means uncommon. They are easily distinguished from each other by their margins, that of *C. marmoreus* being smooth and leathery, while that of *C. ruber* is granulated. The *marmoreus* also grows much larger than the *ruber;* specimens of the former are commonly more than an inch in length.

C. mendicarius, Migh. A few fine specimens of this rare species were dredged (alive) in 35 f., in the Hake Bay. Besides Dr. Mighels's specimen, they are the only ones now known.

Pilidium cæcum. *Patella cœca*, Müll. *P. candida*, Couth. *Pilidium candidum*, St., N. E. Test. Moll. I have been able to identify our species with the European by specimens sent me by Sars. It is not unfrequent at Grand Manan, in the coralline zone.

Tectura testudinalis, Gray. Common in the third and fourth subregions of the littoral zone, of a very large size.

Calyptræa striata, Say. Specimens more than an inch in diameter are not uncommon in deep water. I am quite confident that it will prove a new species, but have no southern examples of the type for comparison.

Diadora Noachina, Gray. During a low spring tide, in August, I obtained a large number of this species from the under surfaces of large stones, near low-water mark. It has been hitherto found, both here and in Europe, only in deep water.

TROCHUS OCCIDENTALIS, Migh. In 25 to 40 f., in the Hake Bay. The specimens were very large and beautiful, especially when alive. The animal has four lateral cirri, thus differing from other *Trochi*, which have three; and from *Margarita*, which has five.

MARGARITA CINEREA, Gould. Inhabits shelly and pebbly bottoms in deep water.

M. OBSCURA, Gould. On sandy bottoms in the laminarian zone, as off Ross's Island.

M. UNDULATA, Sow. On weedy, rocky, and nullipore bottoms, in shallow water.

M. ARGENTATA, Gould. Taken alive in 4 f., coarse sand, off Duck Island boat moorings.

M. HELICINA, Möll. Common on the marine plants which cover the rocks above low-water mark. It is particularly abundant on the Long Island shore.

M. ACUMINATA, Sow., Migh. In 40 f., on a soft muddy bottom, off the Swallow's Tail.

ADEORBIS COSTULATA, St. Dead specimens were taken in 4 f., coarse sand, off Nantucket Island.

LITTORINA RUDIS, Gould. Everywhere above low-water mark, on rocks and sea-weeds.

L. LITTORALIS, F. et H. Found with the last, and even more common. Dark varieties only occur; the banded and finely-colored specimens, so commonly found in Massachusetts Bay, are very rare here.

LACUNA VINCTA, Turt. The variety common here is strong, broad, pale brown, with one white band just under the suture.

RISSOA EBURNEA, St. In 25 f., shelly bottom.

R. ACULEUS, St. In the littoral zone; rare.

R. MIGHELSII, St. In 25 f., off the northern point of Duck Island.

R. PELAGICA, St. Rather common in the coralline zone.

TURRITELLA COSTULATA, Migh. In deep water; rare.

T. EROSA, Couth. Dredged in 40 f., muddy bottom, in the Hake Bay.

T. ACICULA, St. Dredged in 4 f., sand, off Point Franklin, and also found alive, at low-water mark, under stones.

APORRHAIS OCCIDENTALIS, Beck. This fine species was dredged alive, for the first time, on a gravelly bottom in 35 f., to the north-east of the Island. Among the living specimens were both young and adult, the animals of which I have figured and described in my notes. They confirm the conjectures with regard to the proper genus to which it belongs, which have been founded on the shell alone; for the animal agrees in all important particulars with that of *A. pespelicani* of Europe.

SCALARIA GRÖNLANDICA, Gould. On pebbly and shelly bottoms, in from 10 to 60 fathoms.

MENESTHO ALBULA, Möll. Dredged frequently alive on sandy bottoms, in the laminarian and coralline zones.

CHEMNITZIA NIVEA, St. Frequent in 35 fathoms, in the Hake Bay.

Natica flava, Gould. Taken in 50 fathoms, mud, some miles off the Swallow's Tail.

N. heros, Say. In sheltered muddy bays, about low-water mark; rarely found. The specimens were all of the northern, short-spired type, and of a very thin structure, with well-developed epidermis.

N. triseriata, Say. At Fisher's Cove, in the littoral zone, and in 10 fathoms, off Cheney's Head.

N. Gronlandica, Beck. Inhabits very deep water in this region.

N. immaculata, Tott. Rather common on the sands of Fisher's Cove at low water, and more rarely occurring at various depths, to 25 fathoms.

N. clausa, Brod. et Sow. Taken in 25 fathoms, gravel, off the northern point of Duck Island.

Velutina haliotoides, Möll.

V. zonata, Gould. Very large specimens of this and the preceding species are taken in the laminarian zone, this inhabiting, however, deeper water than the former, which occasionally occurs at low water.

Lamellaria perspicua, Lovèn. Inhabits rocks in the coralline zone. It is rarely taken by the dredge, however, from its preferring the crevices of the ledges to their upper surfaces.

Admete viridula, St. Common on shelly bottoms, in the coralline zone.

Trichotropis borealis, Brod. et Sow. Rarely taken alive, though dead shells are not uncommon in the coralline zone.

Purpura lapillus, Lam. A large, thick, dark chocolate-colored variety is common.

Nassa trivittata, Say. This species must be exceedingly rare here, notwithstanding its abundance further south, as only one specimen was found.

Buccinum undatum, Linn. This species is exceedingly abundant here in the lower levels of the littoral zone. It is seldom found in deep water, though a beautifully sculptured specimen sometimes occurs in the coralline zone.

Tritonium Islandicum, Lovèn. Found at all depths from low-water mark to 40 fathoms.

T. pygmæum, St. Found on muddy and sandy bottoms, at various depths.

T. decemcostatum, Midd. Common at low-water mark, and at various depths to 40 fathoms.

T. clathratum, Müll. On a patch of shelly bottom, about two miles north of Duck Island, this rare species is common as dead shells, but living specimens occurred in only two instances.

Fasciolaria ligata, Migh. Several of this fine species were taken in 25 fathoms, in the Hake Bay.

Colombella rosacea, St. Living specimens are by no means rare in deep water.

C. dissimilis, St. This species occurred only once, but then in great numbers, at a haul of the dredge on a sandy spot in 8 fathoms, about two miles north-east of Cheney's Head.

Mangelia turricula, F. et H. In twenty-five f., in the Hake Bay.

M. pyramidalis, St. The specimens from this region are mostly shorter and broader than usual. Taken occasionally at low water.

M. CANCELLATA, St. Dredged alive in twenty-five f., shelly, off Duck Island.

M. DECUSSATA, St. Specimens here are very small and variable.

TECTIBRANCHIATA.

BULLA HIEMALIS, Couth. In forty f., mud, off Long Island.

B. TRITICEA, Couth. Common.

B. PERTENUIS, Migh. In ten f., sand, off Cheney's Head.

B. DEBILIS, Gould. Taken alive in six f., coarse sand, off Duck Island boat moorings.

PHILINE LINEOLATA, St. Common in the shallows among the lower islands.

Besides the species above catalogued, a few probably new species of univalves occurred, which have not yet been determined for want of opportunity of comparison with European examples of the same genera.

NUDIBRANCHIATA.

CANTHOPSIS HARVARDIENSIS, Agass., Bost. Proc., iv. 191 (no descr.). A good colored drawing of this remarkable mollusk is in Professor Agassiz's possession. It is very common in sheltered muddy bays in this region, feeding on filamentous chlorosperms about low-water mark.

EOLIS FARINACEA, Gould, MSS. This fine species approaches *E. angulata*, A. et H., Brit. Nudib., Pl. 23, but is much larger, being sometimes an inch and a half in length. Its color is also different, being made up of numerous flake-white blotches and dots on a dark fawn ground. The papillæ are short and very numerous, so closely arranged that their grouping into rows can scarce be distinguished. It is very numerous, spawning on the rocks above low-water mark in August.

EOLIS STELLATA, St., n. s. Body small, slender, elongated, pale white, pellucid; head with a flake-white patch above in front of the oral tentacles. Dorsal tentacles long, but shorter than the orals, slender, wrinkled transversely, especially in contraction. They arise very near together, and bear the prominent black eyes at their bases behind. Oral tentacles very long and slender, smooth, and gracefully curved. Papillæ or branchiæ rather few in number, long and slender, arranged in about five clusters on each side; those in the second and third clusters being longest. Foot narrow, pointed behind, and strongly auricled in front. Colors: papillæ bright crimson, tipped with a ring of opaque white; tentacles pale pink near their bases, with their anterior halves white. Length, two-fifths of an inch. This species resembles somewhat *E. rufibranchialis*, Johnst., but its foot is not so long, nor its dorsal tentacles so tapering; and its papillæ are fewer and longer. It is found under stones at low-water mark, and when disturbed rolls itself up so that its branchiæ project in all directions like the rays of a star.

E. PURPUREA, St., n. s. Body large, full, robust; tentacles rather short, thick, smooth; the dorsal ones with the eyes far behind their bases. Papillæ large, flattened, crowded, arranged in five or six clusters on each side, leaving the middle third of the body bare. Foot broad, with short auricles in front. Mouth-disk large, triangular. Colors: body pale whitish, dark in the middle line from the viscera showing through; papillæ dark purplish, with the tips covered with intense white specks. Length one inch. Found at Duck Island, under stones, at low water.

E. DIVERSA, Couth., Bost. Journ., ii. 187. The examples described by Couthouy were undoubtedly mutilated, and I have heard it suggested that the species should be exploded. At Grand Manan, however, I found specimens agreeing with his description in the tentacles, color, etc., and prefer to catalogue them for the present under this name. They occurred in 4 f. on *Laminariæ.*

E. MANANENSIS, St., n. s. Body pale white; tentacles rather thick;—the dorsal ones brownish with pale tips, looking as if hollow, wrinkled;—the oral blunt, curved, with a row of opaque-white specks along the outer edge; papillæ slender, irregular, and variable in length, arranged in clusters along the sides of the back, of a bright vermilion color, with a ring of opaque-white at the tips. Foot auricled, not very broad. Length one inch and a half. It is narrower than *E. salmonacea,* has fewer papillæ, and the dorsal tentacles are wrinkled instead of serrated. It was taken in 35 f., on a gravelly bottom in the Hake Bay.

DOTO CORONATA, Lovèn., Arch. Skand. Nat., 151. A pale brown variety, with the papillæ dotted with white, was dredged on rocks in 15 f., near Duck Island.

DENDRONOTUS ARBORESCENS, A. et H., I. pl. iii. Fine large specimens are taken at low water, and in all parts of the laminarian zone, on rocky bottoms. The most common variety is white or colorless. The ova were deposited in August.

ANCULA SULPHUREA, St., n. s. This species approaches so near to *A. cristata,* Lovèn, that perhaps the best mode of describing it will be to point out the differences. It is much larger in size, being often an inch and a quarter in length; and proportionally broader. The mouth tentacles are longer; and the processes from the dorsals arise at their bases, rather from the body than the tentacles. The laminæ also in the dorsal tentacles are more numerous. The number of branchial tentaculiform appendages varies from eight to twelve; they are of a light sulphur color. The ova are deposited in a gelatinous belt, often three inches long, attached by one edge in a serpentine manner to the rocks. It is very common under stones at low water, and in the laminarian zone.

DORIS PLANULATA, St., n. s., Fig. 14. Body broad, depressed; mantle expanded widely beyond the foot, covered above with minute tubercles, and white with a row of irregular bright yellow spots down each side just without the margin of the foot. Dorsal tentacles elongated, slender; branchiæ very small, consisting of about ten delicate pinnated plumes. Foot narrow, truncated anteriorly, and extending posteriorly to the edge of the mantle. Mouth very small, with a flat triangular lobe on each side. Length 0.6 inch; breadth 0.45 inch. It differs but slightly from *D. repanda,* A. et H.

DORIS PALLIDA, Ag., Bost. Proc., iii. 191 (no descr.). This species is remarkable for the large size of the tubercles of the cloak. It is perhaps *D. fusca,* O. Fabr., F. G. 344 (non Müll.), and resembles much *D. diaphana,* A. et H. It was taken in 25 f. gravel, off the northern point of Duck Island.

Besides the above nudibranches, a specimen of a remarkable and probably new form, was taken, but it is not here systematically characterized, as only a few rough notes of it remain, it having fallen a sacrifice to the voracious jaws of certain *Dendronoti* shortly after its discovery. Some idea of its form may be derived from Fig. 15. It approached Eolis in the characters of the head and tentacula, while its branchiæ were in the form of numerous scalloped transverse ridges, or raised membranes. It was of a dark reddish-brown color, dotted with black; except the foot, which was white.

CEPHALOPODA.

LOLIGO BARTRAMII, (?) Les., J. A. N. S., ii. 92. A species of *Loligo* is common here during some seasons, and is used by the fishermen for bait. I did not meet with it myself, but from their accounts I am inclined to refer it to the above name.

DENDROCŒLA.

For the elucidation of this part of my subject, I am indebted to my friend, Mr. Charles Girard, who has for some time devoted himself to the subject, and to whom I referred my notes and specimens.

PLANARIDÆ.

PROCERODES WHEATLANDII, Grd., Bost. Proc., iv. 251. Under stones near high-water mark.

TYPHLOLEPTA ACUTA, Grd., n. s. Body depressed, ovoid, elongated, posteriorly rounded; anterior extremity terminating in an acute point; mouth underneath, and situated at about the middle of the body. Length about a sixteenth of an inch. Ground color pale, with reddish confluent blotches above. Found in considerable numbers creeping over the surface of *Chirodota lævis*.

LEPTOPLANA ELLIPSOIDES, Grd., n. s., Fig. 16. Greatest length one inch, width about five-eighths of an inch. Color light yellowish-brown above, gray beneath. Two anterior elongated and narrow gray patches, and two posterior ones, rounded and black, situated immediately behind, and farther apart. These patches, at first, appear as if two simple pairs of visual organs; but on close examination with a magnifying-glass, they are resolved into an agglomeration of minute and black specks. This species swims by rapid undulations, somewhat as in *Aplysia*. One was observed by Mr. Stimpson thus supporting itself in the water for nearly two minutes before it took ground again. Found at low water, under stones, in four f., nullipores, and in thirty f., shelly bottom.

NEMERTIDÆ.

POSEIDON AFFINIS, Grd., n. s. Body very slender, nearly filiform, about two inches in length when extended and in activity. Color clear reddish above, white below. Two elongated clusters of eyes at the anterior extremity. Mouth underneath, situated behind the visual clusters. In the laminarian zone.

NAREDA, Grd., n. g.

Body elongated, sub-cylindrical. Head obtusely triangular in front; neck slightly contracted; one pair of rounded ocelli.

N. SUPERBA, Grd., n. s., Fig. 17. Length from one to two inches; body posteriorly attenuated; head forming an equilateral triangle; the base of which is at the contracted neck. Color above uniform soft red; head margined by a narrow band of white. The neck is also marked by a transverse band of white, on which the eyes are situated, far apart. Below white. Dredged in thirty-five f., in the Hake Bay.

TETRASTEMMA SERPENTINA, Grd., Kell. et Tied., Nordam. Monatsb., ii. 4. Under stones, in the higher levels of the littoral zone.

OMATOPLEA STIMPSONII, Grd., n. s., Fig. 18. Length usually about six inches, often ten or more. Width in extension one-eighth of an inch; in contraction often one-half inch. Body sub-compressed, rounded above, and flat below. Head pointed, separated from the body by a slightly contracted neck. Posterior extremity tapering. Eyes six or more, minute, situated in an oblique, simple row, on either side of the head anteriorly. Mouth terminal. Color brown above, with a white margin to the head; a narrow band of white, convex forward, across the middle of the head; and a sub-triangular, somewhat elongated patch of white on each side, on the posterior part of the head and neck. It is common at low-water mark under stones.

POLIA OBSCURA, St. *Nemertes obscura*, Desor., Bost. Journ., vi. 2. *Polia gracilis*, Grd., K. et T., Nord. Monatsb., ii. 4. Common in the 1st subr., littoral zone.

GEPHYREA.

SIPUNCULUS BERNHARDUS, Forbes. *Phascolosoma Bernhardus*, Pourtales, Proc. Am. Assoc. 1851. Common in the coralline zone, in shells of *Dentalium* especially.

STERNASPIS FOSSOR, St., n. s., Fig. 19. Body subglobular in contraction, narrowed anteriorly, and annulate with fifteen or more slightly elevated rings. These rings are narrow, and dotted with minute papillæ toward the posterior or plate-bearing extremity, except on the smooth ventral surface; while they are broader and better marked toward the involute anterior terminal opening or mouth. At the posterior extremity below are placed two hard, black, corneous, subquadrate plates, nearly joining each other at their anterior interior corners, but separated by the median line, which is continued for a short distance beyond them on the ventral surface of the animal. Each of these plates is indistinctly marked with lines of growth, and bears a prominent diagonal line separating it into two unequal areas, the posterior of which is the largest. From beneath the posterior and the lateral edges of the plates project strong bristles, those from the lateral edges being much the longest. The anterior extremity of the animal, when the mouth is evolved, is bipapillate; each knob having two or three concentric semicircles of strong short bristles. The general color is cinereous, and the greatest length about one inch. It lives on muddy bottoms in the coralline zone, and when in confinement is very active, boring into the mud with great celerity, in a manner resembling that of the foot of *Solen*, or perhaps that of the proboscis of *Arenicola*.

ANNULATA.

TUBICOLÆ.

SPIRORBIS SPIRILLUM, Lam. Gould, Inv. Mass., 8. On seaweeds at low water, very common.

S. NAUTILOIDES, Lam., An. sans vert., v. 359. On shells, etc.

S. VITREA, St. *Serpula vitrea*, O. Fabr., F. G., p. 382. A specimen was taken on a *Pecten* in 20 f., which agrees perfectly with the description of Fabricius.

S. PORRECTA. *Serpula porrecta*, Müll., O. Fabr., F. G., p. 378. Found chiefly on *Sertulariæ* and other corallines.

S. QUADRANGULARIS, St., n. s. Tubes large, thick, and strong, white, somewhat rugose with lines of growth; under-side flat, upper surface with two strong carinæ, one on each side; so that a transverse section of the tube is a square. Aperture rounded within and turned upwards. Diameter one-eighth of an inch. Taken in 10 f. on shells.

S. GRANULATA. *Serpula granulata*, Müll., Prodr., 2857. Common on stones, shells, and the carapaces of crabs in 20 to 50 f.

VERMILIA SERRULA, St., n. s. Tubes thick, very small; the largest having a length of one inch, a breadth of one-fortieth of an inch, and a height somewhat greater than the breadth. It is generally straight or slightly undulated, with the base somewhat expanded, the dorsal carina very prominent, sharp, and furnished with large teeth. It is frequent on the test of *Ascidia callosa,* and sometimes on *Pectens* from deep water.

PROTULA MEDIA, St., n. s. *Tubes* large, cylindrical, rather thick and strong, marked with indistinct lines of growth, irregularly and variably contorted, and adhering throughout their length. *Animal* pale yellowish; disk broad, membranous, very thin and delicate, with a scalloped margin, and extending much beyond the extremities of bristles of the seven segments it occupies. On the succeeding 40 to 50 segments there are no long bristles, while those of the last 20 + segments are very long and hair-like. Branchial plumes moderately large, of a very pale yellowish tint. The tentacula of each are about 36 in number, arranged in a spiral of one turn and a quarter, with a thin raised membrane encircling their bases within. These plumes usually drop off in specimens preserved in alcohol, and disclose two black dots corresponding to the two plume-bases which look very much like eyes. The tubes are often six inches or more in length, with a diameter at the aperture of one-fifth of an inch. It is dredged on muddy and gravelly bottoms in the coralline zone, attached almost invariably to dead valves of *Pecten Magellanicus.* It was very abundant at a spot directly under the 45th parallel of latitude, half way between the equator and the pole, from which circumstance I have derived its name, for want of a better.

SABELLA PAVONINA, Sav., Grube, Fam. der Ann., 88. *Tubularia penicillus,* O. Fabr., F. G., p. 438 (in part). This species as found here is rather short and broad, of a pale white color, with the tentacles (which are about 24 in number) white below and brownish towards their extremities. The tube is long, erect, leathery, and evenly coated with sand on the outside. It inhabits deep water.

S. ZONALIS, St. *Tubularia penicillus,* O. Fabr. (in part). Of a dark-brownish color, with about 20 tentacula, which are colored with brown and white arranged alternately in narrow zones. It is a more elongated species than the former. Found in 4 f. among nullipores; the specimens taken having their tubes thickly coated with mud.

PECTINARIA GROENLANDICA,(?) Grube. *P. Belgica,* curved var., Gould, Inv. Mass., pl. i. f. i. Very common on sandy and muddy bottoms in deep water, and at low-water mark on the sand-flats of Fisher's Cove.

LUMARA, St., n. g.

This genus is nearest allied to *Terebella,* from which it differs in the following characters. The body is elongated, and not suddenly thickened anteriorly, but tapers regularly to the posterior blunt extremity. The setæ, of both kinds, exist on all the segments of the body (42 +) instead of the anterior ones only; the aciculæ, commencing at the second segment, being very long; and the uncinate setæ, commencing at the fourth segment, being bidentate in front, with a strong, sharp projection at the dorsal apex, and having no projections corresponding to the lateral ones in *Terebella.* (See Fig. 20.) The ventral shields are oblong, nearly touching the lateral pinnæ, and extend entire to about the 17th segment; where a median depressed line commences, running on the remaining length of the body. The branchiæ are on the first two segments. The neck is provided with a ring of eye-spots, numerous and variable in size, under the labia of the tentaculiferous disk. On the 22d segment, at the right side, just above and behind the superior pinna, arise two long tube-like cirri, which in one of my specimens are filled with eggs (?). It inhabits a tube of a thin leathery structure.

I at first considered the animals above described as immature, on account of the presence of eyes at the neck; as Prof. Agassiz states such to be the case in young specimens of his *Terebella fulgida.* (See Bost. Proc., iii. 191.) But having, among many specimens, observed none larger or further developed, and considering most of the remaining characters above mentioned as important, I have been led to propose a new genus for the reception of the species.

Lumara flava, St., n. s. Of a bright-yellow color; branchiæ with 6–8 rami, and a few short processes on the sides of their rings. Length one and a half inch; breadth, 0.11 inch. Tubes thin, of a light-yellowish color, usually with pebbles attached to the outer surface. Dredged in 35 f. in the Hake Bay.

Terebella brunnea, St., n. s. This species is large, of a uniform, dark, reddish-brown color; segments about 56; aciculæ of the anterior feet rather short; the ventral shields on the first eight segments oblong, transverse, and rather narrow. Tentacula large and very numerous, brownish; branchiæ in three pairs, with 7–12 rami to each, those of the first pair being most numerous. Length about five inches; greatest breadth three-tenths of an inch. It inhabits thick-walled tubes, formed of mud and sand, which are found in great numbers on the under surfaces of large stones, near low-water mark.

The uncinate setæ in this species are very variable in shape. They are of the same type as those of *T. parvula,* Leuckart, as figured in Wiegm. Archiv, 1849, Taf. iii. f. 6, but are much more elongated and projecting above.

T. cirrata, Cuv. Leuck., l. c. This species differs from the preceding in its smaller number of rami in the branchiæ, in the rhomboidal shape of the last ventral shields, and in the bright-yellow color of the anterior ventral surface. The uncinate setæ conform generally to the same type as those of *T. brunnea,* and though they have sometimes slight denticles besides the upper frontal tooth, I have never met with any precisely like those of *T. cirrata* figured by Leuckart (l. c., fig. 5). The aciculæ are longer than those of the preceding species, and widened near their extremities, which taper to fine hair-like lashes. My specimens are about three inches in length, with nearly seventy segments. They were all found in deep water, chiefly on shelly bottoms, in 20–40 fathoms.

Clymene lumbricalis, St. (non Aud. et Edw.) *Sabella lumbricalis,* O. Fabr., F. G., p. 374. Tubes adherent to stones, shells, etc., in deep water.

MARICOLÆ.

Arenicola piscatorum, Cuv., Regne Anim., etc. Common on sandy shores above low-water mark, especially where there are scattered boulders.

Siphonostomum asperum, St., n. s. Body slender, thickest anteriorly behind the head, and covered with dark-colored granulate papillæ, which are largest and most prominent above. There are four rows of bristles extending the whole length of the body, of which the dorsal are longest. These bristles become very long on the anterior five rings, where they are directed forwards, and extend beyond the thick green tentacula, but do not form a dense brush. The segments are about sixty in number, and the animal is two inches in length. It was dredged in the Hake Bay, on a shelly bottom, in 25 fathoms.

TECTURELLA, St., n. g.

This name I propose to apply as a generic appellation to a singular worm, of which I obtained a few specimens, and which must be very closely allied, if not identical with the *Siphonostomum vaginiferum* of Rathke, described at length by R. Leuckart, in Wiegman's Archiv for 1849, i. p. 164. A full description is therefore unnecessary here. The sheath formed by the closely arranged anterior bristles, the very numerous filiform cirri, arranged in two clusters, and the character of the lateral bristles, or rather hooks, seem good generic characters. The name was suggested by the mantle-like exterior envelop, which adheres very loosely to the interior coat.

TECTURELLA FLACCIDA, St., n. s., Fig. 21. This species presents, when alive, the appearance of a loose, flabby, elongated sac, covered with sordes, with a transverse slit at one extremity, which discloses when its labia are laid back, the broad green tentacula, and the filiform cirri. It will adhere and hang loosely by its hooked bristles (see figure), which are arranged, one to each segment, along each side of the body. The number of segments is about forty. The largest specimen obtained was two inches in length and two-fifths of an inch in breadth. It was taken among nullipores and shells in 3–15 fathoms.

BRADA, St., n. g.

Body short, cylindrical, composed of few segments. Bristles very short, equal in length in all parts of the body; the upper ones lancet-shaped (Fig. 22), the lower ones minute and imperceptible without the aid of the microscope. Oral cirri few (6) in number, green, nearly equal in size with the two tentacula. This genus I have separated from *Siphonostomum*, from having found two species, agreeing with each other except in trivial characters, and both differing from that genus in the want of the anterior brush of forward-directed bristles.

BRADA GRANOSA, St., n. s. Body covered with granulate papillæ, which are smaller on one side than on the other. Length, 0.7 inches; breadth, 0.16 inches. Color, dark brown. On sandy bottoms in 4–6 fathoms.

B. SUBLÆVIS, St., n. s. Body nearly smooth, of a light reddish-brown color, from the thin coating of mud which always invests it. Length, 1 inch; breadth, .2 inch. Dredged on nullipore and muddy bottoms in the Laminarian zone.

OPHELIA GLABRA, St., n. s. Body robust, smooth and shining, tapering at both extremities, flat or even concave below. Posterior extremity with two large inferior papillæ, and eight small superior ones. Lateral cirri short and thick; about twenty pairs, on the middle and toward the posterior part of the body. At their bases are two approximated bundles of capillary setæ, which extend anteriorly as far as the mouth—where they are very minute on the broad smooth rings—and to the anus posteriorly. Color, light fawn, with iridescence. Length, 1.5 inch; breadth, 0.25 inch. Dredged on muddy bottoms in deep water.

ARICIA QUADRICUSPIS, (?) Grube. *Scoloplos quadricuspida,* Oersd., Gronl. Ann. Dors., pl. viii. f. 110. The small specimen taken was too much injured for certainty of reference.

GLYCERA CAPITATA, Oersd., Gronl. Ann. Dors., 44, pl. vii. f. 88. Of a pale flesh color. Found at low-water mark under stones on sandy shores.

G. VIRIDESCENS, St., n. s. This species is much smaller than the preceding, being only one and a half inches in length. Its color is light green. Its setæ are longer than those of *G. capitata,* but not so long as those of *G. setosa.*

PHYLLODOCE GRŒNLANDICA, Oersd., l. c., pl. ii., f. 19, 21, 22, 29–32. A large bright-green species. It is not uncommon in 25 f., shelly, back of Duck Island.

NEPHTHYS CILIATA, Müll. *N. borealis,* Oersd., Maricolæ, 32. The specimens found were mostly jet black. Dredged in 25 f. mud, near Duck Island, and in 40 f. mud, off Long Island.

N. INGENS, St., n. s. Resembles *N. cœca,* Oersd., Gronl. Ann. Dors., 41, pl. vi. 73, etc., but is somewhat more slender, and differs in the form of the head, which is rounded anteriorly, truncate behind, and has very short tentacula close together in front. The proboscis has about twenty fleshy teeth at its extremity, and the same number of longitudinal rows of short processes on its sides anteriorly. Length, 7.5 inch, breadth, 0.42 inch. One specimen only was taken, which was dredged by Mr. Wm. Bridges, in deep water.

NEREIS ABYSSICOLA, St., n. s. Smaller than *N. pelagica,* Linn., broadest in front, tapering gradually posteriorly. Color reddish, cupreous, darkest anteriorly. Pinnæ with four short subequal lobes; dorsal cirri and setæ long, especially on the posterior rings. Eyes four, conspicuous; those on each side being close to each other, while those in each pair are remote from each other. Proboscis with a denticulated basal ring, as in *N. denticulata,* herein described, except that the papillæ above have a circle of denticles instead of being covered with them. The setæ are longer than those of *N. pelagica,* the tentacular cirri smaller, and the body more tapering. The eyes of the anterior pair also are more distant from each other than the posterior ones. Length, 1.5 inch, breadth, 0.14 inch. In 40 f. mud, off Long Island.

N. IRIS, St., n. s. Small; body slender, translucent, bluish, with shades of light-copper color on the back. Neck rather long, palpi large, tentacular cirri long and slender. Differs from *N. abyssicola* in the want of the long superior cirri on the pinnæ, and is also much more slender. Length, 1.6 inch. It was found in a thin leathery tube, encased without with small pebbles. In 20 f., north of Duck Island.

N. DENTICULATA, St., n. s., Fig. 23. Body subcylindrical, tapering rather suddenly posteriorly. Color light reddish-brown, pearly above, nearly white below.

Pinnæ small; ventrals with the setæ longest and most numerous; dorsal and ventral cirri on the whole length of the animal. Head with short tapering tentacula; eyes small but conspicuous, posterior ones nearest each other. Proboscis with a ring of minute denticles almost encircling its base, but interrupted above by a smooth space, on which there are two prominent denticulated papillæ; also with four radiating ridges of denticles and an inferior denticulated patch, at its extremity. Maxillæ slender, much curved. Length, 6 inches; breadth, 0.25 inch. Found at low-water mark. Described from a Massachusetts Bay specimen, those from Grand Manan being lost. In Fig. 23, *a* represents a pinna of the twentieth ring; *b*, one of the posterior pinnæ.

N. GRANDIS, St., n. s., Fig. 24. Large, broad, thick anteriorly, and somewhat flattened posteriorly. Body dark brown, cupreous above, with the pinnæ lighter colored. Rings about 180 in number. Head small; eyes four, inconspicuous; tentacula very small, equalling in length only that of the very thick palpi; tentacular cirri tapering to slender threads, the longest equalling in length the first three segments of the body. Maxillæ broad and strong, dentated. Dorsal pinnæ with large subcordate lamellæ, which have short cirri above in the first forty segments. Length, 17 inches; breadth, 0.5 inch. At low water, under large stones. It is, perhaps, *N. grandifolia* of Leuckart (l. c. 207), but cannot be that of Rathke, who states his species to be *Heteronereis arctica* of Oersted, Gronl. A. D., pl. iv. f. 51, which is very different from our species.

In Fig. 24, *a* represents one of the anterior pinnæ; *b*, one behind the middle of the body.

ENONELLA, St., n. g.

Body elongated, much compressed, tapering posteriorly. Head small, subovate, terminating anteriorly in two short tentacles placed transversely, one on each side. Neck somewhat contracted. Pinna with a strong, short, simple dorsal cirrus, above which is a hard, arcuated knob or mamilla, concave towards the cirrus. These mamillæ in their succession form something like two keels to the body. Strong muscular fibres proceed from them, and they are probably of use to the animal in working through the sand, which it does with great celerity. Setæ falcigerous, long and numerous, in one bundle to each pinna. This genus wants the folded cirrus (branchia) of *Œnone*, and differs also in possessing tentacles and superior lateral cirri. See the figures.

ENONELLA BICARINATA, St., n. s., Fig. 25. Body very much elongated, subulate. Eyes small, scarcely perceptible from the thickness of the skin over them. Color uniform pale-greenish yellow when alive, but in preserved specimens dark-brown. Length, 1.5 inch; breadth, 0.09 inch. Found in fine sand at low-water mark, at High Duck Island.

Figure 25. *a*, head above; *b*, the same below, showing the mouth; *c*, pinnæ, etc., from above; *d*, side view of a pinna.

EUNICE OERSTEDII, St., n. s. Depressed, but narrow; head small, with the three middle tentacula, between the eyes, very long and curved; the lateral ones are shorter. Tentacular cirri small. Branchiæ commencing on the fourth segment from the neck, in the form of a slender process from the cirrus of the superior pinna, which process forks on a succeeding segment, and becomes gradually more complicated till the 13th segment. On this segment, and on those succeeding it to the 30th, the branchiæ are in the form of a beautiful comb of five slender processes, reaching nearly to the middle of the back. At the 31st, they begin to decrease in size and number of filaments, and leave only the dorsal cirrus at the 40th. Above the base of this cirrus, on each segment, there is a black pigment spot under the skin. The superior setæ of the setiferous pinna are long and slender, the inferior ones are short, and form a thick tuft. Inferior cirrus thick and short, but tapering. Color light fawn or reddish with iridescence. Length, one inch + (the specimens wanting the posterior rings); breadth, 0.1 inch. In its principal characters it resembles *E. Harassii*, Aud. et M. Edw. Dredged in 20 f., on a shelly bottom, off the northern point of Duck Island.

Eunice vivida, St., n. s., Fig. 26. A large strong species. Body broad and rather thick, rounded above, somewhat flattened below. Head with the middle tentacle longest, reaching the sixth ring of the body from the neck; the outer ones scarcely reaching the first ring. Tentacular cirri thick at base, pointed, reaching as far as the eyes. Branchiæ commencing at the first ring and ending at the 45th; increasing and decreasing in complication as in the last species. The branchial comb, where thickest, has nearly 20 closely arranged filamentary teeth. Pinnæ small, with very minute setæ; dorsal cirri tapering to a fine point; ventral cirri short, on thick globular bases. Color above cupreous. Length, 6 inches; breadth, 0.26 inch. This species I at first thought to be the adult of *E. Oerstedii*, but the proportionally smaller pinnæ and setæ seem to forbid. It is very active, and almost as uneasy as a snake, in confinement, gyrating so rapidly and in such curious circumvolutions as to threaten with destruction such unlucky invertebrates as might be caught with it.

Onuphis Eschrichtii, Oersd., Gronl. Ann. Dors., 20, pl. iii., f. 33–41, 45. Our specimens are much smaller and more compressed than those of Oersted. It is finely colored with red annulations on a bluish ground. The tube is broad, flat, and composed of large angular fragments of shells and chips of slaty stones. Taken on shelly bottoms in the coralline zone.

CRYPTONOTA, St., n. g.

Body broad, oval; segments very narrow; head minute, papilliform, placed at about the anterior fourth of the length of the animal; single median tentacle short, much narrower than the head; eyes two at the base of the tentacle. Back entirely covered by the crowded dorsal setæ, leaving only a median line of separation, which terminates anteriorly at the head, and posteriorly not far from the margin. The dorsal pinnæ are thus transverse in the middle, and longitudinal at the extremities of the body—as if radiated from the two points forming the extremities of the dorsal line. The ventral pinnæ are short and provided with strong hooked setæ. They completely surround the ventral surface of the animal. The mouth is at about the anterior sixth of the length of the animal below, and from it the anterior feet radiate, as from the head above. The branchiæ probably resemble those of *Euphrosyne*, to which genus this has, perhaps, the nearest relations. These organs, however, and some other details, could not be made out from the single specimen obtained.

Cryptonota citrina, St., n. s., Fig. 27. Of a beautiful lemon-yellow color, resembling very much that of some sponges which occurred with it. Head, flake-white; back, beneath the setæ, dark brown. Segments about thirty in number. Length, 0.45 inch; breadth, 0.25 inch. Dredged on a gravelly and somewhat muddy bottom, in thirty-five fathoms in the Hake Bay.

Euphrosyne borealis, Oersd., Gronl. Ann. Dors., 18, pl. ii. f. 23–27. This species is not uncommon in deep water, and often occurs of a size double that given by Oersted. It frequents muddy bottoms.

Pholoë tecta, St., n. s. Back entirely covered by the elytra, those of the opposite sides overlapping as well as the consecutives. Segments about thirty-six in number, on which are about twenty-two pairs of elytra, there being anteriorly one to each alternate segment, while posteriorly every ring has one. These elytra or scales are broad, sinuated broadly in front, and remotely ciliated behind. Superior pinna arched, dotted with black along the summit at the base of the row of long curved capillary setæ. Inferior pinna with a plume of few long falcigerous setæ. Head ovate, with two very large oval eyes, and terminating anteriorly in a short pointed tentacle. Tentacular cirri rather short. Color, brownish and black, variegated, darkest anteriorly. Length, 0.28 inch; breadth, 0.035 inch. Dredged in 4 f., on a bottom of coarse sand and nullipores.

Oersted gives "branchiarum squamiformium paria maximam dorsi partem nudam reliquentium" as a generic character of *Pholoë*. But as this species agrees with that genus in its remaining characters, the size of the dorsal scales would seem to be of little importance in the *Aphroditaceæ*. As another instance of this, I would mention the large *Acoëtes* (*A. lupina*, St.) of South Carolina, which has scales so small as to leave the back nearly bare, and yet agrees in all other important particulars with *A Pleei*, Aud. et M. Edw., which has remarkably large scales.

Lepidonote cirrata, Oersd. *Aphrodita cirrata*, Müll., O. Fabr., F. G., p. 308. Of a bright pink or violet color; taken about low-water mark.

L. punctata, Oersd. *Polynoe squamata*, Gould, Inv. Mass. Very common under stones at low water, and some ways above it. Sometimes also in the Laminarian zone.

L. scabra, Oersd., Gronl. Ann. Dors., 12, pl. i. f. 2, 7, 10, 12, 13, 17, 18. *Aphrodita scabra*, O. Fabr. Taken occasionally of a very large size, on gravelly bottoms in the coralline zone. One specimen occurred at low-water mark.

Aphrodita aculeata, Baster. Gould, Inv. Mass., 343. A fine large species, often four inches in length, which is taken occasionally in deep water. It is identical with the above species, at least as far as can be judged from figures. The numerous small Aphrodites which are found on muddy bottoms in the laminarian and coralline zones, are perhaps varieties of the young of this species, but require farther investigation.

CRUSTACEA.

PYCNOGONIDES.

PYCNOGONON PELAGICUM, St., n. s. The legs are much shorter and stouter than in *P. littorale*, and are also without the projections at the joints which are seen in the figures of that species. The surface is generally smooth and clean, without prominent hairs, and it is of a uniform yellowish-brown color. Its diameter, or the distance between the extremities of opposite legs, is three-fourths of an inch. It was taken in 30 f., on a gravelly bottom, off Head Harbor.

PHOXICHILIDIUM MAXILLARE, St., n. s. Body slender, with a sharp conical papilla on the back, just behind the origin of the mandibles; caudal projection short, but very stout. Jaw-feet or mandibles comparatively large and strong, scarcely extending beyond the end of the blunt proboscis, and with the finger and thumb curving so as to touch each other only towards their extremities. Ovigerous feet slender, except at the basal joint, which is very thick. They are long and slender, curving in genuflexions as in *Nymphon*, and arise from the lateral projections supporting the first pair of legs. The legs are long, smooth, without spines or hairs, and have small subcheliform hands at their extremities, the fingers of which are very sharp and slender. The color in life is blackish or sepia. Length of body, 0.13 in.; of a leg of the first pair, 0.53 in. Taken in tangled groups of a dozen or more, attached to the under sides of stones at low water.

ZETES SPINOSA, St., n. s. One specimen only of this species was taken, which occurred in the laminarian zone. It was hispid with minute hairs, especially on the legs, and so covered with marine sordes that the parts were made out only with great difficulty. The diameter of this specimen is one-half an inch. The body is short, and terminates posteriorly in a long, slender, subclavate anal tube, which projects obliquely upwards. The clavate proboscis is large, broad, and not so much constricted at the base as in the species figured in Voy. en Skandinavie, Laponie, etc. The ovigerous feet are long, pellucid, and flexible; the joints being with difficulty distinguished. Of the appendages between them and the proboscis only two pair were made out with certainty, of which those above the proboscis were very short, and those between it and the ovigerous legs almost filiform, and exceeding it a little in length. On each of the first two joints of the legs above is a short acute spine. The general color of the animal, as nearly as could be ascertained, is light brown; the proboscis being straw-colored or yellowish.

PALLENE HISPIDA, St., n. s. Body short and broad, seeming wider than it really is, and almost orbicular, from the close approximation of the basal joints of the legs. The legs are very thick at their bases, but taper gradually to slender extremities, where they are provided with elongated, subcheliform hands. The first two joints of each are provided on their outer edges with a semicircle of sharp spines, which projects over the succeeding joint in an imbricated manner. This arrangement gives the body the appearance of being surrounded by two concentric spinous ridges. The legs are also very hispid, the hairs being short, compressed, spine-like, and arranged in three or four longitudinal rows; the interspaces being smooth. The ovigerous feet equal in length about three-fourths that of the true legs, and in my specimens had two rounded masses of eggs attached to their basal joints. The proboscis is very short, and tapers nearly to a point at its extremity. The mandibles are large and strong, extending much beyond the extremity of the proboscis, and curving downwards. The finger and thumb are small, and tipped with a hard, glossy, mahogany-colored enamel. The oculiferous knob is prominent, with a black summit divided by a cross into four minute eye spots. Finally, the caudal process is small, but prominent, smooth, and glossy, and projects nearly perpendicularly upwards. The color of the body and legs, beneath the dark brown spines and hispidities, is light yellowish. The length of the body[1] is 0.14 in.; of one of the legs, 0.37 in. It was taken among *Ascidiæ callosæ*, in deep water.

Nymphon grossipes, Kroyer. This large and fine species is by no means uncommon here in the coralline zone. It is generally found creeping among the polypidoms of *Tubulariæ* and other hydroids, upon the polypes of which it probably feeds. In life, it is of a pale wine-yellow color externally, the stomach being often of a light rose tint, varying in depth so as to give the legs a distantly annulated appearance. Specimens in egg occurred during the first week in September. The figure given by Kroyer in Voy. en Skand., Lap., etc., does not apply to our specimens in every particular, but there can be no doubt of the identity of our species with the *Pycnogonum grossipes* of Otho Fabricius, Fauna Gronl., p. 229. The curious six-legged young of this animal, so different from the adult, occurred in August in considerable numbers parasitic on *Goniaster phrygiana*. These were a quarter of an inch in diameter.

EPIZOA.

Lernæa branchialis, (?) Lin. A few specimens were found fixed in the flesh of the neck, in young cod-fishes.

Caligus piscinus, Gould, Inv. Mass., 340; Latr., Hist. Nat. des Crust. (?) Found in great abundance on the surface of the Halibut.

CIRRIPEDIA.

Balanus geniculatus, Conrad, J. A. N. S., vi. 265. Gould, Inv. Mass., 14, pl. i. f. 9. This species is identical with one of those of Northern Europe, as I have

[1] The length of the body in this species and the others herein described, is taken from the base of the proboscis to the extremity of the caudal process.

ascertained by comparison of specimens; but the synonymy of this European species is unknown to me, as I have not yet seen the work on Cirripedes by Darwin, in which it is fully elaborated. It occurs abundantly on dead valves of *Pecten*, and on stones, in the coralline zone, and it varies greatly in form.

B. BALANOIDES. *Lepas balanoides*, Lin. *Balanus ovularis*, Lam., An. sans vert., v. 660. Gould, Inv. Mass., 17. pl. i. f. 7. *B. rugosus*, Mont., Gould, l. c., 16, pl. i. f. 10. Found abundantly, and generally of large size, on the rocks in the littoral zone. Several fine specimens were found attached to living examples of *Littorina littoralis*.

ENTOMOSTRACA.

CYPRIDINA EXCISA, St., n. s., Fig. 28. This fine entomostracan occurred in considerable numbers among nullipores in four or five fathoms. It is about one-tenth of an inch in length, and in shape regularly oval with a deep emargination below anteriorly. Such details as can be observed of the parts protruding from the shell when the animal is in motion are given in the figure. The color is pale yellowish, and sometimes bright pink on the back, from the large round eggs showing through.

BRANCHIOPODA.

CUMA BISPINOSA, St., n. s. This species is distinguished from all those of Northern Europe, described by Kroyer in his Tidsskrift, by the short spine-like projections on the carapax, of which there is one on each side, not far behind the large triangular rostrum. In other particulars, it differs but little from the ordinary forms. The tail terminates in a slender stylet, set on the extremity of a thicker one of equal length, from the base of which proceed the long lateral stylets with bifid extremities. The color of the body is brownish; that of the tail paler or nearly white. Length, 0.45 inch. Dredged in 35 f., gravel, in the Hake Bay.

ISOPODA.

IDOTÆA TUFTSII, St., n. s. This species resembles *I. cæca*, Say, J. A. N. S., i. 424, more than any other species, but it differs in the following particulars. It is smaller, being but four-tenths of an inch in length. The eyes are easily seen, and of an opaque-white color in life. The internal antennæ are blunt at their tips, and equal in length one-third that of the external ones. The tail is greatly elongated, and regularly sublanceolate. It is of a pale fawn color, with crowded dark brown dots or punctations. It was dredged on a sandy bottom in 10 fathoms, off Cheney's Head.

I have dedicated this species to Mr. Samuel Tufts, of Lynn, Mass., one of our most active marine zoologists, to whom I have been often indebted for new and curious forms of deep sea animals from Massachusetts Bay.

I. IRRORATA, M. Edw., Suites à Buffon, Crust. *Stenosoma irrorata*, Say, J. A. N. S., i. 423. Gould, Inv. Mass., 338. This species is found on marine plants about low-water mark. It rarely occurs here, although so common on the southwestern portions of the coast of Maine.

IDOTÆA MONTOSA, St., n. s. Body elongated ovate, abruptly narrowing at the commencement of the abdomen. The back seems divided longitudinally into three unequal lobes, of which the middle one is by far the largest. This results from the prominent, well-defined, rounded lobes into which the segments expand at each extremity of their width. The lateral incisions, separating these segments, reach, in depth, the margin of the middle lobe of the back. The abdomen in length equals six-tenths that of the thorax, and has its segments soldered together, except that slight transverse depressed lines indicate two short[1] anterior segments, which bear a large rounded knob in their middle; and one scutiform posterior segment, which also bulges up strongly in the middle; this latter protuberance being separated from the former by a deep depression. The antennæ are very small; the internal or superior ones much the longest, reaching the second thoracic segment; the external ones about half the length of the internals, and without an articulated flagellum. The feet are identical in character throughout, each terminating in a delicate, elongated, subcheliform hand, with a very slender, almost acicular finger or nail. The first pair is shortest; they then increase in length to the fifth, which is longest, and then decrease very slightly to the seventh and last pair. The opercular abdominal appendages are margined with a sharp elevated ridge, and have very minute articulated pieces at their posterior extremities, and elongated subsidiary pieces for about half their length anteriorly and interiorly. The color is dark grayish. Length, 0.4 in.; greatest breadth, at the fourth segment, 0.19 in.; length of a foot of the fifth pair, 0.2 in. Taken in deep water on sandy and muddy bottoms. The characters of the antennæ would, strictly, exclude this species from *Idotæa.* It belongs to a group of which I have three or four species from the New England coast, and which will probably be found to constitute a new genus.

JÆRA COPIOSA, St., n. s., Fig. 29. Body suboblong, narrowing slightly at each extremity, and a little convex above. Head rather large, with the small but very obvious black eyes near its posterior corners; thoracic segments not widely separated at their hairy external edges, but far apart along the middle; abdomen with three segments, of which the anterior two are very small and narrow, and the posterior one broad, with its caudal appendages very minute and close together in a niche at its posterior extremity. The thick-based internal antennæ are about one-third the length of the rather stout external ones, which reach the third segment of the body. Feet weak and slender, all of the same character, terminating in a sharp nail. Branchial lamina or operculum, considerably smaller than the abdominal cavity. Color above grayish, punctate; those with eggs are bright green below. Length, 0.2 in.; greatest breadth, at the third segment, 0.1 in. Found in great numbers on our whole New England coast north of Cape Cod, living on the under surfaces of stones in the first (upper) subregion of the littoral zone. At Grand Manan, it was most frequent in sheltered situations.

[1] By the length of a segment, is meant its extent longitudinal with the body, so that its width in Isopods is almost always much greater than its length.

ASELLODES, St., n. g.

Body loosely articulated as in *Asellus*. Abdomen uniarticulate, with two long bifid caudal styles. External pair of natatory feet having each two laminæ like the others, but broader and hardened so as to perform the office of an operculum. External antennæ longer than the body, and terminating in very long multiarticulate flagella. Internal antennæ minute, with flagella of few articulations, each of which bears a very long hair-like appendage. Legs nearly as long as the body, with the terminal article in each bearing two or more minute unguiform spines at its extremity. In the first pair, the last two articles form a large subcheliform hand.

The very long external antennæ and legs call to mind the genus *Munna* of Kroyer, in which, however, the caudal appendages are rudimentary.

A. ALTA, St., n. s., Fig. 30. Body suboblong; head with its anterior angles produced, and with a prominent sharp rostrum, which is almost erect and curves forward at its summit; internal antennæ very short and slender, with long hairs, which are numerous at the extremities; externals with an articulated scale or spine on its second segment exteriorly; outer edges of the dorsal segments produced at their anterior angles, and each having one or two deep emarginations laterally. Abdominal segment subquadrangular, a little broader anteriorly, minutely serrated on its lateral margins, and undulated at its posterior margin. Color pale whitish, with numerous black pigment spots somewhat regularly arranged above. Antennæ and feet white. Eyes large, black. Length, 0.27 in.; breadth, 0.1 in. Dredged in soft mud in 40 f., off Long Island, G. M.

ÆGA POLITA, St., n. s. Elongated, very convex, so that the sides of the back are perpendicular, and a little incurved below; head subtrapezoidal, broadest before; at its anterior corners are the rather small but prominent black eyes, which are elongate-trapezoidal in shape, narrowest anteriorly. Antennæ small but rather stout at base, placed transversely, curving backward, the superior ones being three-fifths as long as the inferior ones, which reach the middle of the first thoracic segment at its lower edge. Feet long, compressed, hairy on their edges, with their second and third articles produced at the outer angles. The epimera in the first thoracic segment are indicated by a slight depressed line only; while in the second, third, and fourth they are better separated; and in the fifth, sixth, and seventh they are articulated, elongate-triangular, and produced into acute angles posteriorly, the last pair thus reaching the fifth abdominal segment. The first five abdominal segments occupy three-sevenths the length of the abdomen; the first one being scarcely distinct from the last thoracic, the next three equal, the next a little longer than the preceding ones. The terminal segment is scutiform, narrower than the others, and with caudal styles resembling the natatory feet in character, but thicker, harder, and narrower; the inner stylet being three times as broad as the outer, and elongate-subrhomboidal in shape. The color is light opaque yellowish, with patches of black punctæ on the front of the head, on the posterior two-thirds of all the dorsal segments except the terminal one, which is almost entirely covered with them, on the middle of the caudal styles, and on the exterior or first pair of natatory feet. There are also a few black dots on the legs. The length of the largest specimen is 0.62 inch. The proportions of the other parts to the length are as follows: breadth, .24; length of longest (5th) thoracic segment, .11; of the abdomen, .34; of the terminal abdominal plate, .20; of the longest leg (of 6th segment), .41. Found on the fine sands at low-water mark on High Duck Island. A species from Charleston, S. C., Harbor (*Æ. concharum*, St., n. s.), resembles this very closely, but the superior antennæ are shorter, the eyes larger and triangular, the last epimer reaching only the third abdominal segment, the inner lamina of the caudal styles thinner and broader, and the legs proportionately broader. The color is nearly the same. The length is 0.9 inch; of which the proportions corresponding to those above are, .23, .15, .29, .16, and .33.

ANISOPODA.

PRANIZA CERINA, St., n. s., Fig. 31. This curious little Isopod resembles *P. cærulata*, of the coast of Great Britain, in its proportions, but is very distinct from that species in its details. The two reduced neck segments are very small and narrow, but nevertheless distinct; and the rings are not difficult to make out, even on the ventricose middle portion of the body. The rudimentary legs of the first two thoracic segments reach forward nearly to the extremities of the mandibles. They are pressed against, and seem to constitute a portion of the mouth parts, and one pair is provided with strong hooked nails. The remaining five pairs of well-developed feet are long, but almost filiform, and somewhat hairy; the last pair but one being shortest. The superior antennæ are shorter than the inferior ones, of which a flagellum of about seven articulations constitutes nearly one-half the length. The eyes are prominent, bulging out from the sides of the head. The natatory feet are of large size, with very long plumes of hairs; the fifth pair being much smaller than the rest. Caudal styles hairy on their edges, the inner one of each pair broadest and with pointed extremity, extending considerably beyond the end of the triangular caudal segment. Its color a pale yellowish or waxen. Length of body, 0.22 inch; of which the proportions of the other parts are: length of head and first four segments, .27; of the abdomen, .32; of the longest leg (that of 5th thoracic segment), .32; width of body at the third segment, .11; at the sixth, .37; at the abdomen, .07. Many specimens were dredged on gravelly and coralline bottoms in 20–30 fathoms in the Hake Bay.

With the above, and in about equal numbers, was taken another form, which, with some doubt, I am at present inclined to consider the female of the same species. In color and details it differed from *P. cerina* but slightly, but the proportions were very different; as the very ventricose middle portion of the body, which in every case was filled with eggs, constituted nearly the whole of the animal; the head and abdomen being very short, and projecting but little beyond it.

ANCEUS AMERICANUS, St., n. s. Body very regularly rectangular, abruptly narrowed at the commencement of the abdomen, which has the appearance of another very small rectangle set into the first, and of only one-third its width. It is of a dark brownish color above; the back with transverse ridges at the articulations, very rugose and covered with marine sordes. Below, white. Last thoracic segment deeply emarginate behind for the reception of the abdomen. Maxillæ very strong, crossing each other toward their extremities, and curving upward beyond the anterior margin of the head. Eyes minute. Antennæ two on each side, close together, one above the other, at the corners of the head; the inferior ones being a little the longest. Legs slender, with hard curved nails at their extremities. Abdominal segments well defined, the anterior one narrowest, and the terminal one becoming very narrow and tapering after the juncture of the caudal appendages, which are highly developed, subequal, and extending considerably beyond the extremity of the caudal segment. Length, 0.2 in.; breadth of thorax, 0.08 in.; length of abdomen, 0.085 in. Dredged on a sandy bottom in ten fathoms, off Cheney's Head. It is very sluggish in its motions, which are ambulatory only. It is more elongated than *A. maxillaris* of Europe, the head and jaws not so large, and the caudal appendages much larger.

Anthura brachiata, St., n. s. Body very slender, subcylindrical, tapering at the head, broadest at the fifth thoracic segment, and greatly constricted at the articulations of the second thoracic segment, which is narrower than any of the others. The first three thoracic segments are sharply convex below; the next three concave along the middle, with a deep indentation on the back of each anteriorly; the last one very short, equalling in length a little more than one-third that of the penultimate one. The antennæ are very minute, about equal in length, and all arising close together at the anterior extremity of the head. The first three pairs of legs are placed anteriorly on their respective segments; the last four on the middle. Those of the first pair are a little shorter than the others, but very thick throughout their length, the large ovate hand being set by the middle of its lower side on the third and fourth articles, which are only rudimentary, while the first and second are greatly developed. The finger or nail of this hand is very small. The legs of the second and third pairs are shorter and not so slender as those of the fourth, fifth, sixth, and seventh, but all terminate in small subcheliform hands. The segments of the abdomen are with difficulty distinguished above. The caudal appendages (last pair of abdominal feet), are much expanded, especially the exterior laminæ, which curve over above so as to inclose the terminal segment in a kind of trumpet-shaped cavity. The outer laminæ of the first or exterior pair of natatory feet are hardened, and serve as opercula to the others, while the inner laminæ of this pair are minute, and articulated at about half the length of the outer ones on their inner surfaces. The color is a uniform light brown when the animal is clean, but it is usually covered with a reddish-brown muddy slime, owing to its sluggish habits. Its length is 0.69 inch, of which the proportions of the other parts are: length of the abdomen, .13; of the longest leg, .20; of the antennæ, .10; and the greatest breadth, .125. It was dredged on a shelly and somewhat muddy bottom, in twenty fathoms, off the northern point of Duck Island.

Tanais filum, St., n. s. Very minute, slender, rounded on the back, white, looking very much like a short piece of thread. Head small, and rather narrowed in front; first thoracic segment of great length; the second half as long as the third, which is about equal in length with the fourth, fifth, and sixth; the seventh being a little shorter than the sixth. The segments of the abdomen are well defined, the first five equalling each other in length, and the terminal one longer than the fifth, but narrower, and rounded behind. Antennæ short and thick, without flagellæ, with blunt tips crowned with few hairs, as are also their articulations. The inner ones are directed forward, and much the stoutest, especially toward their bases; while the outer ones are more slender and curve outward and backward. First pair of legs exceedingly thickened, with very large ovate hands and strong curved fingers. They are generally closely applied against the breast. The remaining thoracic feet are very slender, terminating in sharp slender fingers, which in the second pair are very long and nearly straight, and in the other pairs short. The legs of the posterior pair are a little the longest and thickest. The ambulatory feet in five pairs are of great length and resemble those of Amphipods. The caudal stylets are in length about four-fifths that of the abdomen, and consist of four or five articles, with few hairs, each article becoming narrower, the last one with a tuft of few hairs at its extremity. Length, .15 inch; breadth, .02. Dredged among *Ascidiæ callosæ,* in 20 fathoms, in the Hake Bay.

AMPHIPODA.

CAPRELLA LOBATA, Kroyer. *Squilla lobata,* Müll., O. Fabr., F. G., p. 248. This species is more slender than any of the others, of a bright crimson color, and an inch or more in length. The first two segments are especially elongated, the second bearing the arms nearly at its posterior extremity; and the inferior antennæ are scarce half the length of the superior ones. It is found, not commonly, however, among nullipores, in 4–6 fathoms.

C. SANGUINEA, Gould, Inv. Mass., 336. A very common species in the higher levels of the laminarian zone. It may be distinguished from the others by its very slender antennæ and proportionally large hands. Color bright crimson. Length three-fourths of an inch.

C. LONGIMANUS, St., n. s. Body with a few spines along the back of each segment. Superior antennæ rather stout and twice as long as the inferior ones, which are very slender. Hands very long and rather broad, with two or three teeth along the inner edge; the arms to which they belong are placed on the thickened posterior part of the second segment. Color light-yellowish brown. Eyes red. Length about three-fourths of an inch.

C. ROBUSTA, St., n. s. This is a very large, thick, and robust species, of an olivaceous or often a light brown color. There are numerous short spines on the back, very variable in size and number in different specimens. The antennæ are not large, the upper ones being about half the length of the body, and the lower ones nearly as long and very hairy. Arms placed at about the middle of the second segment, with the hands having strong teeth on the lower edge, and short thick nails. Length (excluding antennæ), 1.25 inch; breadth, 0.1 inch. Dredged on a rocky bottom, in 12 fathoms, back of Duck Island ledge.

ÆGINA SPINOSISSIMA, St., n. s. Body slender, much thickened at the origins of the appendages, covered everywhere on the back and sides with sharp broad-based spines, some of which are very long. These sometimes show a tendency to arrangement in transverse rows. There is one very strong spine just above each branchial lamina. The head is large, with prominent eyes; the inferior antennæ very much more slender than the superior ones, and the mouth parts well developed, the tri-articulate palpi of the mandibles being small but obvious. The arms are placed at the thickening near the anterior extremity of the second segment, and have two spines on the first article in each, also two spines on the hand, one at its extremity and the other on the inner edge, just reached by the long curved finger when closed. The posterior thoracic legs are highly developed with their subcheliform hands provided with a spine in the middle. Abdomen very short, with a pair of posterior appendages which nearly equal it in length. The ground color is either purplish or brownish, upon which are numerous spots and patches of sulphur-white irregularly distributed. Length of the body (excluding antennæ), one inch; of which the proportions of the other parts are: greatest breadth, .09; length of superior antennæ, .8; of inferior antennæ, .3; of the third and fourth segments conjointly, .34; of the arms to tip of finger, .47; of one of the last pair of legs, .33; of the abdomen, .035. This beautiful species was dredged in great numbers adhering to *Gemellaria dumosa* in ten fathoms, off Cheney's Head.

UNCIOLA IRRORATA, Say, Journ. Acad. Nat. Sci., Philad., i. 389. This large and finely-colored species is found here in considerable numbers, as well as on our whole New England coast. It inhabits invariably sandy bottoms, usually in the laminarian zone, but is occasionally found at low-water mark. The color of my specimens is bright red or vermilion, mottled with flake white.

PODOCERUS NITIDUS, St., n. s. Small, slender, subcompressed, smooth and shining above, and of a pale wine-yellow color. Head rather elongated, eyes oval, black, placed obliquely at the bases of the superior antennæ, a little below. Antennæ slender, the superior ones most so, very hairy, about equal in length; the superior ones having the longest flagellum. Thoracic legs of the first pair elongated, with numerous long hairs on their edges, with the hand smaller and narrower than the antepenultimate article, and a strong finger equalling the hand in length. Those of the second pair large, with a short spine on the second article in front; hand large, oval, with a small curved finger of about half its length. The legs of the third and fourth pairs are very small; those of the sixth and seventh long, and with their terminal unguiform articles strong and sharp. Caudal styles of the first pair much the longest, reaching to the extremities of those of the second; those of the third pair small, biramous, with blunt tips. Length,[1] 0.3 in.; of which the proportions of the other parts are: greatest breadth, .25; height at the middle of the fourth thoracic segment, .25; length of the superior antennæ, .6; of a leg of the second pair, .37; of a leg of the longest (seventh) pair, .5. This species was dredged in thirty fathoms on a shelly bottom in the Hake Bay.

[1] The length of an Amphipod, as herein given, is taken from the bases of the antennæ to the extremities of the posterior caudal stylets.

LEPTOTHOE, St., n. g.

Body linear, segments well separated, epimera very small; superior antennæ longest, with a long accessory flagellum; inferior ones subpediform; legs of the first two pairs with subcheliform hands, those of the second pair being largest, with uniarticulate fingers. Caudal stylets of the last pair very long, with equal lanceolate rami on short peduncles. This genus differs from *Podocerus*, Leach, in possessing accessory flagella to the superior antennæ; and from *Cratophium*, Dana, in its long nonuncinate terminal stylets, and in having the superior antennæ longest.

Leptothoe Danæ, St., n. s., Fig. 32. Body somewhat compressed, but rounded above, glabrous, and of a uniform bright flesh color; head three times as long as the first thoracic segment, but not as broad, and bearing the small subreniform eyes. Superior antennæ with long terminal flagellum, and an accessory one of nearly one-third its length, set on the very short penultimate article; inferior antennæ with the penultimate article as long as the terminal one; both pairs very hairy Legs of the first two pairs compressed, those of the first pair very small, but similar in character to those of the second, which have very large hands obliquely truncate at their extremities for the reception of the short finger when closed. The remaining thoracic legs are slender, those of the posterior pairs having elongated basal articles. Natatory feet much elongated. The first three abdominal segments together nearly equal in length that of the last four thoracic segments conjointly, and the last of the three is considerably expanded below and produced backwards. The caudal stylets of the first pair project beyond those of the second, and those of the third pair are very long, their peduncles constituting only about one-fifth of their length. The tail terminates in a short, lamellar, bifid process. The thoracic segments in this species are each marked with an indistinct vertical line down the middle on each side. Length, 0.9 inch; of which the proportions of the other parts are: greatest breadth, .1; height at the middle of the fourth thoracic segment, .12; at the seventh, .13; length of the superior antennæ, .42; of the inferior antennæ, .25; of a leg of the second pair, .28; of a leg of the longest (seventh) pair, .37; of the caudal stylets of the first pair, .19; of the terminal stylets, .2. This species inhabits the laminarian zone, and seems to prefer for its residence patches of sandy bottom, on which there are numerous weedy rocks. I have frequently taken what appeared to be the young, in the coralline zone. It is more sluggish in its motions than is usual with Amphipods.

Cerapus rubricornis, St., n. s., Fig. 33. *Male* much broader than high, tapering at both extremities, the head being about half the width of the second thoracic segment; the black eyes at the anterior corners of the head, on the oblique or almost horizontal line connecting the bases of the upper and lower antennæ. The second thoracic segment is the point of the greatest breadth, from its bulging out to accommodate the very large second pair of legs. Epimera very small, but increasing in size from the first to the fifth thoracic segment, in which latter they are comparatively large, while those of the sixth and seventh are scarcely perceptible.

Antennæ strongly subpediform, curving downwards and very hairy; the inferior ones, which arise beneath the head and behind the eyes, being a little the longer. Legs of the first pair small, with a small subcheliform hand; those of the second pair long, with the basal article curved, and the hand of great size, bearing a long spine or thumb below, and a large bi-articulate finger, the penultimate article of which is very thick, and seems rather part of the hand. The whole hand, when closed, is of an elongated oval or suboblong form. The legs of the third and fourth pairs are small, but with broad, flat, basal articles; those of the fifth pair shortest of all; those of the sixth and seventh slender, with sharp nails at their extremities. Caudal stylets of the first two pairs with long peduncles; those of the first pair projecting a little beyond the others; those of the last pair very short, simple, and subuncinate at their extremities. Color on the back dark mottled gray; epimera blackish; terminal articles of the four antennæ bright red; hands yellowish. *Female* generally larger than the male; superior antennæ as long as the inferior ones; legs of the second pair not large, with a small, short, and broad hand, which has a short uniarticulate finger, and a thumb consisting of a sharp projection from the base of the antepenultimate article. In other words, the penultimate article is here expanded into a hand, instead of the antepenultimate as in the male, which latter article, however, bears the thumb in both. The colors are the same as in the male, except that the under side of the thorax is bright yellow, from the contained eggs. The dimensions of a large female are as follows: length, 0.5 inch; of which the proportions of other parts are: greatest breadth, at the 4th segment, .21; height at 4th segment, .1; length of superior antennæ, .42; the 1st pair of caudal stylets, .15; of a leg of 2d pair, .35; of a leg of the longest (7th) pair, .36. The largest male was 0.41 inch in length, the proportion of the breadth at 4th segment being .2; of the length of the second pair of legs, .61. The figures represent views of the posterior caudal stylets. This species was dredged abundantly on stems of *Bolteniæ* in 20 f., rocks, off Moose Inlet, towards the Seal Islands. It afterwards occurred sparingly in 10 f., off Cheney's Head, and in 25 f., off Duck Island. Specimens occurred on the tenth of August, with eggs, which were hatched on the twenty-fifth of the same month.

The *Cerapus rubricornis* inhabits flexible tubes, of sizes corresponding to that of the individuals, composed of fine mud and some animal cement by which it is agglutinated. These tubes are generally adherent for about one-half their length, and closed below. They are usually found in large groups, attached to submarine objects, and to each other. The animals are very active, protruding and retracting the anterior portion of their bodies, while their antennæ are in continual motion, lashing about in search of some object which might serve for food. It is very amusing to watch a colony of these animals, with their comical gestures in their disputes with each other, and their awkward celerity in regaining their respective tubes after having left them on temporary excursions. I have in no instance met with an individual transporting a free tube, as is said by Mr. Say to be the case with his *C. tubularis.* (Journ. Acad. Nat. Sci., i. 51; Pl. iv., f. 7–11.) There can be no doubt that the tube is fabricated by the animal, and this is not without precedent in the *Crustacea,* for I have often met with examples of *Pagurus,* which had enlarged their borrowed shells by additions to its aperture. From what I have seen in such species of *Corophidæ* as have fallen under my observation, I am inclined to think that most of the members of that family form more or less permanent tubes under certain circumstances. The *Unciola*, when kept in captivity, will frequently retire to some corner and collect the sand around it by some glutinous substance, so as to form a cavity, in which it will often remain for some time; but it may easily be made to leave it, and will make another if it be destroyed. On the other hand, some of the other individuals in the same jar will make no tubes; and often at low water it may be seen swimming about perfectly free. The same is true of some of the other species of the family here mentioned, and of many species whose habits I had opportunities of observing in the Harbor of Charleston, S. C., in the winter of 1851–2.

It will be seen from this and the succeeding descriptions, that the female of *Cerapus* has uniarticulate fingers on the second pair of legs, and Kroyer mentions an instance of a male *Podocerus* having bi-articulate fingers. It might be concluded from this that the genera should be united. But there are *Podoceri* in which both males and females have uniarticulate fingers; to these the genus should perhaps be restricted, while Kroyer's species will come under *Cerapus*. Dana gives, in a diagnosis of *Cerapus*, "Styli caudales 3tii biramei, ramis subæquis, longiusculis" (Amer. Journ. Sci., 2d ser., xiv. 309). In the *Cerapi* herein described, however, the posterior pair of these caudal appendages consists of two thick simple stylets, at the extremities of which are articulated one or two short spines, curved upward.

Cerapus fucicola, St., n. s., Fig. 34. *Male*, slender, smooth above, with the breadth and height about equal. Epimera, small but conspicuous, proportionally larger than in *C. rubricornis.* Inferior antennæ stout, strongly subpediform, with their terminal articles constituting about one-fourth their length. Superior antennæ of about two-thirds the length of the inferior ones. First pair of legs very small, subchelate. Second pair with long curved basal articles; the fourth or antepenultimate short; the penultimate elongated, very thick, curved, thickly hirsute along the inner edge with short pinnate hairs, and with a stout curved finger of less than half its length. Third and fourth pairs with long narrow basal articles; last three pairs with broad ones. Caudal stylets of the last pair short, the peduncle constituting nearly their whole length, with two very short curved processes at the extremity of each. *Female*, differing from the male in having its superior antennæ of nearly the same length with the inferior ones, and in its small, slender, simply subchelate feet of the second pair, which have no pinnate hairs. The color varies from light olive or greenish, to bright crimson. Eyes usually white. The articles of the antennæ are sometimes alternately red and white. Length of a large male, 0.36 inch. Proportions: breadth, .22; length of inferior antennæ, .61; of a leg of the 2d pair, .59; of a leg of the 6th pair, .46. The figure represents the caudal stylets. It inhabits slender tubes, which are found in considerable numbers on large algæ in the laminarian zone. In this species, the hand is formed of the penultimate article of the second pair of legs, the preceding article being very short; so that it cannot strictly remain in the genus. But it is so closely allied in general appearance, habit, and details to the preceding species, that it cannot with propriety be separated.

CERAPUS FASCIATUS, St., n. s., Fig. 35. *Female*, elongated, head narrow, thorax very broad in the middle, where the height equals scarcely one-third of the breadth; abdomen very slender throughout its length, being about one-half the width of the thorax. Antennæ very slender, with long flagella, the inferior arising much behind, and somewhat longer than the superior ones, which are greatly thickened at their bases. Legs of the first two pairs with small subcheliform hands, those of the second pair largest. The remaining thoracic legs are slender, the third and fourth pairs with oval basal articles, and the last pair longer than the others. Natatory feet of great length. Caudal stylets very long and slender, those of the first pair projecting beyond the others, those of the last pair short and rather thick, each terminating in two short curved processes. Ground color wine-yellow, with narrow transverse bands of dark-reddish brown, one to each segment, on the back. The small epimera of the last three thoracic segments are also dark brown. Eyes rather large, rounded, black. Length, 0.32 inch; proportions of other parts: greatest breadth, .23; length of superior antennæ, .5; of the last pair of legs, .44; of the abdomen, .43; of the first pair of caudal stylets, .19. The figure represents the caudal stylets, seen from above. It was dredged in thirty-five fathoms, on a gravelly bottom, in the Hake Bay. The degree of elongation and flexibility of the terminal articles of the antennæ seems a character of insufficient importance to separate this species from *Cerapus*.

ORCHESTIA GRYLLUS, Gould, Inv. Mass., 334. *Talitrus gryllus*, Bosc, Hist. Nat. des Crust., ii. 104 (?). Say, Journ. Acad. Nat. Sci., i. 386. This species is found plentifully among the half-dried *Fuci*, which line some of the shores just above high-water mark in large quantities. It is of a dark-yellowish color, very glossy, with three dark olive longitudinal bands along the back. It is very active, leaping to considerable distances. I have never found it immersed, although some moisture is, of course, necessary to its existence. The species found in similar positions in Massachusetts Bay is undoubtedly the same, but there are doubts whether it is identical with that described by Bosc, from the salt marshes of South Carolina.

ALLORCHESTES LITTORALIS, St., n. s., Fig. 36. Small, robust, rounded above, smooth and shining; eyes very large, black, rounded, not far removed from each other; superior antennæ about two-thirds as long as the inferior ones, which are rather stout, and equal in length about one-fourth that of the body; second pair of legs with short, but stout hands, much larger than those of the first pair; posterior legs long, with each article projecting a little at the insertion of the succeeding one. Caudal stylets short, but very thick, spinous; those of the first pair much the longest; the simple ones of the posterior pair very short but thick at base. Tail terminating in an arched lamella. Color varying from bright green, through the various shades of olive, to brown. Length, 0.3 inch. Taken abundantly on stones in the second subregion of the littoral zone, especially where the *Fucus nodosus* and *F. vesiculosus* flourish. It occurs on our whole coast from Massachusetts Bay to Grand Manan.

LYSIANASSA SPINIFERA, St., n. s. Body smooth and shining, slightly compressed, but rounded above, broadest anteriorly, tumid at the head, and much compressed at the abdomen, which constitutes nearly one-half the length of the body. Epimera not very large. Head rounded, with a prominent down-curving rostrum, and rather large red eyes. Superior antennæ two-thirds as long as the inferior ones, thick at their bases, but tapering suddenly after the juncture of the long accessory flagellum, which is nearly one-half the length of the principal one. Inferior antennæ with very thick basal articles, and equalling in length two-thirds that of the body, their flagella constituting more than one-half their length. Legs hairy, all terminating in short hooked fingers; those of the first two pairs slender, longer than the rest, with the antepenultimate article in each a little expanded, but scarce sufficiently to form a hand. Posterior legs much shorter than usual, and provided along their edges with short spine-like hairs. First three segments of the abdomen serrated above on their posterior edges; last three compressed above into sharp spine-like projections, of which the middle one is the longest. Caudal stylets of the first pair very long and slender, projecting beyond the sharp extremities of the second pair, which are short, while those of the third pair are long, with long lanceolate rami projecting beyond the others. The tail terminates in two long spines. Color wine-yellow; inferior antennæ annulate with reddish. Length, 0.32 inch. Dredged in forty fathoms on a soft muddy bottom off Long Island, G. M.

ANONYX NOBILIS, St., n. s. This species most resembles *A. appendiculosus*, Kroyer, Grönlands Amfipoder, Tab. i. f. 2, from which it differs in the following particulars. The black eyes are oblong or oval, and sometimes nearly round, instead of clavate. The basal joints of the superior antennæ are cylindrical rather than conical. The epimerals are much larger, especially those of the fifth segment; and there are no deep serrations on the edges of the femora in the last two pairs of legs. The rami of the last pair of caudal stylets are much larger. Color white. Antennæ light fawn. Length three-fourths of an inch. It was taken in considerable numbers on the sandy flats of Fisher's Cove, Nantucket Island, etc., at low-water mark.

The curious appendicula on the segments of the flagella of the antennæ appear like little flasks attached by their constricted necks. The legs of the second pair terminate in small, compressed, circular articles, provided with hairs, but without any indication of a finger or nail.

A. POLITUS, St., n. s. Elongated, broad and rounded above, but with less height than is usual in *Anonyx;* head small, tumid, with the eyes subrectangular, but broadest below, and of a bright red color. Superior antennæ very short and thick, regularly tapering to a point, with a short accessory flagellum, and in length one-fourth that of the inferior ones, which equal in length about one-half that of the body, and have very long and slender flagella. Legs of the first pair with small but well-formed subcheliform hands; those of the second pair very long, but usually bent up beneath the epimera, and terminating in a small, flat, rounded, hirsute article, without a nail. Abdomen with a deep sinus between the segments bearing the natatory feet, and those bearing the caudal stylets; all of which latter appendages terminate in long, smooth, pointed rami. The tail terminates in two pointed spines, about two thirds the length of the last pair of caudal stylets. Color light-yellow. Length, 0.4 inch. Dredged in forty fathoms, on a soft muddy bottom off Long Island, G. M.

A. PALLIDUS, St., n. s. Body short, slightly compressed, rounded above, with a sinus at the abdomen as in *A. politus.* Head with large, black, subclavate eyes, broadest below, as in *A. appendiculosus*, Kr. Antennæ hairy, very short, the superior ones very thick and tapering, equalling the inferior ones in length, that is, reaching the second thoracic segment. Legs slender, very hairy, in structure like those of the above species. Caudal stylets of the first two pairs long and pointed, slightly serrated above, those of the last pair short, thick, and spinous. Color pale-whitish, the brownish viscera showing through along the middle. Length, 0.35. Taken in four fathoms, in sand, off Duck Island moorings; in ten fathoms off Cheney's Head; and in twenty fathoms, mud and shells, off the northern point of Duck Island.

A. EXIGUUS, St., n. s. Minute, compressed, but rounded on the back; last three thoracic segments nearly equalling the first four in extent. Epimera of the first four pairs equalling in height that of the segments which bear them. Abdomen with its third segment tumid posteriorly, and curving downwards to the fourth, thus forming a sinus, which appears deeper from a blunt projection on the middle of the fifth segment. Head small, with the eyes bright red or vermilion in color Superior antennæ short and thick, about half the length of the very slender inferior ones, which reach the fourth thoracic segment. Legs slender, in structure nearly the same as in the above species. The posterior five pairs terminate in long slender fingers. Basal joints of the posterior three pairs very broadly expanded, and deeply serrated along their posterior edges. Caudal stylets as in *A. politus*. Color yellowish. Length, 0.2 inch. Dredged on sandy bottoms in 8–15 fathoms, east of the Passage, and off Cheney's Head.

STENOTHOE CLYPEATA, St., n. s. Body compressed; epimera very large, especially those of the fourth pair, which constitute great shields extending for a length equal to that of three thoracic segments. Superior antennæ short, curved, with long flagella; inferior antennæ long and slender, with very short flagella. External maxillipeds very long, reaching up to the bases of the antennæ. First pair of legs slender, with small hands; those of the second pair with very large hands, each of which has two strong teeth on the lower edge, the basal one longest, and a stout, curved finger. Legs of the fifth pair wanting the expansions of the basal joints. Caudal stylets of the first two pairs biramous, subulate; those of the third pair simple, terminating in a thick sharp spine. Tail terminating in a minute elongated scale. Natatory feet terminating in long slender lashes. Color, bright yellow; in the young, pale bluish. Eyes conspicuous, red. Length, 0.5 inch. Dredged in thirty fathoms, on a shelly bottom in the Hake Bay.

LEUCOTHOE GRANDIMANUS, St., n. s., Fig. 37. Large, robust, thick; epimera very small; head depressed below the first thoracic segment, subquadrate, with a slight rostrum in front, between the superior antennæ. Eyes large, on the sides of the head. Mandibles with minute, triarticulate palpi. Maxillipeds slender, freely projecting. Superior antennæ with very thick and elongated basal articles, and short flagella; inferior ones arising some distance below, and much more slender, but about as long as the superior ones, which are in length about one-fourth that of the body. In the first pair of legs the third joint is very minute, the antepenult subquadrate, compressed, and with its inferior apex produced into a slender process, or thumb, of equal length with the penult joint, which is very much elongated, slender, and bears a slightly curved finger, or terminal unguiform joint, which overlaps the thumb for nearly half its length. In the second pair of legs, the antepenult joint projects into a curved thumb of about half the length of the penult article, which forms a thick ovate hand of great size, equalling in length more than that of the first three thoracic segments together. Its finger is strong, and curved. The remaining legs are rather long, but very slender, with short terminal joints. Caudal stylets long, slender, nearly smooth, and pointed. Color, in life, pale yellowish. Length, 0.44 inch; height at the fourth segment, 0.14 inch; breadth, 0.12 inch. Dredged in thirty fathoms, on a shelly bottom off Low Duck Island.

ACANTHONOTUS SERRATUS, St. *Oniscus serratus*, O. Fabr., Fauna Grönl., No. 237. *Amphithoe serra*, Kroyer, Grönlands Amfipoder, t. 2, f. 8. This species is very beautiful in coloration, which consists of deep pink annulations, one to each segment of the body, on a yellowish-white ground. The anterior half of each ring is thus pink, and the posterior half white. The last pair of epimerals is also conspicuously colored. The anterior halves of the antennæ are also red. This species occurred in thirty-five fathoms on a gravelly bottom, north-east of Nantucket Island.

AMPHITHONOTUS[1] CATAPHRACTUS, St., n. s. Body robust, carapax very stout, with seven carinæ extending for greater or less distances on the back and sides, viz.: one strong median dorsal carina commencing on the first thoracic segment, becoming strongly dentate on the last thoracic segments, and ceasing on the second abdominal; the next two carinæ (proceeding outwards) are developed in the form of strong teeth on the last two thoracic, and all the abdominal segments, being spine-like on the second, and almost lamelliform on the last four abdominals; the next carinæ are sharp ridges, extending along the bases of the epimera, and slightly continued on the first two abdominal segments; and the last, or outer carinæ, are very short, extending only along the bases of the last three pairs of legs. Epimera large, angular. Head with very large, rounded, convex eyes, and a rostrum of great size, which is elongate-triangular, pointed, curving downwards, concave above, and with a sharp median ridge below. Antennæ slender, about equal in length, and one-fourth the length of the body. Legs of the first two pairs with large ovate hands, dentate below, with curved fingers of about two-thirds their length; antepenult joints with slight thumbs. The remaining legs are slender; femora of posterior pairs but slightly expanded. Caudal stylets all biramous; external rami of the last two pairs shorter than the inner ones. Tail terminating in a subquadrate lamella. Color very variable, generally dark reddish or brown, variegated and mottled with white. Some specimens were of a uniform deep purple, others pure white. Eyes yellowish or vermilion colored, with a black dot in the middle. Length, half an inch. This is one of the most curious, and by far the finest species

[1] *Amphithonotus*, Costa, in Catalogo Crustacei Italiani, per Fr. Gugl. Hope, Napoli, 1851. "Illis ex *Amphithois* sp. constitutum est hoc genus, quæ dorsum vel omnino carinatum et spinosum, vel saltem quibusdam abdominis articulis si non et thoracis postice in spinam vel dentem productis habent; ex quo peculiarem habitum præbent, *Amph. marionis*, Edw., *A. panopla*, Kroyer, *A. carinatus*, ejusd. et quæ sequntur ad hunc genus pertinent." This genus is synonymous with *Acanthosoma*, Owen; which name, however, is preoccupied in insects. It may include those species of *Amphithoe* which have dorsal carinæ, and small epimera of the fifth pair.

taken. It occurred only once, but then in considerable numbers, in ten fathoms, on a sandy bottom, inside of Duck Island ledge. It resembles *Acanthosoma hystrix*, Owen, which, however, has no rostrum. Certain northern *Acanthonoti* also approach it in external appearance; but the characters of the legs of the first two pairs separate it from that genus. In its very hard carapax and large strong epimera, it possesses great security; and, when disturbed, it rolls itself up and remains quiescent, as if feigning death, as is the manner of some spiders. Most other Amphipods will, on the contrary, endeavor to escape when molested. When in motion, this animal preserves an erect posture, like the Isopods, with its tail bent up underneath. It seldom swims, but makes powerful leaps by means of its well-developed caudal stylets.

AMPHITHOE[1] VIRESCENS, St., n. s. Slender, of a softer structure than is usual, smooth and rounded above. Epimera small, rounded below. Head of moderate size, with very small red eyes.[2] Antennæ about equal in length, more than half as long as the body; the superior ones with flagella constituting nearly two-thirds of their length; the inferior ones thick-based, and slightly subpediform. Mandibles large, with their curved apices long and projecting. Legs covered with long simple hairs; the first two pairs with hands of moderate size, equal; posterior three pairs with strong, hooked, terminal articles. Caudal stylets of the first two pairs spinous above; those of the last pair with short, thick rami, the outer ones having two hooks at their extremities above, the inner ones simply hairy. Natatory feet of great length. Color, pale-greenish, with minute black punctæ distantly and regularly arranged, most numerous on the epimera. Length, 0.45 inch; height at the fourth segment, 0.1 inch; breadth, 0.08 inch. Dredged in four fathoms, on a nullipore bottom, off Duck Island boat-moorings.

A. MACULATA, St., n. s. Body rather broad, smooth and well rounded above; epimera of moderate size, those of the fifth pair largest; antennæ rather stout, subequal; inferior ones subpediform, with very short terminal articles; hands of the second pair of legs larger than those of the first pair; posterior five pairs with small, sharp, curved nails; fifth pair very short; caudal stylets short and thick. Color greenish or grayish, with very numerous minute punctations, and a white spot on each of the segments along the middle of the back. Length, 0.65 inch; breadth, 0.14 inch; height at the fourth segment, 0.15 inch; length of antennæ, 0.22 inch; of the second pair of legs, 0.2 inch; of the head and first five segments together, 0.34 inch; of the abdomen, 0.28 inch. Taken on rocky bottoms in the laminarian zone, and occasionally at low water. It differs from the last species in being more robust and of a much harder structure; also totally in coloration.

IPHIMEDIA VULGARIS, St., n. s. Smooth, subcompressed, abdomen with segments slightly projecting at the articulations, but not dentated; head large, with very large reniform eyes, which are colorless in preserved specimens. Antennæ sub-

[1] The genus is here taken as restricted by Dana; to those species which have large epimera of the fifth pair, and uncinate external rami to the posterior caudal stylets.

[2] The color of the eyes is quite characteristic of the species in the *Amphipoda*. It is, however, only to be observed in living individuals; as the eyes invariably become either black or colorless after death.

equal, with very long, slender, filiform flagella, and in length about equalling that of the body; the superior ones thick-based, and a little the largest. Mandibles with sharp curved apices, and large palpi consisting of three articles, the basal one of which is very short, the second broad, and the terminal one very slender. Maxillipeds slender, pointed, with large internal lamellæ. Hands very small, those of the first pair largest. Posterior five pairs very slender, terminating in curved fingers. Natatory feet well developed. Caudal stylets of the first two pairs almost acicular, with small spines above; those of the third pair with broad lancet-shaped rami. Tail terminating in two lamelliform spines. Color variable, generally dark-mottled purplish. Length, 0.4 inch, generally much smaller. It differs from *Amph. inermis,* Kr., Grönl. Amfip., t. iii. f. 11, in its larger eyes and epimera, and much longer caudal stylets. This species may always be found in the greatest abundance in the little pools left by the tide among the rocks near low-water mark. They are very active, swimming about in all directions, and seldom resting long in one place.

MONOCULODES, St., n. g.

Body tumid anteriorly; head rostrate, with the eyes so close together as to appear one. Superior antennæ without accessory flagellum; inferior ones subpediform. Legs of the first two pairs with large subcheliform hands, formed of the last two articles of each; the antepenult joints having their inferior apices produced into slender thumbs. Legs of the posterior five pairs unguiculate, those of the last pair being exceedingly long. Caudal stylets all biramous; the rami being equal. Maxillipeds large, elongated, with unguiform terminal articles, and internal lamellæ of about one-half their length. Mandibles palpigerous.

This genus resembles *Eusirus* in the structure of the hands, and *Œdicerus* in its long posterior feet.

M. DEMISSUS, St., n. s. Body smooth and shining, broad and thick anteriorly, and slender posteriorly; the abdomen constituting more than three-sevenths of the total length. Epimera of the first five pairs of considerable size; the rest very small. Head tumid, terminating anteriorly in a large, subtriangular rostrum, curving downward; at the base of which above are the large vermilion-colored eyes, which are so near together as to appear one, even when viewed from above. Antennæ thick-based and about equal in length, reaching the fourth thoracic segment; the superior ones with a much longer flagellum than the subpediform inferior ones. Legs of the first two pairs with large oval hands, strong fingers, and thumbs formed from prolongations from the antepenult joints, which are largest in the second pair. The remaining legs are simply unguiculate, the fifth and sixth pairs being very short, and the seventh of great length. Caudal stylets nearly smooth, of considerable length, tapering to fine points; the first pair reaching the extremities of the third. Color wine yellow. Length, 0.35 inch. Dredged in four fathoms, on a coarse sand and nullipore bottom, off Duck Island boat-moorings.

GAMMARUS SABINII, Leach, Sabine's Appendix, t. i. f. 8–11; Kroyer, Grönland's

Amfipoder, t. i. f. 3; Tidsskr., ii. 257. The specimens obtained differ from the figures and descriptions of the above species, in possessing the same appendicula to the flagella which are seen in *Anonyx appendiculosus* and *nobilis.* This is perhaps a sexual character; if so, the specimens figured by Kroyer, in his Grönland's Amfipoder, are females. The hands, also, are there represented smaller than is the case with our specimens.

G. MACROPTHALMUS, St., n. s. Very closely allied to the preceding species in color and general appearance. The back, however, is carinated only at the abdomen, which readily distinguishes it. The appendicular branches of the superior antennæ are minute, and scarcely perceptible. Eyes very large, subreniform, near each other. Epimera small. Caudal stylets of the first pair as long as those of the second; both with their outer rami shorter and narrower than the inner ones; last pair with broad, lancet-shaped rami, shorter than in *G. Sabinii.* Color sometimes bright crimson, but usually mottled red and flake-white; very variable. Length, 0.5 inch; of the inferior antennæ, which are longest, 0.2. Dredged on rocky bottoms in the laminarian zone, and occasionally taken at low-water mark.

G. PULEX. *Cancer pulex,* Lin. *Oniscus pulex,* Mull.; O. Fabr., F. G., 254. *Gammarus locusta,* Mont., Lin., Trans., ix., pl. iv. f. 1; Kroyer, Grönl. Amf., 27; Tidsskr. ii. 258; Gould. Inv. Mass., 334. This species is very abundant under stones in all parts of the littoral zone. It is usually of a dark-green color, but often lighter, never, however, variegated. The length of some specimens is more than an inch. Notwithstanding its abundance on the shores, only one specimen occurred below low-water mark, which probably got there accidentally; showing that the littoral zone is its proper habitat.

G. PURPURATUS, St., n. s. Large, compressed, but rounded on the back, with slight spinous prominences on the posterior abdominal segments, as in *G. pulex.* Eyes small, black, oval. Superior antennæ slender, two-thirds as long as the body, with very slender accessory flagella; inferior ones five-sevenths as long as the superiors. Hands of the second pair much the largest; femora of the posterior pairs of legs very large, and suboblong. Caudal stylets of the posterior pair with the internal rami minute, and the external ones long, thick, and sword-shaped, equalling in length one-fifth that of the body. The color never varies, being a uniform dark purple in all the specimens which have come under my notice. Length one and one-tenth inch. Taken on a sandy bottom, in twelve fathoms, off Cheney's Head. It also occurs in deep water in Massachusetts Bay. Except in color, this species has almost precisely the external appearance of *G. pulex;* but the remarkable character of the posterior pair of caudal stylets at once distinguishes it. They are also entirely different in station.

PTILOCHEIRUS, St., n. g.

Body broad, as in the *Corophidæ;* epimera large and strong, much higher than broad. Mandibles with greatly elongated palpi; maxillipeds with their internal lamellæ of half their own length. Superior antennæ appendiculate, inferior ones subpediform. Legs of the first pair subchelate, very thick and strong throughout their length, in the male; those of the second pair plumose, without hands, but minutely unguiculate; those of the third and fourth pairs small, slender, and tapering, with the last three articles forming a kind of hooked finger, but with no dilated hand; posterior three pairs strongly unguiculate; those of the last pair much the longest. Caudal stylets all biramous, those of the first two pairs with a strong spine projecting from the inferior apex of the peduncle, along with the rami.

This genus resembles in most characters *Leptochirus*, Zaddach, and may perhaps prove the same; that name, however, is preoccupied in insects. It has relations with the *Pontoporinæ* in its plumose hairs, and somewhat in the structure of the legs of the third and fourth pairs; while it also approaches those genera of the *Gammarinæ* which recall the *Corophidæ*.

P. PINGUIS, St., n. s. *Male*, robust, very broad anteriorly, narrowing posteriorly; head large, equalling in length that of the first thoracic segment, and bearing the reniform black eyes at the anterior angles, between the bases of the superior and those of the inferior antennæ. First thoracic segment equalling in length that of the second and third together; third abdominal segment also very large, nearly equalling the first and second together. Epimera very strong; the first large, subrhomboidal; the second much the largest, projecting downward, and furrowed along the middle; the fifth very small. Superior antennæ in length about half that of the body, terminating in long filiform flagella, with a minute appendicular branch; inferior ones as long as the superior, and strongly subpediform. Legs of the first pair very thick throughout their length, with a very short, subquadrate hand, and curved finger. Those of the second pair elongated, covered with long plumose hairs, and terminating in an exceedingly minute, slender, unguiform article. Legs of the posterior pairs with well-expanded femora. Caudal stylets very spiny above, those of the last pair short. *Female*, with the superior antennæ longer than the inferior ones; the head equalling in length that of the first two segments, which equal each other, together. Epimera of the first pair very small, subtriangular; those of the second pair without groove, and not projecting beyond the others, though still the largest. This results from the smaller size of the legs of the first pair, which are much more slender, and those of the second pair proportionally more elongated, than in the male.

The color is dark grayish, on all the segments, epimera, and femora, except at their margins. Antennæ and legs white. The dimensions of a large male are: Length, 0.64 inch; breadth, 0.18 in.; height at the third thoracic segment (epimera included), 0.2 in.; length of a leg of the first pair, 0.21 in.; one of the seventh pair, 0.37 in.; distance between the centres of the eyes, 0.06. This species is abundant on the whole coast of New England, as well as at Grand Manan. It is most abundant on sandy bottoms in the laminarian zone; although sometimes occurring at low-water mark, as at Fisher's Cove; or in the coralline zone, as in twenty-five fathoms, off Duck Island.

PSEUDOPTHALMUS, St., n. g.

Body greatly compressed, with large epimera. Head with an irregular deposition of blackish or reddish pigment anteriorly, in which are one or two orbicular clear spots on each side, without facets. Maxillipeds with five articles, of which the terminal one is oval; internal lamellæ with combs of spines at their apices. Mandibles palpigerous. Antennæ very slender, the superior ones with their basal articles much thickened, and without accessory flagella; inferior ones arising much behind the bases of the superior ones. Legs of the first and second pairs sometimes with small subcheliform hands, shorter than the antepenult segment, but often simply unguiculate; those of the third and fourth pairs elongated, tapering, with their second joints very small, the third expanded into a hand; posterior pairs short; last pair with very broad basal joints. Caudal stylets all biramous. Tail terminating in a thin lamella. Epimera and third and fourth pairs of legs with plumose setæ along their edges.

P. PELAGICUS, St., n. s. Compressed, very smooth and shining; head with dark-red pigment, with two clear spots on each side, one above the other, at the bases of the superior antennæ. Inferior antennæ very slender, as long as the body; superior ones two-fifths as long as the inferior ones. Legs slender, posterior ones with few stout spine-like hairs. Caudal stylets of the first and third pairs projecting beyond those of the second. Abdomen sinuated above on the last three segments. Color pale wine-yellow. Length, 0.4 inch. Taken on a soft muddy bottom in 35–50 fathoms, off Long Island, G. M., and in 30 f., sand, in the Hake Bay.

Another species (*P. limicola*, St., n. s.) is taken at low water in Charleston Harbor, S. C., living in holes in the soft mud, which is larger than the preceding, and has but one clear eye-spot on each side of the head. The first two pairs of legs are simply unguiculate, and in the third and fourth pairs the third joint forms a slender hand, and the last three joints a finger, of which the terminal unguiform article is exceedingly long and slender. The last pair of caudal stylets terminate in very broad, flat, lanceolate rami. This notice of a southern species is added to illustrate the genus.

PHOXUS FUSIFORMIS, St., n. s. Body tapering at both extremities. Head small, with white eyes. Rostrum subtriangular, scarce distinct from the head, broadly projecting over the bases of the antennæ, which are short, in structure like those of *Anonyx*, except that the bases of the inferior ones are broad, compressed, and very hairy on their edges. The superior and inferior ones are about equal in length, and would reach the second thoracic segment. The accessory flagella of the superior ones are nearly as long as their terminal articles. Legs of the first two pairs subequal, with broad, oval, subcheliform hands, which have a slight offset on the lower edge, just reached by the finger when closed. Third and fourth pairs with the antepenult article but slightly expanded, and three or more unguiform spines set on the extremity of the terminal article. Sixth pair with long, straight, spine-like terminal articles. Antennæ, epimera, and legs all hirsute with plumose setæ. Caudal stylets all biramous; those of the third pair with the internal rami much shorter and more slender than the outer ones. Tail terminating in two short lamellæ, in length one-half that of the last caudal stylets. Color white. Length, 0.2 inch. Dredged on coarse sandy bottoms, in the laminarian and coralline zones. It has more nails on the third and fourth legs than *P. plumosus*, Kr.

P. Kroyeri, St., n. s. Larger, and thicker than the preceding, glabrous above, and of a pale-red color, with the eyes white. The antennæ, legs, and epimera are all very hairy, but the hairs are simple instead of plumose. Superior antennæ shorter and more slender than the inferior ones. Mandibles with palpi almost as long as the superior antennæ. Legs of the first pair with more elongated hands than in the preceding species; those of the sixth pair not so long in proportion. Third and fourth pairs with simple terminal nails. Tail terminating in two sharp spines. Length, 0.3 inch. Taken at low-water mark, on a sandy shore, at High Duck Island. It resembles most *P. Holbollii*, Kr.

STOMAPODA.

Mysis oculata, (?) Kr. A species of Mysis is very abundant in the waters at the mouth of the Bay of Fundy, swimming near the surface in swarms, and generally far from land. They form almost the only food of the herring, whose stomachs may always be found distended with this kind of food. It is particularly numerous in what are called the "Ripplings," which take place on the flood-tide at a line of shoals several miles east of Grand Manan; which form the chief fishing-ground of the herring-catchers.

DECAPODA.

Pandalus levigatus, St., n. s. This large species differs from *P. borealis*, Kroyer, in the want of dorsal spines on the third and fourth abdominal rings, and in having only eleven superior spines or serrations on the rostrum, which are situated only on the posterior two-thirds of its length. Its color is usually a very pale yellow, with narrow blue lines on the back. Dredged on rocky bottoms in the laminarian zone.

Hippolyte aculeata, Gould, Inv. Mass., 332. Very common in the laminarian zone. It is beautifully mottled with bright red, with some white or bluish spots.

Crangon vulgaris, Fabr., M. Edw., Gould, Inv. Mass., 331. Taken, not commonly, at low water, in sheltered, sandy coves.

C. boreas, Phipps. This fine species was dredged in four fathoms, on a nullipore bottom, near the Passage, and in twenty fathoms, shelly, off Duck Island ledge.

Homarus Americanus, M. Edw., Hist. Nat. des Crust., ii. 334. The lobster is said by the inhabitants to occur in great numbers in May, at Grand Harbor, living in holes in the sand just below low-water mark. They are easily taken with boat-hooks.

BERNHARDUS STREBLONYX, Dana. *Pagurus Bernhardus,* Fabr., M. Edw., Gould, Inv. Mass., 329. Not so common here as the succeeding species. I have had opportunities of comparing this with European specimens, and find them precisely the same.

B. PUBESCENS, St. *Pagurus pubescens,* Kroyer, Tidsskrift, ii. 251. Taken in considerable numbers, but not abundantly, in the laminarian zone, especially on nullipore bottoms. It inhabits chiefly shells of *Buccinum undatum.* It is easily distinguished from *B. streblonyx,* by its hairy, carinated hands.

HYAS COARCTATA, Leach; M. Edw., Hist. Nat. des Crust., i. 312. Not uncommon in the laminarian zone.

CANCER IRRORATUS, Say; Gould, Inv. Mass., 322. *Platycarcinus irroratus,* M. Edw., De Kay. Found, very rarely, however, in cavities among the rocks at low water.

FINIS.

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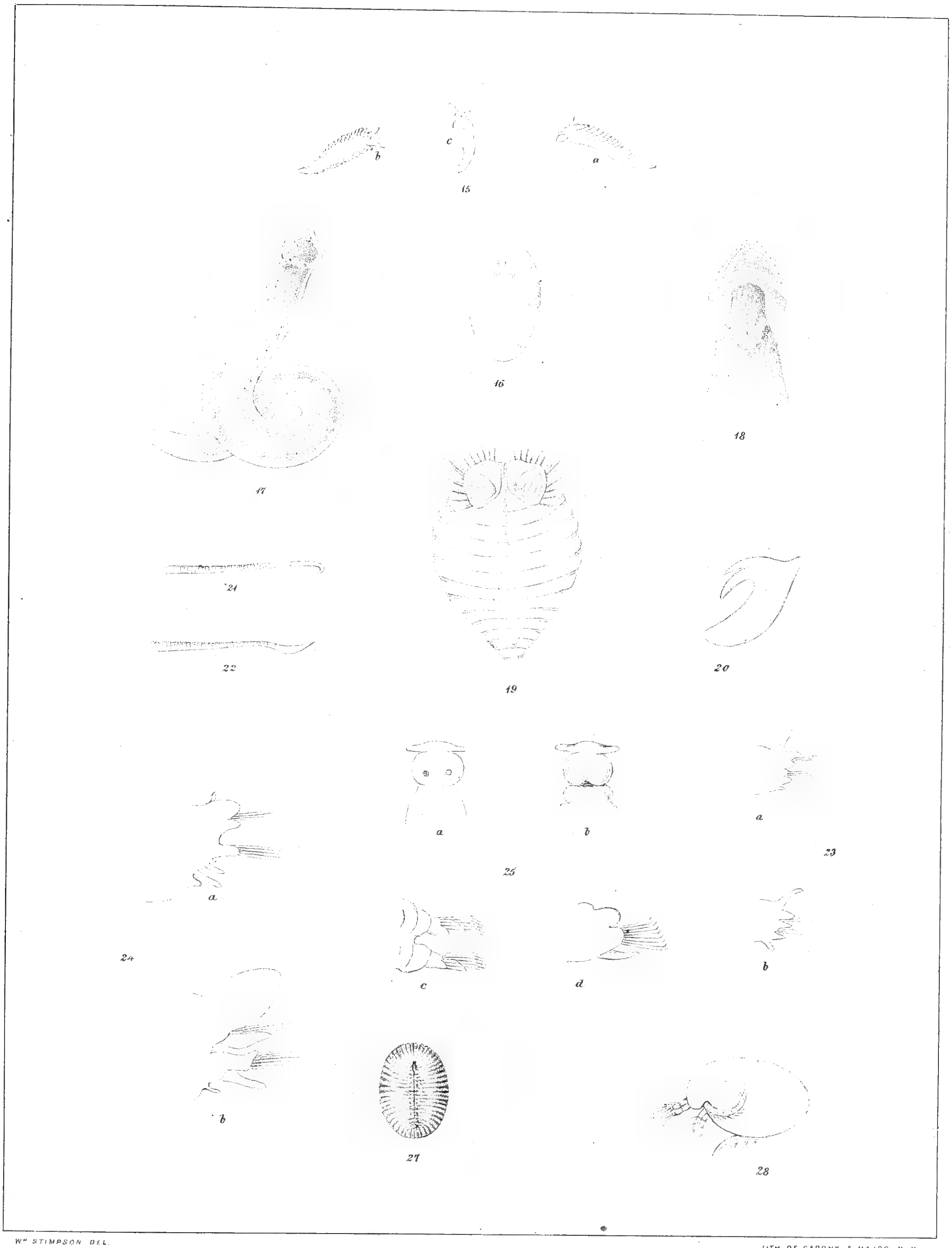
MARCH, 1853.

Plate 1.

WM STIMPSON DEL.

LITH. OF SARONY & MAJOR N. Y.

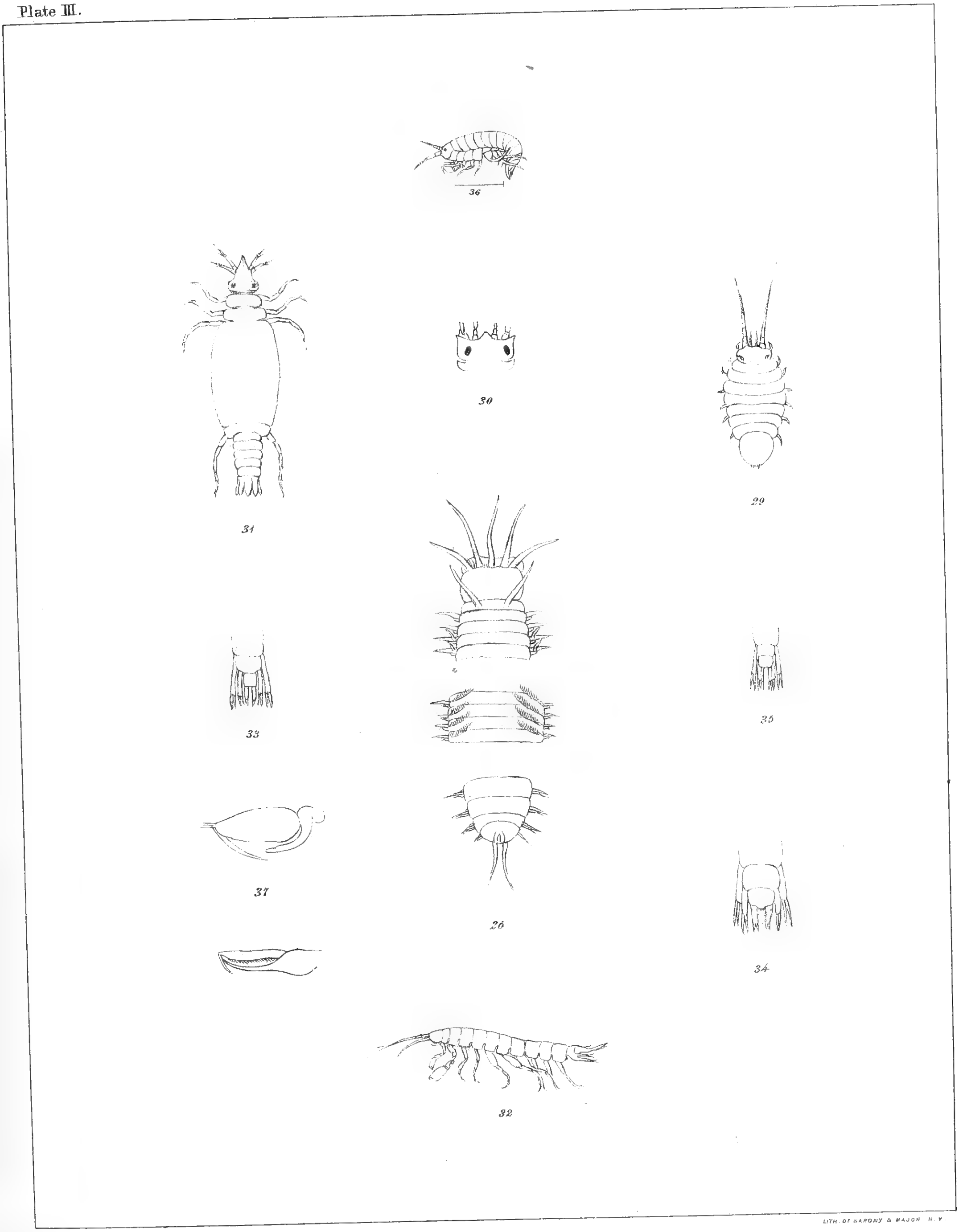
Plate II.



W^m STIMPSON DEL.

LITH. OF SARONY & MAJOR N.Y.

Plate III.



Wm SIMPSON DEL

LITH. OF SARONY & MAJOR N. Y.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

WINDS

OF THE

NORTHERN HEMISPHERE.

BY

JAMES H. COFFIN, A. M.,

PROFESSOR OF MATHEMATICS AND NATURAL PHILOSOPHY IN
LAFAYETTE COLLEGE, EASTON, PENNSYLVANIA.

Accepted for Publication, November, 1850.
Revised, November, 1852.

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

Prof. W. B. Rogers.
Prof. E. Loomis.

Joseph Henry,
Secretary S. I.

CONTENTS.

INTRODUCTION.

This memoir is an expansion of a report on the winds of North America and the North Atlantic Ocean, prepared in obedience to a request of the American Association for the Advancement of Science, and read at its meeting in Philadelphia in 1848. Although the northern portion of the eastern continent did not properly fall within the limits of the report, yet it was thought that it would be more complete if it could be made to include the entire northern hemisphere; and this has been done partly through the aid of American missionaries and others residing abroad, who kindly sent manuscript records of their observations, and partly through meteorological registers published in different European journals, &c. In this way, I have been enabled to obtain a large amount of material from Europe, Asia, Northern and Western Africa, and several islands in the Atlantic and Pacific Oceans. With a view to obtain more full data at sea, I made arrangements, through the aid of a friend in New York, to procure from shipowners in that city the loan of a number of log-books kept during voyages in the Atlantic and elsewhere. From these, and other sources, I had collected records of observations at sea for periods amounting in the aggregate to between six and seven years, when, learning that Lieut. Maury, of the National Observatory, was successfully prosecuting the same work under far greater advantages, I relinquished that field, and confined myself to observations on land.

An interval of several years which has elapsed since the memoir was first presented to the Smithsonian Institution, while it may have rendered some parts less valuable, has enabled me to improve others by the addition of new matter derived from the Smithsonian operations, and those of the National Observatory. Among the materials obtained from the latter may be mentioned, a collection of observations at sea, amounting in the aggregate to a period of more than one hundred and twenty years. I may also mention, as an important addition, the discovery of systems of deflecting forces on both sides of the Atlantic.

My acknowledgments are due to the following gentlemen for the aid they have rendered me in obtaining the data necessary for the investigation, either by contributing their own observations, or affording facilities for procuring those of others:—

Duncan Finlayson, Resident Agent of Hudson's Bay Company, British Amer.
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Dr. Azariah Smith, Erzeroom, Asia Min.
Rev. P. O. Powers, Broosa, Asia Minor.
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Joseph Reed, Tehran, Persia.
George A. Stevens, Tabreez, Persia.
Solon Albee, Langdon, N. H.

I have also made free use of the published papers of Prof. Dové, and others, whenever I could obtain them.

La Fayette College, August, 1849.

WINDS

OF THE

NORTHERN HEMISPHERE.

THE design of this memoir is to answer, as far as practicable, the following questions, viz:—

1. What is the *mean direction* in which the lower strata of the air move over different portions of the Northern Hemisphere; including in the term *lower* strata all that part of the atmosphere on which direct observations can be made, whether by the motion of the clouds, or by means of a vane?

2. What is the *rate of progress* in this mean direction, as compared with the total distance travelled by the wind?

3. What *modifications* does this mean direction, and rate of progress, undergo in *the different months of the year?*

4. What is the direction and amount of the *deflecting forces* that cause these modifications?

5. What is the average *relative velocity* of winds from the several points of compass?

6. How will the introduction or omission of this latter element affect the answers to the preceding questions?

The data which I use for elucidating the questions here proposed, consist of series of observations on winds taken at nearly 600 different stations on land, and during numerous voyages at sea, extending from the equator nearly to the parallel of 83° of latitude (the most northerly point ever reached by man), and embracing an aggregate period of over 2,800 years. Were these stations distributed uniformly over the entire Northern Hemisphere, we should have about one in every 418 miles square, which would afford us tolerably fair data for the investigation. But, unfortunately, this is not the case, as may be seen by inspecting Plate I., which shows by dots their position. In the United States, and in several of the countries of Europe, the materials are abundant, and, through the operations of the National Observatory, under the direction of Lieut. Maury, we have very satisfactory means for studying the winds of the North Atlantic, from the equator to the parallel of 55° of latitude. Over the remaining four-fifths of the Northern Hemisphere, the data are more deficient, though not entirely wanting. It was apprehended that they must be very meagre in the high northern latitudes, dependent as we are for them entirely upon the reports of the different arctic expeditions, and considering the difficulty of taking meteorological observations through the entire year in those frozen and inhospitable regions. Yet they were found to be more satisfactory than was anticipated; and I have been able to embody in this memoir the results of 38½ years' observations, taken at twenty different stations north of lat. 60°, nine of which are within the Polar Circle. Indeed, so far as information is to be obtained from regular and published series of observations, Plate I. shows that we are better informed in regard to the winds about the north pole than on the Pacific Ocean; although the latter is constantly traversed by ships, and the former never, unless for the purpose of scientific research.[1]

There is a considerable gap in the interior of British America, which would have been still greater, but for the politeness of several of the officers of the Hudson's Bay Company, who kindly contributed collections of observations taken at their respective stations.

In Asia, the stations are few in number, compared with the vast extent of territory; and yet they are as numerous, perhaps, as could reasonably be expected. In the southwestern part, there are twelve places from which I have obtained observations, chiefly through the kindness of American missionaries residing there. Kupffer's voluminous collections,[2] published by the Russian government, also afforded me a number in Siberia and the Ural Mountains. Throughout the wide area of the Chinese empire, embracing the whole of Central and Southeastern Asia, we have records only from Pekin,[3] nor is there, so far as I know, a prospect of obtaining others. Some observations that I was encouraged to expect from the southern part of China Proper, have not yet come to hand. In Southern Asia, the

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[1] I am happy to learn that the National Observatory, under the direction of Lieut. Maury—to whose labors we are so much indebted for the publication of the Charts of the Winds of the North Atlantic—has prepared, and will shortly publish, similar charts of the North Pacific. When this is done, and when returns shall have been received of the observations taken under the direction of the Smithsonian Institution, in Oregon, California, and New Mexico, we shall be more fully prepared for the study of the winds of the Northern Hemisphere.

[2] I exceedingly regret my inability to avail myself, to the extent I desired, of the fund of information contained in these important volumes. The original hourly or bi-hourly records of the directions of the wind are published in full, and without abstracts or condensation, so that the labor of reducing them is very great; and as I had no access to the volumes, except by resorting to distant libraries for the purpose, want of time compelled me to content myself with imperfect abstracts of one or two years only at each station, counting in some cases only every fourth observation. The reduction of the entire series, by some one more favorably situated, would be a valuable service toward developing the meteorology of those comparatively unknown regions.

[3] Two separate series of observations were obtained from this station; one taken by the French missionaries, if I mistake not, in the last century, and the other quite recently, under the direction of the Russian Government.

only stations from which I have been able to obtain observations, are the few marked on Plate I. in Hindoostan, though other collections, taken at Aden, in Arabia, at Singapore, and at several other stations in Hindoostan, are known to exist.

Our information in regard to the winds of Africa, is confined to a few stations on the northern and western borders, embracing in the aggregate a period of only eleven months. I am aware of no series of observations ever taken in the interior, except for three months only by the Niger expedition, and that still remains unpublished, I believe, in the possession of the Royal Society of London. The series taken by Mr. Aimé, at Algiers, and by Mr. Lambert, at Cairo, must be valuable, but I have not been able to obtain them.

There is reason to believe that most of the observations which form the basis of this memoir, were taken with such accuracy that reliance may be safely placed on the results, though there is, doubtless, considerable difference among them in this respect. At nearly every station, the direction of the wind was recorded for at least eight points of compass; at many, for sixteen points or more, together with estimates of the force; and at several,[1] either the direction, or force, or both, were accurately measured and recorded by means of self-registering anemometers.

The method of applying these data to determine the mean direction of the wind consists, as has already been remarked, not simply in finding from what point of compass it has blown most frequently, and rejecting all the rest, but in resolving the traverse of all the different courses. A ship at sea, having sailed on different tacks, would find itself sadly out of its reckoning, if it were to take into account merely the tack upon which it had sailed most frequently, or for the longest time. The same would be the case if a balloon were set afloat in the air, and we wished to know its *course* and *distance* after a given time, which is what is intended by the terms *mean direction* and *rate of progress*, or *percentage of resultant*, as used in this memoir. May not the imperfect manner in which the subject has generally been studied, account for the belief so commonly entertained, that the winds in the temperate zones are subject to no fixed laws; the prevailing direction being so dependent upon the local features of the surrounding country, as often to furnish next to no indication of the direction in which the air as a whole moves? In any well-defined valley of considerable extent, it is a familiar fact that the winds incline to take the direction of the valley, marked examples of which the reader may see in the stations on Hudson River, in the State of New York, as exhibited in Plate III. Half the winds, or more, follow the course of the river, either up or down, and yet the mean direction of the whole is nearly at right angles to it.

The questions already enumerated will serve as a general index to the plan of the work. It consists mainly of tabular statements, the different series being designated by the capital letters, A, B, C, &c.

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[1] Toronto, Ogdensburg, and Girard College, on this continent; probably the three stations in Boothia Felix; and Greenwich, Devonport, and Sturbington, in England.

Series A, contains a list of the stations, or places of observation, with their latitudes and longitudes from Greenwich, and the names of the observers as far as known.[1]

Series B, contains abstracts of the observations on the direction of the wind at the different stations. With a view to greater condensation, months of the same name in different years are often united, so as to make but a single table of monthly abstracts, even though the observations extend through a number of years. The wind-roses, in the Plate of this series, exhibit to the eye the relative predominance of the different winds, the width of the shading at the different points of compass being proportional to the time during which the winds prevailed from those points.

Series C, shows the mean direction and rate of progress of the wind at the different stations, computed in the manner already described, from the data contained in series B. Besides the general results for the whole time, there is given also, at a few places, the separate results for each year. I undertook, at first, to do the same for all the stations, but the labor was so great that it became questionable whether the results would be worth the cost, and the idea was relinquished. Accompanying the tabular statements is a series of maps, on which the mean direction and rate of progress of the wind at the different stations is exhibited to the eye by means of straight arrows. The length of the arrow, exclusive of the point, shows the ratio of the progressive motion of the wind to the whole distance travelled, the unit being one inch. That is to say, if the wind were to blow uniformly in one direction, it would be represented by an arrow one inch long; if the progressive motion were fifty miles, for every hundred miles travelled, the length of the arrow would be half an inch, and so on.

Series D, shows the deflections of the wind from its mean annual course in the different months of the year, together with the direction and amount of the forces which produce these deflections. For a more full description of the process employed, the reader is referred to the Introduction to this series. The tabular statements are illustrated by two series of plates, one showing the monthly direction of the wind, and the other the deflecting forces. The former are shown by means of curves, divided into 12 parts, each part showing the mean path of the wind for one month, and, consequently, the whole the annual curve. The latter are represented by means of arrows, twelve for each station, corresponding to the months of the year. The direction and length of the arrow for any given month shows the direction and amount of the deflecting force in that month, the scale being the same as in the plates following Series C.

Series E, shows the average relative force, or velocity, or both, of winds from the several points of compass, and is accompanied by wind-roses exhibiting the same facts to the eye, the width of the shading at each point of compass being proportional to the average velocity of the wind at that point.

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[1] When this investigation was first undertaken, the author had no idea of ever publishing the results, and proper care was not taken to preserve the name of the person by whom, or under whose direction, the observations were taken, so that in many cases, particularly on the Eastern Continent, I am not able now to give appropriate credit.

Series F is deduced from Series E, and shows the effect of combining the element of *force* with that of *time*, in computing the mean direction of the wind. A more full and particular description of the process is given in the Introduction to the series, further on.

That no errors have been committed in reducing so great a mass of observations, and making the numerous calculations growing out of them, is more than I dare to assert. I can only hope that they are not so serious as materially to affect the general results.

SERIES A.

List of places of observation, with their latitudes and longitudes from Greenwich, the length of time embraced, and the name of the observer.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
1. Within the Arctic Circle.				
Spitzbergen and vicinity	79° 55′	16° 49′ E.	5 months	Parry.
Baffin's Bay			13 do.	Parry and Ross.
Melville Island and vicinity	74 45	110 48 W.	1 year	Parry.
Port Bowen and vicinity	73 14	88 55	1 do.	Do.
Igloolik and vicinity	69 21	81 42	1 do.	Do.
Winter Island and vicinity[1]	66 11	83 10	1 do.	Do.
Felix Harbor	70 0	91 53	1 do.	Jas. Ross.
Sheriff's Harbor	70 2	91 52	1 do.	Do.
Victoria Harbor	70 9	91 34	6 months	Do.
2. Iceland and Greenland.				
Eyafiord, Iceland	65° 50′	20° 0′ W.	2 years	Van Scheels.
Reikiavik, do.	64 40	22 0	7 months	Gladstone and Park.
New Herrnhutt, Greenland	64 50	49 10	1 year	
Frederichthal, do.	60 1	44 45	7 months	
3. British and Russian America.				
Fort Enterprise	64° 28′	113° 6′ W.	1 year	Franklin.
Great Bear Lake	65 11	123 7	20 months	Do.
Great Slave Lake	62 46	109 1	8 do.	Back.
Nain, Labrador	56 0	61 0	1 year	
Norway House, Hudson's Bay Ter.	55 0	98 0	7 do.	Donald Ross.
Michipicoten, Lake Superior	47 56	84 50	1 do.	Swanston.
St. John's, Newfoundland	47 35	52 38	4 do.	Templeman.
Quebec, Canada	46 49	71 16	6 do.	Watt and others.
Montreal, do.	45 31	73 35	3 do.	McCord.
Toronto, do.	43 39	79 22	5 do.	Lefroy.
Wilberforce, do.	43 20	81 36	1 month	
Windsor, Nova Scotia	44 57	64 35	1 year	
Sitka, Russian America	57 3	135 25	1 do.	Homann and Ivanoff.
Iluluk, Aleutian Islands	53 0	167 46	1¾ do.	Sproull.
4. Maine.				
Fort Kent	47° 15′	68° 46′ W.	1 year	Surg. U. S. Army.
Fort Fairfield	46 50	67 59	1 do.	Do.
Hancock Barracks	46 10	67 50	14 years	Sprague.
Addison	44 31	67 34	5 months	Wafs.
Bangor	44 48	68 47	6 do.	Young.
Biddeford	43 31	70 26	1 year	Garland.
Bremen	44 45	68 44	3 months	Blake.
Bath	43 55	69 45	11 years	Hayden.
Eastport	44 44	67 4	12 do.	Surg. U. S. Army.
Gardiner	44 10	69 48	4 months	Gardiner.
Hampden	44 42	68 56	3⅜ years	Herrick.
Machias	44 40	67 24	1 month	Stearns.

[1] This station is just without the Arctic Circle.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
4. Maine.—*Continued.*				
Manhegin Island	44° 0′	69° 17′ W.	3 months	
Owl's Head	44 2	68 56	6 do.	
Portland	43 39	70 20	10 years	Surg. U. S. Army.
Saco	43 31	70 26	3½ do.	Batchelder.
Steuben	44 29	67 47	3 months	Parker.
South West Harbor	44 0	68 39	1 month	Howes.
Vinal Haven	44 2	68 48	2 months	Calderwood.
Winthrop	44 19	69 59	2 do.	Maine Farmer.
South Thomaston	44 6	69 0	9 do.	Bartlett.
5. Vermont and New Hampshire.				
Bennington, Vt.	42° 52′	73° 20′ W.	4 months	Hunt.
Burlington, Vt.	44 29	73 11	1 year	Thompson.
Charlestown, N. H.	43 15	72 25	7 months	
Dartmouth College, N. H.	43 43	72 19	3 years	Adams and Young.
Dover, N. H.	43 13	70 54	6 do.	Tufts.
Fayetteville, Vt.	42 56	72 40	2 do.	Field.
Grafton, Vt.	43 13	72 34	3 months	Putnam.
Keene, N. H.	42 57	72 14	5 do.	Wheelock.
Newbury, Vt.	44 6	72 7	27 years	Johnson.
Peterborough, N. H.	42 52	71 38	1 month	Youngman.
Portsmouth, N. H.	43 4	70 46	14 years	Surg. U. S. Army.
Middlebury, Vt.	44 3	73 12	1 month	Keith.
White Island, N. H.			1 do.	
6. Massachusetts, Rhode Island, and Connecticut.				
Amherst, Mass.	42° 22′	72° 31′ W.	5 years	Snell.
Boston, Mass.	42 21	71 4	5⅓ do.	Paine and others.
Cambridge, Mass.	42 22	71 8	11 months	Bond.
Cabotville, Mass.	42 9	72 37	3 do.	Huntington.
Dartmouth, Mass.	41 31	70 58	8 do.	Bailey.
Edgartown, Mass.	41 23	70 28	1 month	
Dumplin Rock, Mass.	41 31	70 58		Levi Smith.
Framingham, Mass.	42 18	71 39	8 months	Hyde.
Ipswich, Mass.	42 41	70 46	1 year	Cutler.
Little Compton, R. I.	41 30	71 15	1 month	
Litchfield, Conn.	41 46	73 12	3 years	Hendrick.
Medfield, Mass.	42 28	71 14	2 months	
Mendon, Mass.	42 4	71 38	4 years	Metcalf.
Middletown, Ct.	41 33	72 39	$2\frac{1}{12}$ do.	Prof. Smith.
New Haven, Ct.	41 18	72 57	4 do.	Connecticut Academy.
New London, Ct.	41 22	72 9	7 do.	Surg. U. S. Army.
Nantucket, Mass.	41 17	70 6	4⅓ do.	Mitchell.
New Bedford, Mass.	41 38	70 56	16 do.	Rodman.
Northampton, Mass.	42 19	72 38	4 months	Plant.
Newport, R. I.	41 29	71 19	1 year	
Newburyport, Mass.	42 49	70 53	5 months	Perkins.
North Yarmouth, Mass.	42 37	70 11	1 month	Bailey.
Provincetown, Mass.	42 2	70 11	16 months	Graham.
Providence, R. I.	41 49	71 25	5 years	Caswell and others.
Point Judith, R. I.	41 23	71 31	1 month	Hadwer.
Salem, Mass.	42 31	70 54		Holyoke.
Stafford, Ct.	42 0	72 18	1 do.	Linsley.
Salisbury, Ct.	42 0	73 24	2 years	Plumb.
Worcester, Mass.	42 16	71 48	7 do.	

Name of Station.	Latitude.	Longitude.	Time.	Authority.
6. Massachusetts, Rhode Island, and Connecticut.—*Continued.*				
Williams College, Mass.	42° 43′	73° 13′ W.	23 years	Dewey and Kellogg.
Waltham, Mass.	42 24	71 14	1 do.	Fisk.
Fort Adams, R. I.	41 30	71 19	1 do.	Surg. U. S. Army.
Fort Wolcott, R. I.	41 30	71 18	14 do.	Do.
Race Point, Mass.	42 4	70 15	3 months	Graham.
7. State of New York.				
Adams	43° 52′	75° 50′ W.	1 month	Webb.
Albany	42 39	73 44	24 years	Beck and Ten Eyck.
Amenia	41 48	73 36	1 year	Winchell.
Auburn	42 55	76 28	22 years	Hopkins.
Bridgewater	42 55	75 17	4 do.	
Bloomingdale	40 48	74 4	1 year	Morris.
Buffalo	42 51	79 5	2 years	
Buffalo Barracks	42 53	78 55	2 do.	Surg. U. S. Army.
Brooklyn	40 42	73 59½	1 month	
Cambridge	43 1	73 23	14 years	Beattie and others.
Canajoharie	42 53	74 35	3 do.	
Canandaigua	42 50	77 15	11 do.	Howe.
Cayuga (Aurora)	42 43	76 37	13 do.	Foster and others.
Cherry Valley	42 48	74 47	15 do.	Dixon and others.
Clinton (East Hampton)	41 0	72 19	17 do.	Dayton.
Cordtlandt (Homer)	42 38	76 11	17 do.	Bradford.
Cuba	42 7	78 14	3 do.	Talcott.
Chatham	42 25	73 30	4 months	
Delaware (Delhi)	42 16	74 58	2 years	Shepard and others.
Deaf and Dumb Inst., N. Y. City			3 do.	Morris.
Dutchess (Poughkeepsie)	41 41	73 57	17 do.	Burchan and others.
Erasmus Hall (Flatbush)	40 37	73 58	24 do.	Strong.
Franklin (Prattsburg)	42 34	77 20	13 do.	Gaylord and others.
Fairfield	43 5	74 55	20 do.	Blanchard and others.
Franklin (Malone)	44 50	74 23	3 do.	Coburn and others.
Farmers' Hall (Goshen)	41 20	74 11	13 do.	Crane, Webb, and others.
Fredonia	42 26	79 24	18 do.	Redington and others.
Gouverneur	44 25	75 35	13 do.	Grant and others.
Fort Columbus	40 41	74 1	19 do.	Surg. U. S. Army.
Granville	43 20	73 17	15 do.	Parker and others.
Fort Wood	40 43	74 11	2 do.	
Greenville	42 22	74 4	3 do.	
Gaines	43 17	78 15	4 do.	Gilbert and others.
Gallop's Island	43 53	76 25	1 month	Gill.
Hamilton College	43 5	75 6	1 do.	Eaton.
Hamilton	42 49	75 34	20 years	Weed and others.
Hartwick	42 38	75 1	16 do.	Miller.
Hudson	42 15	73 45	18 do.	Ford.
Ithaca	42 27	76 30	16 do.	Wetherell and others.
Johnstown	43 0	74 23	16 do.	Burke and others.
Kinderhook	42 18	73 40	17 do.	Metcalf.
Kingston	41 55	74 2	20 do.	Wells.
Lansingburgh	42 47	73 43	20 do.	Pease and others.
Lewiston	43 9	79 10	18 do.	Fitts.
Leonardsville	42 46	75 23	1 month	Hope.
Lowville	43 47	75 33	19 years	Mayhew and others.
Lockport	43 11	78 46	4 months	Giddins.
Monroe (Henrietta)	43 0	77 51	3 years	Ransom.
Middlebury	42 49	78 10	19 do.	Sanford and others.
Mexico	43 27	76 14	12 do.	Gillespie and others.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
7. State of New York.—*Continued.*				
Montgomery	41° 32′	74° 0′ W.	14 years	Harmon and others.
Mount Pleasant	41 9	73 47	13 do.	Merrill and others.
Millville	43 8	78 20	7 do.	Brooks and others.
Nassau	42 37	73 35	1 month	Bullard.
New York City	40 42	74 1	14 years	Redfield, Fisher, and others.
Newburgh	41 30	74 5	19 do.	Lyon and others.
North Salem	41 20	73 37	18 do.	Jenkins.
Ogdensburg	44 43	75 26	1 year	Coffin.
Oneida Conference (Cazenovia)	42 57	75 46	19 years	Bannister and others.
Oneida Institute (Whitesborough)	43 7	75 14	7 do.	
Onondaga	42 59	76 6	16 do.	Runkle.
Oxford	42 28	75 32	18 do.	Douglass and others.
Oyster Bay	40 50	73 49	2 do.	
Palmyra	43 5	77 16	1 year	
Penn Yan	42 42	77 7	1 month	Sartwell.
Plattsburg	44 42	73 25	3 years	Taylor and others.
Plattsburg Barracks	44 41	73 26	2 do.	Surg. U. S. Army.
Pompey	42 56	76 5	17 do.	Stebbins.
Redhook	42 2	73 56	12 do.	Cook and others.
Rhinebeck	41 55	73 55	1 month	Platt.
Rochester	43 8	77 51	18 years	Dewey.
Rouse's Point	45 0	73 21	1 year	Surg. U. S. Army.
Syracuse	43 1	76 15	1 do.	Conkey.
Sackett's Harbor	43 55	76 10	2 years	Surg. U. S. Army.
Springville	42 30	78 50	5 do.	Earle.
Sand's Point	41 11	73 49	2 months	Calkins.
St. Lawrence (Potsdam)	44 40	75 1	22 years	Barnes and others.
Somerville	44 11	75 25	1 year	Hough.
Schenectady	42 48	73 55	11 years	
Seneca Falls	42 54	76 51	1 year	Fairchild.
Troy	42 44	73 35	2 years	Cook.
Watertown	43 58	76 0	5 do?	Surg. U. S. Army.
Watervliet	42 44	73 41	11 do.	Do.
West Point	41 22	73 57	16 do.	Wheaton.
White Plains	41 2	73 47	4 months	
Washington (Salem)	43 45	73 30	10 years	Butler and others.
Union (Ellisburgh)	43 45	76 10	9 do.	Littlefield and others.
Union Hall (Jamaica)	40 41	73 56	24 do.	Kelsey.
Utica	43 7	75 13	22 do.	Sheldon and Aylesworth.
Youngstown	43 15	79 5	6 do.	Surg. U. S. Army.
8. New Jersey.				
Bloomfield	40° 49′	74° 11′ W.	2 months	Cook.
Burlington	40 6	74 55	3 do.	Smith.
Cape May (Five Fathom Bank)	38 52	74 42	1 month	Merrill.
Haddonfield	39 54	75 8	1 do.	Clement.
Middletown	40 26	73 59	4 years	Jenkins.
Newark	40 45	74 10	2 do.	
Trenton	40 14	74 30	6 do.	Ewing.
9. Pennsylvania.				
Armstrong	40° 40′	79° 17′ W.	2 months	Peelor.
Alleghany Arsenal	40 26	80 2	7 years	
Beaver	40 44	80 20	10 months	W. and J. Allison.
Butler	40 52	79 56	2 years	Mechling.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
9. Pennsylvania.—*Continued.*				
Bellefonte	40° 55′	77° 49′ W.	11 months	Harris.
Bedford	40 1	78 30	1 year	Brown.
Bethlehem	40 33	75 28	2 months	Kummer.
Cochranville	39 52	76 0	2 do.	Linton.
Coudersport	41 45	78 19	5 do.	S. Ross.
Carlisle	40 12	77 12	2¾ years	Allen and others.
Canonsburg	41 17	80 14	3 months	Campbell.
Chambersburg	39 56	77 43	1 month	Thompson.
Danville	40 58	76 39	2 months	Frick.
Easton	40 43	75 16	3¼ years	Elliot, Green, and others.
Ebensburg	40 31	78 45	1 year	Lewis.
Erie	42 7	80 10	3 months	Park and Reid.
Franklin	41 25	79 53	1 year	Connelly.
Fort Mifflin	39 51	75 12	2 years	Surg. U. S. Army.
Gettysburg	39 51	77 15	1⅚ year	Jacobs.
Girard College	39 58	75 11	5 years	Bache.
Green Hill	40 48	78 30	1 month	Wright.
Germantown	40 3	75 10	3 months	Weister.
Harrisburg	40 16	76 50	1 year	Heisley.
Huntingdon	40 31	78 1	1 do.	Miller.
Haverford	40 0	75 20	10 months	
Indiana	40 40	79 10	9 do.	White.
Lamar	41 2	77 43	1 month	Matthias.
Lancaster	40 3	76 21	2 years	Atlee.
Lewistown	40 35	77 37	5 months	Culbertson.
Meadville	41 39	80 11	1 year	Limber and Dick.
Mifflintown	40 32	77 28	21 months	Kinkead.
Mercersburg	39 50	77 56	4 do.	Green.
Milford	41 18	74 50	1 month	Bull.
Newtown	40 14	74 57	1¾ year	Parsons.
Norristown	40 7	75 18	5 months	Coison.
Northumberland	40 55	76 49	1⅝ year	Huston.
Philadelphia	39 57	75 10	5⅓ years	Hamilton and others.
Pottsville	40 41	76 9	5 months	Porter.
Port Carbon	40 43	76 6	11 do.	P. C. Lyceum.
Pittsburg	40 32	80 2	1 year	Bakewell and others.
Reading	40 19	75 55	10 months	Egelman.
Rose Cottage	41 7	79 9	3 do.	Gaskell.
Silver Lake	41 55	76 1	1¾ year	Rose.
Somerset	40 1	79 5	2 years	Mowry.
Stroudsburg	40 58	75 16	10 months	Stokes.
Smithport	41 54	78 33	1 year	Atkins and Chadwick.
Uniontown.	39 54	79 42	11 months	Weethee.
Warren	41 51	79 14	8 do.	Brown and King.
West Chester	39 59	75 35	11 months	Jeffries.
West Greenfield				Campbell.
York	39 58	76 40	3 do.	Mason.
Wilkesbarre	41 14	75 56	2 do.	Dennis and Maxwell.
10. Delaware, Maryland, and Virginia.				
Alexandria, Va.	38° 46′	77° 1′ W.	1 month	Mountford.
Annapolis, Md.	38 58	76 27	5 years	Surg. U. S. Army.
Baltimore, Md.	39 17	76 37	1 year	Maryland Academy.
Bellona Arsenal, Va.	37 40	77 41	1 do.	Surg. U. S. Army.
Emmetsburg, Md.	39 41	77 20	3 months	Giraud.
Fort McHenry, Md.	39 17	76 36	12 years	Surg. U. S. Army.
Fort Washington, Md.	38 41	76 58	2 do.	Do.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
10. **Delaware, Maryland, and Virginia.**—*Continued.*				
Gosport, Va.	36° 47′	78° 15′ W.	8 months	Patton.
Isthmus, Md.	38 45	76 15	10 do.	Banning.
New Castle, Del.	39 40	75 33	1 year	Surg. U. S. Army.
Norfolk, Va.	36 51	76 19	1 month	Do.
Newark, Del.	39 37	75 47	5 months	Norton.
Old Point Comfort, Va.	37 2	76 12	17 years	Surg. U. S. Army.
Washington, D. C.	38 53	77 1	16½ do.	Cranch and others.
West Brunswick, Va.	36 40	77 46	12 months	Astrop.
11. **North and South Carolina.**				
Abbeville, S. C.	34° 11′	82° 24′ W.	2 years	Parker.
Camden, S. C.	34 17	80 33	1 year	Holbrook.
Charleston, S. C.	32 46	79 57	5 years	Ryan and others.
Fort Moultrie, S. C.	32 42	79 56	10 do.	Surg. U. S. Army.
Chapel Hill, N. C.	35 54	79 17½	2 do.	Phillips.
Beaufort, N. C.	34 44	76 39	2 do.	Surg. U. S. Army.
Florence, N. C.	36	80	1 month	Watkins.
Wake Forest College, N. C.	35 59	78 28	1 do.	White.
Fort Johnston, N. C.	34 0	78 5	10 years	Surg. U. S. Army.
12. **Georgia, Alabama, Mississippi, and Louisiana.**				
Athens, Ga.	34° 2′	83° 31′ W.	5 years	McCay.
Augusta, Ga.	33 28	81 54	4 do.	Holbrook.
Do. Arsenal, Ga.	33 28	81 53	14 do.	Surg. U. S. Army.
Arendale, Ala.	34 56	86 1	2 months	Jones.
Baton Rouge, La.	30 26	91 18	7 years	Surg. U. S. Army.
Eutaw, Ala.	32 46	87 54	1 year	Winchell.
Glenville, Ala.	32 10	85 1	1 month	Taylor.
Knoxville, Ala.	33 2	87 52	3 months	Adams
La Grange College, Ala.	34 40	87 46	8 do.	Tulwiler.
Mobile, Ala.	30 42	87 59	2⅓ years	North.
Natchez, Miss.	31 34	91 25	17 do.	Tooley.
New Orleans, La.	29 57	90 0	5⅝ do.	Barton, Little, and others.
New Orleans Barracks	29 57	89 59	6 do.	Surg. U. S. Army.
Port Gibson, Miss.	31 50	91 0	2 months	Reid.
Oglethorpe Barracks, Ga.	32 6	81 8	2 years	Surg. U. S. Army.
Petite Coquille, La.	30 10	89 38	4 do.	Do.
Savannah, Ga.	32 5	81 8	3 do.	Posey, Oemler, and others.
Summerville, Ga.	34 28	85 34	1 year	Holbrook.
Springfield, Ala.	32 58	87 57	1 month	Adams.
Tuskeegee, Ala.	32 27	85 46	1⅓ year	Jennings.
Vicksburg, Miss.	32 22	90 56	4 years	Hatch.
Washington, Miss.	31 36	91 20	2 months	A lady.
Whitemarsh Island, Ga.	31 59	80 57	12 do.	Gibson.
Mount Vernon, Ala.	31 6	88 5	10 do.	Surg. U. S. Army.
Spring Hill College, Ala.	30 42	88 1	1 year	Fabre.
Fort Wood, La.	30 2	89 57	3 years	Surg. U. S. Army.
Fort Jesup, La.	31 30	93 37	20 do.	Do.
Fort Jackson, La.	29 27	89 34	1 year	Do.
Fort Pike, La.	30 5	89 54	4 years	Do.
Milledgeville, Ga.	33 7	83 20	2 months	Cotting.
Tuscaloosa, Ala.	33 14	87 38	1 month	Hentz.
Attakepas, La.	29 49	91 35	2 months	
Frank's Island, La.	near	N. Orleans.	2 do.	

Name of Station.	Latitude.	Longitude.	Time.	Authority.
13. Tennessee and Kentucky.				
Greenville, Tenn.	36° 8′	82° 46′ W.	3 months	
Knoxville, Tenn.	35 59	83 54	8 do.	Garvin.
Mt. Atlas, Tenn.	36 0	88 20	6 do.	Travis.
Nashville, Tenn.	36 10	86 49	6 years	Hamilton.
Danville, Ky.	37 40	84 40	5 months	Beatty.
Louisville, Ky.	38 3	85 30	2 do.	Fleming and Peter.
New Concord, Ky.	36 39	88 3	1 month	Williams.
Paris, Ky.	38 16	84 6	2 months	Lyle.
Springdale, Ky.	38 10	85 40	2 do.	
St. Mary's College, Ky.	37 33	85 10	7 do.	Thebaud.
14. Ohio.				
Ashtabula	41° 55′	80° 50′ W.	5 months	
Cambridge	40 5	81 37	1 month	Brown.
Cincinnati	39 6	84 27	7 months	Ray and Williams.
Columbus	39 57	83 3	8 do.	Kennedy.
Conneaut	42 0	80 34	1 month	Dibble.
Chillicothe	39 24	82 56	1⅓ year	Davis and Williams.
Dayton	39 44	84 11	4 months	Williams.
Granville College	40 4	82 34	5 do.	Carter.
Hudson	41 15	81 24	7 years	Loomis.
Lancaster	39 46	82 36	5 months	Kreider.
Lebanon	39 30	84 7	13 do.	Hatfield.
Marietta	39 27	81 29	1 year	Hildreth.
New Athens	41 10	81 11	7 months	Mason.
Ravenna	41 12	81 16	1 month	
Sandusky	41 27	82 42	9 months	Morton.
Steubenville	40 25	80 42	14 years	Marsh.
Zanesville	40 0	82 1	11 months	Peters.
15. Indiana and Illinois.				
Brockville, Ia.	41° 42′	84° 40′ W.	3 years	Coffin.
Brookville, Ia.	39 25	84 54	4 months	Hayward.
Greencastle, Ia.	39 39	86 46	3 do.	Downey.
Greensburg, Ia.	39 20	85 28	3 do.	Lathrop.
Indianapolis, Ia.	39 48	86 10	3 do.	Wheeler.
Rensselaer, Ia.	40 57	87 9	1 month	Luther.
Winnamac, Ia.	41 7	86 45	3 months	Do.
Chicago, Ill.	42 0	87 35	4¼ years	Wilson and others.
Joliet, Ill.	41 30	88 10	6 months	Brownson.
Macomb, Ill.	40 30	90 30	3 do.	Richards.
Jacksonville, Ill.	39 48	90 19	9 do.	Hawley.
Peoria, Ill.	40 35	89 36	1 month	Washburn.
Rock Island	41 28	90 33	8 years	Surg. U. S. Army.
Upper Alton, Ill.	38 57	90 1	2 months	
Shawneetown, Ill.	37 42	88 12	2 do.	Roe.
16. Michigan, Wisconsin, and Iowa.				
Ann Arbor, Mich.	42° 15′	83° 43′ W.	2 months	
Dearbornville, Mich.	42 20	83 1	1 year	Surg. U. S. Army.
Detroit, Mich.	42 24	82 58	3 years	Duffield.
Detroit Barracks, Mich.	42 19	82 58	3 do.	Surg. U. S. Army.
Fort Gratiot, Mich.	42 56	82 18	9 do.	Do.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
16. Michigan, Wisconsin, and Iowa.—*Continued.*				
Mackinac, Mich.	45° 51′	85° 5′ W.	8 years	Surg. U. S. Army.
Fort Winnebago, Wis.	43 35	89 20	10 do.	Do.
Green Bay, Wis.	44 40	87 0	18 do.	Do.
Fort Brady, Mich.	46 39	84 43	18 do.	Do.
Prairie du Chien, Wis.	43 3	90 53	14 do.	Do.
Bloomington, Iowa	41 26	91 2	5 do.	Parvin.
Iowa City, Iowa	41 40	91 37	2 months	Murray.
Fort Atkinson, Iowa	43 0	91 10	2 years	Surg. U. S. Army.
Fort Snelling, Iowa	44 53	93 8	20 do.	Do.
Turkey River, Iowa.	43 6	92 0	1 month	
Presque Isle, Mich.	45 18	83 30	3 months	Woolsey.
Source of the Des Moines, Iowa	44 3	96 1		Nicollet.
Lac qui Parle, Iowa	45 0	95 30	2 do.	Williamson.
East Troy, Wis.	42 50	88 30	1 month	Jennings.
17. Missouri, Arkansas, and Western Territories.				
St. Louis, Mo.	38° 37′	90° 16′ W.	10 years	Surg. U. S. Army.
Washington, Ark.	33 43	93 37	5 months	Slaughter.
Fort Wayne, Ark.	36 4	94 38	2 years	Surg. U. S. Army.
Little Rock, Ark.	34 40	92 12	2 do.	Do. and Goulding.
Council Bluffs	41 45	96 0	5 do.	Surg. U. S. Army.
Fort Gibson	35 47	95 10	15 do.	De Camp and others.
Fort Leavenworth	39 20	95 11	11 do.	Surg. U. S. Army.
Fort Smith	35 30	94 31	3 do.	Do.
Fort Towson	33 33	95 1	10 do.	Do.
Fort Laramie	42 12	104 48		Fremont.
Fort Vancouver	45 37	122 37	1⅓ year	C. Hall and others.
Fremont's Town			1¼ do.	Fremont.
18. Florida, Texas, California, and Mexico.				
St. Augustine, Fa.	29° 48′	81° 35′ W.	13 years	Rodiman and others.
Tampa Bay, Fa.	27 57	82 35	12 do.	Bunce and others.
Pensacola, Fa.	30 24	87 10	8 do.	Surg. U. S. Army.
Key West, Fa.	24 32	81 47	7 do.	Whitehead and others.
Fort King, Fa.	29 8	82 12	5 do.	Surg. U. S. Army.
Cedar Keys, Fa.	29 8	83 9	1 year	Do.
Tortugas Islands, Fa.	24 37	83 0	1 do.	Thompson.
Indian Key, Fa.	24 54	80 43	1 do.	Howe.
Carysford Reef, Fa.	25 2	80 15	1 do.	Whalton.
Cape Florida, Fa.	25 47	79 58	1 do.	Dubose.
Galveston, Texas	29 24	95 4	1 month	
Mazatlan, Mexico	16 0	95 20	1½ do.	
Yucatan	21	83		Purdy.
Monterey, California	36 40	121 40	11 days	
19. West Indies and South America.				
Matanzas, Cuba	23° 3′	81° 30′ W.	4 years	Mallory.
Ponce, Porto Rico	17 57	66 40	1 month	
Turk's Island	21 29	71 5	1 do.	Arthur.
Barbadoes	13 5	59 43	9 months	Dawson.
Chagres, New Grenada	9 10	80 17	1 month	Cobb.
Porto Cabello, Venezuela	10 28	68 17	3 months	Litchfield.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
20. **Atlantic Ocean and its Islands.**				
Hamilton, Bermudas			3½ years	Reid.
Ireland Isle, Bermudas			4 months	
Canary Islands	28° 43′	17° 46′ W.	1 month	
Funchal, Madeira	32 38	17 6	3 years	
Fayal, Azores	38 32	28 40	2 months	Hunt.
St. Michael's, Azores	37 40	25 50	2 do.	Do.
Terceira, Azores	38 40	27 50	2 do.	Do.
Graciosa, Azores	39 12	27 58	12 days	Do.
St. Mary's, Azores	37 0	24 59	10 do.	Do.
On board ship			115 years	Hamilton, Quintard & others.
21. **Great Britain and Ireland.**				
Aberavon, Wales	51° 35′	3° 48′ W.	3 months	
Bronxholm, Scotland	55 27	3 0	10 years	
Elgin, Scotland	57 38	3 16	3 do.	
Clunie Manse, Scotland	56 25	3 36	4 do.	
Inchkeith, Scotland	56 3	3 9	10 do.	
Banff Castle, Scotland	57 35	2 45	1 year	
Calton Hill,[1] Scotland			10 years	
Castle Toward, Scotland			2 do.	
Kinfaun's Castle, Scotland	56 55	3 30	12 do.	
Cheltenham, Eng.	51 55	2 21	1 year	
Alderly Rectory, Eng.	52 38	0 52	1 do.	
Thetford, Eng.	52 20	0 40 E.	1 do.	
London, Eng.	51 31	0 7 W.	13 years[2]	Howard.
Liverpool, Eng.	53 22	3 0	7 do.	Abraham.
Greenwich, Eng.	51 29	0 0	11 do.	Royal Society.
High Wycombe, Eng.	51 38	0 50	1 year	
Carlisle, Eng.	55 1	3 13	1 do.	
Keswick, Eng.	54 44	2 46	5 years	
Southwick, Eng.			11 do.	
Kendal, Eng.	54 18	2 46	5 do.[2]	
Mansfield Woodhouse, Eng.	53 8	1 1	10 do.	
Bristol, Eng.	51 27	2 36	2 do.	
Delphen, Eng.	52 0	0 7 E.	1 year	
Devonport, Eng.	50 23	4 9 W.	3 years	
Sturbington, Eng.	near	Portsmouth.	1 year	
Sidmouth, Eng.	50 41	3 13 W.	2 years	
Derby, Eng.	52 58	1 30	2 do.	
Gosport, Eng.	50 48	1 6	5 do.	
Lancaster, Eng.	53 29	2 46	6 do.	
Penzance, Eng.	50 5	5 28	5 do.	
Helston, Eng.	50 7	5 15	2 do.	
Manchester, Eng.	53 25	2 10	4 do.	
Bushy Heath, Eng.	51 38	0 1	7 do.	
New Malton, Eng.	54 10	0 48	6 do.	
Cork, Ireland	51 24	8 23	1 year[3]	
Dublin, Ireland	53 23	6 20	1 month	
Londonderry, Ireland	55 0	7 15	1 year	
Isle of Man	54 8	4 30	9 years	
22. **Denmark, Norway, Sweden, and Russia.**				
Copenhagen, Denmark	55° 41′	12° 40′ E.	50 years	
Apenrade, Denmark	54 50	9 14	9 do.	

[1] On the Frith of Forth. [2] Probably more. [3] Time not known, but probably more than one year.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
22. **Denmark, Norway, Sweden, and Russia.**—*Continued.*				
Christiansoc, Denmark	54° 55′	14° 56′ W.	8 years	
Goersdoff, Denmark	54 39	8 24	2 do.	Muller.
Skagen, Denmark	57 38	10 0	9 do.	
Wyburg, Denmark?	56 34?	9 18	1 year	
Spydburg, Norway	59 30	8 58	2 years	
Stockholm, Sweden	59 20	18 9	4 do.	
Cronberg, Sweden	56 0	13 23	1 year	
Holmia, Sweden	63 8	17 23	3 years	
Soendmor, Sweden?			12 do.	
Archangel, Russia	64 34	38 59	18 do.	
Dorpat, Russia	58 23	26 44	1 year	M. Kaemptz.
Kazan, Russia	55 48	49 18	1 do.	M. Simonoff.
Kerk, Russia?	45 16?	36 14?	2 years	
Lougan, Russia	48 35	39 21	2 do.	
Moscow, Russia	55 45	37 31	5 do.	
Monachium, Russia	48 2	30 44	4 do.	
St. Petersburg, Russia	59 57	30 20	21 do.[1]	
Schoessl, Russia			$2\frac{5}{12}$ do.	
Wilna, Russia	54 41	25 28	1 year	
23. **Prussia, Austria, and Turkey.**				
Berlin, Prussia	52° 32′	13° 26′ E.	25 years	Beguelin.
Dantzic Prussia	54 .22	18 38	15 do.	
Dusseldorf, Prussia	51 12	6 40	1 year	
Braunsburg, Prussia	54 22	20 6	1 do.	
Hofmansgave, Prussia			4 years	
Konigsburg, Prussia	54 42	20 55	1 year[1]	
Pillau, Prussia	54 38	20 20	18 years	
Posen, Prussia	52 24	17 0	8 months	
Sagan, Prussia	51 42	15 22	5 years	
Buda, Austria	47 30	19 5	4 do.	
Divio, Austria?	47 19	22 36?	2 do.	
Graetz, Austria	47 4	15 26	1 year	
Prague, Austria	50 4	14 45	2 years	Kreil.
Schoenthal, Austria	50 5	13 0	1 year	
Vienna, Austria	48 13	16 23	1 do.	M. Littrow.
Constantinople, Turkey	41 1	28 35	$1\frac{2}{3}$ do.	Dwight.
24. **Germany.**				
Anspach, Bavaria	49° 18′	10° 28′ E.	1 year	
Gunzenhausen, Bavaria	49 6	10 32	1 do.	
Erfurth, Saxe	50 50	11 12	5 years	
Hof, Bavaria	50 18	12 30	1 year	
Herbipolis,[2] Bavaria	49 46	10 14	5 years	
Ratisbon, Bavaria	48 58	12 6	4 do.	
Uffenheim, Bavaria	49 30	10 19	1 year	
Munich, Bavaria	48 9	11 37	7 years	
St. Andex, Bavaria			5 do.	
Giengen on the Brenz, Bavaria	48 46	10 34	1 year	
Ingolstadt, Bavaria	48 44	11 15	1 do.	
Wurtzburg, Bavaria	49 46	10 13	5 years	

[1] Probably more.

[2] Intended for Wurtzburg, it is presumed.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
24. Germany.—*Continued.*				
Peissenberg,[1] Bavaria?	47° 47′	10° 42′ E.	4 years	
Tegernsee, Bavaria	47 49	11 47	4 do.	
Manheim, Baden	49 26	8 31	10 do.	
Carlsruhe, Baden	49 4	8 30	3 do.	
Mergentheim, Baden	49 21	9 27	1 year	
Hamburg,	53 34	9 55	30 years	
Gottingen, Brunswick	51 32	9 57	1 year[2]	
Burglengenfield			1 do.	
Stuttgard, Wirtemberg	48 44	9 21	1 do.[2]	
Issny, Wirtemberg	47 42	10 3	1 do.	
Tutlingen, Wirtemberg	47 55	8 40	1 do.	
Luneburg, Hanover	53 15	10 36	15 years?	
Cuxhaven, Hanover	53 53	8 45	15 do.?	
Neustadt[3]	49 38?	10 43?	9 months	
Badenbach			1 year	
Giengen			1 do.	
Schussenreid			1 do.	
Stone Lighthouse			1 do.[2]	
25. Holland and Belgium.				
Amsterdam, Holland	52° 25′	4° 40′ E.	54 years	
Franeker, Holland	53 10	5 45	13 do.	Van Swinden.
Utrecht	52 6	5 8	1 year	
Alost, Belgium	50 43	3 35	2 years	
Breda, Belgium	51 34	4 40	6 do.	
Brussels, Belgium	50 51	4 22	20 do.	M. Quetelet.
Ghent, Belgium	51 3	3 44	3 do.	
Louvain, Belgium	50 53	4 41	1 year	
Mailand, Belgium	51 57	4 18	1 do.[2]	
26. France, Spain, and Portugal.				
Paris, France	48° 50′	2° 20′ E.	42 years	Royal Society.
Nancy, France	48 45	6 15	6 do.	
Denainvilliers, France	48 12		31 do.	
Marseilles, France	43 18	5 27	20 do.	
Montmorenci, France	49 0	2 20	15 do.	
Hafnia (Havre?), France	49 29?	0 6	3 do.	
Toulouse, France	43 36	1 30	19 do.	Marconelli.
Bordeaux, France	44 50	0 35 W.	2 do.	Abria.
Cambray, France	50 11	3 14 E.	2 do.	Evard.
Dijon, France	47 19	5 2	4 do.	Perry.
La Chapelle, France	49 49	1 8	1 year	Racine and Nell de Bréauté.
Metz, France	49 7	6 10	13 years	Schuster.
Orange, France	44 8	4 48	14 do.	Gasparin.
Rodez, France	44 21	2 34	3 do.	Blondeau.
Rouen, France	49 26	1 5	4 do.	Preisser.
St. Hyppolyte, France	43 54	3 55	13 do.	D'Hombres.
St. Lo, France	49 7	1 4 W.	3 do.	Lamarch.
Syam, France	46 45	5 54 E.	2 do.	Thorel.

[1] This place is described as being situated in "Longitude 28° 34′ E., 1220 feet above the river," but the meridian from which the longitude is reckoned is not stated. I have assumed it to be that of Ferro, which makes its longitude from Greenwich as here given.

[2] Probably more.

[3] There are several places of this name in Germany, and as the latitude and longitude were not given, it is not certain which was intended.

Name of Station.	Latitude.	Longitude.	Time.	Authority.
26. France, Spain, and Portugal.—*Continued.*				
Strassburg, France	48° 35′	7° 45′ E.	20 years	
Valognes, France	49 31	1 28 W.	1 year	Benoist.
Versailles, France	48 48	2 7 E.	2 years	Hueghens, Berigny, and La Croix.
Montpelier, France	43 37	3 58	37 do.?	
Cantabria, Spain?	42 30	2 9 W.	1 year	
Gibraltar, Spain	36 6	5 19	3 months	
Mafra, Portugal?	38 55?	9 11?	4 years	
Oporto, Portugal	41 10	8 22	2 months	
27. Switzerland, Italy, and the Mediterranean Sea.				
Regensburg, Switzerland	47° 47′	8° 20′ E.	7 years	
Mt. St. Gothard, Switzerland	46 36	8 39	4 do.	
Bologna, Italy	44 30	11 21	1 year	
Genoa, Italy	44 25	8 58	1 month	
Naples, Italy	40 55	14 20	1 year	Melloni?
Padua, Italy	45 22	12 1	4 years	
Parma, Italy	44 50	10 30	1 year	
Rome, Italy	41 54	12 29	3 years	
St. Zeno, Italy	44 40?	10 0?	1 year	
Eastern part of the Mediterranean Sea			3 years	
28. Asia.				
Barnoule, Siberia	53° 20′	83° 27′ E.	1 year	Prang 1st.
Catharinenberg, Siberia	56 50	63 35	2 years	Rochkoff.
Bogoslowsk, Siberia	59 45	59 59	1 year	
Nertchinsk, Siberia	51 18	119 21	1 do.	Prang 2d.
Nigne Taguilsk, Siberia			2 years	
Tobolsk, Siberia	58 12	68 18	10 do.	
Yacoutsk, Siberia	62 1	129 44	1 year	Neveroff.
Zlatouste, Siberia	55 8	59 38	1 do.	
Beirut, Syria	33 50	35 29	8 months	De Forest.
Bahmdun, Syria	33 46	35 39	11 do.	Calhoun.
Smyrna, Asia Minor	38 28	27 7	10 do.	Benjamin.
Trebizonde, Asia Minor	40 25	39 45	1 year	
Erzeroom, Armenia	39 57	41 36	1 do.	Smith.
Jerusalem, Palestine	31 47	35 20	15 months	McGowan.
Teflis, Georgia	41 41	44 50	8 do.	Philadelphine.
Tabreez, Persia	38 2	46 16	4 do.	Stevens.
Ooroomiah, Persia	37 30	45 10	19 do.	Perkins.
Tehran, Persia	35 40	50 52	4 do.	Reed.
Bagdad, Turkey	33 20	44 46	1 year	
Bassora, Turkey	30 30	47 25	5 months	
Futtehpore, Hindoostan	27 5	77 40	8 do.	
Putna, Hindoostan	25 40	85 20		
Calcutta, Hindoostan	22 35	88 28	8 years	
Duklum, Hindoostan	18 26	74 41	5 do.	
Pekin, China	39 54	116 27	7 do.	Gachkevitche.
29. Africa.				
Cape Palmas, Liberia	4° 22′	7° 32′ W.	2 months	
Bassa Cove, Liberia	5 58	10 1	3 do.	
Coast of Sierra Leone and Liberia			1 month	
Tripoli, Barbary	32 51	13 12 E.	5 do.	

Name of Station.	Latitude.	Longitude.	Time.	Authority.
30. Pacific and Indian Oceans.				
Oahu, Sandwich Islands	21° 20′ N.	158° 22′ W.	1 month	Johnson.
Waioli, Sandwich Islands	22 15	160 0	1 year	
Pago-pago, Navigators' Islands	14 0 S.	170 0	10 months	
Russell, New Zealand			4 do.	
Tananarivou, Madagascar	19 0	45 40 E.	3 do.	

General Summary.

Places of Observation.	No. of stations.	No. of years.
1. Within the Arctic Circle	9	8
2. Iceland and Greenland	4	$4\frac{1}{6}$
3. British and Russian America	14	$34\frac{1}{6}$
4. Maine	21	$59\frac{3}{4}$
5. New Hampshire and Vermont	13	$54\frac{5}{6}$
6. Massachusetts, Rhode Island, and Connecticut	31	$111\frac{5}{6}$
7. New York	88	$883\frac{5}{6}$
8. New Jersey	7	$12\frac{7}{12}$
9. Pennsylvania	52	$61\frac{1}{12}$
10. Delaware, Maryland, and Virginia	15	$58\frac{5}{6}$
11. North and South Carolina	8	$32\frac{1}{6}$
12. Georgia, Alabama, Mississippi, and Louisiana	32	$109\frac{1}{4}$
13. Tennessee and Kentucky	10	9
14. Ohio	17	$29\frac{3}{4}$
15. Indiana and Illinois	15	$18\frac{7}{12}$
16. Michigan, Wisconsin, and Iowa	19	$112\frac{11}{12}$
17. Missouri, Arkansas, and Western Territories	11	61[1]
18. Florida, Texas, California, and Mexico	14	$52\frac{1}{4}$
19. West Indies and South America	6	$5\frac{1}{4}$
20. Atlantic Ocean and its Islands[2]	9	$122\frac{1}{2}$[3]
21. England, Scotland, and Ireland	38	$176\frac{1}{3}$
22. Denmark, Norway, Sweden, and Russia	21	$158\frac{5}{12}$
23. Prussia, Austria, and Turkey	16	$83\frac{1}{3}$
24. Germany (Bavaria and smaller States)	30	$128\frac{3}{4}$
25. Holland and Belgium	9	101
26. France, Spain, and Portugal	26	$262\frac{5}{12}$
27. Switzerland, Italy, and the Mediterranean	10	$24\frac{1}{12}$
28. Asia	25	$49\frac{2}{3}$
29. Africa	4	$\frac{11}{12}$
30. Pacific and Indian Oceans	5	$2\frac{1}{2}$
Total	579	$2829\frac{1}{6}$

It is probable that in the foregoing lists there are some mistakes in the location of places in Europe. Frequently the latitudes and longitudes were not given in the records and works which I consulted, so that I had no guide but the name, which might be common to several places. In some other cases, there was an uncertainty in regard to the meridian from which the longitude was reckoned.

Series of observations, continued only for a few months, may seem of too little importance to be worth preserving; but such collections, though insufficient to de-

[1] Including Fremont's tour. [2] Not including two stations in Iceland. [3] Including voyages.

termine the mean annual direction of the wind, are useful in obtaining monthly results, and hence the annual curve. To determine the latter, with the same accuracy that we do the mean direction for the year, we need much more extensive data; and these monthly collections serve to swell the list, and increase the number of months on which the average is based. More complete series, and also collections of observations from additional places,[1] might, no doubt, have been obtained in many cases by applying directly to the observers; but I had already taxed my friends so far that I felt unwilling to put them to any more trouble; especially as a long time must necessarily intervene between furnishing the data and seeing any fruit of their labor.

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[1] See Appendix A.

SERIES B.

The following abstracts show the proportionate length of time that the winds from each point of compass prevailed at the several stations, as indicated by the number of observations.

Course.	May.[1]	June, July, Aug.[1]	June, July, Aug.[2]	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Winds within the Arctic Circle.																
Spitzbergen and vicinity.				Melville Island and vicinity.[3]												
North	1	9	6	15	16	28	19	22	13	16	3	12	11	25	6	186
N. by E.			0	0	0	1	0	0	3	2	0	0	0	0	0	6
N. N. E.	9	14	1	2	0	0	3	0	1	6	0	9	0	0	1	22
N. E. by N.			3	0	0	0	0	0	0	0	0	0	0	0	0	0
N. E.	12	5	1	0	0	0	0	2	0	0	2	3	0	0	0	7
N. E. by E.			0	0	0	0	0	0	0	0	1	0	0	0	0	1
E. N. E.	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	3
E. by N.			0	0	0	0	0	0	0	1	0	0	0	0	0	1
East	7	25	9	5	2	0	5	2	1	0	1	0	1	0	9	26
E. by S.			3	0	0	0	0	0	0	0	0	0	0	0	4	4
E. S. E.	0	1	9	2	1	2	4	2	0	0	4	0	1	0	4	20
S. E. by E.			3	0	0	0	0	0	0	0	0	0	0	0	0	0
S. E.	4	16	13	3	2	0	3	0	7	2	5	0	0	0	2	22
S. E. by S.			0	0	0	0	0	0	1	0	0	0	0	0	0	1
S. S. E.	0	4	4	2	0	1	1	1	2	4	0	0	2	2	0	15
S. by E.			1	0	2	0	0	0	0	0	0	0	0	0	3	5
South.	2	2	7	1	0	2	1	8	4	8	0	0	1	0	4	29
S. by W.			3	0	0	0	0	0	2	1	0	0	0	0	0	3
S. S. W.	2	0	0	1	0	0	1	1	4	4	2	0	2	0	0	15
S. W. by S.			0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. W.	9	9	10	0	0	1	0	0	2	3	0	7	6	3	1	23
S. W. by W.			1	0	0	0	0	0	0	0	0	3	0	0	0	3
W. S. W.	0	0	5	1	0	0	0	0	1	0	2	2	0	1	0	7
W. by S.			0	0	1	0	0	0	0	0	0	0	0	0	0	1
West	5	17	3	1	2	4	0	0	8	1	13	0	9	3	2	43
W. by N.			2	0	2	0	0	0	0	0	4	2	0	0	0	8
W. N. W.	2	2	3	5	2	0	0	2	0	7	6	4	2	0	4	32
N. W. by W.			0	0	0	0	0	0	0	0	2	2	0	0	1	5
N. W.	6	14	2	1	0	6	6	10	6	2	0	4	0	2	7	44
N. W. by N.			1	0	0	0	0	0	0	0	0	0	2	0	2	4
N. N. W.	1	8	0	15	18	8	8	6	4	3	2	8	15	14	6	107
N. by W.			0	7	4	6	1	0	1	0	1	2	10	8	4	44
Variable and calm	2	22	3	1	6	3	8	6	0	2	13	2	0	2	2	45

[1] These observations were taken from May 1 to 7, on Parry's voyage from Hammerfest, Norway, to Spitzbergen; from June 20 to August 28, at Hecla Cove, lat. 79° 55′, lon. 16° 49′ E.; and during the remainder of the time, off the north and west coasts of Spitzbergen.

[2] These observations were taken on the ice north of Spitzbergen, between the island and lat. 82° 45′, the most northerly point ever reached by man.

[3] These observations were taken from August 28, 1819, to August 27, 1820; viz.: 314 days at Winter Harbor, lat. 74° 45′, lon. 110° 48′ W., 48 days along the southern shore of the island, and the remaining 4 days a little eastward of the island.

Winds within the Arctic Circle.—*Continued.*

Felix, Sheriff's, and Victoria Harbors.[1]

Course.	Felix.	Sheriff's.	Victoria.	Average for the different months. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	1159	891½	498	360	154	145	245¼	265½	169½	418½	337½	276	215	334	199	3119¼
N. by E.	57	64	4	0	4	0	0	4½	0	34½	13½	60	2	20	24	162½
N. N. E.	852	240	24	44	76	45	225	235½	184½	262½	49½	79½	68	138	54	1461½
N. E. by N.	186	16	0	0	48	1	6	0	13½	12	1½	6	16	111	0	215
N. E.	477	248	40	8	45	69	103½	103½	166½	183	165	60	31	65	26	1025½
N. E. by E.	34	29	0	0	0	2	0	7½	6	0	33	9	0	24	0	81½
E. N. E.	42	76	5	5	13	9	9	12	16½	28½	46½	12	4	9	0	164½
E. by N.	48	7	0	0	0	2	0	3	0	1½	0	33	28	0	0	67½
East	192	307	180	18	36	67	49½	150	31½	111	112½	37½	81	45	104	843
E. by S.	10	37	2	6	1	2	0	12	0	10½	0	15	6	2	7	61½
E. S. E.	24	92	33	0	10	11	4½	33	6	19½	27	21	20	16	18	186
S. E. by E.	3	29	3	3	0	0	0	1½	0	3	0	0	0	29	0	36½
S. E.	121	332	262	65	76	49	34½	88½	31½	96	52½	39	69	111	117	809
S. E. by S.	0	17	12	0	0	1½	4½	0	3	0	0	0	10	7	6	32
S. S. E.	71	155	172	52	18	39	42	40½	19½	46½	30	24	31	77	46	465½
S. by E.	41	71	18	15	0	0	10½	9	6	36	4½	7½	37	30	13½	169
South	580	854	315	183	243	170	138	120	163½	96	160½	204	158	177	230	2043
S. by W.	74	69	10	37	6	20	6	12	24	0	22½	43½	12	2	4	189
S. S. W.	340	178	127	114	84	47	66	39	106½	33	36	49½	64	49	67	755
S. W. by S.	32	13	0	0	0	4	0	4½	6	0	0	15	24	0	0	53½
S. W.	596	681	68	206	162	154	181½	114	288	61½	63	57	137	78	98	1600
S. W. by W.	11	21	0	0	0	0	0	9	10½	0	9	10½	1	5	0	45
W. S. W.	147	219	19	3	27	38	66	55½	60	21	40½	79½	64	12	26	492½
W. by S.	41	35	1	2	4	10	16½	0	0	0	13½	25½	23	0	1	95½
West	463	658	82	70	62	114	121½	174	244½	102	147	106½	150	102	108	1501½
W. by N.	40	67	0	4	3	0	15	9	6	0	39	25½	37	6	0	138½
W. N. W.	187	298	8	13	7	43	67½	105	82½	37½	60	61½	88	44	22	631
N. W. by W.	20	39	0	1	0	2	1½	7½	0	18	16½	15	17	0	0	78½
N. W.	699	892½	192	171	122	157	218¼	148½	180	114	231	102	319	143	209	2114¾
N. W. by N.	64	156	4	16	0	4	42	18	12	6	48	85½	33	16	14	294½
N. N. W.	697	722	1319	383	455	424	280½	214½	102	96	273	325½	178	90	347	3168½
N. by W.	236	101	187	107	12	8	39	46½	4½	33	46½	150	134	35	15	630½
Calm and variable	1174	1026	802	346	367	595	166½	193½	216	262½	153	124½	175	399	476	3474

Igloolik and vicinity.[2]

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	14	8	12	9	4	14	6	3	2	4	2	4	82
N. by E.	0	2	0	0	0	2	0	0	0	0	0	0	4
N. N. E.	0	4	0	0	2	0	2	4	0	0	0	2	14
N. E. by N.	0	0	0	0	0	0	0	0	0	2	0	0	2
N. E.	2	0	2	0	6	2	2	4	0	10	0	2	30
N. E. by E.	0	0	0	0	0	0	1	0	0	0	0	0	1
E. N. E.	6	2	0	0	0	0	0	0	8	4	0	4	24
E. by N.	0	0	0	0	0	0	0	0	0	2	0	0	2

[1] These observations extend from October, 1830, to March, 1832, inclusive.

[2] These observations were taken from August 13, 1822, to August 12, 1823, viz.: 317 days at Igloolik, lat. 69° 21′, lon. 81° 42′ W.; 9 days on the coast of the island, 28 days in the strait of Fury and Heckla, lat. 69° to 70°, lon. 82° to 86° W.; and the remaining 11 days, off the west entrance of the same.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Winds within the Arctic Circle.—*Continued.*													
Igloolik and vicinity.—*Continued.*													
East	0	0	0	0	0	2	0	6	0	4	0	0	12
E. by S.	0	0	0	0	0	0	0	0	0	0	0	0	0
E. S. E.	0	0	0	0	4	0	2	2	4	4	2	0	18
S. E. by E.	0	0	0	0	0	0	0	0	0	0	0	0	0
S. E.	4	0	0	0	6	2	20	7	4	5	2	0	50
S. E. by S.	0	0	0	0	0	0	1	0	2	1	0	0	4
S. S. E.	2	0	0	0	2	0	6	1	4	2	0	0	17
S. by E.	0	0	0	0	0	0	0	0	0	0	0	0	0
South	2	0	0	0	8	4	0	0	0	5	2	0	21
S. by W.	0	0	0	0	0	0	0	0	0	0	0	0	0
S. S. W.	0	0	0	0	0	0	0	0	0	0	0	2	2
S. W. by S.	0	0	0	0	0	0	0	0	0	0	0	0	0
S. W.	2	0	4	0	4	6	0	2	0	0	4	0	22
S. W. by W.	0	0	0	0	0	0	0	0	0	1	0	0	1
W. S. W.	0	0	0	6	3	0	0	0	0	0	0	2	11
W. by S.	0	0	0	0	2	0	0	0	0	0	0	0	2
West	2	4	12	6	4	6	2	3	6	0	12	22	99
W. by N.	0	2	0	0	0	0	0	0	2	0	0	0	4
W. N. W.	4	2	4	2	1	2	2	4	6	1	6	0	34
N. W. by W.	0	0	0	0	0	0	0	6	2	0	0	0	8
N. W.	16	26	20	18	8	8	8	7	18	13	18	16	176
N. W. by N.	0	0	2	0	0	0	0	2	0	0	0	0	4
N. N. W.	6	6	6	15	6	10	2	7	2	4	10	6	80
N. by W.	2	0	0	0	2	2	2	0	0	0	0	2	10
Calm or variable	0	0	0	0	0	0	6	2	0	0	2	0	10
Winter Island and vicinity.[1]													
North	6	6	8	6	4	6	6	0	0	4	10	11	67
N. by E.	0	2	2	0	0	0	0	5	0	12	4	0	25
N. N. E.	1	0	4	2	4	4	6	0	0	6	8	2	37
N. E. by N.	0	0	0	0	0	0	0	0	0	0	0	0	0
N. E.	2	0	0	3	8	0	4	3	3	2	2	0	27
N. E. by E.	0	0	0	0	0	0	0	0	2	0	2	0	4
E. N. E.	5	0	0	4	0	4	0	1	0	0	0	0	14
E. by N.	0	0	0	0	0	0	0	0	2	0	2	0	4
East	0	0	0	4	0	2	2	2	2	4	2	0	18
E. by S.	0	0	0	0	0	0	0	0	2	0	0	0	2
E. S. E.	0	0	2	2	2	8	4	0	4	5	0	2	29
S. E. by E.	0	0	0	0	0	0	0	0	0	0	0	0	0
S. E.	0	0	0	2	2	6	4	2	4	4	2	8	34
S. E. by S.	0	0	0	0	0	0	0	0	0	0	0	0	0
S. S. E.	0	0	0	2	0	0	0	1	3	0	0	0	6
S. by E.	0	0	0	0	0	0	1	0	0	0	0	0	1
South	0	0	0	2	1	1	10	4	6	0	2	0	26
S. by W.	0	0	0	0	0	0	0	2	4	0	0	0	6
S. S. W.	0	0	0	0	0	2	0	6	2	0	0	2	12
S. W. by S.	0	0	0	0	0	1	0	0	1	0	0	0	2
S. W.	0	2	5	6	2	4	0	5	0	4	4	0	32
S. W. by W.	0	0	0	0	0	0	0	1	0	0	0	0	1
W. S. W.	0	0	0	2	3	0	0	2	0	0	0	0	7

[1] These observations were taken from August 1, 1821, to July 31, 1822, viz.: 269 days at Winter Island, lat. 66° 11′, lon. 83° 10′ W.; 65 days in various bays and straits within 100 miles of it; 6 days in the upper part of Hudson's Strait, and the remaining 25 days off the northeast coast of Melville Peninsula. The island itself lies just without the Arctic Circle (21 miles), but some of the observations were taken within.

Winds within the Arctic Circle.—*Continued.*

Winter Island and vicinity—*Continued.*

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
W. by S.	0	0	0	0	0	1	0	4	1	0	0	0	6
West	6	0	2	4	6	5	2	1	1	0	6	0	33
W. by N.	0	0	2	0	2	1	1	2	2	0	0	0	10
W. N. W.	10	3	13	4	2	0	0	12	2	2	2	4	54
N. W. by W.	0	0	0	0	0	0	4	2	4	0	0	0	10
N. W.	18	22	18	7	12	12	10	3	4	4	10	25	145
N. W. by N.	0	2	0	0	0	1	0	0	2	0	0	0	5
N. N. W.	14	17	6	6	14	0	2	4	0	6	4	8	81
N. by W.	0	2	0	0	0	0	4	0	7	9	0	0	22
Calm or variable	0	0	0	4	0	2	2	0	2	0	0	0	10

Baffin's Bay, and the contiguous Bays, Straits, and Inlets.

Course.	June, 1821.	June, 1824.	July, 1824.	July, 1819.	July, 1821.	Aug. 1819-20	Aug. 1822.	Aug. 1823.	Aug. 1824.	Sept. 1824.	Sept. 1819.	Sept. 1823.	Total.
North	0	1	19	4	9	6	0	4	7	2	0	6	
N. by E.	0			0	1	2	0	0			0	0	
N. N. E.	1			4	1	0	0	2			4	6	
N. E. by N.	0			0	3	0	0	0			0	0	
N. E.	0	4	10	0	3	0	0	3	3	5	3	2	
N. E. by. E.	0			0	0	1	0	0			2	0	
E. N. E.	0			0	0	0	0	0			0	2	
E. by N.	0			0	2	4	0	0			0	0	
East	0	22	1	4	3	3	0	4	6	7	2	4	
E. by S.	2			1	1	0	0	0			0	2	
E. S. E.	0			0	0	0	2	0			2	2	
S. E. by E.	2			2	0	0	0	0			2	0	
S. E.	3	2	10	2	6	0	0	3	14	13	3	3	
S. E. by S.	0			2	1	0	0	0			2	0	
S. S. E.	4			5	2	0	2	6			2	0	
S. by E.	0			2	0	0	0	0			0	0	
South	0	17	5	0	2	1	2	5	7	11	8	2	
S. by W.	0			0	2	4	0	0			0	0	
S. S. W.	5			0	2	2	1	0			0	4	
S. W. by S.	0			0	2	0	0	0			0	0	
S. W.	2	6	3	5	1	7	3	2	5	2	2	3	
S. W. by W.	2			0	2	3	0	0			0	0	
W. S. W.	4			2	1	4	1	0			4	0	
W. by S.	0			0	2	0	0	0			0	0	
West	6	0	3	7	3	3	1	2	3	6	3	8	
W. by N.	0			0	1	0	2	0			0	0	
W. N. W.	2			0	0	1	5	0			2	8	
N. W. by W.	2			4	4	4	0	0			4	0	
N. W.	1	4	11	2	3	7	2	2	14	14	5	6	
N. W. by N.	0			0	0	0	0	0			0	0	
N. N. W.	2			11	2	2	0	5			5	2	
N. by W.	0			2	0	0	0	0			1	0	
Calm or variable	0	4	0	3	2	6	0	0	3	0	8	0	

NOTE.—The following table shows the latitudes and longitudes in which these observations were taken:—

Date.	Latitude.	Longitude.	Date.	Latitude.	Longitude.	Date.	Latitude.	Longitude.
June, 1821	58° to 62⅔°	11° to 65°	July, 1824	69° to 71°	53° to 62°	Aug. 1824	71° to 74°	61° to 64°
" 1824	59½ to 69	9½ to 51	Aug. 1819-20	72¼ to 75	78 to 101½	Sept. 1819	60 to 67	40 to 84
July, 1819	61 to 64	65 to 76	" 1822	69 to	80 to	" 1823	60 to 67	40 to 84
" 1821	61 to 64	65 to 76	" 1823	66 to 69	82 to 83	" 1824	57 to 74	32 to 66

Winds within the Arctic Circle.—*Continued.*

Port Bowen.[1]

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	6	6	0	5	6	3	8	18	4	8	4	8	76
N. E.	5	4	1	0	6	2	2	17	4	5	0	2	48
E.	36	37	36	36	19	25	0	2	9	21	17	30	268
S. E.	3	0	0	4	2	5	10	0	9	13	16	9	71
S.	0	0	0	0	6	4	4	3	0	2	0	0	19
S. W.	0	0	4	0	2	9	6	5	6	0	5	2	39
W.	0	2	4	8	4	5	24	3	21	1	3	3	78
N. W.	6	5	15	5	15	7	8	14	5	10	11	4	105
Calm	6	2	2	2	2	0	0	0	2	2	4	4	26

Winds in Iceland and Greenland.

Eyafiord, Iceland. Reikiavik, Iceland.

			Total for the separate months.												Reikiavik, Iceland.						
Course.	June 1, 1811, to June 1, 1812.	June, 1812, to June, 1813.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
N.	161	148	10	13	27	11	46	44	49	29	20	22	19	19	35	23	18	9	29	78	42
N. E.	62	95	3	6	5	8	16	29	26	37	6	6	13	2	29	26	6	7	5	51	18
E.	36	83	0	2	7	3	10	7	12	20	14	34	9	1	31	4	6	22	54	3	24
S. E.	40	36	0	3	7	4	11	0	7	6	16	13	7	2	35	29	57	57	42	20	12
S.	154	144	36	24	36	23	18	7	16	13	28	24	37	36	9	21	12	12	17	2	0
S. W.	156	121	36	25	31	26	4	31	4	20	30	14	25	31	0	15	6	21	4	7	6
W.	101	133	34	24	27	41	19	6	5	4	20	8	16	30	11	6	6	23	4	9	12
N. W.	141	64	17	37	19	20	22	24	8	4	6	4	15	29	15	26	30	17	19	0	0
Calm	85	103	5	7	9	19	22	12	29	20	22	13	18	12	21	0	27	0	0	16	6

New Herrnhutt, Greenland.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	2	1	1	5	4	5	3	11	5	1	0	6	44
N. E.	9	3	5	5	6	2	2	1	0	2	6	8	49
E.	13	12	24	7	12	8	6	4	16	7	20	15	144
S. E.	0	3	0	0	0	0	1	0	0	1	1	0	6
S.	2	7	0	4	0	0	6	5	5	14	2	2	47
S. W.	2	2	1	4	4	3	3	7	2	2	1	0	31
W.	3	0	0	4	5	12	10	3	2	4	0	0	43
N. W.	0	0	0	1	0	0	0	0	0	0	0	0	1
Calm	0	0	0	0	0	0	0	0	0	0	0	0	0

Frederichthal, Greenland.[2]

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	28	17	18	1						31	21	0	
N. E.	0	0	0	0						0	0	0	
E.	0	0	0	0						0	0	0	
S. E.	0	0	3	10						0	6	3	

[1] These observations were taken at Port Bowen, from September 28, 1824, to July 19, 1825, 46 days in Prince Regent's Inlet, and the remaining 24 days, to complete the year, between the parallels of latitude 73° 40′ and 74° 24′, and in longitudes ranging from 66° 52′ to 85° 48′; 17 days out of the 24 being spent west of longitude 80°.

[2] These observations were taken from October, 1841, to April, 1842, inclusive.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Winds in Iceland and Greenland.—*Continued.*													
Frederichthal, Greenland.—*Continued.*													
S.	2	6	10	14						0	0	25	
S. W.	0	0	0	0						0	0	0	
W.	0	0	0	0						0	0	3	
N. W.	0	5	0	5						0	3	0	

Winds in British and Russian America.

Fort Enterprise.[1] — Fort Reliance, Great Slave Lake.

Course.	Jan.	Feb.	Mar.	April.	May.	Course.	Jan.	Feb.	Mar.	April.	May.	Part of Oct.	Nov.	Dec.	Total.
North	3	9	11	12	0	North	3	9	14	6	0	0	3	13	48
N. by E.	1	6	1	2	0	N. by E.	0	0	0	0	0	0	0	0	0
N. N. E.	2	15	0	3	0	N. N. E.	0	0	0	0	0	0	0	5	5
N. E. by N.	1	1	1	0	1	N. E. by W.	0	0	0	0	0	0	0	0	0
N. E.	4	19	11	14	2	N. E.	11	38	26	37	27	0	42	42	223
N. E. by E.	0	1	3	4	0	N. E. by E.	0	0	0	0	0	0	0	0	0
E. N. E.	4	20	11	23	1	E. N. E.	3	6	12	3	12	5	3	9	53
E. by N.	7	7	1	2	1	E. by N.	3	0	5	6	6	0	14	6	40
East	17	12	14	23	2	East	6	2	5	25	57	22	21	23	161
E. by S.	2	3	6	10	5	E. by S.	0	0	3	0	0	6	6	3	18
E. S. E.	0	1	9	0	5	E. S. E.	0	0	0	3	9	0	6	0	18
S. E. by E.	0	0	0	0	3	S. E. by E.	0	0	0	0	0	0	0	0	0
S. E.	0	2	7	1	5	S. E.	0	5	2	4	3	3	11	3	31
S. E. by S.	0	1	1	0	3	S. E. by S.	0	0	0	0	0	0	0	0	0
S. S. E.	0	0	0	1	0	S. S. E.	0	0	0	0	0	0	0	0	0
S. by E.	0	1	3	2	1	S. by E.	0	0	0	0	0	0	0	0	0
South	4	6	3	2	0	South	0	4	3	2	0	10	2	2	23
S. by W.	1	0	2	2	1	S. by W.	0	0	0	0	0	0	4	6	10
S. S. W.	0	4	3	2	0	S. S. W.	3	0	0	0	0	0	0	3	6
S. W. by S.	1	0	0	1	1	S. W. by S.	0	0	0	0	0	0	0	0	0
S. W.	4	6	13	3	0	S. W.	34	23	29	6	2	6	23	30	153
S. W. by W.	2	0	2	0	0	S. W. by W.	0	0	0	0	0	0	0	0	0
W. S. W.	13	12	9	3	3	W. S. W.	8	2	2	2	2	0	0	0	16
W. by S.	4	5	8	3	3	W. by S.	3	0	2	0	0	0	0	9	14
West	22	4	11	4	2	West	5	12	7	17	7	0	2	3	53
W. by N.	3	4	5	2	0	W. by N.	6	0	3	0	0	0	4	0	13
W. N. W.	10	2	3	6	0	W. N. W.	2	2	2	2	2	0	0	0	10
N. W. by W.	1	2	4	0	0	N. W. by W.	0	0	0	0	0	0	0	0	0
N. W.	5	14	15	5	0	N. W.	6	3	4	8	4	0	16	2	43
N. W. by N.	0	0	6	5	0	N. W. by N.	0	0	0	0	0	0	0	0	0
N. N. W.	0	3	2	10	0	N. N. W.	0	0	0	0	0	0	6	0	6
N. by W.	0	2	0	6	0	N. by W.	0	0	0	0	0	0	0	0	0
Calm or variable	3	9	20	21	2	Calm and variable	96	62	66	59	6	0	17	27	333

[1] These observations were taken from September 1, 1820, till August 31, 1821, but were published *in full* only from January 12 to May 9. In the published *abstracts* for the year, the winds are divided merely into easterly and westerly, as follows:—

Easterly	14	15½	15¾	18	24	24	17½	15	15	22⅓	18⅔	10¾	210½
Westerly	17	12½	15¼	12	7	6	19½	15	15	17⅔	11⅓	20¼	148½

The station is about 300 miles north of Great Slave Lake.

Winds in British and Russian America.—*Continued.*

Sitka,[1] Russian America.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	11	6	78	42	12	36	42	18	18	30	12	6	311
N. E.	127	7	198	90	24	42	78	42	18	30	30	18	704
East	48	14	222	233	156	162	90	156	246	240	270	210	2047
S. E.	167	330	48	59	114	60	6	90	102	174	90	204	1444
South	3	48	48	52	78	60	66	90	60	90	30	78	703
S. W.	5	31	48	113	156	66	120	54	72	18	42	36	42
West	57	13	66	65	144	186	168	108	42	72	72	48	1041
N. W.	41	10	36	53	30	72	36	24	36	6	24	48	416
Calm	279	237	0	14	18	36	120	162	120	66	150	96	1298

Fort Franklin, Great Bear Lake.

Course.	1825.				1826.											1827.				
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.
N. to N. E. by N.	3	4	2	2½	1	1	3½	0	0	0	0	0	6½	6	0	1	0	1	0	0
N. E. to E. by N.	7	1	13	6	9	6	3	8	4	3	7	4	4	4½	10½	6	3	6	2	0
E. to S. E. by E.	9	4	17	3	16½	6	17	28	34	16	29	9	5	5½	11	9½	17	38	31	23½
S. E. to S. by E.	2	14	6	4	2½	1	3½	5	6	16	7	4	18½	9½	5½	4½	4	4	14	2
S. to S. W. by S.	0	2	1	3	0	0	0	0	0	0	1	0	1½	0	0	0	1	0	0	1
S. W. to W. by S.	0	1	1	1	1	½	1½	½	3	0	3	3	½	½	4	1½	0	1	1	0
W. to N. N. by W.	2	6½	8	16	5	10	9½	2	0	3	4	4	4	14	4	6	4	4	4	0
N. W. to N. by W.	6	15	10	19	23	22	18½	10	13	8	11	24	15½	21	20	27½	22	6	6	3½
Calm or variable	7	3½	4	7½	4	9½	9½	6½	2	0	0	2	6½	4	7	7	5	0	2	2

Norway House,[2] Hudson's Bay Territory.

Course.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	TOTAL FOR THE SEPARATE MONTHS.												Total.
								Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
North	49	58	92	85	43	41	60	23	38	53	30	31	27	38	24	32	50	51	31	428
N. E.	55	38	34	37	60	51	47	25	34	30	47	43	27	16	13	15	23	24	25	322
East	13	14	9	4	12	11	29	7	6	6	8	7	6	9	4	4	13	13	9	92
S. E.	31	17	14	10	31	27	22	18	12	11	12	10	9	9	10	22	14	14	11	152
South	61	85	69	66	61	78	100	31	32	44	42	47	59	57	48	38	28	44	50	520
S. W.	34	25	24	30	27	29	12	24	16	14	14	16	19	13	20	11	9	7	15	181
West	15	11	16	18	14	17	19	21	9	6	3	3	2	4	14	18	9	9	12	110
N. W.	53	43	54	93	64	61	36	46	30	26	32	20	16	32	49	39	48	30	36	404
Calm or variable	54	74	53	23	53	50	40	22	20	27	22	40	45	39	35	31	23	18	28	347

[1] March to December, 1842, and January and February, 1844.

[2] "Norway House is situated on a branch of Nelson's River, about 20 miles due north of the outlet of Lake Winnepeg, and is supposed to be about 400 feet above the level of the sea."—D. Ross.

Winds in British and Russian America.—*Continued.*

Nain, Labrador.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	34	16	37	13	6	8		5	9	12	8	12	160
N. E.	1	9	8	9	21	23		2	3	2	4	0	82
East	0	0	4	0	6	17		7	24	7	12	0	77
S. E.	0	0	0	0	4	0		0	0	2	1	0	7
South	0	1	0	1	0	0		1	0	2	1	0	6
S. W.	0	1	0	1	1	1		3	2	3	0	0	12
West	16	19	4	3	7	5		28	17	22	29	30	180
N. W.	11	10	9	33	17	4		14	5	12	5	20	140
Calm	0	0	0	0	0	2		0	0	0	0	0	2

St. John's, Newfoundland.[1]

Course.	1840.	1841.	1842.	1843.	AVERAGE FOR THE SEPARATE MONTHS, IN HOURS.												
					Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	33	45	28	24	56	40	63	20	28	39	18	24	21	72	52	96	529
N. N. E.	46	38	31	43	12	64	87	60	96	24	9	24	48	56	72	48	600
N. E.	60	84	40	53	68	60	78	56	124	63	15	87	78	84	128	0	841
E. N. E.	2	9	8	4	8	16	12	4	0	0	6	0	6	16	16	0	84
East	18	28	8	13	16	8	27	20	36	12	18	21	9	24	40	24	255
E. S. E.	11	2	0	3	0	4	3	8	12	12	0	0	0	8	12	0	59
S. E.	54	84	25	34	44	36	42	48	164	87	75	66	57	36	8	48	711
S. S. E.	11	23	12	12	16	16	12	36	20	33	15	6	9	16	12	48	239
South	59	41	22	18	52	56	27	48	20	36	48	33	57	56	44	48	525
S. S. W.	21	31	34	22	32	36	15	28	12	45	66	30	39	44	8	36	391
S. W.	132	89	78	101	104	32	78	140	56	123	186	228	150	160	44	132	1433
W. S. W.	29	31	32	20	36	12	45	40	24	27	63	39	27	16	32	60	421
West	94	72	72	56	140	68	84	80	68	99	102	99	87	76	100	48	1051
W. N. W.	22	33	19	14	24	60	36	24	4	30	21	6	51	12	28	24	320
N. W.	40	54	32	19	84	120	63	52	16	27	18	0	30	32	76	48	566
N. N. W.	6	19	15	10	40	36	21	8	20	15	3	0	9	4	8	60	224
Calm	30	46	27	42	8	20	42	40	32	57	81	78	42	32	40	24	496

[1] Mr. Templeman, to whom I am indebted for the foregoing observations, accompanies them with the following description of his locality:—

"The town is situated on the *north* side of the harbor, on the declivity of an eminence, the highest point of which does not, I should imagine, exceed 250 feet above the level of the sea. At the back of this (north) there is a succession of valleys and hills, the highest of which must, I should think, be 700 feet above the level. The south side of the harbor is a high mountain ridge from 700 to 800 feet high; the harbor is open to the sea E. S. E. and W. N. W., so that (the land being high on both sides of the narrows) it is often difficult, except when it blows hard, to say precisely *how* the wind is outside when between E. N. E. and S. S. W. We have nothing approaching to *mountains* in the immediate vicinity, and the highest hill does not exceed 1000 feet, and that is 4 or 5 miles from the town. It may, I think, be laid down as a general rule that, except when the wind is very light and blowing between E. N. E. and S. S. W., it is not subject to any local influence." . . . . "There are no extensive rivers in this part of the colony; that which empties itself into the harbor is not more than 30 feet wide at the broadest part, and very shallow."

Winds in British and Russian America.—*Continued.*

Michipicoten, Canada.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	2	4	4	3	1	2	0	3	3	8	3	5	38
N. N. E.	0	0	0	0	0	0	0	0	0	0	0	0	0
N. E.	4	4	4	1	8	3	3	3	7	5	9	9	60
E. N. E.	0	2	1	2	4	1	1	1	2	1	3	3	21
East	17	14	14	9	10	3	5	6	15	3	16	19	131
E. S. E.	0	1	0	1	5	2	0	0	1	0	1	0	11
S. E.	8	14	9	8	4	3	4	7	3	1	1	4	66
S. S. E.	0	0	0	1	0	0	0	0	0	0	0	0	1
South	6	5	2	6	5	6	2	2	2	8	7	7	58
S. S. W.	0	0	0	0	0	1	0	0	0	0	0	0	1
S. W.	5	9	22	20	17	16	16	11	10	14	5	9	154
W. S. W.	0	0	0	1	2	3	3	1	2	0	0	3	15
West	18	2	5	4	6	19	28	23	14	14	9	3	145
W. N. W.	0	0	1	2	0	1	0	3	0	5	1	0	13
N. W.	2	1	0	2	0	0	0	2	1	3	5	0	16
N. N. W.	0	0	0	0	0	0	0	0	0	0	0	0	0

Quebec, Canada.

Course.	1832.	1833.	1834.	1835.	1836.	TOTAL FOR THE SEPARATE MONTHS.												
						Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
East	121	111	120	109	109	44	41	50	59	80	53	45	38	31	37	38	54	570
West	220	205	211	224	209	93	85	88	70	56	76	98	102	104	101	104	92	1069
Variable	25	49	34	32	48	18	16	17	21	19	21	12	15	15	17	8	9	188

Course.	Montreal, Canada.															Wilberforce, Canada, Dec. 1831.	Quebec, May, 1765, to May, 1766.
	1836.	1837.	1838.	MONTHS OF 1838.													
				Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.		
N.	131.70	113.00	133.50	15.50	4.00	7.50	5.25	6.50	5.50	3.00	4.50	5.00	1.50	2.50	6.00	9	3
N. E.	50.02	77.00	26.00	.00	.00	.50	.00	3.50	1.00	1.00	.50	4.00	1.50	1.00	.00	0	1
E.	24.84	15.00	14.50	.00	.00	1.00	.25	1.50	2.00	.00	1.00	.00	1.00	.50	.00	3	25
S. E.	17.64	22.00	24.00	.00	.00	.00	2.00	3.00	.00	1.00	.00	.00	4.00	2.00	.00	0	8
S.	111.32	77.00	98.50	5.00	1.00	1.00	3.75	2.50	4.50	2.00	11.00	1.50	3.00	5.50	8.50	36	1
S. W.	145.34	120.00	98.00	3.00	4.00	.00	5.50	5.50	4.00	6.50	3.50	5.00	5.50	4.00	2.50	12	8
W.	159.82	203.00	189.50	4.00	12.00	2.00	10.75	5.00	6.00	9.50	7.50	8.50	10.50	9.50	9.50	9	54
N. W.	75.32	77.00	60.00	2.50	1.00	1.00	2.50	1.50	1.00	4.00	3.00	2.00	2.00	5.00	4.50	0	12

Winds in British and Russian America.—*Continued.*

Toronto, Canada.

By Osler's Anemometer.

Course.	1841.	1842.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Windsor, Nova Scotia, 1794.	Iluluk, Aleutian Islands, 1¾ years.
	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.	hrs.		
North	795	450	27	57	164	103	112	125	131	77	126	170	42	111	1245	71	92
N. N. E.	348	333	24	25	125	67	26	55	67	50	97	42	36	67	681	21	21
N. E.	330	208	66	22	76	35	61	19	10	37	75	10	67	60	538	21	42
E. N. E.	310	470	43	33	98	94	38	40	28	110	62	87	108	39	780	4	6
East	460	519	26	85	85	173	69	133	52	105	42	69	93	47	979	7	23
E. S. E.	395	278	51	28	54	64	46	108	32	66	71	56	53	44	673	7	15
S. E.	326	333	30	29	44	73	54	71	66	84	70	37	91	10	659	12	49
S. S. E.	301	264	9	19	12	38	69	65	73	77	88	41	46	28	565	14	34
South	315	373	55	33	75	57	51	90	109	84	30	51	17	36	688	26	170
S. S. W.	363	547	69	76	39	36	98	87	139	66	50	27	58	165	910	16	41
S. W.	305	448	121	134	33	48	31	39	62	28	32	42	131	52	753	33	106
W. S. W.	282	346	106	107	20	28	16	19	29	7	40	49	132	75	628	12	45
West	384	356	148	72	55	75	2	31	10	14	22	79	62	146	740	45	85
W. N. W.	326	400	49	108	49	33	21	23	25	2	73	71	109	163	726	11	32
N. W.	357	412	108	93	55	59	53	17	49	30	35	136	83	51	769	36	59
N. N. W.	413	513	81	48	106	98	209	41	100	33	58	79	31	42	926	22	49
Calm	2669	2409	475	375	379	351	397	472	505	618	452	442	260	352	5078		0

(The month columns are headed "TOTAL FOR THE SEPARATE MONTHS.")

Winds in the United States.

Hancock Barracks, Maine.

Course.	1829–30.[1]	1831 to 1842, inclusive.[1]	TOTAL FOR THE SEPARATE MONTHS OF 1829–30.											
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	36	731	7	5	2	1	2	0	0	0	2	8	5	4
N. E.	143	650½	17	13	18	14	11	15	7	13	9	4	8	14
E.	73	296½	1	6	3	7	12	7	10	5	5	8	6	3
S. E.	170	644½	9	5	15	16	16	21	18	15	13	14	13	15
S.	24	907½	0	0	1	3	1	3	7	7	0	2	0	0
S. W.	70	255½	0	5	6	3	9	7	7	12	6	6	6	3
W.	5	256	0	0	0	0	1	1	1	0	0	2	0	0
N. W.	213	641½	28	22	17	16	12	6	12	10	25	19	23	23

Eastport, Maine.

Course.	1822 to 1826, inclusive.[1]	1831 to 1835, inclusive.[1]	TOTAL FOR THE SEPARATE MONTHS FROM 1822 TO 1826, INCLUSIVE.											
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	190	216½	30	16	19	19	5	8	10	17	13	8	23	22
N. E.	125	164½	13	16	8	10	6	7	2	20	14	9	12	8
S. E.	124	152½	8	8	16	17	17	14	11	7	3	9	6	8
S.	52	244½	1	3	10	2	5	5	1	4	4	7	5	5
E.	431	659½	11	15	23	33	48	56	79	65	42	28	14	17
S. W.	242	347½	14	18	15	20	26	21	13	17	23	30	27	18
W.	267	411½	42	24	25	20	15	10	20	12	24	26	18	31
N. W.	398	359½	36	41	39	29	33	29	19	15	27	38	46	46

[1] For the separate years, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Hampden, Maine.[1]

Course.	1844.	1845.	1846.	Proportion for the separate months. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	127	114	94	11.00	11.25	8.50	10.00	4.67	10.67	3.66	7.50	9.25	11.00	10.25	15.25	113.00
N. E.	67	60	54	6.50	4.00	5.25	2.67	7.33	6.33	5.00	7.00	2.75	5.25	8.50	4.00	64.58
E.	16	12	9	1.25	1.00	1.50	1.33	.67	.67	1.33	1.50	.25	2.00	1.75	.25	13.50
S. E.	137	122	54	3.75	4.75	7.25	9.00	1.70	8.33	11.33	9.25	5.75	14.75	9.50	4.25	104.92
S.	329	312	382	17.25	14.50	25.50	24.00	34.00	33.67	44.67	37.75	34.50	23.00	14.50	20.75	324.08
S. W.	129	122	165	18.25	15.00	12.25	8.67	10.33	15.33	12.67	5.75	8.50	15.75	13.75	13.50	149.75
W.	209	235	217	9.25	19.25	20.00	23.67	15.67	22.00	17.00	15.50	14.25	12.25	21.25	19.25	209.33
N. W.	387	333	311	45.25	38.00	30.75	30.33	22.33	16.00	20.00	16.25	30.75	28.50	33.25	39.50	350.92

Portland, Maine.

Course.	1827 to 1830, inclusive.[2]	6 years since 1830.[2]	Total for the separate months from 1827 to 1830, inclusive. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Biddeford, Maine, 1848.	Fort Fairfield, Maine, 1842.	Fort Kent, Maine, 1843.
N.	83	201½	18	11	1	15	9	4	2	2	2	3	10	6	70	39	88
N. E.	119	211	15	8	15	13	13	9	3	3	11	7	11	11		10	10
E.	84	153½	7	4	4	9	9	10	11	7	11	7	1	4	71	21	21
S. E.	170	153½	9	7	16	15	26	21	15	14	14	12	10	11		20	20
S.	311	267½	3	21	21	19	34	30	42	41	34	39	14	13	84	107	46
S. W.	249	349	26	13	18	21	16	20	32	25	19	21	18	20		256	37
W.	245	601½	25	32	18	16	15	14	16	17	12	15	36	29	140	154	77
N. W.	201	252	21	17	31	12	2	12	3	15	17	20	21	30		122	66

Saco, Maine.

Course.	1844.	1845.	1846.	Average for the separate months.[3] Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	172	333	234	400	268	300	200	196	248	129	153	216	219	231	336
N. E.	86	63	50	88	72	108	44	76	40	36	30	57	81	66	129
E.	27	21	21	4	4	12	60	64	24	21	30	57	39	15	9
S. E.	97	52	47	36	52	116	120	88	48	45	99	72	87	72	18
S.	222	230	241	60	96	196	332	336	248	336	405	249	222	132	42
S. W.	128	56	115	32	48	96	64	104	172	171	144	99	114	69	69
W.	155	87	85	108	92	68	56	92	164	189	84	135	141	114	144
N. W.	211	172	146	328	348	156	156	100	88	117	81	120	144	309	300

[1] The average for the separate months extends from August 1, 1843, to April 1, 1847.

[2] For the separate years, see the published volumes of the U. S. Army Meteorological Register.

[3] The average for the separate months extends from July 1, 1843, to December 31, 1846.

Winds in the United States.—*Continued.*

Course.	Bath, Maine. 1832 to 1839, inclusive.[1]	Bath, Maine. 1840.	Bath, Maine. 1841.	Owl's Head, Maine, 6 months.	Steuben, Maine, 3 months.	South Thomaston, Maine, 10 months.	South-west Harbor, Maine, 1 month.	Vinal Haven, Maine, 2 months.	Winthrop, Maine, 2 months.
N.	17	8	9	59	23	67	4	19	7
N. E.	543	43	52	54	94	283	7	25	4
E.	14	2	12	68	4	38	14	7	4
S. E.	497	44	40	78	31	306	8	17	2
S.	27	12	15	39	12	60	9	11	7
S. W.	230	117	105	116	141	427	8	57	5
W.	42	29	13	232	48	154	12	16	4
N. W.	1065	100	99	180	53	317	18	15	6
Calm.	218	11	20	41	9	35	8	14	0

Course.	Addison, Maine, 5 months.	Bangor, Maine, 6 months.	Brewer, Maine, 3 months.	Gardiner, Maine, 4 months.	Manhegin Island, Maine, 3 months.	Machias, Maine, 1 month.	Charlestown, New Hampshire, 7 months.	Keene, New Hampshire, 5 months.	Peterborough, New Hampshire, 1 month.	White Island, New Hampshire, 1 month.
North	6	76	101	10	3	9	119	32	4	1
N. N. E.	14	1	0	29	1	1	8	0	0	3
N. E.	24	26	43	57	12	8	325	10	8	9
E. N. E.	31	0	0	1	6	0	0	5	4	0
East	11	7	16	1	7	13	41	27	4	5
E. S. E.	36	5	0	5	2	0	1	3	0	0
S. E.	5	24	38	50	8	13	47	37	13	4
S. S. E.	20	0	0	10	4	0	0	0	0	0
South	2	28	20	9	2	10	72	67	1	38
S. S. W.	42	1	0	9	1	4	12	7	0	0
S. W.	8	56	71	73	4	20	274	94	21	14
W. S. W.	14	1	0	10	0	0	5	1	0	2
West	17	52	213	8	3	9	99	67	22	9
W. N. W.	37	0	0	23	0	2	5	6	0	1
N. W.	41	229	162	147	1	28	246	362	70	5
N. N. W.	33	0	0	16	0	2	41	5	0	1
Calm	19	527	0	32	0	0	4	0	1	0

Portsmouth, New Hampshire.

Course.	1827 to 1830, inclusive.[2]	1831 to 1839, inclusive.[2]	1842.	TOTAL FOR THE SEPARATE MONTHS FROM 1827 TO 1830, INCLUSIVE. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	71	212	22	22	5	6	7	3	1	4	1	7	3	6	6
N. E.	187	432	40	10	6	16	33	21	14	13	12	21	16	13	12
E.	91	190	14½	2	4	7	12	13	10	10	4	12	6	6	5
S. E.	44	133	6	0	2	3	2	6	5	7	6	4	5	2	2
S.	357	634	75	10	11	28	24	44	53	36	55	31	38	16	11
S. W.	175	399	50½	13	20	10	8	12	13	21	14	9	16	14	25
W.	222	600	59	33	25	19	11	10	11	17	11	13	16	24	32
N. W.	314	687	98	34	40	34	23	15	13	16	21	23	24	40	31

[1] For the separate years, see American Almanac.

[2] For the separate years, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Dartmouth College, New Hampshire.

Course.	1835.	PROPORTION FOR THE SEPARATE MONTHS.[1]												
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	79	15½	6½	5½	6½	9½	6½	9½	8	2	6	21⅔	16	113.17
N. E.	35	6	2½	3½	2	6	6½	3	2½	0	0	5	5½	42.50
E.	11	1	0	½	5	2½	7½	3	1½	0	0	⅓	½	21.83
S. E.	85	4½	4½	11½	10½	19	14½	6	3½	10	7	5⅔	4	100.67
S.	51	11½	3½	15½	13½	9	7½	12½	9	2	4	9⅓	4	101.33
S. W.	382	13½	16	20½	16½	13	18	31	34	32	53	14⅓	14½	276.33
W.	73	11	13½	11	8½	6½	8	9	7½	1	2	6⅓	8½	92.83
N. W.	375	30½	37½	23½	27½	27½	21½	19	27	44	21	27⅓	37½	343.84

Dover, New Hampshire.

Course.	1835.	1836.	1837.	1838.	1839.	1842.	MONTHS OF 1842.											
							Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	5	2	1	5	4	2	1	1	0	0	0	0	0	0	0	0	0	0
N. E.	59	79	62	81	80	65	2	2	9	10	11	5	1	6	5	0	5	9
E.	8	10	10	9	8	1	0	1	0	0	0	0	0	0	0	0	0	0
S. E.	40	59	77	56	84	72	2	4	5	7	6	10	6	16	5	4	7	0
S.	8	3	1	2	5	2	0	0	0	0	1	0	0	1	0	0	0	0
S. W.	91	78	86	89.	83	91	16	6	9	5	3	8	19	1	10	9	2	3
W.	30	38	28	29	27	14	1	2	0	0	0	2	2	1	3	2	1	0
N. W.	124	100	100	94	74	118	9	12	8	8	10	5	3	6	7	16	15	19

Course.	Burlington, Vermont, 1850.	Middlebury, Vermont, 1 month.	Fayetteville, Vermont.		Grafton, Vermont, 3 months.	Bennington, Vermont, 4 months.	Newbury, Vermont, 1823 to 1849, inclusive.[2]	Cabotville, Massachusetts, 3 months.	Edgartown, Massachusetts, 1 month.	Medfield, Massachusetts, 2 months.	Northampton, Massachusetts, 4 months.
			One year.	One year.							
N.	105	29	12	18	39	0	7802	5	1	26	52
N. E.	11	1	31	44	45	9	131	42	10	38	49
E.	11	0	14	7	23	8	122	3	2	45	5
S. E.	23	0	9	13	78	77	181	29	6	20	11
S.	146	40	52	56	34	1	6810	15	0	28	30
S. W.	10	0	78	57	98	12	1267	58	7	73	86
W.	25	4	50	66	90	9	739	7	9	166	58
N. W.	34	10	119	105	174	255	1866	83	58	95	79
Calm	0	0	0	0	5	0	0	1	0	0	0

[1] This average is for the entire year 1835, the months of January, February, March, April, May, June, July, August, and November, 1836, and November and December, 1834.

[2] For abstracts for these years separately, see Annual Report of the Regents of the University of the State of New York for 1850.

Winds in the United States.—*Continued.*

Mendon, Massachusetts.

Course.	1842.	1843.	1844.	1845.	1846.	Total for the separate months of 1845–46. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Boston, Massachusetts. 1828.	1831,2, 4, and 6.
N.	0	2	1	3	3	0	0	0	0	1	0	0	0	2	1	0	1	11	32
N. E.	52	71	66	50	59	11	9	7	11	11	8	8	6	6	10	14	8	59	275
E.	0	8	7	11	23	1	2	2	1	5	4	3	5	1	2	6	2	43	89
S. E.	38	18	16	6	8	1	0	1	2	0	0	4	0	0	2	1	2	21	110
S.	0	13	15	8	7	1	0	2	2	0	0	1	0	1	5	3	0	31	51
S. W.	170	135	169	156	150	18	12	27	27	31	36	31	39	32	22	17	14	96	411
W.	0	7	2	21	29	9	6	7	2	4	4	2	1	6	2	3	4	30	73
N. W.	105	111	85	110	86	21	26	16	15	10	8	13	11	12	18	16	30	75	421

Williams College, Massachusetts.

Course.	1816.	1817.	1818.	1819.	1820.	1821.	1822.	1823.	1824.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	Total.
N.	0	0	0	0	0	0	0	0	0	0	0	8	17	11	29	21	22	45	119	63	78	72	60	545
N. E.	6	2	1	0	5	2	2	4	8	6	5	42	17	15	25	12	17	11	31	28	25	6	10	280
E.	10	1	9	5	10	5	3	2	2	18	8	18	68	76	65	41	61	97	96	114	123	48	77	957
S. E.	74	91	90	137	148	82	64	134	106	63	96	105	228	164	258	223	191	192	174	142	146	204	140	3252
S.	95	77	95	228	208	213	287	258	150	175	209	158	107	129	86	115	148	138	165	170	169	156	146	3682
S. W.	71	99	71	85	84	60	56	52	151	99	97	85	121	79	58	74	36	57	56	84	46	49	65	1735
W.	0	14	16	17	13	14	4	4	9	31	14	109	123	134	74	104	51	150	161	164	111	120	172	1609
N. W.	279	260	269	586	587	686	678	607	602	556	543	477	377	445	471	479	478	325	292	327	399	440	413	10576

Worcester, Massachusetts.

Course.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	Total for the separate months of 1846. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	60	84	27	78	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
N. E.	114	162	41	129	61	57	57	2	3	3	2	13	2	3	3	2	3	14	7
E.	0	6	0	3	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0
S. E.	78	51	11	51	23	15	4	0	0	0	0	0	0	0	2	0	1	0	1
S.	102	72	5	36	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
S. W.	231	246	134	237	102	107	70	3	2	4	5	3	8	7	11	13	5	5	4
W.	60	39	24	138	29	29	1	0	0	0	0	0	0	0	0	0	0	0	0
N. W.	360	321	83	270	113	120	76	7	9	5	5	3	4	7	3	5	7	5	16

Winds in the United States.—*Continued.*

Nantucket, Massachusetts.

Course.	1838.	1840.	1841.	1837 and 1842.[1]	4 months of 1833.[2]	Total for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	36	57	62	46	4	6	22	22	19	20	7	17	20	24	21	12	15	205
N. N. E.	18	23	49	27	2	8	8	13	15	5	12	7	8	15	5	16	7	119
N. E.	68	64	88	47	6	18	10	25	21	18	15	15	33	51	31	25	11	273
E. N. E.	8	10	13	19	3	6	2	8	2	2	3	1	5	10	8	2	4	53
East	16	28	36	30	4	4	12	17	13	7	6	5	15	12	4	10	9	114
E. S. E.	3	8	25	24	6	8	5	8	2	13	8	3	2	1	2	4	11	67
S. E.	28	55	38	30	7	8	17	9	18	11	16	5	18	18	15	7	15	157
S. S. E.	10	9	17	21	2	6	7	3	2	4	5	4	6	5	8	2	7	59
South	34	51	43	25	11	11	11	12	24	23	15	18	10	19	12	6	3	164
S. S. W.	20	17	42	40	8	14	6	9	14	25	11	9	10	8	8	10	3	127
S. W.	144	108	160	102	6	20	34	30	49	51	62	63	60	36	50	31	28	514
W. S. W.	44	19	46	27	7	12	14	8	13	13	22	27	8	12	7	6	7	149
West	33	52	72	31	7	25	28	11	12	23	8	11	4	14	25	11	23	195
W. N. W.	25	32	30	25	7	25	16	6	11	9	2	4	2	5	10	13	18	121
N. W.	109	162	93	60	19	44	45	63	32	17	9	19	21	26	44	79	63	462
N. N. W.	21	37	46	42	6	22	12	23	11	5	3	9	8	11	11	18	19	152

New Bedford, Massachusetts.[1]

Course.	1818.	1819.	1820.	1821.	1822.	1823.	1824.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.
N. & N. W.	104	105	104	110	93	101	101	96	85	115	110	113	92	120	92	105
E. & N. E.	71	69	63	65	55	81	71	76	65	61	60	61	86	50	56	59
S. & S. E.	47	51	89	67	71	50	48	53	73	71	64	56	56	56	57	58
W. & S. W.	143	140	110	123	146	133	146	140	142	118	131	135	131	139	161	143
N.	17	18	17	18	16	17	17	16	14	19	18	19	15	20	15	18
N. E.	35	34	32	32	28	40	36	38	32	31	30	30	43	25	28	29
E.	36	35	31	33	27	41	35	38	33	30	30	31	43	25	28	30
S. E.	24	27	46	35	37	26	25	28	38	37	33	28	29	28	29	30
S.	23	24	43	32	34	24	23	25	35	34	31	28	27	28	28	28
S. W.	96	93	73	82	97	89	97	93	95	79	87	90	87	93	107	96
W.	47	47	37	41	49	44	49	47	47	39	44	45	44	46	54	47
N. W.	87	87	87	92	77	84	84	80	71	96	92	94	77	100	77	87

Course.	Total for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N. & N. W.	227	184	166	107	85	78	70	75	114	140	192	208	1646
E. & N. E.	84	76	100	123	86	57	60	95	95	98	85	90	1049
S. & S. E.	58	59	82	88	115	101	85	104	92	69	56	58	967
W. & S. W.	127	133	148	162	210	244	281	221	179	189	147	140	2181
N.	38	31	28	18	14	13	12	12	19	23	32	34	274
N. E.	42	38	50	61	43	29	30	47	48	49	42	45	524
E.	42	38	50	62	43	28	30	48	47	49	43	45	525
S. E.	30	31	42	45	59	52	44	54	48	36	29	30	500
S.	28	28	40	43	56	49	41	50	44	33	27	28	467
S. W.	85	89	99	108	140	163	187	147	119	126	98	93	1454
W.	42	44	49	54	70	81	94	74	60	63	49	47	727
N. W.	189	153	138	89	71	65	58	63	95	117	160	174	1372

[1] January 1 to August 1, 1842, and August 1 to December 31, 1837.

[2] January, February, May, and July.

[3] The numbers *above* the line are the actual record. Those *below* show the same, distributed by estimation of the observer.

Winds in the United States.—*Continued.*

Amherst, Massachusetts.

Course.	1837.	1838.	1839.	1840.	1841.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	16	20	24	15	17	1	6	4	10	6	7	4	8	14	10	13	9	92
N. E.	37	26	40	36	42	5	8	21	16	30	17	4	20	16	9	18	17	181
E.	11	10	1	1	11	4	2	1	4	7	0	1	3	6	4	2	0	34
S. E.	82	158	52	191	181	66	60	59	66	63	77	64	60	78	67	51	47	764
S.	106	25	20	18	31	22	15	11	11	17	29	21	66	28	16	8	7	200
S. W.	92	122	137	127	77	24	28	29	30	60	50	88	15	43	52	41	38	255
W.	75	15	9	14	31	24	10	10	8	18	10	13	72	13	11	6	14	144
N. W.	314	354	354	354	377	171	156	185	163	117	110	118	125	109	144	167	174	1747

Course.	Dartmouth, Massachusetts, 8 months.	Framingham, Massachusetts, 8 months.	Cambridge, Massachusetts, 11 months.[1]	Ipswich, Massachusetts, 1781.	Waltham, Massachusetts, 1838.	Newburyport, Massachusetts, 5 months.	North Yarmouth, Massachusetts, 1 month.	Provincetown, Massachusetts, 16 months.[1]	Race Point, Massachusetts, 3 months.[1]	Little Compton, Rhode Island, 1 month.	Stafford, Connecticut, 1 month.
North	62	139	50½	42	46	30	2	108½	27	5	7
N. N. E.	18	66	62½	8	6	9	5	46	10	0	1
N. E.	106	65	116½	50	27	39	10	123½	31	15	19
E. N. E.	79	26	28½	1	0	1	3	80½	1	3	2
East	149	85	51	22	25	29	0	57	6	4	16
E. S. E.	21	23	15½	1	0	0	2	37	0	3	2
S. E.	51	38	47	19	7	15	9	71	13	5	10
S. S. E.	16	8	10½	5	0	6	3	62	9	1	0
South	61	75	88½	16	13	38	1	66½	21	1	3
S. S. W.	23	50	74	4	36	0	2	75	17	1	0
S. W.	166	215	263½	94	82	21	17	547½	52	29	33
W. S. W.	96	60	36½	10	8	3	18	186	20	0	1
West	101	467	107½	83	55	156	8	112	20	1	17
W. N. W.	42	71	24	23	9	0	12	77½	7	0	5
N. W.	147	204	163	111	88	65	43	217	14	13	29
N. N. W.	25	34	78	18	34	4	0	81	4	0	3
Calm	16	85	37	1	21	0	0	247	19	2	0

Course.	Fort Wolcott, Rhode Island. 1822 to 1835, inclusive.[2]	TOTAL FOR THE SEPARATE MONTHS FROM 1822 TO 1830, INCLUSIVE. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Friends' School, Providence, Rhode Island. 1837.	1838.	Part of 1842.[3]
N.	342	26	15	35	20	21	13	13	16	23	27	28	28	58	97	39
N. E.	687	35	32	33	50	23	19	27	42	54	42	38	34	45	103	42
E.	103	9	7	7	12	9	9	5	7	5	5	6	2	16	36	17
S. E.	476	11	16	30	33	43	29	24	35	26	18	12	14	18	47	18
S.	194	6	5	15	8	13	20	22	19	13	14	7	8	54	170	63
S. W.	1774	68	60	52	73	107	130	145	124	94	89	75	71	85	206	97
W.	326	22	25	24	15	17	12	10	8	7	16	27	37	37	92	106
N. W.	1195	102	94	83	59	46	38	33	28	41	68	78	85	145	338	60

[1] For convenience of printing, these observations, originally taken for thirty-two points of compass, have been reduced to sixteen points since the computations from them were made, which may slightly affect the results.

[2] For the separate years, see the published volumes of the U. S. Army Meteorological Register. [3] Jan. to July.

Winds in the United States.—*Continued.*

Course.	Fort Adams, Rhode Island. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Brown University, Providence, Rhode Island. 1832, 3, and 4.	1838.	Newport, 1831, 2, 3, and 8.	Point Judith, Rhode Island, 1 month.
N.	8	5	5	0	3	1	0	7	4	2	1	8	44	21	0	30	4
N. E.	6	4	6	13	9	6	4	9	17	6	6	7	93	165	48	114	7
E.	8	7	7	12	9	9	3	24	11	2	2	14	98	21	30	9	3
S. E.	14	10	11	7	8	14	9	6	4	1	0	1	85	21	21	94	8
S.	5	7	10	7	9	13	12	2	2	12	0	0	79	51	24	10	11
S. W.	3	8	10	13	18	15	22	7	11	14	21	0	142	123	150	407	24
W.	10	6	5	6	3	1	9	3	7	20	15	20	105	393	66	50	23
N. W.	8	9	8	2	3	1	3	4	4	5	15	22	84	111	117	319	13

Course.	New London, Connecticut. 7 years.[1]	Total for the separate months of 1827–8. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	New Haven, Connecticut. 1804.	1811.	1812.	1813.	Total.
N.	218	3	1	6	3	3	2	1	2	5	3	6	6	143	105	90	111	449
N. E.	372	12	7	7	9	9	5	1	7	20	8	4	11	99	207	138	138	582
E.	114	1	5	3	4	3	3	1	3	4	5	5	4	33	18	22	23	96
S. E.	301	10	5	9	11	16	10	8	7	8	6	7	4	131	108	135	110	484
S.	234	2	5	8	4	5	15	13	5	3	8	5	4	58	69	113	80	320
S. W.	521	9	11	10	13	13	16	34	29	13	16	7	13	224	255	153	261	893
W.	282	8	9	7	6	5	4	3	2	5	8	13	14	81	69	102	57	309
N. W.	514	17	13	12	10	8	5	1	7	2	8	13	6	329	264	345	315	1253

Middletown, Connecticut.

Course.	1835.	1836.	Parts of 1834 and 43.[2]	Proportion for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	115	125	118½	135	108	84	63	63	18	21	63	58	54	66	78
N. E.	61	38	35½	12	12	30	30	27	26	27	18	24	36	20	39
E.	15	47	19	3	6	15	12	0	54	15	0	12	12	10	0
S. E.	32	20	31½	15	12	15	15	30	16	24	12	18	4	10	15
S.	85	51	69	12	24	48	63	24	58	36	57	44	50	12	18
S. W.	70	78	110	18	18	30	51	42	44	90	57	74	72	52	45
W.	62	68	76	36	42	42	30	72	32	36	30	36	58	22	5
N. W.	153	141	248	108	117	90	87	18	64	42	111	78	64	118	102
Calm	0	0	57	0	0	0	0	75	0	0	0	0	0	0	0

[1] For the separate years, see the published volumes of the U. S. Army Meteorological Register.
[2] Making together a complete year, except the month of June.

Winds in the United States.—*Continued.*

Litchfield, Connecticut.

Course.	1849.	1850.	1851.	Total for the separate months.											
				Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	60	73	73	14	15	18	18	16	16	16	15	21	18	29	23
N. E.	52	48	52	9	7	19	13	13	10	10	18	17	12	6	6
E.	88	94	67	14	20	15	16	28	16	29	23	23	16	7	9
S. E.	63	49	33	7	9	10	17	13	10	17	19	17	14	14	9
S.	73	31	53	7	10	10	18	17	15	19	23	17	14	23	23
S. W.	88	138	161	35	27	27	21	23	45	44	46	32	36	20	28
W.	102	144	147	43	31	31	24	33	39	32	31	26	32	30	22
N. W.	135	137	131	40	35	43	39	31	35	28	32	33	34	24	13

Salisbury, Connecticut.

Course.	1844.	1845.	Total for the separate months.												
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	215	346	56	61	53	37	46	44	50	32	53	34	41	54	561
N. by E.	6	3	2	0	0	1	1	1	0	1	0	0	1	2	9
N. N. E.	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1
N. E.	41	46	8	11	5½	6½	6	7	6	10	4	12	3	8	87
N. E. by E.	2	0	2	0	0	0	0	0	0	0	0	0	0	0	2
E. N. E.	2	0	2	0	0	0	0	0	0	0	0	0	0	0	2
East	40	40	9	8½	9	14	4½	5	7	4	8	4	5	2	80
S. E.	56	261	8	8½	7½	20	18	33	37	47	47	46	30	15	317
S. E. by S.	0	1½	0	1½	0	0	0	0	0	0	0	0	0	0	1½
S. S. E.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1
S. by E.	21	4½	0	1	6½	3½	5½	1	3	0	2	1	2	0	25½
South	205	157½	18½	34½	46	37	45½	33	23	35	14	30	23	23	362½
S. by W.	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1
S. W.	32	96	12	1	4	6	6	14	12	15	12	8	23	15	128
S. W. by W.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1
West	30	20	5	1½	3	4	1½	4	7	2	2	11	4	5	50
N. W. by W.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1
N. W.	71	116	22½	13½	20½	21	19½	8	10	9	6	9	17	31	187
N. N. W.	3	1	3	0	0	0	0	0	0	0	1	0	0	0	4
N. by W.	4	1½	4	0	0	0	1½	0	0	0	0	0	0	0	5½

Surface Winds at New York City. (Redfield.)

Course.	1838.	1839.	Total for the separate months.												Proportion for 7 years.
			Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
N. E. quarter, including N.	282½	423	67	58½	99	67	51½	42½	21½	64	52½	55	61	66	216
S. E. quarter, including E.	215	211	14	16½	33	37½	51	75	38	46½	39½	29	34	12	127
S. W. quarter, including S.	720	529	149	73	74	92	128	120	152½	103½	120	70½	81½	85½	382
N. W. quarter, including W.	507½	502	74½	110½	90	88½	59½	57	66½	85½	72	62	114½	129	275

Winds in the United States.—*Continued.*

Course.	Upper current at New York City, (Redfield.)														
	1838.	1839.	Total for the separate months.												Proportion for 7 years.
			Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
N. E. quarter, including N.	37	84	5	4	11	16	2	7	6	21	12	12	5	20	53
S. E. quarter, including E.	26	52	20	1	1	17	9	5	0	6	4	14	0	1	24
S. W. quarter, including S.	713	549	154	53	108	60	102	125	81	93	145	99	130	112	565
N. W. quarter, including W.	567	517	56	92	85	122	124	110	147	98	25	78	77	70	358

State of New York.

Course.	Granville.		Lewiston.		Hudson.		Mt. Pleasant.		Montgomery.		Cazenovia.		Lowville.	
	4 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]	7 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]	8 years previous to 1839.[1,2]	1841 to 1847, inclusive.[1]	6 years previous to 1839.[1,2]	1839 to 1844, inclusive.[1]	10 years previous to 1839.[1,2]	1839, 40, and 42.	8 years previous to 1839.[1,2]	1839 to 1846, inclusive.[1]	8 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]
N.	1013	2183	414	520	1430	998	605	627	799	120	170	203	1033	1308
N. E.	91	192	391	642	362	224	378	406	794	204	113	78	174	114
E.	24	42	262	282	167	82	119	78	214	16	104	115	107	93
S. E.	110	231	356	261	832	1009	320	483	370	63	268	346	786	727
S.	505	1868	776	937	1571	1197	915	875	1052	46	903	1058	1089	1733
S. W.	879	1545	1897	2364	203	153	647	512	1075	274	1125	962	534	451
W.	153	245	637	862	451	169	221	208	1670	380	923	1278	918	587
N. W.	147	268	381	706	828	1280	1177	1195	1332	359	2206	1804	1210	1560

State of New York.

Course.	Rochester.		Potsdam.		Kinderhook.		Jamaica.		Lansingburgh.		Kingston.	
	7 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]	10 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]	9 years previous to 1839.[1,2]	1839 to 1846, inclusive.[1]	12 years previous to 1839.[1,2]	1839 to 1847, inclu sive.	11 years previous to 1839.[1,2]	1839 to 1846, inclusive.[1]	9 years previous to 1839.[1,2]	8 years since 1838.[1]
N.	358	497	521	349	2207	2779	505	648	1264	591	388	325
N. E.	492	659	972	1191	114	71	1226	735	258	170	1346	1495
E.	220	222	56	55	119	29	334	305	67	39	257	133
S. E.	349	433	194	280	214	163	796	493	314	665	424	427
S.	346	459	1136	877	2350	2234	825	760	2345	1206	641	459
S. W.	1087	1186	2589	2349	235	145	1737	1267	672	808	1381	1436
W.	1321	1402	617	511	192	52	583	755	1584	1352	685	355
N. W.	939	1716	1221	960	1143	371	2758	1611	1574	1013	1452	1212

[1] For separate abstracts for these years, both annual and monthly, see Annual Reports of the Regents of the University of the State of New York.

[2] 1829 omitted.

Winds in the United States.—*Continued.*

State of New York.

Course.	Middlebury. 9 years previous to 1839.[1][2]	Middlebury. 1839 to 1845, inclusive.[1]	Newburgh. 8 years previous to 1839.[1][2]	Newburgh. 8 years since 1838.[1]	Ithaca. 7 years previous to 1839.[1][2]	Ithaca. 8 years since 1838.[1]	Mexico. 1837–38.[1]	Mexico. 1840 to 1846, inclusive.[1]	North Salem. 7 years previous to 1839.[1][2]	North Salem. 1840 to 1847, inclusive.[1]	Onondaga. 9 years previous to 1839.[1][2]	Onondaga. 1839 to 1844, inclusive.[1]
N.	735	190	467	339	892	211	120	354	259	310	393	175
N. E.	377	235	1134	1148	247	112	72	124	762	486	193	97
E.	66	72	52	118	180	41	31	305	300	239	187	249
S. E.	84	87	259	527	570	393	242	760	567	683	467	332
S.	141	347	1000	697	1501	710	231	647	245	704	1824	1014
S. W.	3542	2348	1559	1138	286	1015	266	414	911	1452	464	322
W.	776	1327	599	961	393	824	224	1631	611	669	1618	1264
N. W.	853	508	776	916	1045	2538	274	879	1457	1301	1392	931

State of New York.

Course.	Oxford. 9 years previous to 1839.[1][2]	Oxford. 1839 to 1845, inclusive.[1]	Redhook. 8 years previous to 1839.[1][2]	Redhook. 1839 to 1842, inclusive.[1]	Pompey. 11 years previous to 1839.[1][2]	Pompey. 1839 to 1843, inclusive.[1]	Total for the separate months. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	851	474	1830	814	124	17	1	8	16	22	16	11	8	14	12	15	2	9
N. E.	383	505	516	160	103	39	11	5	7	27	15	13	3	10	7	12	2	21
E.	110	20	368	44	51	21	6	8	7	11	8	12	2	1	3	3	5	10
S. E.	96	77	536	89	739	476	128	101	115	127	119	99	44	63	73	105	102	107
S.	968	612	1966	1338	1247	583	164	121	156	178	124	145	115	155	161	152	155	147
S. W.	1341	1189	180	94	2270	595	178	197	234	144	244	266	355	293	268	173	219	225
W.	1707	832	171	152	1710	784	201	227	199	195	237	217	250	183	206	182	183	170
N. W.	1118	1386	277	231	1807	1137	303	239	256	255	229	138	153	267	230	247	292	299

State of New York.

Course.	Springville. 1835.	Springville. 1839, 42, 43, and 47.[1]	Salem. 1828 and 1830.	Salem. 7 years since 1839.[1]	Utica. 12 years previous to 1839.[1][2]	Utica. 1839 to 1845, inclusive.[1]	Whitesborough. 5 years previous to 1839.[1][2]	Whitesborough. 1839 and 40.	Cambridge. 10 years previous to 1839.[1][2]	Cambridge. 1839 and 1841.[1]	Ellisburg. 6 years previous to 1839.[1][2]	Ellisburg. 1842, 43, 44, and 1846.	Henrietta. 1835 and 36.[1]	Henrietta. 1839.
N.	24	175	165	1091	8	51	180	54	1783	238	388	271	144	94
N. E.	69	319	155	593	55	14	54	52	191	91	507	326	67	39
E.	7	144	4	47	1963	848	831	269	50	4	125	139	84	41
S. E.	24	169	19	169	969	211	153	143	139	39	239	361	70	35
S.	36	172	188	983	295	618	257	203	1825	222	923	564	376	140
S. W.	143	729	679	1366	852	237	246	218	1316	367	814	406	378	158
W.	224	858	91	410	4491	2672	1488	449	990	147	819	631	192	173
N. W.	203	354	162	455	170	463	443	74	1012	352	553	224	151	92

[1] For separate abstracts for these years, both annual and monthly, see Annual Reports of the Regents of the University of the State of New York.

[2] 1829 omitted.

Winds in the United States.—*Continued.*

State of New York.

Course.	Bridgewater, 4 years.[1,2]	Canajoharie, 2 years previous to 1839.[1]	Canandaigua, 9 years.[1,2]	Cuba, 1839, 40, and 41.[1]	Delhi, 1837.	Gaines, 1839 to 1842, inclusive.[1]	Greenville, 1827.	Malone, 1839, 40, and 42.[1]	Millville, 1840 to 1847, inclusive.[1]	Oysterbay, 1834 and 37.[1]	Palmyra, 1835.	Plattsburg, 1841, 42, and 47.[1]	Schenectady, 2 years previous to 1839.[1]	Syracuse, 1843.
N.	88	8	253	41.35	88	133	15	122	316	42	44	385	84	8
N. E.	37	1	120	16.45	48	314	65	212	712	316	54	57	93	18
E.	116	182	121	10.82	47	171	26	46	314	35	19	45	41	55
S. E.	117	292	241	7.04	43	262	238	104	557	157	145	132	196	104
S.	775	40	1762	36.41	151	119	17	242	445	107	38	674	223	72
S. W.	438	72	899	35.15	134	622	39	484	1713	378	163	151	65	78
W.	931	401	2340	73.14	158	350	45	701	624	78	118	288	228	249
N. W.	418	464	838	27.16	61	951	285	281	1163	347	149	458	532	146

State of New York.

Course.	Albany.		Auburn.		Gouverneur.		Homer.		Aurora.		Flatbush.	
	13 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]	9 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]	6 years previous to 1839.[1,2]	6 years since 1838.[1]	6 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]	5 years previous to 1839.[1,2]	1840 to 1846, inclusive.[1]	11 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]
N.	1070	1097	769	613	267	734	24	7	820	1002	554	432
N. E.	398	626	243	184	423	492	20	20	20	177	1170	1137
E.	103	214	107	78	98	85	0	54	23	137	138	162
S. E.	702	164	617	385	141	246	257	517	118	370	668	653
S.	3010	2110	1451	1743	454	645	1196	711	1610	1258	555	619
S. W.	776	368	1017	1431	1405	1069	753	2365	119	490	1963	1357
W.	1418	224	749	323	847	486	602	46	420	730	721	739
N. W.	2019	1751	1623	1817	747	625	1532	2854	522	950	2267	1475

State of New York.

Course.	Fairfield.		Goshen.		Fredonia.		Poughkeepsie.		Prattsburgh.	
	9 years previous to 1839.[1,2]	8 years since 1838.[1]	2 years previous to 1839.[1,2]	8 years since 1838.[1]	8 years previous to 1839.[1,2]	1839 to 1847, inclusive.[1]	8 years previous to 1839.[1]	1841 to 1847, inclusive.[1]	1 year previous to 1839.[1,2]	1839 to 1846, inclusive.[1]
N.	84	34	49	221	521	532	824	1249	69	249
N. E.	85	45	145	1234	373	426	636	522	32	150
E.	1111	1018	48	197	202	218	104	129	6	87
S. E.	952	866	91	168	393	312	1463	368	11	206
S.	181	100	149	525	902	1017	874	915	167	1275
S. W.	290	287	526	1663	1414	837	873	880	121	659
W.	1190	2074	286	1248	1494	2829	221	601	197	910
N. W.	2683	1420	166	588	545	403	851	448	127	2308

[1] For separate abstracts for these years, both annual and monthly, see Annual Reports of the Regents of the University of the State of New York.

[2] 1829 omitted.

Winds in the United States.—*Continued.*

State of New York.

Course.	Easthampton.		Hartwick.		Hamilton.		Cherry Valley.		Johnstown.	
	11 years previous to 1839.[1, 2]	1839 to 1843, inclusive.[1]	8 years previous to 1839.[1, 2]	4 years since 1838.[1]	8 years previous to 1839.[1, 2]	7 years since 1838.[1]	9 years previous to 1839.[1, 2]	1841 to 1845, inclusive.[1]	9 years previous to 1839.[1, 2]	1841 to 1845, inclusive.[1]
N.	490	373	276	150	398	294	287	172	38	20
N. E.	932	430	90	128	141	158	442	226	433	302
E.	943	470	102	46	37	77	330	238	932	562
S. E.	868	294	233	99	225	214	206	91	333	195
S.	988	430	2060	1116	984	913	948	364	49	40
S. W.	1309	500	588	249	1657	883	1357	741	433	302
W.	836	495	1046	296	526	774	2145	1243	3239	1984
N. W.	1670	660	1447	836	1878	1799	861	577	389	245

Ogdensburgh,[3] New York.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.	d. h. m.
North	0 9 15	0 12 45	1 2 30	0 21 0	1 9 30	0 6 30	0 9 15	0 13 30	0 8 30	0 12 0	0 9 0	0 11 30	7 5 15
N. by E.	0 13 30	0 10 30	0 17 0	0 7 45	0 13 0	0 9 0	0 9 0	0 18 0	0 18 0	0 11 30	0 8 15	0 6 30	5 22 15
N. N. E.	0 15 30	0 7 15	1 5 30	0 2 0	0 17 45	0 22 15	0 18 0	0 13 45	1 5 15	0 23 45	0 9 15	0 4 0	8 0 15
N. E. by N.	0 15 45	0 8 30	2 14 45	0 3 0	1 20 45	1 7 45	0 22 30	0 11 45	1 10 45	0 5 45	0 9 45	0 4 45	10 15 15
N. E.	1 5 15	0 22 30	4 16 30	0 10 0	1 2 30	1 7 30	0 17 0	0 13 0	1 11 15	0 10 0	0 17 30	0 12 52	14 1 52
N. E. by E.	1 3 30	0 19 45	4 0 15	2 4 0	1 5 0	1 1 45	0 14 45	0 20 30	1 14 15	1 1 15	0 23 30	1 0 0	16 12 30
E. N. E.	3 4 15	0 11 30	1 23 0	0 7 0	0 23 45	0 23 15	0 10 0	0 12 15	1 13 45	1 9 45	0 18 45	0 15 23	13 4 38
E. by N.	0 6 45	0 8 0	0 14 30	0 13 0	0 10 0	0 5 30	0 4 15	0 9 45	0 14 15	0 16 30	0 9 30	0 5 30	4 21 30
East	0 4 45	0 3 0	0 7 15	0 8 0	0 6 0	0 2 30	0 3 45	0 7 0	0 7 0	0 9 15	0 2 30	0 2 15	2 15 15
E. by S.	0 4 30	0 4 0	0 4 0	0 8 0	0 4 45	0 3 45	0 2 30	0 11 45	0 3 15	0 4 0	0 2 15	0 3 30	2 8 15
E. S. E.	0 5 15	0 5 15	0 5 15	0 10 0	0 8 45	0 3 45	0 3 45	0 9 15	0 2 30	0 3 30	0 2 45	0 3 45	2 15 45
S. E. by E.	0 5 15	0 5 45	0 4 0	0 0 0	0 16 45	0 5 30	0 3 15	0 9 0	0 2 15	0 5 0	0 2 30	0 2 0	2 13 15
S. E.	0 2 45	0 3 15	0 2 15	0 1 0	0 17 45	0 10 45	0 3 15	0 8 15	0 2 15	0 5 45	0 3 22	0 4 52	2 17 29
S. E. by S.	0 3 0	0 3 45	0 2 45	0 5 0	0 12 30	0 12 15	0 8 52	0 11 15	0 8 30	0 11 30	0 8 8	0 11 38	4 3 8
S. S. E.	0 13 0	0 11 0	0 2 30	0 4 30	0 7 0	1 3 15	0 15 45	0 23 22	0 10 0	0 15 37	0 21 0	0 21 15	7 4 14
S. by E.	0 11 0	2 8 30	0 6 0	0 0 0	0 6 15	0 13 15	0 13 45	0 20 53	1 9 15	0 20 53	1 9 0	1 8 45	8 7 31
South	3 10 0	0 14 0	0 11 30	1 1 0	1 13 30	0 19 30	1 23 45	1 4 0	1 18 30	2 0 0	2 6 30	3 1 45	20 4 0
S. by W.	2 2 30	0 20 0	1 7 30	0 1 0	1 12 30	1 11 30	1 15 30	2 6 30	1 19 45	1 9 15	2 21 45	3 11 0	21 4 45
S. S. W.	1 13 15	1 5 15	0 21 45	1 2 0	2 1 15	1 14 45	2 16 15	1 15 15	1 20 0	1 17 15	2 8 45	3 15 0	22 6 45
S. W. by S.	1 13 45	1 7 30	1 3 45	1 14 0	2 11 30	2 9 15	3 8 0	1 18 30	2 0 15	1 16 30	1 9 0	2 0 30	22 16 30
S. W.	2 4 30	1 23 0	1 15 15	3 15 0	2 7 30	3 14 0	4 8 15	2 8 0	1 22 30	2 12 0	1 13 0	1 13 15	29 12 15
S. W. by W.	3 3 0	2 11 45	1 20 45	2 11 0	1 19 0	3 12 0	2 21 0	1 17 15	1 12 15	1 20 30	1 15 15	1 1 45	25 21 30
W. S. W.	0 14 0	1 15 15	1 1 30	2 18 30	3 2 0	1 16 0	1 7 0	0 22 5	1 0 30	1 1 30	1 0 15	0 21 0	16 23 45
W. by S.	0 19 15	1 15 45	0 17 45	0 23 30	0 16 0	1 5 30	1 5 15	1 1 0	1 5 45	1 2 45	1 11 30	1 2 0	13 6 0
West	0 20 0	2 6 45	0 18 15	2 13 0	0 20 45	1 11 0	1 1 45	1 19 30	1 9 45	1 7 15	1 16 0	1 5 45	17 5 45
W. by N.	0 23 0	1 23 30	0 11 15	1 10 30	0 20 30	0 11 45	0 14 0	1 3 45	0 17 22	0 22 45	1 3 15	0 20 30	11 14 7
W. N. W.	0 22 30	1 9 0	0 5 45	1 2 15	0 6 0	0 8 30	0 9 0	1 6 30	0 11 53	0 17 0	0 23 15	0 17 30	8 19 8
N. W. by W.	0 15 30	1 4 45	0 6 30	1 5 0	0 11 0	0 7 45	0 14 8	1 6 45	0 10 38	1 0 30	1 0 45	0 21 37	9 8 53
N. W.	0 17 0	1 2 0	0 7 0	0 18 0	0 5 0	0 11 0	0 12 0	1 2 0	0 11 15	1 4 30	0 21 45	1 5 8	8 20 38
N. W. by N.	0 15 15	0 20 15	0 9 45	1 6 15	0 9 45	0 7 45	0 14 15	1 3 45	0 15 22	1 9 45	0 21 45	1 1 45	9 15 37
N. N. W.	0 15 30	0 18 30	0 14 30	0 22 15	0 10 0	0 7 30	0 14 45	0 20 30	0 9 30	1 3 15	0 18 0	0 16 0	8 2 15
N. by W.	0 3 45	0 17 30	0 11 15	0 20 30	0 11 30	0 5 45	0 15 30	0 15 15	0 10 15	0 15 15	0 12 15	0 15 0	6 9 45

[1] For separate abstracts for these years, both annual and monthly, see Annual Reports of the Regents of the University of the State of New York.

[2] 1829 omitted.

[3] These observations were taken by means of a self-registering vane, and the time is given in days, hours, and minutes.

Winds in the United States.—*Continued.*

State of New York.

Course.	Deaf and Dumb Institute. 1844.	Deaf and Dumb Institute. 1846.	Deaf and Dumb Institute. 1850.	Fort Columbus. 1822 to 1830, inclusive.[1]	Fort Columbus. 1831 to 1836 and 1839 to 1842, inclusive.[1]	Watertown. 1837 to 1840, inclusive.[1]	Fort Wood. 1837–38.[1]	West Point. 1827 to 1830, inclusive.[1]	West Point. 1831 to 1842, inclusive.[1]	Youngstown. 1829–30.[1]	Youngstown. 1831, 33, 40, and 42.[1]	Plattsburg Barracks. 1840 and 1842.[1]
N.	15	12	19½	125	185½	98½	26	182	620	56	106	95½
N. E.	82	81	59	435	523½	75	118	85	260	92	219½	52
E.	5	8	7	128	165½	137½	19	44	54	58	109	20½
S. E.	27	54	25	414	505½	90	66	241	326	45	61	72½
S.	13	7½	22	352	345½	178	95	201	1141	116	118½	181
S. W.	47	59	62½	660	695½	347½	203	184	415	102	248½	78½
W.	67	73	73	250	512½	310½	85	135	206	168	345½	69½
N. W.	107	70½	90	923	720	224	118	398	1357	93	253	161½

State of New York.

Course.	Adams, 1 month.	Brooklyn, 1 month.	Chatham, 4 months.	Flushing, 1 month.	Gallop's Isl'd, 1 month.	Hamilton College, 1 month.	Leonardsville, 1 month.	Lockport, 4 months.	Nassau, 1 month.	Penn Yan, 1 month.	Rhinebeck, 1 month.	Sands' Point, 2 months.	Troy, 2 months.	White Plains, 4 months.	Bloomingdale, 1846.
N.	25	9	77	4	16	0	10	25	22	4	23	28	37	0	14
N. E.	21	35	36	11	38	0	0	28	0	25	23	36	15	7	71
E.	2	9	15	1	11	13	3	65	0	0	0	5	3	10	10
S. E.	28	2	116	6	17	7	3	21	5	2	0	5	13	14	33
S.	24	11	41	50	10	7	34	14	16	88	13	18	30	12	8
S. W.	140	8	150	50	34	8	0	196	2	27	6	20	28	15	73
W.	60	27	59	52	80	7	0	102	9	38	6	18	65	2	31
N. W.	24	52	371	30	64	46	40	66	22	23	18	47	72	10	65
Calm	50	4	13	0	0	14	0	29	2	44	1	0	0	0	48

State of New York.

Course.	Amenia, 1849.	Buffalo. 1831–32.	Buffalo. 1841–42.	Sackett's Harbor, 1831 and 1842.[1]	Somerville, 1850.	Rouse's Point, 1839.	Watervliet. 1831–32.	Watervliet. 1834 to 1842, inclusive.[1]
N.	137	33	138	80	95	43	41	388
N. E.	73	193	89	163	81	34	20	209½
E.	11	123	146	20	19½	14	9	76½
S. E.	61	137	79	145	25	54	62	322½
S.	155	107	193	150	151	68	140	784
S. W.	108	567	494	352	166	53	94	320
W.	30[2]	152	214	197	115½	43	139	581½
N. W.	155	150	107	348	72½	56	226	605

[1] For the separate years, see the published volumes of the U. S. Army Meteorological Register.

[2] A hill, directly west of this place, accounts for the winds from that direction. See Regents' Report for 1850, p. 245.

Winds in the United States.—*Continued.*

Total of Winds in the State of New York, deduced from all the observations taken at the several Academies, as reported annually to the Regents of the University.

Course.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.
N.	539	1103	1442	1861	2676	2317	2956	2613	2755	2903	2300	2624	2226
N. E.	310	641	849	1502	1735	1417	1754	1794	2173	2158	2043	1614	1810
E.	345	623	1061	1110	926	890	974	869	971	1359	1442	1155	855
S. E.	616	876	1115	1640	1457	1334	1802	2214	1845	2317	2324	1862	1530
S.	1240	1748	3584	3784	4394	4333	5497	4381	4135	5338	3879	4536	3449
S. W.	942	1828	3890	4805	3586	4468	4790	4571	4894	6784	3559	3553	4619
W.	1273	2225	3312	4900	3652	4886	3937	4074	3960	6206	4283	4618	4116
N. W.	1275	2634	3044	4816	4204	4445	4662	5020	4805	5785	4322	5587	5275

Total of Winds in the State of New York.—*Continued.*

Course.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	Total.
N.	2982	2332	3601	2942	2804	2806	2456	2526	1850	1528	1954	56096
N. E.	2236	2007	2200	2544	2014	2319	1418	2021	1569	1206	1537	40871
E.	1029	871	1037	1254	1171	1064	910	587	598	665	538	22304
S. E.	1709	1970	1876	2317	2023	1861	1535	1823	1367	1553	1962	40928
S.	4332	4458	4949	5502	3752	4475	3492	3537	3104	3015	2516	93430
S. W.	5054	5010	4443	5567	5182	4689	5815	4037	3764	3092	2458	101400
W.	4190	4569	4598	5605	5966	4819	4523	2978	2286	2853	1992	95821
N. W.	5516	5867	5640	6483	5944	5107	5344	4391	3733	4368	3813	112080

Trenton, New Jersey.

Course.	1840.	1842.	1843.	1844.	1845.	1846.	TOTAL FOR THE SEPARATE MONTHS FROM 1842 TO 1845.												
							Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	21	24	29	44	30	25	12	9	7	10	9	8	18	9	17	7	10	11	173
N. E.	60	72	74	79	70	93	21	24	26	38	25	18	13	35	26	26	17	26	448
E.	13	26	17	36	35	40	7	10	6	13	5	16	13	14	16	4	6	4	167
S. E.	52	49	62	63	58	71	12	12	18	23	23	23	24	35	21	21	14	6	355
S.	65	63	41	52	40	54	16	19	20	21	14	17	20	18	14	13	16	8	315
S. W.	97	129	127	130	115	113	40	30	32	35	63	65	67	36	27	42	37	27	711
W.	59	39	47	44	68	42	16	20	16	12	23	17	12	8	13	19	22	20	299
N. W.	90	91	120	103	109	122	41	37	52	29	33	32	25	29	19	42	33	51	635

Winds in the United States.—*Continued.*

Course.	Newark, New Jersey, 11 months.	Bloomfield, New Jersey, 1 month.	Burlington, New Jersey, 2 months.	Five fathom Bank (Cape May), 2 months.	Haddonfield, New Jersey, 2 months.	Middletown, New Jersey, 1831, 2, 3, 4.	Course.	Newark, New Jersey, 11 months.	Bloomfield, New Jersey, 1 month.	Burlington, New Jersey, 2 months.	Five fathom Bank (Cape May), 2 months.	Haddonfield, New Jersey, 2 months.	Middletown, New Jersey, 1831, 2, 3, 4.
North	37	15	15	15	10	61	South	29	0	2	22	25	89
N. N. E.	8	0	1	8	1		S. S. W.	1	0	1	16	1	
N. E.	42	8	8	12	34	145	S. W.	44	9	10	22	17	216
E. N. E.	0	0	1	11	0		W. S. W.	5	10	1	8	0	
East	5	0	12	10	19	65	West	43	17	35	36	8	194
E. S. E.	1	0	1	7	0		W.N.W.	3	1	0	40	0	
S. E.	10	2	6	9	5	118	N. W.	29	10	62	54	40	208
S. S. E.	2	0	0	8	0		N. N. W.	2	0	2	14	3	

Girard College, Pennsylvania.

Course.	1841.	1842.	1843.	1844.	1840 and 45.[1]	TOTAL FOR THE SEPARATE MONTHS.												
						Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	342	177	357	426	376	179	151	166	130	184	123	133	78	180	112	117	125	1678
N. by E.	142	132			76	13	9	8	18	14	22	58	21	45	41	47	54	350
N. N. E.	284	166	311	336	295	115	138	155	147	142	79	95	66	132	91	80	152	1392
N. E. by N.	118	179			34	4	14	19	27	26	16	31	23	46	22	72	31	331
N. E.	280	288	435	312	356	201	131	121	164	100	78	107	175	143	130	167	154	1671
N. E. by. E.	150	227			34	11	17	24	53	28	25	17	50	58	39	46	43	411
E. N. E.	470	325	582	521	385	275	175	265	370	153	114	151	196	195	94	137	158	2283
E. by N.	162	201			50	28	10	18	45	18	42	45	46	35	39	60	27	413
East	186	142	317	347	260	90	82	128	240	88	84	46	154	125	65	70	80	1252
E. by S.	88	81			10	10	2	12	7	13	29	15	42	11	8	17	13	179
E. S. E.	90	63	189	213	167	53	54	57	86	67	65	41	95	56	60	44	44	722
S. E. by E.	32	104			6	3	5	9	11	14	33	15	27	13	4	3	5	142
S. E.	94	128	176	290	165	59	39	57	78	86	87	81	140	86	47	54	39	853
S. E. by S.	52	159			28	2	10	33	13	17	28	36	43	15	21	21	0	239
S. S. E.	114	150	199	267	107	38	27	57	76	112	70	91	138	76	95	35	22	837
S. by E.	92	198			36	19	26	18	11	7	53	46	41	49	32	12	12	326
South	258	151	287	522	284	87	117	141	102	161	160	253	224	121	126	67	43	1602
S. by W.	216	276			108	39	37	43	42	49	37	55	69	84	74	51	20	600
S. S. W.	416	337	579	700	531	191	196	268	213	250	286	337	220	210	166	94	132	2563
S. W. by S.	220	419			64	50	57	66	49	65	51	104	46	58	83	30	44	703
S. W.	570	568	792	761	720	177	170	218	272	458	462	342	212	211	258	230	401	3411
S. W. by W.	220	185			22	35	29	20	17	41	70	64	54	10	17	36	34	427
W. S. W.	232	169	502	413	424	116	158	137	91	179	256	146	143	83	148	131	152	1740
W. by S.	132	155			62	15	21	20	20	23	12	28	41	54	25	47	43	349
West	292	207	465	442	490	227	147	166	90	132	158	121	114	107	198	212	224	1896
W. by N.	206	246			92	21	78	20	45	15	23	27	29	21	36	106	123	544
W. N. W.	490	312	939	632	589	366	455	316	201	207	170	149	197	164	245	356	226	2962
N. W. by W.	228	340			28	46	42	34	20	29	38	35	30	48	58	97	119	596
N. W.	534	602	712	715	865	400	277	309	241	245	159	168	211	310	407	371	330	3428
N. W. by N.	254	250			54	18	6	48	29	25	22	30	59	58	127	57	79	558
N. N. W.	360	181	598	510	634	239	200	217	175	183	148	180	127	205	188	204	217	2283
N. by W.	172	191			52	10	9	12	10	34	40	49	52	79	58	35	27	415

[1] July 1 to December 31, 1840, and January 1 to June 30, 1845.

Winds in the United States.—*Continued.*

State of Pennsylvania.

Course.	Pottsville, 5 months of 1839.[1]	Warren, 1 year, except May, June, Aug., and Oct.[1]	Indiana, 1 year, except April, May, and August.[1]	Mifflintown.		Franklin, 1 year.[1]	Smithport, 1 year.[1]	Huntingdon, 1 year.[1]	Harrisburg, 1 year.[1]	Uniontown, 1 year, except April.[1]	Fort Mifflin.		Butler.			Chambersburg, Feb. 1839.
				1 year, except November.[1]	1 year, except April and Aug.[1]						1823.	1824.	5 months of 1840.[1]	1841.	Sept. 1844, to Sept. 1845.	
N.	12	34	11	6	33	0	32	0	50	18	1.00	.00	1	2	0	0
N. E.	17	15	1	55	65	3	36	0	31	34	7.00	2.08	18	43	55	10
E.	8	11	4	20	32	0	134	314	75	3	1.16	.33	110	305	230	0
S. E.	71	75	27	79	66	205	113	0	187	78	3.83	8.58	11	26	46	5
S.	4	51	23	1	25	1	56	0	51	21	1.08	1.41	9	7	1	0
S. W.	38	182	184	57	68	119	155	0	124	334	6.33	10.08	114	265	413	10
W.	75	71	234	47	112	3	359	755	195	186	2.58	2.66	170	372	291	0
N. W.	169	85	72	168	181	645	142	0	332	197	7.41	5.33	24	69	59	3
Calm	55	176	226	496	207	0	2	0	0	128	0	0	0	0	0	3

State of Pennsylvania.

Course.	Philadelphia (Franklin Institute).								Newtown.		Silver Lake.		Pittsburg, 1 year.[1]	Ebensburg, 1 year.	Bedford, 1 year.[1]	Meadville, 1 year.[1]	Port Carbon, 1 year, except August.[1]	Bellefonte, 1 year, except April.[1]
	1831.	1832, except Jan. and April.	1833.	4 months of 1834.	4 months of 1839.	5 months of 1840.	1841, except Jan. and Aug.	Part of 1842.	1 year, except Jan., April, and August.[1]	1841.[1]	1 year, except Jan., April, and August.[1]	1841.[1]						
North	19	29	6	5	9	25	62	2	13	30	62	153	4	38	10	89	20	110
N. N. E.						7	34		11	17	0	0	0	0	5	26	5	4
N. E.	45	30	37	16	18	37	104	17	117	173	8	25	33	21	7	37	94	98
E. N. E.						3	10		13	9	0	0	7	0	10	9	19	1
East	26	23	46	19	22	10	20	28	7	12	3	0	58	43	18	107	52	20
E. S. E.						7	4		4	12	0	0	10	0	36	23	5	3
S. E.	45	62	76	44	12	17	41	16	41	71	19	17	111	100	111	46	39	47
S. S. E.						2	4		6	14	4	1	2	2	22	6	3	5
South	74	80	72	16	11	40	62	14	14	30	99	120	33	51	42	135	16	73
S. S. W.						15	25		10	9	4	2	6	1	19	7	2	2
S. W.	96	108	69	23	32	71	135	48	164	222	158	176	72	160	185	47	71	118
W. S. W.						17	16		15	30	11	2	8	2	78	10	7	21
West	348	238	371	95	94	39	80	123	27	72	173	323	115	304	55	96	155	168
W. N. W.						19	31		20	36	24	4	12	8	249	4	11	11
N. W.	77	40	53	22	12	85	142	19	293	279	208	267	196	166	185	62	133	149
N. N. W.						10	27		3	10	12	4	11	2	51	3	11	10
Calm													318	116	0	354	276	12

[1] For abstracts for the separate months, see Journal of the Franklin Institute.

Winds in the United States.—*Continued.*

State of Pennsylvania.

Course.	Stroudsburg, 1 year, except May and June.[1]	Beaver, 1 year, except March and April.[1]	Haverford, 1 year, except April and October.[1]	Lancaster, 2 years.	Northumberland, 2 years.	Gettysburg, 2 years.[1]	Carlisle, 1 year, except July, August and September.[1]	Reading, 1 year, except April and August.[1]	Lewistown, 5 months of 1839.[1]	Canonsburg, Jan., July, and Oct.[1]	Erie, 3 months.[1]	Rose Cottage, 3 months.[1]
North	54	8	51	190	254	198	34	30	1	12	12	9
N. N. E.	5	0	38	66	8	68	11	0	7	1	8	0
N. E.	55	31	71	177	205	141	67	56	46	16	34	3
E. N. E.	1	4	22	35	3	15	9	1	7	0	0	2
East	80	12	18	79	137	27	25	49	0	13	3	1
E. S. E.	0	0	4	26	6	8	5	2	1	0	3	0
S. E.	14	96	28	163	158	60	26	59	20	7	4	10
S. S. E.	3	4	4	58	23	39	5	0	4	0	11	0
South	31	8	19	224	271	249	53	11	1	1	36	4
S. S. W.	8	1	20	81	3	93	7	2	32	0	5	2
S. W.	99	122	118	257	81	247	91	132	86	16	37	46
W. S. W.	6	2	45	77	4	47	10	16	15	0	9	3
West	171	22	32	190	336	217	104	74	2	67	69	28
W. N. W.	1	3	45	93	22	72	28	28	6	1	10	5
N. W.	101	378	183	319	230	225	145	444	132	19	26	23
N. N. W.	4	6	37	103	20	34	9	4	6	0	5	3
Calm	0	156	24	0	226	235	180	5	0	22	14	121

State of Pennsylvania.

Course.	Armstrong, 2 months.	Bethlehem, 2 months.	Danville, 2 months.[1]	Greenhill, 1 month.	Lamar, 1 month.	Milford, 1 month.	West Chester, 11 months.[1]	Wilkesbarre, 2 months.[1]	York, 3 months.[1]	Easton.		
										1838.	1839.	1847.
North	7	0	3	1	7	5	124	15	9	2.25	6.25	94
N. N. E.	0	0	0	0	0	0	22	0	0			34
N. E.	6	8	3	0	4	4	116	30	31	58.25	57.74	32
E. N. E.	0	1	0	0	0	1	2	0	1			5
East	22	7	1	19	6	5	93	3	14	3.25	15.10	24
E. S. E.	0	1	0	0	0	0	4	0	0			22
S. E.	16	2	14	12	4	10	20	12	13	23.63	30.99	56
S. S. E.	0	1	1	0	0	1	5	0	5			32
South	25	3	7	5	10	21	117	4	12	5.12	13.44	125
S. S. W.	0	1	1	0	0	1	12	1	2			5
S. W.	65	6	21	17	29	19	126	44	36	158.87	114.07	21
W. S. W.	5	6	0	1	1	0	6	0	5			5
West	165	14	22	131	64	12	318	4	26	18.75	19.75	78
W. N. W.	5	3	0	2	5	0	28	0	3			71
N. W.	49	4	10	0	32	14	145	34	107	102.88	107.66	135
N. N. W.	0	1	0	3	0	1	13	0	11			41
Calm	38	0	57	29	0	0	92	6	4			112

[1] For abstracts for the separate months, see Journal of the Franklin Institute.

Winds in the United States.—*Continued.*

State of Pennsylvania.

Course.	Carlisle, Pennsylvania, (Military Station.) 1840.	1841.	Alleghany Arsenal, Pennsylvania, 1836 to 1842, inclusive.[1]	Cochranville, 2 months.	Coudersport, 5 months.	Germantown, 3 months.	Mercersburg, 4 months.	Norristown, 5 months.	Chambersburg, 1 month.
North	27	52	391	12	68	18	22	25	0
N. E.	57	68	258½	47	30	31	24	49	10
East	132	112	187½	27	20	19	4	84	0
S. E.	68	58	140½	42	65	16	17	13	5
South	53	68	332	49	94	4	14	62	0
S. W.	48	31	463½	73	71	44	54	91	10
West	264	249	400½	51	138	28	140	367	0
N. W.	94	94	383½	112	112	119	111	112	3
Calm				1	111	0	147	9	3

Somerset, Pennsylvania, (Lower Current.)

Course.	1841.[2]	Sept. 1, 1845, to Sept. 1, 1846.	4 months of 1840.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Upper current for 1 y'r, except July, Aug., Nov., & Dec.
North	23	35	6	1	1	5	3	3	6	5	11	3	8	6	6	58	23
N. N. E.	1	3	0	0	0	1	0	1	2	0	0	0	0	0	0	4	2
N. E.	19	17	3	0	2	5	8	6	0	5	5	0	2	1	2	36	3
E. N. E.	4	14	0	0	0	1	4	4	4	4	1	0	0	0	0	18	1
East	23	7	10	0	0	10	10	2	1	1	1	0	3	2	0	30	6
E. S. E.	0	9	3	0	0	0	0	1	6	0	2	0	0	0	0	9	12
S. E.	36	37	3	7	8	6	17	8	6	2	4	1	4	6	4	73	17
S. S. E.	8	12	3	0	0	3	2	3	0	4	6	1	1	0	0	20	3
South	58	76	9	11	4	11	20	6	17	4	16	9	8	9	12	134	36
S. S. W.	7	8	0	2	1	3	2	3	1	0	1	1	1	0	0	15	2
S. W.	109	106	58	12	10	14	16	25	20	29	17	20	14	26	12	215	67
W. S. W.	45	106	20	12	14	12	13	3	9	1	6	9	13	17	42	151	51
West	182	129	72	45	32	32	19	25	20	12	9	27	13	43	34	311	174
W. N. W.	51	94	16	14	10	10	10	14	5	14	4	12	8	16	28	145	51
N. W.	36	46	18	3	4	8	5	10	5	13	6	10	8	4	6	82	52
N. N. W.	2	5	1	0	2	0	1	1	2	0	0	0	0	1	0	7	3
Calm	331	305	103	60	34	56	43	51	65	44	77	48	73	47	38	636	154

Course.	Newark, Delaware, 5 months.	Emmetsburg, Maryland, 3 months.	Isthmus, Maryland, 11 months.	Baltimore, Maryland, 1836.	Washington City, 7 months of 1838.	Course.	Newark, Delaware, 5 months.	Emmetsburg, Maryland, 3 months.	Isthmus, Maryland, 11 months.	Baltimore, Maryland, 1836.	Washington City, 7 months of 1838.
North	13	52	139	41	16	South	7	25	199	63	30
N. N. E.	0	0	0	8	7	S. S. W.	0	7	5	1	23
N. E.	46	10	94	87	62	S. W.	115	49	85	164	85
E. N. E.	0	2	0	1	0	W. S. W.	0	10	0	1	3
East	25	12	74	140	10	West	72	132	55	78	16
E. S. E.	3	0	0	2	1	W. N. W.	0	35	0	1	3
S. E.	42	26	46	140	24	N. W.	174	87	344	213	115
S. S. E.	4	8	2	14	10	N. N. W.	4	7	1	17	0
						Calm	1	47	203	0	16

[1] For separate abstracts for these years, see the published volumes of the U. S. Army Meteorological Register.

[2] November, 1840, substituted for November, 1841.

Winds in the United States.—*Continued.*

Course.	New Castle, Delaware, 1826.	Fort McHenry, Maryland. 1831 to 1842, inclusive.[1]	Total for the separate months from 1831 to 1835, inclusive. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	5	292½	11	2	3	3	2	2	1	3	2	7	11	5
N. E.	39	669½	29	24	18	29	15	16	10	23	22	25	27	29
E.	9	272	14	11	34	32	17	9	3	7	10	14	14	7
S. E.	64	588½	11	11	23	25	34	32	24	33	20	23	18	10
S.	22	308½	1	1	2	3	14	9	19	8	12	1	2	0
S. W.	123	596	16	23	17	10	22	22	38	27	33	25	15	16
W.	21	755	24	25	19	19	30	22	34	25	21	17	18	24
N. W.	82	901	49	44	39	29	21	38	26	29	30	43	45	64

Course.	Annapolis, Maryland. 1822.	Annapolis, Maryland. 1831 to 1834, inclusive.[1]	Washington City.[3] 1823 to 1830, inclusive.[1]	1831, 33, 34, and 1835.[1]	8 months in 1831, 32, 33, 34, and 35.[2]	July 1, 1838, to June 30, 1842.[2]	Total for the separate months from 1823 to 1830, inclusive. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	37	69	161	72	9	263	15	11	9	19	12	16	12	18	18	12	10	9
N. E.	48	151	460	213	95	432	46	44	48	32	26	30	27	43	55	40	34	35
E.	24	44	72	30	4	189	3	4	7	7	11	10	3	6	10	6	2	3
S. E.	40	378	343	94	34	203	31	25	36	24	43	33	33	37	25	21	14	21
S.	83	156	381	163	43	327	19	19	29	29	47	30	36	33	33	39	32	35
S. W.	26	150	595	271	124	562	49	49	27	43	47	63	73	58	34	43	53	56
W.	28	106	71	115	7½	384	14	6	4	4	4	7	2	2	5	12	7	4
N. W.	72	404	835	501	100½	703	71	68	88	79	58	51	62	51	60	74	88	85

Course.	Bellona Arsenal, Virginia, 1832.[1]	Fort Washington, Va., 1833–34.[1]	Old Point Comfort, Virginia. 1826 to 1842, inclusive.[1]	Total for the separate months from 1826 to 1830, inclusive. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	24	28	528	29	13	14	10	3	1	0	6	21	17	13	17
N. E.	49	33	1485½	33	33	36	26	44	26	29	30	40	39	25	32
E.	21	23	465	9	13	7	11	13	18	10	11	13	9	10	7
S. E.	62	46	690½	9	13	22	27	36	29	30	27	18	14	18	11
S.	21	304	582	1	10	5	13	11	10	7	9	6	4	7	8
S. W.	83	111	1387½	28	31	43	36	28	43	68	42	28	28	36	46
W.	53	77	449	16	7	16	12	14	16	7	24	8	17	19	13
N. W.	53	108	622½	30	21	12	15	6	7	4	6	16	27	23	21

[1] For abstracts of these years separately, see the published volumes of the U. S. Army Meteorological Register.

[2] Two independent registers for this station for the years 1831, 33, 34, 35, and 38.

[3] Calms 52.8.

Winds in the United States.—*Continued.*

Course.	Alexandria, Virginia, 1 month.	Norfolk, Virginia, 1 month.	Gosport, Virginia, 8 months.	West Brunswick, Virginia, 12 months.	Beaufort, North Carolina. 1834–35.	Total for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	1	0	76	205	122	12	11	7	7	5	5	4	13	17	9	13	19
N. E.	0	15	110	260	79	3	5	3	7	3	8	2	6	12	15	6	9
E.	0	16	66	49	50	5	3	1	5	3	10	2	4	6	10	1	0
S. E.	1	23	59	82	60	10	4	5	4	4	5	10	2	4	5	3	4
S.	12	13	97	175	113	7	6	10	3	11	16	17	9	7	7	14	6
S. W.	1	40	153	684	188	14	19	22	19	23	9	20	20	13	9	9	11
W.	0	4	78	369	32	1	3	2	8	4	1	1	2	0	0	6	4
N. W.	7	9	61	367	86	9	8	11	8	6	7	6	6	1	7	8	9
Calm	9	0	23	241													

Chapel Hill, North Carolina.

Course.	1845.	1846.	Total for the separate months. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	140	204	24	28	31	24	21	18	26	29	43	38	40	22
N. by E.	2	5	1	0	0	0	0	0	5	1	0	0	0	0
N. N. E.	25	34	1	6	4	1	3	6	3	7	8	17	1	2
N. E. by N.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. E.	146	156	21	24	22	27	25	24	24	29	31	28	12	35
N. E. by E.	20	22	0	3	5	5	3	2	5	4	5	4	2	4
E. N. E.	20	22	0	3	5	5	3	2	5	4	5	4	2	4
E. by N.	3	3	1	1	0	0	1	0	2	0	0	1	0	0
East	181	194	17	14	26	38	45	13	37	56	40	42	26	21
E. by S.	2	0	0	0	0	0	2	0	0	0	0	0	0	0
E. S. E.	8	10	0	0	1	2	7	0	3	0	3	0	1	1
S. E. by E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. E.	85	70	11	4	14	19	18	10	14	15	15	13	12	10
S. E. by S.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. S. E.	10	7	1	2	4	1	4	2	0	0	0	1	1	1
S. by E.	3	2	1	1	0	0	0	0	1	2	0	0	0	0
South	151	177	17	25	23	44	41	35	34	35	17	30	21	6
S. by W.	8	2	1	0	5	0	2	1	0	0	0	1	0	0
S. S. W.	43	39	13	8	10	9	8	7	6	4	3	5	4	5
S. W. by S.	2	1	2	0	0	0	0	0	0	0	0	1	0	0
S. W.	231	169	44	36	38	34	17	36	40	23	20	7	39	66
S. W. by W.	4	0	4	0	0	0	0	0	0	0	0	0	0	0
W. S. W.	26	24	6	5	3	4	7	6	3	4	1	2	5	4
W. by S.	5	5	3	2	0	0	0	1	3	0	0	0	1	0
West	192	206	46	23	37	15	28	27	26	32	32	35	58	35
W. by N.	6	0	4	1	0	0	1	0	0	0	0	0	0	0
W. N. W.	9	6	2	1	2	0	0	3	0	0	1	1	3	2
N. W. by W.	1	0	1	0	0	0	0	0	0	0	0	0	0	0
N. W.	138	83	22	37	20	15	13	23	9	7	17	16	12	30
N. W. by N.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. N. W.	13	5	1	3	2	2	1	1	2	2	2	1	1	0
N. by W.	2	0	2	0	0	0	0	0	0	0	0	0	0	0

Winds in the United States.—*Continued.*

Course.	Fort Johnston, North Carolina. 10 years.[1]	Total for the separate months from 1822 to 1826, inclusive. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Florence, North Carolina, 1 month.	Wake Forest, North Carolina, 1 month.
N.	578	40	43	50	44	41	28	28	46	42	58	47	45	23	9
N. E.	650	8	6	10	10	4	0	2	2	9	7	11	13	12	5½
E.	131	9	8	5	6	13	5	5	9	12	10	10	5	0	2
S. E.	155	2	2	6	6	2	4	12	0	3	2	5	4	0	4½
S.	820	31	29	40	63	62	65	51	44	36	31	36	46	2	10
S. W.	688	15	5	10	3	8	12	19	20	5	5	3	3	16	8½
W.	261	15	24	14	12	18	27	31	22	23	20	21	14	32	10
N. W.	369	35	24	20	6	7	9	7	12	20	22	17	25	8	20½

Course.	Camden, S. Carolina, 1838.	Abbeville, S. Carolina, 1838–39.	Charleston, South Carolina. 1831, 32, and 33, in part.	1834.	1837.	1841.	1844.	Fort Moultrie, South Carolina. 1822 to 1824, inclusive.[1]	7 years since 1830.[1]	Total for the separate months of 1823–4. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	4	21	186	210	156	60	32	43	187	4	7	2	2	6	0	0	0	3	6	4	9
N. E.	97	166	379	114	183	226	65	172	531	21	12	17	12	11	14	4	7	19	14	21	20
E.	4	83	166	90	108	144	38	109	261	5	3	4	11	9	6	5	16	14	17	6	13
S. E.	26	61	287	99	129	126	43	132	367	4	7	8	16	12	16	15	19	11	8	6	0
S.	0	44	138	330	201	81	53	100	296	3	7	7	7	14	17	15	14	7	3	4	2
S. W.	135	94	515	78	138	228	69	103	435	15	8	9	7	7	5	17	6	6	5	12	6
W.	27	196	110	69	45	90	20	49	219	5	7	4	4	3	1	6	0	0	5	6	8
N. W.	65	49	213	84	135	111	45	23	261	5	6	1	1	0	1	0	0	0	4	1	4

Athens, Georgia.[2]

Course.	1841 to 1844.	1845.	Separate months of 1845. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	38	51	6	5	3	2	1	2	8	1	6	7	0	10
N. E.	119	78	4	1	5	5	6	1	4	11	7	22	1	11
E.	88	44	4	2	2	0	5	4	3	3	9	10	0	2
S. E.	30	17	2	0	1	1	3	4	1	2	0	3	0	0
S.	35	11	0	3	0	1	0	1	4	0	1	0	0	1
S. W.	100	96	9	8	6	8	8	15	11	6	9	3	6	7
W.	165	177	25	12	25	23	12	12	20	12	13	6	4	13
N. W.	64	63	5	12	9	2	0	0	4	6	5	1	8	11
Calm or variable		149	7	13	11	18	27	21	7	21	10	10	1	3

[1] For abstracts for these years separately, see published volumes of the U. S. Army Meteorological Register.

[2] The following is an extract from a letter of Prof. McCay accompanying the observations:—

"I do not think there is any local cause for our winds. There are no mountains within 60 or 70 miles—no regular ridges for a still greater distance. The country is undulating, with no changes of elevation amounting to 500 feet in a circle around us of 50 miles. The river near us is very small. Its course is very irregular, sweeping round us in a semicircular course. Other streams near us have a general course to the S. E., nearly S.

Winds in the United States.—*Continued.*

Augusta Arsenal, Georgia.

Course.	1826 to 1830, inclusive.[1]	1831 to 1835, and 1839 to 1842, inclusive.[1]	TOTAL FOR THE SEPARATE MONTHS FROM 1826 TO 1830, INCLUSIVE. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	95	175	13	11	9	6	7	3	2	7	4	17	7	9
N. E.	242	400½	14	26	18	8	20	25	9	28	28	30	11	25
E.	97	245½	14	9	10	7	7	4	8	9	13	9	2	5
S. E.	297	449	19	11	23	28	28	25	34	38	29	17	25	20
S.	151	285	12	7	21	14	10	9	12	13	12	9	15	17
S. W.	458	815	35	29	39	46	56	41	59	35	25	22	41	30
W.	201	407½	21	18	19	26	16	20	17	7	10	13	15	19
N. W.	286	510½	27	30	16	15	11	23	14	17	29	39	35	30

Course.	Oglethorpe Barracks, Georgia. 1834.	1835.	Augusta, Georgia. 1840.	1841.	1842.	1843.	Eutaw, Alabama, 1851. Lower current.	Upper current.	Mobile, Alabama. 1841.[2]	1841.	Part of 1838 & 1840.	Glenville, Alabama, 1 month.	Tuscaloosa, Alabama, 1 month.
N.	29	34					295	79	240	270	30	1	9
N. E.	62	54	321	393	116	49	103	33	132	141	9	10	7
E.	25	28					53	11	27	21	0	1	3
S. E.	69	36	261	195	58	98	302	85	105	150	13	3	1
S.	57	57					175	62	417	396	43	0	2
S. W.	42	59	252	330	113	140	122	227	78	66	15	6	1
W.	20	46					107	310	45	12	1	3	8
N. W.	61	51	210	86	61	71	204	179	51	36	8	9	1
Calm							99	474	0	0	0	0	0

Course.	Milledgeville, Georgia, 2 months.	Whitemarsh Island, Georgia, 13 months.	Savannah, Georgia. 1832, in part.	1833–34.[3]	10 months of 1843 and 1845.	Port Gibson, Mississippi, 2 months.	Washington, Mississippi, 2 months.	Frank's Island, Louisiana, 2 months.	Attakepas, Louisiana, 2 months.
North	5	171	0	223.80	77	16	19	10	17
N. N. E.	0	37	0		11	4	2	0	0
N. E.	35	300	24		59	9	24	9	3
E. N. E.	0	10	0		19	2	2	11	1
East	48	85	0	271.74	114	10	9	41	8
E. S. E.	0	6	0		37	9	1	4	0
S. E.	36	197	8		52	12	27	11	10
S. S. E.	0	15	0		20	5	0	1	0
South	56	329	3	220.77	202	36	23	7	53
S. S. W.	1	34	0		20	4	3	0	0
S. W.	33	299	12		79	19	47	7	7
W. S. W.	0	65	0		19	12	0	0	0
West	128	359	0	238.34	194	44	26	4	2
W. N. W.	1	34	0		21	4	4	2	0
N. W.	39	359	13		54	24	20	6	0
N. N. W.	0	6	0		7	8	12	0	0
Calm	1	227	0		0	10	2	7	55

[1] For abstracts for these years separately, see the published volumes of the U. S. Army Meteorological Register.

[2] Two independent registers.

[3] The numbers in this column are the original observations reduced in the direction of the cardinal points.

Winds in the United States.—*Continued.*

Tuskegee, Alabama.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	0	4	5	2	2	0	4	0	0	0	0	0	17
N. N. E.	0	4	0	0	0	0	0	0	0	0	0	2	6
N. E.	0	0	6	8	6	2	8	18	18	8	6	4	84
E. N. E.	0	0	2	1	1	1	0	0	0	8	0	0	13
East	18	8	4	13	5	8	2	6	14	10	8	8	104
E. S. E.	0	0	3	1	0	1	0	0	0	0	0	2	7
S. E.	0	12	15	20	12	19	20	12	2	8	4	20	144
S. S. E.	0	0	2	1	4	4	0	8	0	8	0	20	47
South	0	0	0	2	1	1	0	0	0	0	0	0	4
S. S. W.	2	0	5	0	2	3	2	0	4	0	0	0	18
S. W.	6	2	5	8	11	4	8	8	2	0	0	2	56
W. S. W.	0	0	0	0	1	1	0	0	0	2	0	0	4
West	6	18	5	2	3	6	4	0	2	0	0	4	50
W. N. W.	4	0	0	0	0	1	0	0	0	0	0	0	5
N. W.	0	8	8	2	13	9	14	10	0	16	0	0	80
N. N. W.	8	0	2	0	1	0	0	0	0	2	0	0	13

Course.	Spring Hill College, Alabama.													Knoxville, Alabama, 3 months.	Springfield, Alabama, 1 month.	Arendale, Alabama, 2 months.	La Grange College, Alabama, 8 months.	Mount Vernon, Alabama, 10 months.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.					
N.	20	16	13	6	18	13	11	13	27	26	22	24	182	59	0	15	62	94½
N. E.	28	4	3	6	4	12	11	16	11	12	6	12	99	20	7	11	35	40
E.	12	4	9	11	6	14	9	8	4	13	3	5	86	33	0	37	28	2
S. E.	12	0	12	7	12	8	16	8	9	16	12	12	115	35	1	11	244	39½
S.	8	8	18	21	19	11	13	13	18	6	16	11	150	89	6	14	103	0
S. W.	4	20	10	8	11	15	16	12	9	2	5	8	102	16	8	36	58	69½
W.	0	8	8	3	6	10	13	13	6	0	2	4	67	135	64	99	48½	0
N. W.	20	8	26	11	5	7	7	6	10	3	13	7	102	63	26	4	143½	56½
Calm or variable	20	44	25	46	43	30	28	39	29	46	41	34	377	143	89	133	1	

Course.	St. Augustine, Florida.																Cape Florida.				
	1825, 26, 28, and 1830.[1]	1831, 32, and 1833.[1]	1835.	5 years since 1836.[1]	TOTAL FOR THE SEPARATE MONTHS OF 1825, 26, 28, and 30.																
					Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Winter.	Spring.	Summer.	Autumn.	Total.
N.	68	75	83	213	18	7	5	2	6	4	0	2	6	5	9	4	6	3	2	4	15
N. E.	473	289	68	511	38	31	38	38	28	41	34	29	56	71	31	38	9	14	0	21	44
E.	41	80	11	141½	1	3	1	5	12	2	3	6	1	5	1	1	7	7	9	16	39
S. E.	458	292	27	266½	13	34	44	41	50	40	54	47	41	24	37	33	17	25	39	15	97
S.	52	121	91	204½	14	11	2	6	3	4	4	0	0	1	2	5	11	21	18	8	58
S. W.	139	91	22	219½	7	9	17	14	18	12	13	21	10	7	4	7	3	2	12	7	24
W.	74	46	14	129	12	8	5	6	3	10	10	11	0	4	1	4	5	3	4	7	19
N. W.	150	102	4	140	21	10	12	7	4	7	6	8	6	7	36	26	32	17	8	13	70

[1] For abstracts for these years separately, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Key West, Florida.

Course.	1835.	1834 to 1837.	Total for the separate months from 1834 to 1837. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Key West Barracks, 1831, 32, and 34.[1]
North	39	216	32	40	16	16	8	8	0	0	8	32	16	40	184
N. N. E.	5	56	8	0	8	8	0	0	0	0	0	8	16	8	
N. E.	75	576	40	40	48	32	24	32	24	32	64	80	88	72	760
E. N. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
East	96	656	56	48	80	32	72	48	72	48	48	32	72	48	360
E. S. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
S. E.	54	536	48	32	24	56	64	40	72	64	64	40	16	16	444
S. S. E.	2	40	0	8	0	8	8	0	0	0	8	0	0	8	
South	9	128	8	0	8	8	8	32	24	24	0	0	8	8	50
S. S. W.	0	32	8	8	0	8	8	0	0	0	0	0	0	0	
S. W.	22	136	8	0	8	16	16	24	16	24	16	8	0	0	92
W. S. W.	0	24	0	8	0	0	8	0	0	0	0	0	0	8	
West	12	48	0	0	0	8	0	8	8	16	8	0	0	0	46
W. N. W.	0	40	0	8	8	0	0	8	0	8	0	0	0	8	
N. W.	42	232	32	24	24	16	24	24	8	16	8	16	16	24	256
N. N. W.	0	56	0	0	8	8	0	0	0	8	8	16	0	8	
Variable	9	48	8	8	16	24	8	16	24	8	8	16	8	0	

Pensacola, Florida.

Course.	7 years.[1]	Total for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	216	29	32	19	11	6	6	17	11	15	28	25	17
N. E.	254	41	20	15	7	8	9	11	28	21	41	18	35
E.	99	9	12	20	2	3	1	5	4	8	7	8	20
S. E.	472	41	30	40	49	22	25	23	30	51	56	52	53
S.	379	28	25	44	43	53	34	25	35	24	22	19	27
S. W.	686	25	43	45	70	96	102	102	72	60	24	29	18
W.	92	6	4	7	6	6	20	13	9	4	4	3	10
N. W.	356	38	32	27	22	21	13	21	27	27	35	56	37
Variable													

Tortugas Islands, Florida.

Course.	Winter.	Spring.	Summer.	Autumn.	Total.
N.	16	4½	0	8	28½
N. E.	32	33½	6	34	105½
E.	11	15	11	16	53
S. E.	7	18	16	13	54
S.	6	5	2	1	14
S. W.	3	3	3	2	11
W.	1	1	2	1	5
N. W.	12	3	1	7	23
Variable	2	9	4	9	24

Tampa Bay, Florida.

Course.	1825, 26, 27, 28, 30, & 31.[1]	1835.	1838 to 1842, inclusive.[1]	Total for the separate months of 1825, 26, 27, 28, and 30. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	1831.
N.	69	34	144	24	5	7	7	1	1	1	2	0	2	3	3	13
N. E.	310	43	391	11	28	19	22	18	8	10	15	34	30	25	25	58
E.	245	19	330½	5	8	6	16	24	35	6	13	21	24	15	15	57
S. E.	352	18	217½	7	21	25	21	25	21	39	34	29	17	18	22	63
S.	213	8	199	21	9	11	11	18	18	35	22	13	9	10	16	21
S. W.	383	19	267½	26	35	35	32	27	28	38	33	11	25	29	11	53
W.	351	12	157	29	21	33	29	26	27	20	21	29	30	28	41	17
N. W.	275	53	120½	27	16	19	12	9	12	6	15	13	18	23	22	83
Variable		6														

Indian Key, Florida.

Course.	Winter.	Spring.	Summer.	Autumn.	Total.
N.	22	14	1	16	53
N. E.	13	2	3	19	37
E.	14	20	46	30	110
S. E.	13	17	23	8	61
S.	8	25	7	3	43
S. W.	1	2	6	4	13
W.	4	8	2	5	19
N. W.	14	2	1	5	22
Variable	1	2	3	1	7

[1] For separate abstracts for each of these years, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Course.	Fort King, Florida. 5 years.[1]	Fort King, Florida. Total for the separate months of 1833, 34, and 35. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Apalachicola, Florida. May.	Cedar Keys, 1842.	Carysford Reef, Florida. Winter.	Spring.	Summer.	Autumn.	Total.
N.	155	4	12	4	13	7	2	0	3	7	2	5	11	3	19	10	10	2	9	31
N. E.	256	15	10	7	13	16	0	9	7	6	25	12	8	21	75½	15	20	15	31	81
E.	203	7	4	14	6	10	14	12	15	29	10	20	16	14	33	16	15	21	15	67
S. E.	188	16	11	16	6	5	17	13	12	7	7	6	12	9	51½	12	18	22	13	65
S.	279	20	12	8	10	15	29	26	12	10	10	9	18	21	29½	4	12	16	2	34
S. W.	406	14	21	21	26	17	19	18	13	10	14	9	5	16	85	6	5	7	7	25
W.	217½	10	5	13	11	11	5	13	28	15	17	24	9	21	26	7	2	1	2	12
N. W.	120½	7	9	10	6	11	5	1	3	6	8	6	13	10	45½	18	4	2	11	35
Variable														16		2	6	6	1	15

Natchez, Mississippi.

Course.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.	1841.	Separate months of 1840, 41, 42, and 46. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	95	72	88	116	110	58	94	105	82	144	143	131	173	132	118	127	123	36	38	32	32	31	32	44	48	46	66	47	32
N. E.	58	44	44	41	45	21	19	38	54	56	34	22	37	41	44	48	42	15	9	10	5	15	7	4	11	30	20	7	14
E.	77	89	91	92	88	58	65	88	75	84	51	79	124	66	77	106	85	24	22	29	20	36	27	34	35	30	34	40	30
S. E.	132	103	76	64	84	44	54	43	40	39	52	33	66	61	66	68	115	35	23	38	35	17	22	26	28	49	39	34	27
S.	80	99	116	132	141	131	110	93	88	149	148	155	119	84	107	155	120	40	49	63	68	64	65	55	52	35	33	41	40
S. W.	88	116	85	68	64	90	54	72	71	96	59	66	123	87	120	94	107	33	19	33	37	39	47	55	26	18	20	17	23
W.	31	31	21	26	26	38	25	25	33	38	31	37	65	53	49	68	40	21	14	13	26	13	22	24	25	8	12	18	16
N.W.	54	46	26	11	25	28	31	16	25	20	20	21	49	30	28	23	12	6	11	14	7	9	7	7	9	4	10	10	8

Vicksburg, Mississippi.

Course.	1840.	1841.	1842.	Separate months of 1842. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	447	447	225	11	9	8	10	8	4	4	3	2	2	0	14
N. E.	45	33	54	0	1	0	0	0	2	1	5	2	3	3	1
E.	72	69	255	3	7	6	3	8	9	7	9	12	8	10	3
S. E.	111	135	69	2	2	1	2	0	0	0	3	5	3	4	4
S.	297	309	240	15	9	16	15	9	1	1	1	2	0	0	11
S. W.	42	27	18	0	0	0	0	0	1	1	2	1	0	1	0
W.	42	45	162	0	0	0	0	4	11	13	4	4	10	8	0
N. W.	42	30	72	0	0	0	0	2	2	4	4	2	5	4	1

New Orleans, Louisiana.

Course.	1826.	1836.	April to Sept. for 1834, 35, 36, and 37.	Nov. and Dec. of 1839.	1840.	1841.	1842.	Total for the separate months of 1841–42. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	New Orleans Barracks, 1838 to 1842, inclusive.
N.	154	204	669	54	162	249	189	19	10	7	7	10	5	10	8	12	21	13	24	302½
N. E.	90	113	969	18	42	57	54	6	9	3	0	1	1	1	6	2	1	5	2	283
E.	141	81	812	36	150	162	117	9	6	7	8	4	1	8	10	13	9	7	11	205½
S. E.	86	128	1446	12	108	93	66	5	3	3	7	5	3	2	7	5	6	4	3	143½
S.	74	131	0	6	252	255	258	12	6	19	13	21	21	18	12	19	10	12	8	231
S. W.	48	117	1578	6	48	78	132	5	9	7	10	5	8	6	7	1	2	5	5	231
W.	90	73	594	9	90	126	174	2	7	12	7	11	20	13	8	5	3	7	5	192½
N. W.	46	119	823	39	63	75	105	4	6	4	8	5	1	4	4	3	10	7	4	248

[1] For separate abstracts for each of these years, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Petite Coquille, Louisiana.

Course.	1827 to 1830, inclusive.[1]	TOTAL FOR THE SEPARATE MONTHS.											
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	104	12	12	9	7	6	3	8	8	8	8	7	16
N. E.	269	21	16	20	12	25	19	15	21	47	41	8	24
E.	254	26	23	21	22	18	12	15	25	15	23	26	28
S. E.	196	9	10	11	29	16	18	16	12	17	10	24	24
S.	97	7	14	14	14	13	8	5	8	4	3	4	3
S. W.	196	9	12	14	7	21	24	38	22	14	15	13	7
W.	139	17	16	11	11	13	20	10	9	5	9	11	7
N. W.	208	23	10	24	18	12	16	18	19	10	15	28	15

Fort Jessup, Louisiana.

Course.	1823 to 1842, inclusive.[1]	TOTAL FOR THE SEPARATE MONTHS FROM 1823 TO 1830, INCLUSIVE.												Baton Rouge, Louisiana, 7 years.	Fort Jackson, Louisiana, 1832.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.		
N.	1158	27	27	20	29	17	4	22	31	33	24	18	26	160	21
N. E.	970½	36	36	31	48	33	33	36	56	68	54	39	32	251	76
E.	873	21	25	17	21	23	31	20	20	32	26	18	16	526	51
S. E.	894½	34	55	60	39	51	53	51	44	32	48	38	61	355	84
S.	839½	25	21	26	18	48	38	36	30	22	20	25	24	265	42
S. W.	908½	49	22	27	38	36	51	41	27	18	24	35	29	399	54
W.	825	18	11	20	13	18	10	19	15	5	7	21	7	319	15
N. W.	835	38	29	47	30	22	20	23	25	30	45	47	53	291	23

Fort Wood, Louisiana.

Course.	1831, 33, and 1835.[1]	TOTAL FOR THE SEPARATE MONTHS.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	52	9	4	1	1	3	3	1	0	5	6	10	9
N. E.	172	7	9	3	13	18	5	17	22	27	23	10	18
E.	100	11	9	8	7	4	6	8	10	11	12	4	10
S. E.	240	16	18	29	22	17	30	31	6	24	15	23	9
S.	88	9	12	8	5	10	18	9	5	3	7	6	3
S. W.	114	4	2	14	12	16	17	12	22	3	2	4	4
W.	99	15	13	13	7	14	6	5	8	6	4	3	7
N. W.	228	19	17	17	23	11	13	10	20	11	24	30	33

[1] For abstracts for these years separately, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Fort Pike, Louisiana.

Course.	1831 to 1834, inclusive.[1]	TOTAL FOR THE SEPARATE MONTHS.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	123	11	20	12	10	5	7	3	4	3	18	15	15
N. E.	204	15	13	17	10	9	13	19	24	20	21	22	21
E.	284	36	32	28	11	18	7	10	23	33	38	24	24
S. E.	263	18	16	31	21	26	30	21	18	28	23	15	16
S.	84	5	11	8	13	7	8	9	2	8	3	5	5
S. W.	151	7	6	9	21	11	20	31	16	11	4	7	8
W.	185	10	6	7	24	23	22	22	22	9	8	12	20
N. W.	165	22	9	12	10	25	13	9	15	6	9	20	15

Fort Smith, Arkansas.

Course.	1840, 41, and 1842.[1]	TOTAL FOR THE SEPARATE MONTHS.												Little Rock, Arkansas, 1840.	Little Rock Arsenal, Arkansas, 1840.	Washington, Arkansas, 5 months.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.			
N.	148	30	5	16	4	4	4	14	11	10	11	22	17	31	93	2
N. E.	304	22	15	9	24	12	15	26	44	49	38	33	17	54½	117	12
E.	201	13	34	16	15	21	10	21	15	15	11	8	22	46	165	4½
S. E.	287	17	16	25	25	24	3	24	20	19	25	33	26	31	144	36
S.	445	17	11	38	39	81	94	65	28	31	21	8	12	53	99	4½
S. W.	296	17	29	33	25	21	21	12	24	30	40	19	25	54	156	49½
W.	286	54	47	30	32	10	7	12	26	14	14	14	26	54½	165	6½
N. W.	250	18	15	21	29	17	3	7	18	12	26	43	41	42	159	1

Nashville, Tennessee.

Course.	1839–40.	1841.	1842.	1843.	1844.	PROPORTION FOR THE SEPARATE MONTHS.											
						Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	67	657	389	592	615	.108	.354	.312	.153	.207	.061	.186	.156	.380	.524	.220	.143
N. E.	101	1872	997	1417	1517	.429	.591	.805	.478	.597	.539	.700	.567	.633	.622	.593	.412
E.	81	589	546	837	847	.231	.173	.172	.136	.197	.218	.282	.567	.523	.142	.193	.253
S. E.	82	521	1693	1127	888	.709	.669	.349	.403	.242	.276	.396	.485	.299	.369	.527	.297
S.	39	119	341	172	259	.146	.072	.080	.114	.078	.021	.069	.069	.054	.070	.118	.057
S. W.	332	4239	3788	3615	3996	1.212	1.080	1.425	1.662	1.865	2.343	1.704	1.612	1.711	1.331	1.150	1.676
W.	331	1666	1809	1527	1229	.844	.911	.618	.771	.656	.477	.430	.449	.309	.836	.753	.622
N. W.	105	337	437	713	649	.241	.249	.239	.286	.158	.065	.105	.097	.091	.196	.340	.395

[1] For separate abstracts for each of these years, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Course.	Greenville, Tennessee, 3 months.	Knoxville, Tennessee, 8 months.	Danville, Kentucky, 5 months.	Louisville, Kentucky, 2 months.	Paris, Kentucky, 2 months.	Springdale, Kentucky, 2 months.	St. Mary's College, Kentucky, 7 months.
North	13	137	12	3	10	0	123
N. N. E.	2	16	0	3	2	3	
N. E.	1	78	51	8	9	5	71
E. N. E.	0	5	0	8	2	6	
East	18	78	46	10	9	5	42
E. S. E.	0	1	0	5	3	2	
S. E.	12	13	58	7	12	5	62
S. S. E.	6	2	0	5	2	5	
South	72	141	42	10	17	24	121
S. S. W.	6	63	2	22	6	21	
S. W.	68	292	365	24	56	20	390
W. S. W.	2	9	0	12	20	2	
West	220	316	252	18	109	6	366
W. N. W.	0	3	3	14	2	2	
N. W.	21	118	125	23	15	12	142
N. N. W.	1	12	0	5	6	20	
Calm	37	231	40	0	0	53	16

Course.	Ashtabula, Ohio, 5 months.	Chillicothe, Ohio, 1 year.	Chillicothe, Ohio, 4 months.	Cincinnati, Ohio, 6 months.	Dayton, Ohio, 4 months.	Granville, Ohio, 5 months.	Sandusky, Ohio, 9 months.	Zanesville, Ohio, 11 months.	Ravenna, Ohio, 1 month.
North	24	44	9	35	44	16	49	164	0
N. N. E.	1	2	15	13	15	3	5	7	4
N. E.	74	41	13	39	10	38	78	67	2
E. N. E.	1	1	0	5	16	23	16	0	11
East	21	20½	1	51	5	29	138	22	2
E. S. E.	0	1	5	11	3	6	4	0	8
S. E.	15	11	65	14	3	27	128	31	14
S. S. E.	1	1	26	9	0	7	2	0	6
South	127	27	13	22	10	19	195	129	3
S. S. W.	4	2	13	18	35	24	20	8	33
S. W.	103	40	105	62	65	244	332	221	45
W. S. W.	5	3	15	24	89	36	7	8	29
West	160	150½	56	295	129	81	362	240	4
W. N. W.	10	9	25	54	51	5	18	14	23
N. W.	193	220	121	56	67	20	174	87	37
N. N. W.	0	19	10	17	20	0	19	1	0
Calm	99	234	1	0	0	12	21	0	0

Steubenville, Ohio.

Course.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N. E.	25	21	9	13	3	10	12	13	10	12	29	20	5	24	18	15	14	32	28	8	7	15	12	17	16	24
S. E.	49	31	12	11	26	25	30	26	25	24	38	44	25	19	40	28	33	36	35	24	30	28	34	35	37	25
S. W.	124	136	171	139	168	135	131	139	111	127	111	98	141	128	160	150	148	148	155	170	183	155	135	156	146	153
N.W.	167	177	173	203	168	195	192	188	219	202	187	204	194	194	216	202	239	204	216	218	214	236	239	226	221	232

Winds in the United States.—*Continued.*

Hudson, Ohio. (Surface Winds.)[1]

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	205.0	207.8	305.4	332.1	316.1	286.6	327.4	325.5	257.4	207.5	141.5	219.2	3131.3
E.	132.3	95.5	154.1	169.5	159.6	116.1	103.8	160.4	154.1	114.7	123.2	137.8	1621.2
S.	294.0	257.5	187.8	215.5	210.6	264.0	190.6	189.4	256.2	255.7	227.1	236.2	2784.8
W.	537.2	526.5	500.9	434.4	470.7	477.7	489.4	397.0	428.0	517.4	486.9	560.3	5826.5

Hudson, Ohio. (Clouds.)

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	70.1	67.0	81.4	74.7	66.5	90.5	113.7	125.4	90.1	96.1	79.7	81.7	1037.1
E.	22.6	14.4	33.0	27.1	29.7	23.8	24.4	50.7	42.3	20.0	33.7	36.2	357.9
S.	121.2	87.9	65.3	78.0	78.7	97.4	82.7	105.4	82.8	89.9	111.1	98.6	1099.2
W.	267.9	256.3	208.3	192.8	214.3	250.9	252.6	222.8	199.4	245.8	240.6	252.9	2804.6

Course.	Cambridge, Ohio, 1 month.	Conneaut, Ohio, 1 month.	Columbus, Ohio, 8 months.	Lancaster, Ohio, 5 months.	Lebanon, Ohio, 13 months.	New Athens Ohio, 6 months.	Marietta, Ohio, 1 year.	Rensalaer, Indiana, 1 month.	Brookville, Indiana, 1 month.	Indianapolis, Indiana, 3 months.	Greensburg, Indiana, 3 months.	Winnamac, Indiana, 3 months.
N.	2	0	142	64	83	72½	62	20	3	6	18	17
N. E.	16	0	99	45	216	75	11	18	33	5	27	17
E.	4	4	89	60½	127	11	6	1	28	2	16	11
S. E.	8	3	61½	60	281	51	19	7	32	9	11	14
S.	4	12	194½	241	228	75½	51	58	16½	9	30	25
S. W.	51	10	244	123	932	232½	127	22	84½	16	147	124
W.	26½	10	459	426½	820	145	46	38	96	4	63	159
N. W.	25½	1	265	56	293	215½	42	12	141	8	31	81
Calm	2	0	42	11	0	235	0	33	41	0	108	0

Brockville,[2] Indiana.

Course.	1841.	1842.	1840 and 1843, in part.	PROPORTION FOR THE SEPARATE MONTHS.												Greencastle, Indiana, 3 months.
				Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
North	24	26	14	3	4	6	4	8	11	6	7	9	0	0	6	21
N. N. E.	34	10	17	4	4	3	3	17	4	4	2	5	10	0	10	7
N. E.	59	37	62	8	5	18	20	21	4	17	27	14	22	1	12	18
E. N. E.	21	22	26	1	1	15	17	11	4	0	1	5	0	6	9	3
East	18	28	46	1	8	17	9	12	4	3	14	10	10	4	5	9
E. S. E.	14	25	13	3	13	11	7	5	0	0	1	4	8	0	4	11
S. E.	99	103	68	29	7	17	23	24	25	33	30	21	40	33	8	19
S. S. E.	38	24	9	20	4	8	7	2	3	5	5	7	0	4	6	17
South	46	99	46	32	15	13	26	15	14	5	23	10	16	23	7	47
S. S. W.	32	18	27	12	7	4	3	4	8	2	1	13	2	8	14	35
S. W.	185	182	185	52	57	50	29	44	56	76	33	57	54	31	40	57
W. S. W.	70	46	41	21	29	27	5	5	6	5	3	6	22	24	15	23
West	89	213	166	60	67	41	39	48	39	31	24	28	48	37	30	70
W. N. W.	108	34	18	13	17	17	21	12	12	14	16	11	22	4	12	39
N. W.	98	110	41	10	9	20	25	30	23	30	39	31	22	9	12	39
N. N. W.	21	1	8	0	1	2	3	3	8	3	0	5	0	1	4	17
Calm	15	18	25	3	1	3	13	4	2	6	14	4	10	0	3	27

[1] These observations were taken with extreme minuteness in regard to direction, and then resolved in the direction of the cardinal points, taking into account both time and estimated force.

[2] This register extends from Nov. 1, 1840, to Sept. 30, 1843

Winds in the United States.—*Continued.*

Chicago, Illinois.

Course.	1833.	1834.	1835.	1836.	3 months of 1845.	Proportion for the separate months. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Peoria, Illinois, 1 month.
N.	54	65	98	115	22	14	22	23	46	39	25	34	18	27	33	9½	11	24
N. E.	49	47	30	20	23	6	8	13	13	19	8½	13	19½	15	6	5	10	19
E.	39	24	16	29	31	6	4	7	15	13	8½	10	19	9	5	4	7	15
S. E.	44	40	18	16	51	14	8	15	8	5	17½	7	12½	10	13	14	15	27
S.	36	33	93	51	15	22	19	19	12	19	11½	24	7	17	14	10½	24	18
S. W.	59	62	34	56	96	18	15	17	11	10	18½	22	27	18	22	32	19	13
W.	38	57	41	47	107	26	19	19	8	13	24	13	8	10	17	34½	21	21
N. W.	46	37	35	29	24	18	18	11	7	4	7	1	10	14	14	18	14	38
Calm						0	0	0	0	0	0	0	0	0	0	0	0	0

Rock Island, near Stephenson, Illinois.

Course.	8 years.[1]	Total for the separate months of 1827, 28, 29, and 30. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Shawneetown, Illinois, 2 months.	Athens, Illinois, 1 year.
N.	385	34	24	14	28	14	13	26	19	32	18	29	19	61	11
N. E.	266	6	8	14	12	16	6	3	10	14	10	3	6	4	38
E.	308	14	6	9	15	9	9	6	13	13	11	15	12	11	1
S. E.	212	12	2	5	8	8	10	10	8	15	9	7	9	1	51
S.	672	21	34	53	26	49	55	39	46	22	40	20	32	24	36
S. W.	328	7	4	7	7	7	7	20	15	6	7	21	17	19	117
W.	444	13	17	12	17	16	12	12	11	7	22	14	18	53	17
N. W.	307	17	18	10	7	5	8	8	2	11	7	12	11	57	90
Calm														97	4

Course.	Jacksonville, Illinois, 9 months.	Macomb, Illinois, 3 months.	Upper Alton, Illinois, 2 months.	Course.	Jacksonville, Illinois, 9 months.	Macomb, Illinois, 3 months.	Upper Alton, Illinois, 2 months.	Course.	Mackinac, Michigan, 8 years.	Ann Arbor, Michigan, 2 months.	Presque Isle, Michigan, 6 months.
North	25½	30	20	South	75	55	11	N.	267½	N. W. to S. W. 36; N. E. to S. E. 16; N. 5; S. 4.	5
N. N. E.	0	10	7	S. S. W.	29½	29	3	N. E.	173		26½
N. E.	6	33	15	S. W.	8	32	24	E.	475		21½
E. N. E.	3½	8	0	W. S. W.	3	32	1	S. E.	268½		14
East	9½	11	1	West	24	62	53	S.	192		10½
E. S. E.	0	3	2	W. N. W.	19½	47	10	S. W.	222½		35½
S. E.	4½	63	15	N. W.	29	163	65	W.	773		67½
S. S. E.	1	30	9	N. N. W.	2	16	7	N. W.	550½		104½
								Calm			7

[1] For separate abstracts for each of these years, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Detroit, Michigan.

Course.	1839, in part.	1840.	1841.	1842.	Proportion for the separate months. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	19	47	61	50	40	32	48	40	32	24	72	60	63	36	12	63
N. by E.	1	6	10	0	0	4	4	0	4	0	0	0	9	15	9	0
N. N. E.	2	18	10	14	12	8	24	20	16	8	9	6	18	3	12	12
N. E. by N.	1	2	0	0	0	0	0	0	0	0	0	0	0	3	0	3
N. E.	15	60	45	31	36	28	96	72	20	20	24	51	30	48	18	30
N. E. by. E.	1	2	10	21	12	4	4	44	8	12	9	3	0	3	12	9
E. N. E.	7	14	25	26	4	12	52	40	28	12	9	15	9	12	15	24
E. by N.	4	25	18	4	8	8	20	32	32	12	6	0	9	24	9	6
East	36	70	62	41	16	24	80	76	44	72	72	57	39	33	72	12
E. by S.	0	5	18	8	4	8	0	4	20	12	15	3	9	15	9	6
E. S. E.	4	8	4	9	0	0	4	4	16	0	9	12	3	3	18	0
S. E. by E.	0	1	0	1	0	0	0	0	0	4	3	0	0	0	0	0
S. E.	15	38	14	10	12	12	8	20	20	16	9	36	21	21	18	15
S. E. by S.	0	0	1	2	0	0	4	0	0	0	0	3	0	0	3	0
S. S. E.	4	14	6	9	12	0	8	8	32	12	3	6	12	3	3	6
S. by E.	2	6	13	0	4	0	16	8	4	4	6	0	15	3	3	3
South	22	32	41	38	24	4	0	8	24	48	33	69	66	39	18	24
S. by W.	1	4	4	1	40	0	0	0	12	0	3	0	9	3	3	0
S. S. W.	8	35	11	14	16	16	4	16	20	32	15	30	24	21	9	3
S. W. by S.	1	6	4	18	12	20	8	0	16	12	15	9	6	0	6	0
S. W.	53	219	139	136	148	148	100	140	124	216	177	129	102	171	78	159
S. W. by W.	5	12	15	29	4	16	20	12	44	8	33	12	12	6	12	9
W. S. W.	10	52	46	65	60	60	28	44	12	52	39	51	30	48	69	63
W. by S.	6	30	20	7	24	28	16	4	16	16	12	3	6	30	30	12
West	46	122	62	68	88	88	52	32	40	36	72	75	75	75	126	81
W. by N.	1	5	8	6	4	4	8	4	8	4	3	6	3	9	12	0
W. N. W.	9	38	8	18	36	36	12	32	40	4	21	3	3	15	21	9
N. W. by W.	0	1	4	3	4	4	0	4	8	4	0	0	0	6	0	0
N. W.	60	138	38	59	84	56	68	36	76	48	30	84	75	45	75	120
N. W. by N.	2	7	5	8	12	8	4	4	8	8	0	3	9	3	6	6
N. N. W.	27	67	13	33	52	36	44	16	20	12	30	15	39	39	24	57
N. by W.	2	17	12	1	4	12	12	4	0	0	12	0	24	12	6	12

Fort Gratiot, Michigan.

Course.	9 years.[1]	Total for the separate months from 1831 to 1835, inclusive. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	1836.	Detroit Barracks, Michigan, 1840, 41, and 42.	Dearbornville Arsenal, Michigan, 1842.
N.	352	9	18	11	24	20	20	26	24	17	7	5	6	5	112½	27
N. E.	568½	16	14	21	32	25	19	24	27	22	18	14	10	118	95½	7½
E.	55½	6	4	2	1	4	0	1	0	1	0	2	6	7	164	25
S. E.	203½	10	10	8	6	11	11	8	11	15	16	6	12	40	42½	6
S.	440	28	23	34	23	20	26	29	32	30	25	27	41	11	272½	97
S. W.	905	36	31	38	21	39	38	43	37	45	46	49	33	120	148	36½
W.	261	19	14	16	12	10	7	9	6	7	14	22	25	8	180	146½
N. W.	501½	31	27	25	31	26	29	14	19	13	29	26	20	57	81	19½

[1] For separate abstracts for each of these years, see the published volumes of the U. S Army Meteorological Register.

Winds in the United States.—*Continued.*

Fort Brady, Michigan.

Course.	18 years.[1]	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
		TOTAL FOR THE SEPARATE MONTHS OF 1823, 24, 25, 26, 27, 28, AND 30.											
N.	567½	13	11	12	5	7	9	12	11	13	9	17	12
N. E.	565	15	13	11	6	14	14	14	13	11	17	10	20
E.	750½	24	22	17	22	24	22	9	13	10	14	35	33
S. E.	1343½	43	39	56	46	40	33	22	28	42	37	32	37
S.	468	11	9	16	10	5	12	12	9	19	15	18	12
S. W.	596	15	14	10	20	15	14	34	32	16	20	17	17
W.	830½	24	30	26	40	38	47	49	50	34	33	20	18
N. W.	1447½	33	32	38	31	43	29	34	30	35	41	31	37

Prairie du Chien, Wisconsin.

Course.	13 years.[1]	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
		TOTAL FOR THE SEPARATE MONTHS OF 1822 AND 1824.											
N.	789½	10	13	7	15	13	6	13	12	8	14	10	13
N. E.	191½	1	0	4	12	2	0	0	1	4	2	4	2
E.	227	0	0	1	5	0	1	0	1	2	0	0	0
S. E.	378½	3	7	10	2	14	9	6	9	12	11	10	5
S.	1061½	14	11	6	3	13	15	11	18	14	8	9	8
S. W.	790	7	5	6	10	9	2	9	5	4	4	5	8
W.	661½	5	8	6	9	2	10	3	5	0	8	8	6
N. W.	968½	22	13	22	4	9	6	13	11	16	15	12	20

Green Bay, Wisconsin.

Course.	18 years.[1]	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
		TOTAL FOR THE SEPARATE MONTHS FROM 1822 TO 1830, INCLUSIVE.											
N.	874	18	33	19	37	22	19	9	15	25	21	24	18
N. E.	1014	49	46	88	84	102	78	89	78	54	48	56	28
E.	300	2	5	13	4	6	5	5	8	12	10	8	6
S. E.	319	1	1	8	5	5	12	6	17	12	17	5	8
S.	1410	36	34	32	24	49	25	40	30	37	49	39	46
S. W.	1481	122	98	81	84	80	92	106	93	81	90	86	113
W.	647	23	25	28	22	9	24	15	23	29	27	30	25
N. W.	444	28	12	11	10	6	15	9	15	21	17	23	33

[1] For abstracts for these years separately, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Fort Winnebago, Wisconsin.

Course.	10 years.[1]	TOTAL FOR THE SEPARATE MONTHS OF 1831, 32, 35, AND 36.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	1063	19	16	15	13	17	14	13	15	18	17	26	19
N. E.	449½	2	6	1	9	14	12	13	6	5	10	13	5
E.	388	9	3	3	6	9	12	5	12	6	11	10	5
S. E.	357½	6	4	5	10	13	8	19	17	5	11	6	14
S.	873	20	34	33	18	35	27	28	32	27	29	18	35
S. W.	573	23	23	34	24	11	10	12	12	31	16	12	11
W.	668½	28	14	21	23	14	22	13	11	13	11	13	15
N. W.	797½	13	18	12	17	11	15	21	19	15	19	21	19

Bloomington, Iowa.

Course.	1840, 43, 44, 45, and 46.	TOTAL FOR THE SEPARATE MONTHS OF 1843, 45, AND 46.											
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N. E.	186	10	9	11	4	6	6	11	6	4	4	4	5
S. E.	397	13	9	19	28	17	15	26	35	29	21	23	21
S. W.	425	28	22	15	24	20	27	28	25	27	40	14	22
N. W.	758	42	44	48	34	19	12	28	27	30	28	49	45

Fort Atkinson, Iowa.

Course.	1841–42.[1]	TOTAL FOR THE SEPARATE MONTHS.											
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	68	2	4	5	4	2½	1½	1	0	3½	4	3	5½
N. E.	97	9½	6½	9½	4	5	1½	2	0	2	2½	4½	4½
E.	107	2½	3	1½	16	2½	1½	3	5½	7½	4	9½	6
S. E.	95	2	3½	5	0	6½	9½	5	3½	5	2	2½	3
S.	118	3	4½	3	2	1	3	8½	10	7	11	2½	5½
S. W.	191	9	2	7½	13	10½	8	6	13	13	12½	3½	4
W.	362	16½	3	12½	13	9	16	0½	23½	15½	14	22	22
N. W.	361	17½	29½	18	8	25	19½	18	6½	6½	13	12½	10½

Source of the Des Moines, Iowa.—"Whenever a bend, an angle, or some prominent bluff, is more exposed to the fury of the *northwest winds* that blow violently *a great part of the year*," &c.—Nicollet.

[1] For abstracts for these years separately, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Course.	Iowa City, Iowa, 2 months.	Lac Qui Parle, Iowa, 2 months.	Turkey River, Iowa, 1 month.	Fort Snelling, Iowa.												
				20 years.[1]	TOTAL FOR THE SEPARATE MONTHS FROM 1822 and 1824 TO 1830, INCLUSIVE.											
					Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	3	53	5	729	20	11	8	8	19	12	13	15	22	19	23	23
N. E.	14	11	16	429	7	9	7	11	14	10	12	9	22	10	13	15
E.	1	31	8	387	4	4	9	21	19	11	10	11	6	8	13	12
S. E.	9	19	32	803	22	17	27	33	30	37	26	31	36	18	18	17
S.	5	24	38	1160	31	33	41	35	56	47	33	43	29	22	21	27
S. W.	5	0	74	1172	66	53	39	41	48	42	58	54	45	79	33	32
W.	2	36	69	1359	49	58	67	57	38	53	60	47	46	53	68	60
N. W.	23	12	4	1264	49	41	50	34	24	28	32	38	35	39	52	62

St. Louis, Missouri.

Course.	10 years.[1]	TOTAL FOR THE SEPARATE MONTHS FROM 1827 TO 1830, INCLUSIVE.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	336	18	11	15	3	17	6	18	2	12	11	14	16
N. E.	258½	11	8	4	2	9	3	13	8	18	9	6	17
E.	242½	2	6	7	5	6	2	2	19	5	8	7	3
S. E.	497	12	26	27	27	8	13	19	29	18	20	20	21
S.	710	29	18	13	27	31	42	26	34	16	11	19	23
S. W.	423	11	5	23	20	13	21	16	21	17	22	19	14
W.	498½	13	8	10	13	20	11	11	3	11	20	9	7
N. W.	686½	28	31	25	23	20	22	19	8	23	23	26	23

Council Bluffs, Indian Territory.

Course.	1822 to 1826, inclusive.[1]	TOTAL FOR THE SEPARATE MONTHS.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	395	42	32	53	27	14	16	13	25	17	38	52	66
N. E.	119	12	5	9	11	12	13	13	11	11	3	9	10
E.	97	2	2	4	9	9	16	16	17	12	5	2	3
S. E.	222	20	10	21	22	18	24	30	14	20	18	12	13
S.	483	35	26	18	41	61	49	49	60	43	38	34	29
S. W.	156	11	15	10	9	13	13	18	13	16	25	6	7
W.	86	5	12	6	11	9	9	3	5	6	8	9	3
N. W.	266	28	39	34	20	19	10	13	10	23	20	26	24

[1] For separate abstracts for each of these years, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Fort Leavenworth, Indian Territory.

Course.	11 years.[1]	TOTAL FOR THE SEPARATE MONTHS FROM 1831 TO 1834, INCLUSIVE.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	497	25	30	22	17	13	8	5	9	14	16	14	23
N. E.	227½	3	2	2	5	4	1	6	8	8	10	7	9
E.	155½	4	1	5	1	6	3	5	4	6	1	4	6
S. E.	520	6	9	11	8	11	14	15	20	19	9	5	21
S.	1368½	40	36	52	62	64	72	73	56	43	47	46	26
S. W.	311½	4	5	2	2	1	2	6	7	9	9	10	4
W.	367½	15	8	19	9	18	7	3	4	11	8	14	12
N. W.	570½	27	22	11	16	7	13	11	16	10	25	18	24

FORT LARAMIE.—It is stated in Fremont's Report, page 44, that the prevailing wind at this station is west.

Old Fort Wayne, Indian Territory.

Course.	1840–41.[1]	TOTAL FOR THE SEPARATE MONTHS.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	77	10	17	8	3	2	0	0	0	3	9	15	10
N. E.	181	26	17	21	9	8	8	13	18	24	21	9	7
E.	127	3	6	20	4	7	21	14	8	16	9	14	5
S. E.	345	17	25	32	44	49	40	39	23	33	17	9	17
S.	175	1	16	24	4	12	28	12	14	12	20	17	15
S. W.	282	31	16	20	18	37	16	38	36	16	9	18	25
W.	137	7	9	27	12	3	1	7	19	5	6	18	23
N. W.	225	29	8	36	26	6	8	5	8	13	34	24	28

Fort Gibson, Indian Territory.

Course.	1828 to 1842, inclusive.[1]	TOTAL FOR THE SEPARATE MONTHS OF 1828, 29, and 30.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	424	16	9	5	4	1	0	1	3	15	7	11	1
N. E.	444	20	11	20	6	2	5	17	10	25	9	7	18
E.	906	5	4	4	4	2	3	3	5	5	13	14	8
S. E.	1526	45	46	54	50	85	76	45	68	40	49	29	40
S.	712½	2	2	0	5	0	1	1	5	3	2	2	1
S. W.	453½	3	4	0	5	0	3	14	1	1	0	4	3
W.	506	0	0	0	1	0	1	1	0	0	0	7	4
N. W.	510	2	9	10	15	3	1	11	1	1	13	17	18

[1] For abstracts of these years separately, see the published volumes of the U. S. Army Meteorological Register.

Winds in the United States.—*Continued.*

Fort Towson, Indian Territory.

Course.	1833 to 1842, inclusive.[1]	Total for the separate months. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	283	18	31	30	25	9	16	5	15	31	34	18	14
N. E.	829	20	22	17	13	9	12	14	17	22	31	18	26
E.	279½	22	10	11	26	15	15	11	15	17	5	8	16
S. E.	524½	36	24	33	34	45	30	36	31	37	26	46	48
S.	768	40	32	58½	57	83	96	104	78	61	45	22	27
S. W.	685½	45	50	41	50	47	47	44	57	29	58	66	50
W.	401	24	34	38	24	15	13	22	10	14	10	30	40
N. W.	371½	42	25	18½	12	23	12	12	24	29	32	33	24

Fort Vancouver, Oregon.

Course.	114 days.[2]	June 1, 1833, to June 30, 1834.	Separate months from June 1833 to June 1834. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Monterey, California, January.
N.	0	9	0	0	2	1	0	0	4	0	1	0	0	1	5
N. E.	0	66	5	0	6	4	3	11	6	1	5	6	9	10	0
E.	23	30	3	1	3	2	0	0	1	2	2	7	2	7	4
S. E.	40	284	44	13	21	16	14	9	13	12	22	27	51	42	0
S.	15	188	1	10	7	10	8	22	19	33	39	23	6	10	3
S. W.	3	139	0	8	10	17	31	13	18	21	5	10	0	6	0
W.	3	23	0	2	5	1	2	4	2	5	2	0	0	0	5
N. W.	30	70	1	8	5	6	6	6	10	11	7	8	2	0	1
Calm		158	32	30	27	24	19	1	3	2	1	6	8	5	4

Fremont's Tour, Oregon and California.

It is not convenient to give an abstract, in tabular form, of the observations taken by Colonel Fremont during his tour in Oregon and California, in the years 1842, 1843, and 1844. The results will be given in another place.

Winds in Mexico, South America, and the West Indies.

Course.	Mazatlan, Mexico, Jan. and Feb.	Chagres, New Grenada, July.	Porto Cabello, Venezuela. Jan.	Porto Cabello, Venezuela. July.	Porto Cabello, Venezuela. Nov.	Pouce, Porto Rico, Jan.	Turk's Island, Bahamas, March.	Matanzas, Cuba. 4 y'rs, 1833 to 1835.	Separate months of 1835. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	20	26	2	21	23	91	22	83	9	11	7	1	0	0	0	0	0	10	4	8
N. N. E.	0	0	2	0	0	0	6	0												
N. E.	8	14	101	46	43	31	53	165	10	7	12	18	23	9	9	13	12	18	22	12
E. N. E.	0	0	10	2	1	2	26	280												
East	1	18	47	58	37	·74	34	50	3	5	6	1	2	0	0	2	0	3	4	4
E. S. E.	0	0	0	0	0	0	20	0												
S. E.	6	5	17	21	21	26	20	3	2	0	0	0	0	0	0	1	0	0	0	0
S. S. E.	0	0	0	9	5	0	2	0												
South	7	5	6	16	26	1	3	69	5	0	3	3	1	0	0	1	2	0	0	2
S. S. W.	0	0	1	2	3	0	0	0												
S. W.	3	25	3	26	19	0	2	2	0	0	0	0	0	0	0	0	2	0	0	0
W. S. W.	0	0	0	0	0	0	0	0												
West	15	34	7	7	11	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
W. N. W.	0	0	0	1	1	0	0	0												
N. W.	8	7	5	8	10	1	10	2	0	1	0	0	0	0	0	0	1	0	0	0
N. N. W.	0	0	0	0	0	0	3	0												
Calm or variable	34	5	5	1	5	3	2	375	2	4	3	7	5	21	22	14	13	0	0	5

YUCATAN.—"On the northern and western coasts of Yucatan, there is a constant N. E. wind throughout the year."—*Purdy's Sailing Directory.*

[1] For abstracts for these years separately, see the published volumes of the U. S. Army Meteorological Register.

[2] Date unknown.

Winds in the West Indies.—*Continued.*

Barbadoes.

Course.	Jan. 1842.	May, 1841.	June, 1841.	July, 1841.	Aug. 1841.	Sept. 1841.	Oct. 1841.	Nov. 1841.	Dec. 1841.	Upper current in Sept. & Oct.
North	0	0	0	0	1	1	0	0	0	18
N. N. E.	1	0	0	1	2	1	1	1	0	4
N. E.	9	0	0	0	7	6	2	1	6	9
E. N. E.	47	1	15	40	21	29	39	51	71	16
East	13	16	34	41	23	8	13	9	2	15
E. S. E.	2	16	28	3	15	4	19	6	1	8
S. E.	0	9	4	2	7	19	8	7	2	26
S. S. E.	0	5	1	2	3	2	2	0	0	31
South	0	0	0	0	0	1	0	0	0	11
S. S. W.	0	0	0	0	0	0	0	0	0	6
S. W.	0	0	0	0	0	2	0	0	0	89
W. S. W.	0	0	0	0	0	0	0	0	0	6
West	0	0	0	0	0	0	0	0	0	0
W. N. W.	0	0	0	0	0	0	0	0	0	1
N. W.	0	0	0	0	0	0	0	0	0	5
N. N. W.	0	0	0	0	0	0	0	0	0	16

Winds at the Bermuda Islands.

Course.	Centre Signal Station, Hamilton?						PROPORTION FOR THE SEPARATE MONTHS.													Ireland Isle.			
	Sept. 1838.	Dec. 1839.	1840.[1]	1841.[2]	1842.[3]	1843.[3]	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	August.	September.	October.	November.
North	6	0	293¼	485	912	790	409	273	223	173¾	198	101	112	93½	232	225	179	240	2459¼	3	5	27	8
N. by E.	0	0	23	115	84	57	0	19	60	59	36	0	0	12	33	24	12	24	279				
N. N. E.	6	0	202½	84	96	176	63	101	21	156	61	0	0	0	56	51	24	31½	564½	0	3	6	6
N. E. by N.	0	0	48	17	60	103	48	41	48	24	0	0	0	24	19	0	24	0	228				
N. E.	54	0	201	262½	552	716	295	178	108½	47	111	58	96	162	336	173	157	48	1769½	9	17	34	28
N. E. by E.	0	0	0	20½	0	45	20½	0	0	0	0	3	0	0	24	0	18	0	65½				
E. N. E.	12	0	54	72	24	3	24	30	48	36	12	0	0	3	12	0	0	0	165	0	4	9	6
E. by N.	12	0	0	0	0	24	0	0	0	0	0	0	0	0	12	0	24	0	36				
East	66	0	341	395	396	426	207	138	51½	129½	210	55	227	188	170	151	64	24	1615	14	4	22	13
E. by S.	12	0	40	10	24	24	0	0	10	64	0	24	0	0	12	0	0	0	110				
E. S. E.	24	0	279½	145	24	51	50	132	53	97½	0	48	11	84	24	0	0	24	523½	9	5	0	0
S. E. by E.	12	0	0	0	24	12	0	0	0	12	0	0	0	24	12	0	0	0	48				
S. E.	216	0	93	227	720	614	20	94	36	24	192	216	310	408	336	155	55	24	1870	20	32	21	9
S. E. by S.	0	0	40	33½	84	24	9½	0	0	48	40	24	0	24	36	0	0	0	181½				
S. S. E.	66	0	148	232	252	136½	160	53	87½	109	66	60	85	92	66	24	0	24	826½	12	9	8	0
S. by E.	18	0	24	0	36	54	0	13	0	0	40	36	24	1	18	0	0	0	132				
South	30	0	270¼	774½	152	884½	239½	235	198½	378¼	293	365	368	353	234	106	152	227	3149¼	35	18	11	3
S. by W.	6	0	24	35	204	139½	0	48	39	72	72½	96	14	36	6	3	24	0	410½				
S. S. W.	36	0	250	198	276	411	89½	202	147	70	131	87	55½	176	165	24	24	0	1171	3	9	0	1
S. W. by S.	0	0	221	24	240	153	0	102	24	107	162	120	48	24	48	0	0	3	638				
S. W.	78	24	316¾	747½	1404	1230	497	258½	325¾	287½	308½	436½	468	181½	399	72	182	310	3726¼	27	21	8	15
S. W. by W.	0	0	152½	279½	72	42	42	0	47	50	88½	222½	72	0	0	0	0	19	541				
W. S. W.	12	0	383	356½	252	25	67½	135	403	61	170	120	24	0	48	0	0	0	1028½	6	1	0	2
W. by S.	0	0	99	94	36	6	6	0	41	35	0	108	12	0	0	0	6	27	235				
West	12	0	362¾	484	492	437	159	200	229¾	247½	198	211	156½	51	132	20	6	172	1782¾	27	6	11	32
W. by N.	0	0	24	78	132	61	0	54	24	51	36	34	24	36	36	0	0	0	295				
W. N. W.	0	24	91¾	174½	192	109	9	123½	157	96¾	55	24	26	24	24	0	24	28	591¼	0	14	0	18
N. W. by W.	0	0	81	40	0	21	0	0	0	0	121	21	0	0	0	0	0	0	142				
N. W.	30	24	334¼	179	312	738	344	180½	313½	188¼	40	48	39	41	54	57	192	107	1604¼	5	26	20	32
N. W. by N.	0	0	64	42	72	82½	51	66	48	16	37½	2	12	12	0	24	2	0	270½				
N. N. W.	6	0	74½	59	264	172	101½	30½	124	56	0	24	24	14	30	0	63	103½	570½	0	0	9	7
N. by W.	0	0	0	48	156	82	64	5	108	16	45	24	0	0	0	0	16	0	278				
Calm or variable	6	0	0	0	12	0	0	0	0	0	0	0	0	0	18	0	0	0	18	16	6	0	0

[1] Except August, September, October, and November.

[2] Except October and November.

[3] Nearly complete.

Winds on the North Atlantic.

Latitude 55° to 60°.

Course.	Lon. 0° to 5°.	Lon. 5° to 10°	Lon. 10° to 15°.	Lon. 15° to 20.°	Lon. 20° to 25.°	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Total.	TOTAL FOR THE SEPARATE MONTHS.											
												Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	2	0	3	0	0	1	3	11	3	3	26	0	0	0	10	1	4	0	4	6	1	0	0
N. N. E.	4	0	6	2	1	0	0	0	0	0	13	0	0	0	1	0	2	2	1	1	6	0	0
N. E.	5	5	1	0	1	2	0	1	0	5	20	0	0	0	1	1	3	0	13	0	2	0	0
E. N. E.	0	0	2	1	0	0	0	0	3	0	6	0	0	0	4	0	1	0	0	0	0	1	0
East	0	3	2	2	2	2	0	2	0	2	15	0	0	0	2	2	6	1	4	0	0	0	0
E. S. E.	0	0	1	2	2	3	0	0	0	2	10	0	0	0	0	6	0	0	0	0	4	0	0
S. E.	0	0	3	0	0	3	4	5	1	0	20	0	0	0	7	4	6	0	0	3	0	0	0
S. S. E.	0	0	8	8	1	1	0	0	0	0	18	0	0	0	0	4	3	1	5	0	5	0	0
South	1	3	2	3	7	2	2	3	0	0	23	0	0	0	3	2	5	1	1	4	7	0	0
S. S. W.	5	2	12	9	12	0	2	0	0	0	42	0	6	2	3	0	7	4	7	5	8	0	0
S. W.	13	0	9	17	10	1	0	6	2	0	58	0	2	0	2	7	6	11	6	13	10	1	0
W. S. W.	1	1	20	11	10	2	0	5	0	3	53	0	5	5	0	5	8	7	9	3	8	3	0
West	1	8	9	7	6	0	0	4	0	0	35	0	2	0	0	7	4	8	4	4	6	0	0
W. N. W.	4	4	6	10	8	0	0	0	0	0	32	0	2	2	1	1	4	4	12	0	6	0	0
N. W.	2	3	5	5	3	0	0	2	0	0	20	0	1	0	2	1	8	1	3	2	1	1	0
N. N. W.	3	4	5	2	4	2	0	1	0	0	21	0	1	0	2	3	6	1	4	3	1	0	0
Calm	0	1	4	1	0	0	0	0	0	0	6	0	0	0	0	0	2	1	0	0	2	1	0
Total	41	34	98	80	71	19	11	40	9	15	418	0	19	9	38	44	75	42	73	44	67	7	0
January	0	0	0	0	0	0	0	0	0	0	0												
February	0	0	17	2	0	0	0	0	0	0	19												
March	0	0	3	6	0	0	0	0	0	0	9												
April	0	0	3	0	6	0	3	20	6	0	38												
May	0	3	10	5	3	14	0	3	3	3	44												
June	3	9	15	15	14	5	8	6	0	0	75												
July	12	6	12	9	3	0	0	0	0	0	42												
August	6	10	14	21	10	0	0	0	0	12	73												
September	17	0	2	3	11	0	0	11	0	0	44												
October	3	6	17	17	24	0	0	0	0	0	67												
November	0	0	5	2	0	0	0	0	0	0	7												
December	0	0	0	0	0	0	0	0	0	0	0												
Total	41	34	98	80	71	19	11	40	9	15	418												

NOTE.—The lower part of this, and several succeeding tables, shows the total number of observations taken in each month between the meridians specified at the top.

Latitude 50° to 55°.

Course.	Lon. 0° to 5°.	Lon. 5° to 10.°	Lon. 10° to 15°.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 60° to 65°.	Total.	TOTAL FOR THE SEPARATE MONTHS.											
														Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	19	42	35	11	0	7	5	0	0	0	3	0	132	12	16	4	13	16	20	13	5	5	10	5	13
N. N. E.	13	23	34	16	9	2	1	1	0	2	4	0	105	10	7	4	11	17	16	9	8	9	6	5	3
N. E.	17	28	35	9	5	2	0	2	0	0	5	7	110	9	7	3	7	16	17	7	4	15	13	11	1
E. N. E.	36	22	54	22	20	10	2	0	0	0	0	0	166	8	18	17	1	23	30	17	7	7	22	9	7
East	20	34	56	28	8	1	8	0	0	0	4	1	160	10	12	7	23	24	21	13	3	8	30	6	3
E. S. E.	19	19	62	35	20	11	17	4	0	3	0	0	190	13	23	18	10	29	25	11	4	21	26	5	5
S. E.	15	23	61	38	21	11	10	3	0	0	4	0	186	14	18	20	20	34	21	9	5	24	18	1	2
S. S. E.	14	28	82	68	47	9	14	2	0	0	2	0	266	25	30	20	14	22	56	21	27	22	13	13	3
South	23	44	69	49	32	15	8	1	0	1	1	2	245	22	36	25	14	35	48	15	8	13	14	6	9
S. S. W.	34	24	79	51	45	26	12	2	0	3	8	0	284	18	47	30	29	20	43	40	12	15	20	5	5
S. W.	45	41	76	36	25	41	21	5	0	0	2	0	292	20	38	15	12	28	44	26	16	23	30	25	15
W. S. W.	25	33	121	71	59	45	20	4	0	2	0	0	380	32	43	23	14	21	70	65	25	28	23	22	14
West	40	79	85	54	35	32	11	3	0	0	0	5	344	19	44	29	17	28	35	44	34	31	20	27	16
W. N. W.	25	42	83	49	34	13	11	5	1	3	0	0	266	19	26	17	18	20	38	31	23	20	18	19	17
N. W.	30	31	49	29	21	14	3	1	0	0	0	0	178	18	11	13	11	23	24	18	9	18	12	13	8
N. N. W.	13	17	63	18	24	23	12	0	0	0	0	0	170	10	19	18	5	25	19	13	19	10	11	12	9
Calm	12	21	31	38	16	8	5	1	0	0	0	0	132	13	14	6	10	12	20	19	14	2	15	5	2
Total	400	551	1075	622	431	270	160	34	1	14	33	15	3606	272	409	269	229	393	547	371	223	271	301	189	132
January	46	45	105	59	17	0	0	0	0	0	0	0	272												
February	28	67	118	90	60	38	8	0	0	0	0	0	409												
March	18	38	116	41	39	9	1	3	1	3	0	0	269												
April	15	20	81	40	23	4	16	0	0	3	27	0	229												
May	37	84	86	95	42	32	17	0	0	0	0	0	393												
June	64	96	150	82	44	52	47	12	0	0	0	0	547												
July	54	53	92	62	48	41	21	0	0	0	0	0	371												
August	18	43	58	36	53	6	9	0	0	0	0	0	223												
September	25	36	96	43	13	19	8	4	0	6	6	15	271												
October	31	18	96	37	46	35	26	10	0	2	0	0	301												
November	19	30	43	28	26	32	7	4	0	0	0	0	189												
December	45	21	34	9	20	2	0	1	0	0	0	0	132												
Total	400	551	1075	622	431	270	160	34	1	14	33	15	3606												

Winds on the North Atlantic.—*Continued.*

Latitude 45° to 50°.

Course.	Lon. 0° to 5°.	Lon. 5° to 10°.	Lon. 10° to 15°.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Total.	TOTAL FOR THE SEPARATE MONTHS.											
															Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	10	15	41	47	52	67	43	20	12	4	2	0	0	313	15	14	13	43	40	24	22	46	24	45	17	10
N. N. E.	7	13	57	41	41	46	49	28	17	25	4	0	0	328	16	23	22	27	37	22	41	44	28	35	16	17
N. E.	6	19	49	33	26	22	33	25	14	1	1	3	5	237	7	19	27	15	41	27	28	15	21	17	10	10
E. N. E.	10	12	60	39	48	33	38	34	41	23	1	2	0	341	11	18	40	24	46	42	40	40	32	26	9	13
East	15	22	26	23	45	28	38	49	36	25	3	1	0	311	16	30	28	26	36	45	23	27	29	36	10	5
E. S. E.	4	22	29	33	35	35	47	47	36	21	3	1	0	313	24	27	24	37	53	30	27	23	27	24	10	7
S. E.	0	19	32	31	30	24	28	24	22	11	2	2	0	225	21	20	18	21	28	13	13	25	27	24	6	9
S. S. E.	4	11	40	56	73	59	48	68	44	21	7	2	0	433	26	33	18	37	48	55	56	35	44	43	18	20
South	21	20	41	60	57	74	80	65	42	26	3	4	0	493	36	46	29	29	47	87	29	40	53	39	23	35
S. S. W.	7	22	89	90	98	128	114	88	66	50	15	4	2	773	62	64	50	58	73	123	67	85	61	55	25	50
S. W.	8	23	65	74	101	98	115	107	75	27	23	22	5	743	29	53	59	40	92	136	67	99	39	44	51	34
W. S. W.	27	14	100	138	129	143	124	123	97	29	22	8	0	954	64	63	62	61	88	135	126	134	50	64	60	47
West	14	20	87	86	135	130	114	104	55	20	17	5	0	787	50	49	48	44	62	136	81	76	54	70	69	48
W. N. W.	3	19	129	124	122	99	133	108	65	17	3	3	0	825	46	54	54	48	59	105	100	86	71	84	62	56
N. W.	9	23	71	83	94	71	66	58	49	13	19	1	2	559	32	33	52	48	42	74	50	57	39	67	37	28
N. N. W.	7	18	85	84	79	83	64	50	44	19	6	1	0	540	20	33	31	54	51	74	39	74	47	69	25	23
Calm	2	4	29	36	50	55	39	46	32	14	4	0	0	311	18	20	8	35	36	55	37	41	20	19	15	7
Total	154	296	1030	1078	1215	1195	1173	1044	747	346	135	59	14	8486	493	599	583	647	879	1183	846	947	666	761	463	419
January	0	12	43	74	67	92	93	71	32	7	2	0	0	493												
February	6	6	52	69	103	111	106	65	66	12	3	0	0	599												
March	3	12	67	74	90	90	59	72	67	36	13	0	0	583												
April	0	19	89	86	125	145	92	43	19	12	17	0	0	647												
May	9	38	128	141	137	131	132	102	53	7	1	0	0	879												
June	49	78	119	132	216	138	138	165	78	44	12	14	0	1183												
July	26	24	94	125	105	99	97	95	103	57	16	3	2	846												
August	21	36	128	100	69	93	106	129	123	80	43	19	0	947												
September	0	20	57	81	111	109	85	78	78	21	8	6	12	666												
October	18	24	88	97	88	75	114	124	73	36	7	17	0	761												
November	22	15	71	46	55	53	86	51	36	20	8	0	0	463												
December	0	12	94	53	49	59	65	49	19	14	5	0	0	419												
Total	154	296	1030	1078	1215	1195	1173	1044	747	346	135	59	14	8486												

Latitude 40° to 45°, Longitude from Greenwich 0° to 45°.

Course.	Lon. 0° to 5°.	Lon. 5° to 10°.	Lon. 10° to 15°.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Total.	TOTAL FOR THE SEPARATE MONTHS.											
											Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	0	2	8	15	19	30	31	43	48	196	5	1	19	16	29	19	8	20	32	23	8	16
N. N. E.	0	5	16	21	20	34	50	42	50	238	6	8	43	33	38	18	11	17	19	25	5	15
N. E.	0	0	14	25	15	14	26	19	19	132	1	14	24	4	15	6	9	10	23	14	6	6
E. N. E.	3	5	16	6	7	33	53	49	45	217	7	3	13	18	24	23	20	33	53	7	4	12
East	3	4	4	2	24	17	31	34	32	151	7	6	9	9	5	17	19	28	26	4	3	18
E. S. E.	0	0	11	1	11	12	41	38	60	174	3	6	9	20	10	14	45	16	24	14	5	8
S. E.	0	0	5	16	20	23	32	54	56	206	1	13	14	25	17	40	49	11	14	3	11	8
S. S. E.	0	0	10	12	21	43	59	96	84	325	18	19	22	32	20	37	60	52	26	16	12	11
South	0	0	8	16	31	40	61	66	97	319	6	22	20	34	40	42	47	32	19	30	15	12
S. S. W.	0	0	9	15	41	46	71	107	161	450	25	17	35	35	53	47	60	59	37	28	18	36
S. W.	0	0	14	22	40	26	63	108	108	381	23	29	26	39	65	62	20	38	24	24	12	19
W. S. W.	0	0	23	33	46	48	82	158	144	534	27	26	62	58	63	71	65	47	31	31	11	42
West	1	0	28	19	41	39	78	121	121	448	17	42	55	36	42	64	38	38	18	31	39	29
W. N. W.	2	2	30	27	29	46	78	112	165	491	19	30	62	47	54	65	35	33	38	50	22	36
N. W.	0	3	19	28	37	33	61	51	94	326	10	28	30	19	37	45	17	30	36	38	8	28
N. N. W.	2	3	18	23	34	50	56	56	101	343	4	13	34	43	47	44	28	34	26	28	13	29
Calm	1	0	2	10	7	34	32	43	64	193	5	5	20	14	10	27	40	17	19	27	4	5
Total	12	24	235	291	443	568	905	1197	1449	5124	184	282	497	482	569	640	571	515	465	393	196	330
January	0	0	17	14	31	3	10	31	78	184												
February	0	0	0	20	30	25	58	79	70	282												
March	0	0	0	37	36	35	80	109	200	497												
April	0	0	31	9	38	70	104	115	115	482												
May	0	3	14	22	46	60	108	136	180	569												
June	0	3	36	33	51	73	107	157	180	640												
July	0	6	4	24	36	93	102	151	155	571												
August	0	3	15	17	60	35	105	133	147	515												
September	0	3	17	18	14	62	87	132	132	465												
October	3	3	16	40	38	63	73	71	86	393												
November	3	3	33	18	17	20	24	43	35	196												
December	6	0	52	39	46	29	47	40	71	330												
Total	12	24	235	291	443	568	905	1197	1449	5124												

Winds on the North Atlantic.—*Continued.*

Latitude 40° to 45°, Longitude from Greenwich 45° to 75°.

Course.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Lon. 65° to 70°.	Lon. 70° to 75°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	81	94	104	115	134	114	642	42	29	52	73	61	70	62	59	54	49	55	36
N. N. E.	88	68	51	67	67	63	404	21	37	24	30	65	27	35	33	59	19	23	31
N. E.	60	89	78	85	116	122	550	28	33	30	36	88	35	67	62	67	41	38	25
E. N. E.	86	39	28	59	56	51	319	25	14	21	18	31	34	31	49	36	20	31	9
East	51	77	78	92	154	110	562	22	22	56	37	59	77	76	70	52	33	38	20
E. S. E.	88	56	49	32	67	36	328	26	20	32	16	38	25	43	50	24	13	21	20
S. E.	70	92	86	82	129	97	556	16	13	60	39	58	53	85	80	39	27	44	42
S. S. E.	126	76	54	84	129	62	531	21	15	27	30	66	53	87	103	44	32	22	31
South	96	131	138	126	216	191	898	39	17	74	60	119	110	160	118	74	55	37	35
S. S. W.	124	90	121	102	156	131	724	32	22	36	50	78	112	150	88	72	30	23	31
S. W.	98	168	201	205	216	268	1156	46	38	73	73	126	195	222	134	90	39	82	38
W. S. W.	160	101	97	146	181	116	801	33	30	39	57	86	137	186	55	48	31	58	41
West	126	179	207	188	253	165	1118	51	46	79	56	113	158	204	119	86	64	80	62
W. N. W.	123	102	115	125	142	119	726	59	60	66	49	49	71	86	40	49	60	75	62
N. W.	94	154	154	128	175	176	881	64	89	89	63	75	54	90	62	55	75	84	81
N. N. W.	88	93	92	93	128	78	572	35	39	47	57	63	36	61	24	47	59	77	27
Calm	59	86	76	89	121	78	509	20	18	25	39	55	40	112	71	46	25	35	23
Total	1618	1695	1729	1818	2440	1977	11277	580	542	830	783	1230	1287	1757	1217	942	672	823	614
January	91	89	94	64	143	99	580												
February	106	88	96	84	62	106	542												
March	121	108	118	126	206	151	830												
April	115	120	126	86	156	180	783												
May	195	160	170	189	281	235	1230												
June	213	202	184	216	235	237	1287												
July	173	236	263	350	414	321	1757												
August	166	193	158	170	336	194	1217												
September	147	172	167	159	182	115	942												
October	108	101	131	105	124	103	672												
November	98	130	117	150	186	142	823												
December	85	96	105	119	115	94	614												
Total	1618	1695	1729	1818	2440	1977	11277												

Latitude 35° to 40°, Longitude from Greenwich 0° to 45°.

Course.	Lon. 0° to 5°.	Lon. 5° to 10°	Lon. 10° to 15°.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	4	27	58	42	26	42	47	40	26	312	24	3	8	20	46	30	50	47	47	26	0	11
N. N. E.	7	36	63	75	51	113	73	81	62	561	31	3	21	38	71	63	141	54	74	34	9	22
N. E.	11	27	25	63	34	38	42	44	37	321	17	1	17	30	35	45	60	38	34	19	4	21
E. N. E.	24	11	40	46	38	60	93	78	45	435	30	2	9	18	61	52	63	90	63	15	16	16
East	22	29	7	22	9	37	50	43	34	253	13	4	9	18	24	35	51	19	28	36	4	12
E. S. E.	12	22	23	14	12	46	69	66	76	340	23	7	10	18	28	45	60	35	26	39	30	19
S. E.	6	16	16	10	15	27	63	68	82	303	24	3	11	19	32	67	46	22	18	20	20	21
S. S. E.	0	7	26	24	18	92	127	123	117	534	39	4	7	25	39	60	148	66	55	30	20	41
South	4	10	22	27	50	91	97	93	107	501	41	4	18	33	31	49	98	75	39	60	28	25
S. S. W.	1	6	47	31	59	137	200	156	215	852	76	6	22	37	75	82	231	149	89	36	21	28
S. W.	11	9	49	34	41	78	80	95	128	525	47	12	15	25	47	73	101	73	57	44	15	16
W. S. W.	9	19	59	59	42	187	152	124	192	843	64	9	11	36	82	114	254	115	66	36	21	35
West	40	36	35	35	26	80	50	72	49	423	43	9	10	47	41	57	92	49	42	15	5	13
W. N. W.	2	8	48	62	36	88	92	78	101	515	51	7	21	25	49	89	102	55	31	43	14	28
N. W.	5	28	35	36	21	48	41	37	39	290	20	4	12	15	54	48	42	23	18	30	4	20
N. N. W.	2	29	48	49	46	90	55	53	53	425	44	3	11	17	70	51	78	43	37	29	7	35
Calm	24	6	16	13	17	99	67	50	44	336	18	3	9	8	42	37	101	48	25	22	9	14
Total	184	326	617	642	541	1353	1398	1301	1407	7769	605	84	221	429	827	997	1718	1001	749	534	227	377
January	18	51	116	112	63	64	51	48	82	605												
February	0	0	0	0	19	6	19	25	15	84												
March	0	9	25	13	5	33	24	19	93	221												
April	21	21	77	46	43	49	35	72	65	429												
May	45	62	118	82	59	105	88	140	128	827												
June	12	24	45	48	58	179	206	212	213	997												
July	42	52	55	82	72	443	372	348	252	1718												
August	3	36	30	46	50	259	256	167	154	1001												
September	9	22	42	86	69	108	177	97	139	749												
October	22	31	56	56	42	54	85	74	114	534												
November	12	3	22	5	15	15	32	54	69	227												
December	0	15	31	66	46	38	53	45	83	377												
Total	184	326	617	642	541	1353	1398	1301	1407	7769												

Winds on the North Atlantic.—*Continued.*

Latitude 35° to 40°, Longitude from Greenwich 45° to 75°.

Course.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Lon. 65° to 70°.	Lon. 70° to 75°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	39	54	103	145	201	382	924	53	58	116	91	105	93	80	60	74	69	60	65
N. N. E.	49	81	75	86	125	230	646	23	44	41	90	87	67	41	58	62	55	28	50
N. E.	28	64	101	134	219	365	911	37	49	56	105	120	78	84	98	92	95	50	47
E. N. E.	62	79	38	44	75	182	480	20	23	35	62	79	48	39	41	40	43	23	27
East	20	39	69	65	138	255	586	24	29	67	51	66	64	77	56	38	60	28	26
E. S. E.	46	87	32	51	60	118	394	33	7	21	36	39	43	42	40	50	27	16	40
S. E.	52	81	77	55	136	189	590	23	27	41	45	95	53	92	62	44	47	27	34
S. S. E.	139	146	78	79	89	133	664	32	22	47	44	80	83	63	91	54	67	33	43
South	140	135	137	123	197	320	1052	67	35	90	92	131	142	136	124	67	84	47	37
S. S. W.	235	249	115	96	128	202	1025	45	25	66	92	110	204	198	103	54	35	46	47
S. W.	108	158	258	260	376	487	1647	76	65	131	155	191	258	308	168	100	48	86	61
W. S. W.	171	173	137	148	182	228	1039	68	40	76	83	103	118	223	90	55	39	66	78
West	78	87	201	230	300	375	1271	98	50	153	114	117	138	175	93	81	68	85	99
W. N. W.	102	139	106	138	201	205	891	83	91	126	68	70	87	62	29	37	48	88	102
N. W.	39	60	134	196	284	381	1094	117	85	164	123	64	102	57	38	55	80	87	122
N. N. W.	81	96	82	75	114	211	659	45	38	83	85	56	47	38	47	28	31	76	85
Calm	38	67	58	67	124	144	498	11	29	42	65	37	37	114	57	39	27	22	18
Total	1427	1795	1801	1992	2949	4407	14371	855	717	1355	1401	1550	1662	1829	1255	970	923	873	981
January	91	110	128	117	129	280	855												
February	19	79	103	102	91	323	717												
March	76	118	149	194	360	458	1355												
April	86	136	143	156	335	545	1401												
May	114	147	169	184	324	612	1550												
June	251	281	225	248	296	361	1662												
July	250	277	265	253	461	323	1829												
August	135	145	166	193	229	387	1255												
September	145	144	128	152	194	207	970												
October	104	127	128	144	144	276	923												
November	80	100	96	129	188	280	873												
December	76	131	101	120	198	355	981												
Total	1427	1795	1801	1992	2949	4407	14371												

Latitude 30° to 35°, Longitude from Greenwich 5° to 45°.

Course.	Lon. 5° to 10°.	Lon. 10° to 15°.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	4	36	38	29	44	21	35	19	226	10	3	12	19	25	33	34	31	34	18	2	5
N. N. E.	3	58	71	81	102	45	61	68	489	24	17	18	12	34	48	99	93	40	48	30	26
N. E.	5	19	45	40	20	31	53	51	264	31	0	6	10	36	21	36	31	29	33	3	28
E. N. E.	2	23	31	47	90	57	125	96	471	38	4	10	16	41	78	59	73	31	55	29	37
East	4	4	9	16	32	45	56	85	251	20	7	9	5	20	29	37	33	23	29	22	17
E. S. E.	0	6	14	19	35	70	73	102	319	21	5	18	17	16	33	30	45	23	30	45	36
S. E.	0	2	11	22	25	42	69	67	238	29	7	6	24	12	27	7	26	8	14	42	36
S. S. E.	0	4	19	41	47	89	130	158	488	39	17	17	52	45	51	32	62	27	36	52	58
South	0	1	10	18	29	63	100	83	304	26	7	19	38	18	42	13	41	12	15	24	49
S. S. W.	0	5	23	30	55	68	108	104	393	30	10	21	44	29	43	40	61	26	33	43	13
S. W.	1	6	5	45	72	47	62	42	280	29	15	3	16	23	26	25	53	20	31	26	13
W. S. W.	2	7	23	29	80	50	83	75	349	29	3	8	29	37	69	31	30	33	28	34	18
West	4	7	15	24	26	20	36	24	156	11	8	1	10	8	22	12	22	12	23	11	16
W. N. W.	2	25	36	45	37	31	45	42	263	16	3	24	8	13	44	29	32	19	43	13	19
N. W.	1	23	16	22	29	28	25	31	175	10	3	8	10	14	41	17	12	22	14	16	8
N. N. W.	2	39	31	44	74	24	48	52	314	37	2	4	19	29	49	43	36	30	30	19	16
Calm	5	5	10	35	60	20	59	69	263	5	6	16	2	24	44	41	31	20	44	16	14
Total	35	270	407	587	857	751	1168	1168	5243	405	117	200	331	424	700	585	712	409	524	427	409
January	3	63	58	35	41	74	81	50	405												
February	0	9	15	14	23	30	10	22	117												
March	0	21	33	22	15	33	31	45	200												
April	0	9	15	29	29	47	106	96	331												
May	0	32	35	11	24	49	112	160	424												
June	0	9	33	77	157	104	155	165	700												
July	10	35	15	86	201	50	104	84	585												
August	3	32	62	117	169	96	126	107	712												
September	9	18	56	71	51	46	86	72	409												
October	7	27	32	74	75	84	130	95	524												
November	0	0	22	27	35	87	108	148	427												
December	3	14	36	24	37	52	119	124	409												
Total	35	270	407	587	857	751	1168	1168	5243												

Winds on the North Atlantic.—*Continued.*

Latitude 30° to 35°, Longitude from Greenwich 45° to 75°.

Course.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Lon. 65° to 70°.	Lon. 70° to 75°.	Total.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
								TOTAL FOR THE SEPARATE MONTHS.											
North	30	20	17	21	93	85	266	18	13	28	34	32	14	11	22	17	25	26	26
N. N. E.	49	56	54	51	165	164	539	39	34	56	88	80	19	31	43	46	49	30	24
N. E.	43	40	26	34	98	47	288	15	12	25	43	35	14	24	13	29	45	20	13
E. N. E.	74	50	47	79	138	105	493	36	12	40	48	85	21	45	37	43	57	52	17
East	43	40	25	24	52	54	238	15	7	16	29	26	11	25	20	14	49	19	7
E. S. E.	83	39	67	72	184	114	559	28	21	49	62	89	21	78	39	37	59	37	39
S. E.	59	30	35	25	96	87	332	20	4	43	30	40	26	41	35	31	34	18	10
S. S. E.	112	70	25	61	216	150	634	36	30	57	104	92	54	49	50	50	45	44	23
South	60	36	19	33	122	98	368	16	32	28	53	50	47	49	24	6	30	19	14
S. S. W.	98	79	67	86	317	238	885	64	68	97	125	71	69	154	77	41	43	51	25
S. W.	34	31	23	46	151	102	387	24	19	52	48	42	32	50	42	15	13	22	28
W. S. W.	60	52	55	122	204	164	657	48	44	97	68	59	56	44	53	28	28	72	60
West	39	30	31	63	115	55	333	34	33	42	57	22	17	10	11	9	19	31	48
W. N. W.	37	55	48	104	212	163	619	65	74	111	89	34	26	20	11	19	43	49	78
N. W.	18	23	13	32	93	89	268	26	22	45	39	23	13	9	4	9	23	31	24
N. N. W.	56	44	24	61	154	161	500	35	39	59	76	50	29	24	38	34	33	46	37
Calm	52	14	34	59	103	64	326	21	13	23	37	32	39	19	27	43	24	25	23
Total	947	709	610	973	2513	1940	7692	540	477	868	1030	862	508	683	546	471	619	592	496
January	60	49	60	62	136	173	540												
February	18	29	37	53	190	150	477												
March	60	67	33	116	333	259	868												
April	111	72	28	111	397	311	1030												
May	62	24	34	116	431	195	862												
June	117	31	25	32	203	100	508												
July	118	84	74	114	208	85	683												
August	46	72	55	106	125	142	546												
September	53	34	76	59	142	107	471												
October	120	137	97	59	93	113	619												
November	101	66	65	66	146	148	592												
December	81	44	26	79	109	157	496												
Total	947	709	610	973	2513	1940	7692												

Latitude 25° to 30°, Longitude from Greenwich 15° to 45°.

Course.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Total.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
								TOTAL FOR THE SEPARATE MONTHS.											
North	14	25	61	31	17	14	162	12	15	8	16	8	20	32	19	10	12	7	3
N. N. E.	81	203	210	89	81	48	712	34	26	23	24	23	96	155	125	58	41	72	35
N. E.	37	75	152	50	121	50	485	24	12	15	24	24	40	144	35	29	45	46	47
E. N. E.	34	80	149	172	204	149	788	69	39	30	46	51	67	140	89	68	62	64	63
East	12	27	77	62	90	71	339	20	15	6	22	20	26	48	57	28	37	26	34
E. S. E.	15	37	57	75	121	81	386	31	16	28	31	20	29	31	23	30	34	46	67
S. E.	5	13	22	55	46	24	165	27	14	11	6	8	16	8	7	12	12	15	29
S. S. E.	14	11	35	94	69	38	261	27	7	12	23	7	20	8	12	34	32	32	47
South	7	9	40	54	51	13	174	7	8	18	14	13	10	5	4	4	24	33	34
S. S. W.	10	16	40	87	92	29	274	24	13	20	22	15	29	9	6	28	28	46	34
S. W.	3	7	26	36	24	26	122	9	8	12	14	6	8	3	9	11	8	14	20
W. S. W.	7	23	35	53	45	16	179	16	10	20	7	16	19	13	14	15	16	16	17
West	5	13	25	7	9	9	68	7	9	3	2	6	4	12	3	5	8	7	2
W. N. W.	12	22	51	41	47	34	207	25	24	9	8	10	17	7	7	18	24	41	17
N. W.	5	12	26	34	18	8	103	7	5	15	7	6	11	11	1	10	9	15	6
N. N. W.	23	41	76	63	40	12	255	18	16	23	22	15	46	36	6	17	29	14	13
Calm	5	16	48	39	53	26	187	13	8	17	6	6	21	18	12	15	20	40	11
Total	289	630	1130	1042	1128	648	4867	370	245	270	294	254	479	680	429	392	441	534	479
January	49	41	51	76	91	62	370												
February	28	36	52	76	33	20	245												
March	29	12	45	63	86	35	270												
April	10	37	56	52	99	40	294												
May	17	19	54	64	60	40	254												
June	21	64	99	122	105	68	479												
July	55	131	218	101	107	68	681												
August	11	101	148	51	48	70	429												
September	8	65	82	110	90	37	392												
October	3	35	90	117	115	81	440												
November	32	53	115	105	155	76	534												
December	26	36	122	105	139	51	479												
Total	289	630	1130	1042	1128	648	4867												

Winds on the North Atlantic.—*Continued.*

Latitude 25° to 30°, Longitude from Greenwich 45° to 80°.

Course.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Lon. 65° to 70°.	Lon. 70° to 75°.	Lon. 75° to 80°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	4	8	37	84	61	25	30	249	37	25	48	28	13	2	3	9	8	16	37	23
N. N. E.	5	15	27	101	69	23	16	256	19	17	22	48	26	1	3	11	16	15	36	42
N. E.	12	34	116	302	195	74	27	760	68	47	66	118	97	40	39	50	49	56	70	60
E. N. E.	31	24	66	106	85	17	39	368	24	27	18	47	35	22	36	40	19	25	55	20
East	58	44	111	203	124	60	58	658	47	41	50	69	95	38	97	65	28	59	28	41
E. S. E.	27	41	79	136	68	33	25	409	27	23	20	26	44	32	53	49	21	42	51	21
S. E.	27	41	163	271	151	50	41	744	39	31	58	87	134	77	67	80	41	56	30	44
S. S. E.	8	12	32	79	48	28	18	225	8	17	18	21	50	29	14	15	9	25	11	8
South	14	13	61	115	68	49	17	337	20	28	41	41	60	22	26	15	15	26	9	34
S. S. W.	2	3	37	75	61	23	4	205	8	22	22	21	36	14	14	11	17	23	4	13
S. W.	11	21	74	153	112	42	10	423	48	28	54	43	40	50	33	22	17	34	20	34
W. S. W.	12	5	21	38	28	19	6	129	14	19	27	12	8	10	2	5	3	4	11	14
West	7	10	41	90	38	27	13	226	27	25	35	45	15	9	7	20	6	7	10	20
W. N. W.	8	5	19	33	10	8	18	101	20	9	32	7	6	4	3	4	0	7	0	9
N. W.	12	12	33	80	66	33	22	258	38	39	45	35	19	9	1	8	11	11	13	29
N. N. W.	2	5	25	39	32	14	10	127	21	24	15	22	16	0	2	2	2	3	6	14
Calm	6	14	38	82	57	27	18	242	16	29	18	24	19	12	14	26	33	22	12	17
Total	246	307	980	1987	1273	552	372	5717	481	451	589	694	713	371	414	432	295	431	403	443
January	25	12	76	150	114	28	76	481												
February	31	12	18	173	128	63	26	451												
March	12	26	111	200	152	65	23	589												
April	13	21	135	277	157	56	35	694												
May	13	38	132	288	150	45	47	713												
June	19	10	63	150	58	45	26	371												
July	20	25	104	138	69	27	31	414												
August	27	46	88	137	83	31	20	432												
September	8	31	77	103	49	22	5	295												
October	33	44	96	134	67	37	20	431												
November	36	32	38	107	104	45	41	403												
December	9	10	42	130	142	88	22	443												
Total	246	307	980	1987	1273	552	372	5717												

Latitude 20° to 25°, Longitude from Greenwich 15° to 45°.

Course.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	20	41	37	39	14	12	163	7	28	21	10	2	9	25	20	10	14	9	8
N. N E.	29	292	308	160	78	21	888	38	55	24	33	28	112	210	153	77	56	63	39
N. E.	10	83	157	151	152	50	603	42	19	18	31	33	64	129	77	42	36	56	56
E. N. E.	9	76	183	242	276	116	902	62	68	30	58	49	92	110	86	82	91	101	73
East	4	36	67	103	78	44	332	42	19	21	20	16	29	8	20	34	37	41	45
E. S. E.	6	24	30	79	45	38	222	29	25	15	16	3	19	4	11	13	19	44	24
S. E.	0	7	8	22	13	5	55	10	8	5	1	0	3	0	3	1	8	14	2
S. S. E.	4	9	17	34	26	7	97	8	18	7	4	0	12	1	7	9	8	13	10
South	0	13	8	16	9	10	56	5	5	12	1	0	2	1	0	1	12	10	7
S. S. W.	6	12	36	32	15	5	106	17	4	19	12	1	5	3	0	4	11	16	14
S. W.	0	8	28	16	7	6	65	15	5	10	3	0	2	2	0	2	11	12	3
W. S. W.	1	23	19	15	11	10	79	17	4	12	7	4	0	13	0	3	5	7	7
West	1	3	4	12	4	0	24	5	1	4	1	8	0	0	0	1	2	1	1
W. N. W.	1	20	22	27	30	9	109	17	9	24	5	6	3	0	3	6	16	15	5
N. W.	0	14	17	9	5	1	46	8	3	5	12	1	2	2	1	0	3	8	1
N. N. W.	8	30	53	45	24	4	164	13	9	29	28	8	19	5	8	13	16	6	10
Calm	2	11	28	17	15	10	83	2	2	8	6	4	8	2	5	6	15	14	11
Total	101	702	1022	1019	802	348	3994	337	282	264	248	163	381	515	394	304	360	430	316
January	17	50	35	115	79	41	337												
February	2	62	63	70	64	21	282												
March	22	29	57	66	50	40	264												
April	6	47	61	50	59	25	248												
May	6	13	40	29	54	21	163												
June	7	67	83	159	57	8	381												
July	10	125	144	129	79	28	515												
August	10	105	161	24	49	45	394												
September	1	74	95	74	38	22	304												
October	7	36	121	79	90	27	360												
November	9	56	99	122	104	40	430												
December	4	38	63	102	79	30	316												
Total	101	702	1022	1019	802	348	3994												

Winds on the North Atlantic.—*Continued.*

Latitude 20° to 25°, Longitude from Greenwich 45° to 80.°

Course.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Lon. 65° to 70°.	Lon. 70° to 75°.	Lon. 75° to 80°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	15	38	57	43	13	7	0	173	24	21	35	29	5	4	3	13	7	9	10	13
N. N. E.	68	43	79	50	11	2	4	257	28	24	33	30	17	9	19	13	33	10	13	28
N. E.	49	245	397	236	51	28	0	1006	58	89	68	125	179	83	59	86	65	45	87	62
E. N. E.	67	168	196	124	24	7	3	589	42	40	66	54	62	43	85	49	40	30	48	30
East	53	184	290	163	50	24	3	767	24	64	81	97	90	57	92	64	46	60	46	46
E. S. E.	32	87	128	90	19	12	6	374	22	23	36	58	36	29	32	20	20	52	27	19
S. E.	14	100	209	152	28	17	7	507	28	40	60	78	75	29	22	24	60	68	14	29
S. S. E.	18	26	42	35	11	1	1	134	9	16	11	14	20	9	6	3	3	21	17	5
South	17	45	61	44	17	7	0	191	30	15	21	37	18	9	6	4	10	14	18	9
S. S. W.	9	27	27	25	3	0	1	92	10	10	7	9	4	5	0	4	10	14	17	2
S. W.	8	40	34	39	12	3	0	136	9	9	20	24	7	7	3	3	15	22	7	10
W. S. W.	9	16	15	10	1	3	0	54	5	5	13	6	5	3	0	2	2	8	3	2
West	4	25	23	7	11	0	0	70	11	10	20	13	5	0	0	0	3	3	4	1
W. N. W.	11	11	18	5	10	0	0	55	3	5	20	14	0	3	0	0	3	3	1	3
N. W.	2	25	30	22	10	1	3	93	18	8	20	27	5	2	0	0	0	5	5	3
N. N. W.	9	17	14	20	2	3	0	65	15	4	14	8	2	0	1	0	6	1	5	9
Calm	12	24	44	33	13	8	3	137	10	9	21	24	11	8	7	0	11	8	18	10
Total	397	1121	1664	1098	286	123	31	4720	346	392	546	647	541	300	335	285	334	373	340	281
January	21	61	140	87	18	12	7	346												
February	26	65	149	122	23	3	4	392												
March	61	147	119	149	57	10	3	546												
April	38	146	228	149	44	31	11	647												
May	22	107	247	131	32	2	0	541												
June	22	76	117	69	16	0	0	300												
July	23	85	161	51	0	15	0	335												
August	27	95	78	69	9	7	0	285												
September	39	110	141	32	9	3	0	334												
October	75	103	89	58	27	21	0	373												
November	28	95	107	81	20	9	0	340												
December	15	31	88	100	31	10	6	281												
Total	397	1121	1664	1098	286	123	31	4720												

Latitude 15° to 20°, Longitude from Greenwich 45° to 80°.

Course.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Lon. 65° to 70°.	Lon. 70° to 75°.	Lon. 75° to 80.°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	25	25	19	12	2	4	1	88	12	6	22	13	5	2	3	1	2	4	1	17
N. N. E.	34	69	37	3	3	4	1	151	7	40	26	15	4	14	7	9	3	8	9	9
N. E.	352	521	203	36	47	42	9	1210	70	109	143	167	173	126	79	85	38	72	68	80
E. N. E.	158	289	178	17	21	11	1	675	27	44	68	82	103	74	67	42	42	45	59	22
East	147	242	146	22	74	47	15	693	33	55	117	97	83	31	50	49	36	59	43	40
E. S. E.	58	86	56	7	19	2	1	229	9	14	32	42	24	13	5	17	16	22	22	13
S. E.	46	74	72	13	20	14	6	245	13	9	26	67	22	4	1	10	17	41	23	12
S. S. E.	14	8	10	1	1	3	4	41	0	1	3	9	4	0	0	5	2	8	6	3
South	18	30	13	4	1	3	3	72	4	0	8	18	4	0	3	4	12	6	11	2
S. S. W.	3	4	3	0	0	3	3	16	0	0	1	9	0	0	0	0	1	4	0	1
S. W.	9	14	8	0	0	0	0	31	2	0	3	8	6	0	0	0	2	6	3	1
W. S. W.	6	1	0	3	0	0	0	10	0	0	0	4	0	0	0	5	0	0	0	1
West	3	10	2	1	0	3	0	19	0	0	3	9	0	0	0	0	1	2	3	1
W. N. W.	5	0	1	1	0	1	0	8	0	0	5	2	0	0	0	0	1	0	0	0
N. W.	14	5	7	0	0	2	0	28	0	1	7	8	0	0	6	0	1	1	2	2
N. N. W.	1	1	4	0	0	0	1	7	0	1	0	2	0	0	0	0	0	0	0	4
Calm	13	16	16	0	1	9	2	57	4	3	4	15	6	0	0	0	0	9	10	6
Total	906	1395	775	120	189	148	47	3580	181	283	468	567	434	264	221	227	174	287	260	214
January	21	74	27	21	10	28	0	101												
February	24	132	81	6	20	14	6	283												
March	122	141	109	38	42	10	6	468												
April	118	288	123	7	23	41	17	567												
May	88	210	115	3	11	7	0	434												
June	50	145	61	4	4	0	0	264												
July	70	97	39	5	1	9	0	221												
August	94	79	32	10	6	6	0	227												
September	87	42	20	3	13	0	9	174												
October	87	80	65	8	22	16	9	287												
November	96	90	52	8	7	5	0	260												
December	49	67	49	7	30	12	0	214												
Total	906	1395	775	120	189	148	47	3580												

Winds on the North Atlantic.—*Continued.*

Latitude 15° to 20°, Longitude from Greenwich 15° to 45°.

Course.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	3	66	69	13	7	7	165	9	11	14	8	4	10	39	20	18	22	4	4
N. N. E.	26	415	379	144	69	12	1045	48	53	36	37	63	115	210	185	94	74	76	54
N. E.	7	96	296	228	114	122	863	56	32	61	62	48	112	112	87	95	66	72	60
E. N. E.	4	105	286	316	157	87	955	59	51	48	46	37	87	114	104	84	103	143	79
East	1	31	95	70	51	67	315	23	18	23	21	16	19	20	36	31	30	50	28
E. S. E.	1	33	44	37	23	39	177	13	5	3	5	6	0	21	17	28	30	27	22
S. E.	0	1	18	8	2	25	54	0	2	12	4	0	2	0	2	10	10	7	5
S. S. E.	0	7	23	12	3	6	51	2	3	6	1	0	0	2	11	5	10	5	6
South	1	10	6	3	4	4	28	2	3	2	2	0	0	5	1	2	3	6	2
S. S. W.	0	12	9	2	0	0	23	1	3	2	0	2	0	0	5	3	3	3	1
S. W.	0	5	9	0	1	2	17	3	2	3	0	0	0	0	5	2	2	0	0
W. S. W.	1	15	9	1	2	0	28	5	1	2	1	0	0	8	3	0	5	1	2
West	1	2	10	2	1	1	17	1	1	2	0	2	0	0	1	0	7	0	3
W. N. W.	2	18	8	0	2	0	30	1	1	2	4	3	1	0	4	3	7	1	3
N. W.	4	8	7	0	0	0	19	0	2	2	0	1	1	3	4	0	1	5	0
N. N. W.	0	57	40	16	12	1	126	9	9	16	7	3	16	3	31	14	7	5	6
Calm	0	26	19	24	11	3	83	1	7	1	3	3	2	20	8	6	12	15	5
Total	51	907	1327	876	459	376	3996	233	204	235	201	188	365	557	526	395	392	420	280
January	6	51	82	66	19	9	233												
February	0	60	54	56	25	9	204												
March	7	45	64	56	26	37	235												
April	0	23	79	49	34	16	201												
May	0	31	41	53	33	30	188												
June	0	73	122	118	31	21	365												
July	9	204	163	81	72	28	557												
August	4	160	208	47	54	53	526												
September	2	110	116	69	23	75	395												
October	6	61	168	62	48	47	392												
November	7	55	115	151	51	41	420												
December	10	34	115	68	43	10	280												
Total	51	907	1327	876	459	376	3996												

Latitude 10° to 15°, Longitude from Greenwich 45° to 75°.

Course.	Lon. 45° to 50°.	Lon. 50° to 55°.	Lon. 55° to 60°.	Lon. 60° to 65°.	Lon. 65° to 70°.	Lon. 70° to 75°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	17	8	0	0	4	1	30	0	3	6	3	0	2	1	0	2	4	0	9
N. N. E.	55	26	0	2	3	0	86	23	18	14	7	2	1	0	3	4	4	5	5
N. E.	675	277	6	13	23	1	995	57	127	167	153	125	106	68	39	20	26	62	45
E. N. E.	214	119	25	10	9	0	377	16	35	69	63	66	30	13	14	7	27	21	16
East	107	66	19	17	30	3	242	14	15	40	41	47	9	9	8	18	14	5	22
E. S. E.	37	32	13	6	5	0	93	8	11	23	8	7	0	4	8	3	6	10	5
S. E.	31	21	4	3	3	1	63	3	2	5	14	10	1	4	4	7	8	0	5
S. S. E.	11	4	5	1	0	0	21	1	0	0	0	3	0	0	2	9	4	2	0
South	5	4	0	1	1	3	14	0	1	1	3	0	0	0	0	4	4	0	1
S. S. W.	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
S. W.	5	1	0	0	0	1	7	0	0	0	1	1	0	1	0	0	4	0	0
W. S. W.	0	1	0	0	0	1	2	0	0	1	1	0	0	0	0	0	0	0	0
West	3	3	0	0	0	2	8	0	1	0	2	1	0	0	0	2	0	0	2
W. N. W.	2	0	0	0	0	2	4	0	0	0	2	0	0	0	0	0	0	0	2
N. W.	4	9	1	0	0	0	14	0	1	3	1	1	0	0	0	3	1	0	4
N. N. W.	5	2	0	0	0	1	8	0	2	2	2	0	0	0	0	0	0	0	2
Calm	10	10	0	0	0	0	20	1	0	3	3	0	0	1	1	7	2	2	0
Total	1182	583	73	53	78	16	1985	123	216	334	305	263	149	101	79	86	104	107	118
January	68	23	16	9	7	0	123												
February	140	59	5	6	6	0	216												
March	156	141	8	9	20	0	334												
April	172	110	6	6	0	11	305												
May	175	74	2	0	9	3	258												
June	110	39	0	0	0	0	149												
July	77	21	0	0	3	0	101												
August	67	12	0	0	0	0	79												
September	45	20	9	9	3	0	86												
October	52	32	12	3	5	0	105												
November	69	31	3	4	0	0	107												
December	51	21	12	7	25	2	118												
Total	1182	583	73	53	78	16	1985												

Winds on the North Atlantic.—*Continued.*

Latitude 10° to 15°, Longitude from Greenwich 15° to 45°.

Course.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	6	67	60	21	14	28	196	5	5	9	5	16	21	17	55	31	16	7	9
N. N. E.	45	383	87	28	45	52	640	41	47	36	38	37	48	64	74	67	68	69	51
N. E.	11	211	280	163	202	535	1402	72	88	122	137	142	126	155	149	97	103	119	92
E. N. E.	13	188	299	186	83	167	936	58	48	79	79	60	138	91	71	52	72	135	53
East	0	50	261	218	114	125	768	32	47	45	60	37	62	83	60	43	87	151	61
E. S. E.	11	50	78	42	27	29	237	14	15	11	10	1	20	25	26	26	36	29	24
S. E.	0	10	31	26	28	39	134	2	3	1	2	1	4	17	26	15	27	21	15
S. S. E.	2	53	17	10	14	8	104	0	1	1	0	0	3	13	33	14	30	6	3
South	0	25	37	14	9	16	101	0	0	0	0	0	7	9	44	26	7	7	1
S. S. W.	13	84	25	16	7	6	151	0	0	0	0	0	2	30	71	30	13	3	2
S. W.	4	34	51	21	20	18	148	0	0	0	0	0	1	33	63	39	9	3	0
W. S. W.	7	53	17	9	17	6	109	0	0	1	1	0	3	19	43	29	9	4	0
West	1	7	13	18	19	15	73	0	0	0	0	0	1	12	25	23	9	3	0
W. N. W.	28	45	6	7	6	5	97	4	9	1	4	2	10	17	21	21	7	0	1
N. W.	6	15	15	8	11	11	66	0	1	0	0	1	8	13	24	13	4	1	1
N. N. W.	11	92	15	7	4	9	138	1	3	2	1	3	14	24	56	24	9	1	0
Calm	19	96	67	25	28	16	251	2	3	1	2	0	13	62	78	44	27	15	4
Total	177	1463	1359	819	648	1085	5551	231	270	309	339	300	481	684	919	594	533	574	317
January	15	55	72	33	17	39	231												
February	35	62	62	31	16	64	270												
March	4	45	64	60	40	96	309												
April	10	66	65	45	16	137	339												
May	4	68	55	54	28	91	300												
June	15	135	150	66	40	75	481												
July	21	205	174	104	69	111	684												
August	21	287	250	99	113	149	919												
September	16	202	137	65	135	39	594												
October	5	149	98	91	72	118	533												
November	26	107	130	113	75	123	574												
December	5	82	102	58	27	43	317												
Total	177	1463	1359	819	648	1085	5551												

Latitude 5° to 10°, Longitude from Greenwich 10° to 55°.

Course.	Lon. 10° to 15°.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Lon. 45° to 50°.	Lon. 50° to 55°.	Total.	TOTAL FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	1	25	92	33	18	31	14	3	1	218	19	27	26	30	27	22	19	6	8	11	6	17
N. N. E.	36	94	271	45	32	84	77	43	10	692	85	64	107	108	53	47	26	11	27	40	35	89
N. E.	1	25	150	224	192	436	511	254	25	1817	140	215	294	325	226	215	104	32	13	59	91	104
E. N. E.	5	47	170	148	97	101	154	71	7	800	66	95	102	114	85	68	30	16	10	50	101	63
East	4	21	51	193	95	93	110	56	5	628	34	32	37	32	76	68	45	29	31	55	118	71
E. S. E.	24	55	102	75	29	55	50	17	1	408	18	16	7	14	19	35	36	40	29	68	95	31
S. E.	2	42	87	107	66	83	99	36	1	523	11	10	18	13	21	65	93	53	61	72	80	26
S. S. E.	33	335	306	73	40	41	44	9	0	881	5	1	4	4	22	72	225	307	115	75	35	16
South	54	490	293	145	55	41	36	2	2	1118	5	2	8	0	3	72	239	514	145	76	43	11
S. S. W.	138	391	325	71	31	16	11	1	0	984	6	7	9	2	9	76	188	368	174	100	30	15
S. W.	8	64	85	81	51	13	31	3	0	336	2	1	2	2	3	25	63	94	97	33	12	2
W. S. W.	29	113	127	36	7	8	6	0	0	326	8	9	4	4	7	29	73	93	60	26	6	7
West	9	24	20	36	15	21	21	7	0	153	1	7	0	2	3	8	33	48	20	21	6	4
W. N. W.	57	47	40	11	8	24	4	1	0	192	19	14	22	14	10	12	30	18	18	16	5	14
N. W.	6	21	16	32	11	26	5	2	0	119	1	7	7	6	6	21	21	9	16	20	2	3
N. N. W.	16	50	91	11	4	13	9	1	0	195	17	18	15	17	17	31	17	13	14	18	6	12
Calm	73	120	144	118	69	49	45	17	2	627	19	20	14	4	8	88	109	74	44	115	62	70
Total	496	1964	2370	1439	810	1135	1227	523	54	10018	456	545	676	691	595	954	1351	1725	882	855	733	555
January	48	49	108	77	25	56	69	24	0	456												
February	49	63	103	72	19	70	123	40	6	545												
March	31	41	92	71	81	126	144	80	10	676												
April	10	65	124	59	86	126	126	92	3	691												
May	2	38	134	86	42	86	140	65	2	595												
June	12	119	265	181	82	88	147	60	0	954												
July	43	332	351	187	109	122	167	40	0	1351												
August	115	718	489	123	62	92	92	31	3	1725												
September	24	255	249	112	76	84	41	40	1	882												
October	52	138	227	164	68	124	58	17	7	855												
November	52	59	102	200	104	113	80	23	0	733												
December	58	87	126	107	56	48	40	11	22	555												
Total	496	1964	2370	1428	810	1134	1228	525	54	10018												

Winds on the North Atlantic.—*Continued.*

Latitude 0° to 5,° Longitude from Greenwich 10° to 55°.

Course.	Lon. 10° to 15°.	Lon. 15° to 20°.	Lon. 20° to 25°.	Lon. 25° to 30°.	Lon. 30° to 35°.	Lon. 35° to 40°.	Lon. 40° to 45°.	Lon. 45° to 50°.	Lon. 50° to 55°.	Total.	TOTAL FOR THE SEPARATE MONTHS.											
											Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	0	16	36	29	68	13	5	6	2	175	11	17	38	58	21	4	0	0	4	4	4	14
N. N. E.	1	29	92	137	194	61	32	6	0	552	49	67	106	191	60	10	8	2	1	14	10	34
N. E.	0	20	51	58	77	268	203	14	4	695	57	87	139	183	114	25	6	2	5	17	19	41
E. N. E.	5	57	97	118	141	106	81	7	0	612	54	75	94	84	90	50	27	16	12	25	41	44
East	2	25	65	84	83	148	100	13	0	520	73	47	38	45	72	37	31	20	48	18	38	53
E. S. E.	11	121	287	294	343	86	80	3	0	1225	84	88	70	72	68	133	120	96	88	112	189	105
S. E.	24	242	421	261	139	306	161	12	0	1566	71	63	47	56	113	154	216	276	141	145	165	119
S. S. E.	146	645	424	180	60	80	31	0	0	1566	40	45	31	33	56	127	218	443	273	130	97	73
South	193	404	96	33	12	25	10	0	0	773	31	8	20	12	25	50	69	279	171	76	18	14
S. S. W.	123	246	90	23	9	6	0	0	0	497	19	13	20	20	27	30	54	111	138	46	2	17
S. W.	17	66	17	2	3	6	3	0	0	114	6	5	9	2	10	7	1	29	26	8	1	10
W. S. W.	15	68	25	11	5	2	0	0	0	126	7	11	7	19	11	16	6	19	14	10	4	2
West	6	6	4	4	4	2	0	2	0	28	1	0	1	1	4	2	2	9	5	2	0	1
W. N. W.	0	28	27	7	9	0	0	0	0	71	6	7	15	3	12	11	1	6	1	3	0	6
N. W.	0	6	7	12	6	3	2	1	0	37	4	2	7	11	5	1	1	0	0	2	0	4
N. N. W.	0	23	31	39	20	4	3	0	0	120	12	13	21	37	20	2	0	2	2	1	2	8
Calm	0	52	113	68	44	43	16	2	0	338	31	32	40	52	56	16	8	4	6	8	26	59
Total	543	2054	1883	1360	1217	1159	727	66	6	9015	556	580	703	879	764	675	768	1314	935	621	616	604
January	15	91	115	122	89	90	34	0	0	556												
February	0	72	139	112	111	103	43	0	0	580												
March	0	100	121	103	155	114	100	7	3	703												
April	8	66	146	166	166	191	133	3	0	879												
May	0	71	173	104	119	195	97	4	1	764												
June	22	96	181	106	84	91	95	0	0	675												
July	49	245	141	79	52	122	73	7	0	768												
August	266	602	240	79	46	52	23	6	0	1314												
September	135	417	152	64	100	28	33	6	0	935												
October	38	162	134	107	89	61	27	3	0	621												
November	2	39	131	205	132	69	38	0	0	616												
December	8	93	210	113	74	43	31	30	2	604												
Total	543	2052	1883	1365	1216	1158	724	66	6	9015												

Winds at the Straits of Gibraltar.

Lat. 35° to 40°, Longitude 0° to 10° West from Greenwich.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	4	0	1	1	9	2	5	1	2	6	0	0	31
N. N. E.	4	0	3	0	3	0	17	6	2	5	3	0	43
N. E.	4	0	0	3	10	2	2	3	4	8	1	1	38
E. N. E.	4	0	1	3	9	1	8	0	0	0	9	0	35
East	3	0	0	6	8	3	8	8	6	1	1	7	51
E. S. E.	6	0	0	1	4	0	11	8	2	1	1	0	34
S. E.	3	0	0	5	8	3	0	3	0	0	0	0	22
S. S. E.	4	0	0	0	1	0	0	0	0	0	0	2	7
South	1	0	0	0	3	1	2	2	0	4	0	1	14
S. S. W.	2	0	0	0	5	0	0	0	0	0	0	0	7
S. W.	2	0	0	2	1	2	4	1	0	8	0	0	20
W. S. W.	4	0	0	0	7	6	3	0	4	4	0	0	28
West	16	0	0	19	13	10	5	1	8	2	0	2	76
W. N. W.	1	0	1	0	1	2	4	0	1	0	0	0	10
N. W.	1	0	1	0	6	3	6	5	0	10	0	1	33
N. N. W.	10	0	2	0	9	1	5	0	2	1	0	1	31
Calm	0	0	0	2	10	0	14	1	0	3	0	0	30

Winds on the Atlantic Ocean and at the Azores.

Course.	Atlantic Ocean. Lat. 0° to 10°.	Lat. 10° to 20°.	Lat. 20° to 30°.	Lat. 30° to 34°.	Lat. 34° to 36°.	Lat. 36° to 40°.	North of Lat. 40°.	Separate months north of lat. 36.° Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Azores.[1] Fayal.	St. Michael's.	Terceira.	Graciosa.	St. Mary's.
North	2	24	85	16	29	132	2725½	283	329	381½	250	344	108	144	240	362	192	107	117	2857½	106	60	79	47	14
N. by E.		48	12	4	33	23	93	0	0	50	3	21	6	0	0	0	24	12	0	116	0	13	0	7	0
N. N. E.	12	55	49	17	67	106	313½	57	16	126½	75	44	0	0	0	52	37	12	0	419	12	93	35	0	10
N. E. by N.		44	32	44	21	0	75	0	0	11	4	21	0	0	0	24	12	3	0	75	0	0	0	0	0
N. E.	24	213	377	41	95	174	101	36	9	231	60	58	0	15	15	24	16	40	8	512	275	122	58	0	45
N. E. by E.		121	112	0	82	15	41	28	0	8	0	0	0	0	0	0	0	20	0	56	0	0	0	0	0
E. N. E.	22	122	119	23	61	10	170	27	31	44	45	0	0	0	0	0	0	33	0	180	13	28	8	13	12
E. by N.		160	12	0	63	12	33	25	0	0	0	0	12	0	0	0	0	6	2	45	0	0	0	0	0
East	114	428	441	17	47	22	4624	227	309	538	316	788	396	252	360	352	352	312	444	4646	8	67	47	7	6
E. by S.		45	178	0	45	0	163	65	0	9	12	12	24	0	0	0	0	40	1	163	0	0	0	0	0
E. S. E.	17	68	256	10	9	11	135	13	0	33	20	12	4	9	0	0	18	35	0	146	10	11	14	0	15
S. E. by E.		0	62	5	20	3	84	3	0	0	0	0	4	0	0	0	0	51	29	87	0	0	0	0	0
S. E.	189	32	163	41	27	37	141	5	28	31	16	6	28	15	0	0	12	37	0	178	105	23	21	8	0
S. E. by S.		0	11	0	7	0	48	0	12	0	3	12	5	0	0	0	0	12	4	48	0	0	0	10	0
S. S. E.	96	0	115	50	20	54	152	27	32	36	9	0	19	0	0	42	0	23	18	206	18	29	0	6	0
S. by E.		0	24	74	34	0	11	0	0	0	0	0	4	0	0	0	0	3	4	11	4	0	0	0	0
South	169	0	47	111	27	94	2557	141	256½	275½	447	400	291	149	192	168	60	67	204	2651	73	42	28	6	15
S. by W.		0	49	49	40	43	48	4	30	36	3	0	0	4	0	14	0	0	0	91	0	0	0	0	0
S. S. W.	11	6	152	97	35	46	314	24	21	52	10	12	47	10	60	80	12	32	0	360	31	72	62	0	2
S. W. by S.		0	21	17	41	22	113	0	7	25	0	11	44	12	12	0	0	24	0	135	0	0	0	0	0
S. W.	37	4	165	133	36	73	607	0	18	183	50	85	23	65	42	115	60	39	0	680	168	67	114	7	15
S. W. by W.		0	32	0	0	21	80	0	23	30	12	0	12	12	0	0	12	0	0	101	0	0	0	0	0
W. S. W.	11	4	100	61	40	130	542	97	42	156	50	82	5	12	23	126	37	42	0	672	22	43	63	0	0
W. by S.		0	24	24	3	6	76	0	15	11	18	2	0	12	0	0	0	24	0	82	0	20	0	0	0
West	102	0	183	100	47	112	13919½	584	876	1488½	1931	1639	1056	879	1572	996	1076	794	1140	14031½	52	60	198	0	0
W. by N.		0	65	7	0	5	141	0	14	11	37	12	0	12	12	24	24	0	0	146	0	4	0	0	0
W. N. W.	3	0	58	70	35	51	650	12	41	107	39	116	0	36	72	167	8	90	13	701	16	49	92	0	0
N. W. by W.		0	48	12	0	9	61	0	0	5	4	0	0	33	0	24	0	4	0	70	0	4	0	14	0
N. W.	7	0	70	204	51	70	763	21	149½	27	96	163	0	12	36	192½	48	70	18	833	41	100	108	0	25
N. W. by N.		0	34	0	7	0	63	0	13	2	12	0	0	12	12	12	0	0	0	63	0	0	0	4	0
N. N. W.	0	4	74	29	24	36	249	27	88	52	45	5	0	5	12	40	0	0	11	285	2	33	32	0	0
N. by W.		0	10	0	6	23	53	0	9	15	18	19	0	0	0	0	0	15	0	76	0	5	0	35	0
Calm or variable	8	34	102	182	144	63	2754	138	144	281	243	381	240	151	403	284	204	96	252	2817	21	5	0	0	1

Winds at the Madeira and Canary Islands.

Course.	Funchal, Madeira. 1826.	1827.	1828.	Total for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Teneriffe.[2] Course.	December, 1826.
N.	26	21	57	5	7	13	4	6	3	4	0	4	4	5	28	104	N.	14
N. E.	184	157	141	19	21	13	22	30	28	41	58	19	28	26	20	482	N. E.	120
E.	39	56	31	3	4	13	9	4	7	3	2	5	10	5	5	126	E. N. E.	60
S. E.	14	20	12	8	1	4	2	0	0	0	2	4	3	1	1	46	E.	122
S.	3	2	2	4	0	0	1	0	0	0	0	0	0	0	0	7	S. E.	14
S. W.	7	7	8	5	0	0	3	2	0	0	0	0	4	1	0	22	Calm or variable	174
W.	69	74	81	16	18	11	15	12	13	13	0	28	7	11	6	224		
N. W.	23	29	34	2	6	8	4	8	9	1	0	0	6	11	2	86		

[1] These observations were taken in the months of June and July, 1839.

[2] These observations were taken on board the brig Ocean, partly while lying at anchor at Teneriffe, and partly between there and the Madeiras.

Winds in Great Britain and Ireland.

Course.	Elgin, Scotland. 1835.	1836.	1837.	Total for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Aberavon, Wales, Sept. Oct. and Nov.	Dublin, Nov. 1840.	Bronxholm, Scotland, 10 years.	Inchkeith, Scotland, 10 years.	Calton Hill, Scotland, 10 years.
North	9	2	5	1	0	0	1	4	5	2	0	0	1	1	1	16	7	2		152	93
N. N. E.	1	4	1	0	0	1	0	2	0	1	2	0	0	0	0	6	1	0			
N. E.	4	8	28	3	0	3	8	7	9	6	1	2	0	1	0	40	4	2		205	158
E. N. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0			
East	11	4	9	1	0	3	4	2	1	0	3	4	0	5	1	24	5	2	1333	739	471
E. S. E.	5	1	0	0	1	1	1	1	0	0	1	1	0	0	0	6	4	0			
S. E.	27	8	51	10	5	4	6	6	4	7	9	9	6	7	13	86	6	2		224	158
S. S. E.	55	42	6	7	3	9	5	6	8	10	12	18	15	7	3	103	2	0			
South	30	38	41	13	7	1	8	3	10	17	4	11	7	18	20	109	3	0		292	111
S. S. W.	6	17	8	1	4	7	2	0	0	1	1	1	4	7	3	31	0	0			
S. W.	101	124	135	23	42	38	28	20	20	31	30	28	38	31	31	360	6	0		339	630
W. S. W.	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	5	4			
West	39	32	33	23	3	12	10	8	3	9	10	3	7	11	5	104	1	6	2319	1371	798
W. N. W.	11	0	0	0	1	0	0	2	6	1	0	0	1	0	0	11	3	4			
N. W.	39	41	48	9	7	12	10	19	17	16	11	4	6	1	16	128	7	4		217	444
N. N. W.	25	45	0	2	10	2	7	13	6	3	9	9	8	1	0	70	1	2			
Variable																				113	789

Course.	Clunie Manse, Scotland. 1833.	1834.	1835.	1836.	Total.	4 years.[1]	Banff Castle, 1 year, Scotl'd.	Castle Toward, Scotland. 1834.	1835.	Londonderry, Ireland. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	16	11	11	23	61	3	50	31	43	0	0	3	3	1	9	2	7	5	3	4	4
N. E.	34	33	38	36	141	11	52	10	10	2	0	0	2	1	0	0	0	6	4	1	1
E.	44	28	42	27	141	9	29	79	87	2	3	3	0	4	0	0	2	3	1	0	3
S. E.	38	39	29	22	128	11	30	20	14	14	19	17	1	6	0	0	3	3	0	2	10
S.	19	28	11	24	82	2	87	72	68	4	3	3	2	2	2	2	5	3	0	0	1
S. W.	104	134	113	119	470	28	61	55	42	1	3	3	2	3	3	4	2	6	3	0	6
W.	46	28	54	61	189	15	24	45	40	12	5	5	15	6	11	23	17	7	11	12	12
N. W.	64	64	67	51	249	21	31	53	61	2	0	1	3	7	14	1	0	4	17	23	7

Course.	Kinfaun's Castle, Scotland. 1813.	1814.	1815.	1816.	1817.	1819.	1820.	1821.	1825.	1828.	1835.	1836.	Course.	Isle of Man, Irish Sea. 1822.	1823.	1824.	1825.	1826.	1827.	1828.	1829.	1830.
N. & N. E.	10	3	9	32	25	28	19	10	9	44	37	42	N.	81	104	93	80	82	105	64	102	83
E. & S. E.	76	109	102	105	91	109	97	132	119	93	84	64	E.	57	60	92	97	87	102	107	110	84
S. & S. W.	101	65	85	62	133	60	67	45	95	146	119	142	S.	102	108	61	62	86	93	113	91	104
W. & N. W.	178	188	169	167	116	168	183	178	142	83	125	118	W.	111	93	120	126	110	65	82	62	94

[1] Date not known.

Winds in England.

Course.	London. 1806 to 1818, inclusive.														Manchester.					New Malton.				
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	12 y'rs.[1]	1801.	1819.	1820.	1821.	3 y'rs.[1]	6 y'rs.[1]	1820.	1821.	1822.	1825.
N.	32	17	16	36	12	25	26	17	23	18	29	29	280	283	44	4	1	0	0	15	39	55	31	67
N. E.	38	21	89	67	67	49	25	31	53	53	50	37	580	584	277	21	41	38	10	15	52	42	51	36
E.	28	21	38	33	40	22	14	18	32	27	18	28	319	322	11	21	17	10	5	6	26	15	23	14
S. E.	28	23	21	34	32	22	19	14	40	35	27	24	319	321	19	58	34	33	12	5	14	15	25	19
S.	26	27	16	14	21	9	20	18	21	30	22	10	234	235	22	44	46	12	10	15	54	60	41	49
S. W.	73	100	69	55	74	74	97	98	67	87	87	99	980	989	412	124	122	159	39	22	84	84	94	89
W.	39	37	39	24	19	39	48	53	41	43	44	46	472	478	153	21	46	53	12	13	39	59	39	40
N. W.	60	50	48	47	40	68	85	96	44	38	51	58	685	689	12	53	31	42	12	9	37	15	26	30
Calm or Variable	47	38	32	44	55	48	34	21	35	36	28	39	457		0	19	28	18	0	6	21	20	34	21

Course.	Greenwich.											Devonport.[2]		Sturbington,[3] 1 year.	Carlisle, 1 year.	Delphen, 1 year.
	1800.	1801.	1802.	1803.	1804.	1805.	1806.	1807.	1808.	1841.[1]	1842.[1]	1841.	1842.			
North	146	255	91	172	103	166	136	187	311	418	482	400	479	42	17	47
N. N. E.	111	73	90	103	182	102	139	238	125	136	168	106	255	354	25	41
N. E.	756	772	762	903	531	1213	1106	763	871	240	454	267	430	317	64	82
E. N. E.	165	126	115	189	202	248	139	54	175	234	210	80	170	147	34	69
East	828	641	397	873	522	496	500	285	438	204	438	430	468	75	28	128
E. S. E.	95	80	104	109	112	47	68	61	63	74	62	231	340	68	3	20
S. E.	115	130	76	114	205	137	113	97	66	78	30	590	622	81	33	44
S. S. E.	136	125	77	36	163	61	40	33	0?	136	46	273	500	77	40	27
South	598	558	714	759	676	597	669	497	772	508	480	780	680	136	65	47
S. S. W.	389	685	205	308	262	265	702	293	0?	684	432	390	360	149	24	72
S. W.	577	583	647	653	376	617	770	951	0?	1196	916	772	635	265	121	162
W. S. W.	208	195	313	213	230	66	220	392	189	808	792	320	270	609	104	67
West	330	521	391	398	346	425	349	404	577	798	538	780	435	383	93	92
W. N. W.	230	155	248	195	247	229	241	274	229	220	118	530	460	877	11	37
N. W.	180	383	344	186	264	182	181	378	393	200	86	1393	1000	412	58	70
N. N. W.	0	0	0	35	49	65	7	0	70	164	142	330	464	298	10	47
Calm																21

Course.	Mansfield Woodhouse, 10 years.	Alderly Rectory, 1 year.	Cheltenham, 1 year.	High Wycombe, 1 year.	Thetford, 1 year.	Keswick, 5 years.	Southwick, 11 years.	Kendal.		Bristol.		Lancaster.						Liverpool.						
								5 years.[1]	1828.	1777.	1778.	1816.	1817 or 1818?	1819.	1820.	1821.	6 years.[1]	1828.	1829.	1830.	1831.	1832.	1833.	1834.
N.	131	63	67	49	85	5	249	9	40	35	13	17	15	26	18	16	4	7	17	18	25	34	18	25
N. E.	395	0	91	25	83	6	492	22	22	218	170	44	41	36	32	23	10	35	39	24	31	14	22	27
E.	195	45	65	30	65	15	291	3	23	21	16	22	18	34	48	44	10	19	23	12	16	5	8	24
S. E.	195	0	82	32	82	9	376	5	12	100	116	54	31	30	33	39	10	108	85	68	64	73	68	64
S.	176	167	73	43	118	15	276	6	30	35	24	45	53	46	61	46	15	17	23	25	42	33	34	24
S. W.	994	0	227	56	130	17	1116	38	83	252	280	93	111	83	88	110	26	58	27	55	56	46	36	62
W.	702	86	57	66?	73	24	367	11	124	17	9	64	70	71	66	67	19	42	34	44	28	51	48	37
N. W.	682	0	68	64	95	9	784	6	32	54	102	27	26	39	20	20	6	81	117	121	103	110	131	102

[1] Date uncertain. [2] By Osler's Anemometer. [3] By Whewell's Anemometer.

Winds in England.—*Continued.*

Course.	Bushey Heath. 1818.	1819.	1820.	1821.	1822.	1824.	1825.	Penzance. 4 years.[1]	1819.	1820.	1821.	1822.	Helston. 1822.	1825.	Sidmouth, 1812.	Gosport. 3 years.[1]	1816.	1817.
N.	24	19	18	7	5	8	10	9	53	34	20	29	28	47	54	10		
N. E.	172	208	215	63	77	67	84	7	35	30	16	24	31	21	40	9	64	67
E.	61	42	38	14	18	17	18	8	30	37	21	28	48	62	13	14		
S. E.	119	117	104	40	47	35	32	16	45	60	59	56	26	26	58	8	71	54
S.	28	32	21	6	6	4	5	9	22	15	42	43	35	29	42	11		
S. W.	300	262	285	145	132	129	112	19	55	63	75	77	92	75	95	13	99	134
W.	75	78	77	15	34	28	33	16	65	48	65	58	36	43	38	21		
N. W.	157	216	204	69	46	73	69	16	58	79	56	42	69	62	66	14	132	110
Calm or variable	45	26	37	5	0	5	0	0	0	0	11	8						

Course.	Gosport. 1818.	1819.	1820.	Sidmouth, 1813.	Derby. 1812.	1813.
N. to N. E.	38	45½	35¾	87	85	84
N. E. to E.	47½	24	38½			
E. to S. E.	26½	49½	54	58	56	39
S. E. to S.	54½	29	26			
S. to S. W.	62	35	36	111	119	123
S. W. to W.	68	34½	51			
W. to N.W.	43	87½	71¾	120	106	119
N. W. to N.	25½	60	53			

Winds in Denmark, Norway, and Sweden.

Course.	Copenhagen. 26 years.	50 years.	Apenrade, 9 years.	Christiansoe, 8 years.	Wyburg, 1 year.	Stockholm, 4 years.	Soendmor? 12 years.	Goersdoff. 1847.	1848.	Total.	Spydberg. 1784.	1785.	Cronberg, 1842. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
N.	1948	4910	700	441	1	15	697	87	55	142	200	205	2	3	8	2	5	8	7	4	6	3	17	4	69
N. E.	3311	4861½	1183	819	11	11	252	75	53	128	130	97	17	15	6	43	39	15	16	28	23	10	15	24	251
E.	5435	6607½	1684	859	4	11	388	178	151	329	82	77	42	14	9	33	13	9	2	21	8	15	5	10	181
S. E.	5244	5918½	847	969	16	9	434	101	65	166	124	172	2	0	0	3	2	2	5	4	2	1	0	0	21
S.	3627	7051	739	702	2	12	939	76	51	127	129	164	0	9	3	1	6	5	2	7	5	5	6	1	50
S. W.	2476	9361	1368	1426	30	14	239	136	141	277	111	111	13	21	17	0	7	19	26	9	28	25	11	15	191
W.	3545	10448	1749	1631	9	19	1390	230	173	403	67	28	11	15	41	4	14	21	24	14	12	16	25	26	223
N. W.	3006	6892½	1585	1105	27	9	199	147	72	219	75	49	0	1	9	2	7	10	10	5	1	8	3	7	63

Winds in Denmark, Norway, Sweden, and Russia.

Course.	Skagen, 9 years.	Holmia. 1783.	1784.	1785.	Monachium. 1781.	1783.	1784.	1785.	North and west coast of Norway, September.
North	415	127	85	87	85	57	80	67	0
N. N. E.	285	18	21	42	0	9	1	0	0
N. E.	929	38	97	65	43	81	23	63	0
E. N. E.	388	25	13	35	0	4	9	1	0
East	440	88	63	74	155	234	233	135	0
E. S. E.	325	22	11	14	0	19	20	2	0
S. E.	1095	39	79	60	54	28	23	77	0
S. S. E.	472	25	24	23	0	6	9	2	3
South	683	91	62	46	135	66	77	91	4
S. S. W.	529	30	24	40	0	11	13	13	0
S. W.	1645	81	114	84	138	174	164	144	9
W. S. W.	837	34	38	52	0	13	10	14	2
West	1056	185	129	84	429	340	395	447	2
W. N. W.	573	13	22	31	0	16	1	3	6
N. W.	802	42	83	63	38	0	31	32	6
N. N. W.	283	4	27	42	0	0	3	0	0
Calm					0	0	41	58	0

Course.	Archangel, 18 years.	Moscow, 5 years.	Kasan, 1 year.	Kerk, 2 years?[2]	Wilna, 1 year.	Petropolis? 1 year.[3]	Dorpat, 1 year.	Schoessl, 2 5-12 years.
N.	2350	25.6	135	11	271	39	100	352
N. E.	1426	35.8	84	7	161	21	89	1429
E.	2339	81.6	8	14	291	55	101	613
S. E.	2760	36.7	204	6	671	24	127	307
S.	1969	54.9	176	10	291	71	157	120
S. W.	2757	38.3	160	15	541	18	174	1077
W.	3007	54.1	14	22	911	80	225	1211
N. W.	2023	33.3	71	15	461	40	122	1783
Calm	1784							

[1] Date uncertain. [2] Locality doubtful. [3] St. Petersburg. (?)

Winds in Russia.—*Continued.*

Lougan.[1]

Course.	Jan.	Jan.	Feb.	Feb.	March.	March.	April.	April.	May.	May.	June.	June.	July.	July.	Aug.	Aug.	Sept.	Sept.	Oct.	Oct.	Nov.	Nov.	Dec.	Dec.	Total.
N.	5	8	0	14	4	0	14	5	6	11	11	40	9	15	4	24	5	7	0	4	0	0	0	8	194
N. E.	6	7	12	5	11	13	26	14	9	11	2	29	15	10	5	9	3	11	4	8	2	0	9	6	227
E.	18	96	42	28	95	83	102	39	118	65	21	26	67	34	53	19	101	142	127	37	73	33	98	40	1557
S. E.	17	5	5	13	0	70	7	58	24	9	9	1	14	6	20	19	6	6	5	8	23	4	21	15	365
S.	40	4	34	27	34	19	15	28	19	36	12	15	33	13	47	11	16	4	12	7	16	30	0	11	473
S. W.	23	13	12	14	2	27	0	31	1	23	15	18	0	15	0	20	1	0	0	13	0	19	1	30	277
W.	45	39	57	45	17	6	25	14	10	16	36	31	20	47	32	66	39	8	17	59	3	92	3	44	771
N. W.	5	1	0	5	2	3	6	9	1	9	22	24	8	22	2	10	0	1	0	18	0	19	0	7	174
Calm	89	75	62	73	83	17	45	42	60	68	112	56	91	86	85	70	69	61	83	94	123	43	116	87	1790

St. Petersburg.

Course.	20 years.[2]	1818.	1830.	1831.	1832.	July, 1835, to July, 1836.	July, 1836, to July, 1837.	TOTAL IN HOURS FOR THE SEPARATE MONTHS SINCE 1830.											
								Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	852	27	56	29	44	177	142	137	140	74	43	226	146	276	167	282	200	192	106
N. E.	772	36	175	310	147	271	448	397	348	595	784	954	980	628	671	637	398	416	405
East	961	51	43	100	60	279	231	91	155	222	350	209	312	218	252	260	383	404	298
S. E.	680	24	106	84	103	509	436	353	661	629	462	267	234	330	399	267	552	599	426
South	835	34	194	119	168	426	290	503	470	708	394	215	263	271	308	432	594	786	1052
S. W.	905	32	380	275	324	374	344	1163	1033	925	867	739	537	859	700	801	1057	710	595
West	1292	124	81	65	168	560	489	609	472	300	334	623	728	742	609	473	266	160	343
N. W.	1009	22	11	4	4	201	188	130	50	27	9	161	99	149	174	112	99	114	195
Calm or variable		15	49	109	80	131	300	334	85	240	357	326	298	247	440	336	171	219	294

Winds in Prussia and Austria.

Course.	Dusseldorp, 1 year.	Dantzic, 13 years.					Sagan.				Divio.		Buda.				Prague.	
		Winter.	Spring.	Summer.	Autumn.	Total.	5 years.[2]	1781.	1783.	1784.	1783.	1784.	1782.	1783.	1784.	1785.	1783.	1784.
North	97	147	493	590	195	1425	6	39	60	37	250	248	15	23	32	50	18	49
N. N. E.	74	38	152	158	30	378			10	11	42	25	29	27	22	34	11	12
N. E.	78	34	116	147	84	381	12	127	126	120	50	51	118	127	67	59	18	19
E. N. E.	25	16	58	83	33	190			21	26	14	2	22	40	14	11	15	28
East	107	104	234	156	175	669	9	128	90	87	48	51	20	17	40	62	1	22
E. S. E.	32	62	74	58	98	292			24	14	7	7	12	14	8	14	30	59
S. E.	83	175	132	56	137	500	9	100	84	78	24	26	91	92	60	33	24	49
S. S. E.	72	79	95	29	85	288			26	23	26	21	18	36	32	32	21	45
South	59	798	474	308	704	2284	17	177	110	132	242	228	32	32	66	62	20	154
S. S. W.	45	157	107	113	205	582			58	59	29	45	56	34	75	36	36	66
S. W.	83	183	165	140	273	761	24	239	211	233	96	132	153	123	87	57	130	120
W. S. W.	23	95	98	72	97	362			29	20	37	26	12	11	6	13	111	58
West	152	636	496	702	565	2399	11	154	76	81	111	107	18	21	85	139	51	88
W. N. W.	22	255	241	278	225	999			34	35	31	17	189	150	237	237	72	67
N. W.	62	115	143	155	153	576	12	90	121	107	36	62	246	300	207	156	67	61
N. N. W.	58	48	48	32	46	174			8	15	26	23	27	28	35	53	32	24
Calm or variable													93?	71?	98?	115?	34?	14?

[1] There are two different records of observations taken at this place, both dated 1838.

[2] Date uncertain.

Winds in Prussia and Austria.—*Continued.*

Berlin, Prussia.

Course.	25 years.	Proportion for the different seasons for 17 years.[1]				Proportion for the separate months for 11 years.[1]											
		Winter.	Spring.	Summer.	Autumn.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	1068	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0
N. E.	1965					0	0	1	1	1	0	0	0	0	0	0	0
E.	3227	100	100	100	100	5	4	3	1	2	0	0	0	2	1	2	3
S. E.	2658					0	0	0	1	2	2	0	0	0	3	3	0
S.	1349	190	113	85	167	0	1	0	0	0	0	0	0	0	1	0	0
S. W.	6031					2	5	2	4	3	2	0	3	3	1	1	3
W.	6149	137	132	277	160	2	3	4	5	3	4	7	5	6	3	3	3
N. W.	4826					0	1	0	1	2	4	2	3	1	0	1	0

Course.	Vienna, Austria, 1841.													Posen, Poland, 1847–48.							
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Jan.	Feb.	March.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	10	19	9	13	33	11	16	4	15	1	2	9	142	0	0	1	0	0	1	2	0
N. E.	0	5	0	1	7	0	2	0	4	1	0	1	21	10	1	0	1	0	0	2	0
E.	1	1	0	1	3	2	4	7	0	0	0	1	20	9	1	1	4	0	0	5	5
S. E.	6	55	31	29	22	21	3	28	29	37	39	32	332	1	2	4	2	1	0	5	0
S.	18	7	20	13	17	6	13	15	19	32	21	17	198	1	5	3	0	0	1	6	1
S. W.	13	2	7	6	5	3	2	5	3	3	17	12	78	2	10	6	0	2	1	8	2
W.	12	0	1	5	4	2	4	1	0	5	10	4	48	0	3	2	0	3	1	1	3
N. W.	64	22	55	51	32	74	79	63	50	44	41	48	623	0	0	1	1	1	4	1	0

Course.	Schoenthal, Austria, 1841.													Pillan, 18 years.	Hofmansgave, 4 years.	Braunsburg, 1 year.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.			
N.	5	2	0	2	1	11	1	6	0	0	0	0	28	1073	7	84
N. E.	10	58	15	45	44	13	7	18	27	12	19	12	280	825	9	14
E.	2	0	14	0	1	0	0	0	7	0	8	6	38	1349	10	63
S. E.	5	11	0	1	3	2	2	3	0	3	0	13	43	1581	14	83
S.	3	4	5	7	2	4	1	5	9	2	4	2	48	1210	14	165
S. W.	60	9	52	21	23	56	76	57	47	74	59	53	587	2525	20	229
W.	5	0	4	4	8	2	2	0	0	0	0	3	28	1892	15	228
N. W.	3	0	3	10	11	2	4	4	0	2	0	4	43	2027	11	133

[1] Proceedings of British Association.

Winds in Germany.

Course.	Manheim.																St. Andex.				
					SEPARATE MONTHS OF 1785.																
	10 years.[1]	1781.	1784.	1785.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	1781.	1782.	1783.	1784.	1785.
North	352	27	46	24	4	2	2	1	5	5	0	0	0	0	1	4	45	47	36	31	47
N. N. E.	517	50	51	78	10	7	7	7	11	8	2	1	2	2	5	16		2	2	0	0
N. E.	673	53	49	84	9	6	14	13	15	4	2	1	3	2	5	10	131	67	39	24	17
E. N. E.	935	120	106	77	5	5	12	3	7	3	3	4	6	13	5	11		6	3	0	0
East	398	44	27	53	4	2	3	9	3	1	4	4	10	5	1	7	72	103	94	26	49
E. S. E.	835	89	85	81	13	7	1	6	6	2	5	8	10	14	7	2		0	3	0	1
S. E.	615	52	53	51	7	2	3	1	2	1	9	8	5	5	6	2	48	16	51	67	30
S. S. E.	626	75	69	54	6	3	2	1	2	4	3	10	7	3	8	5		0	1	0	0
South	278	23	19	42	2	1	0	3	2	1	2	8	9	5	8	1	38	49	26	35	70
S. S. W.	894	117	103	84	6	8	5	4	1	4	5	16	11	15	5	4		5	3	7	3
S. W.	818	58	99	83	4	8	5	2	12	1	13	12	11	6	7	2	156	88	92	139	98
W. S. W.	885	87	90	77	1	8	4	1	5	8	18	8	7	7	4	6		2	1	0	0
West	456	40	31	46	1	7	5	4	2	2	11	4	3	4	2	1	222	447	259	291	280
W. N. W.	751	74	83	79	5	8	5	11	5	15	6	5	2	5	6	6		12	10	1	0
N. W.	541	57	56	81	3	3	12	10	7	11	5	3	4	4	11	8	266	119	137	62	125
N. N. W.	1045	129	153	101	13	7	13	14	8	20	3	1	0	5	9	8		9	8	1	0
Calm																		42	0	0	0
3–4 ?																		71	62	64	83

Ratisbon.

Course.	1781.	1783.	1784.	1785.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
					SEPARATE MONTHS OF 1785.											
N.	77	105	112	114	3	12	8	15	14	20	3	1	2	1	16	19
N. E.	116	163	163	117	32	13	15	9	14	2	1	2	3	1	11	14
E.	140	140	119	94	6	11	19	7	8	6	3	4	7	2	6	15
S. E.	162	170	126	205	38	2	13	16	16	9	9	13	15	25	24	25
S.	34	34	30	20	0	0	0	1	2	0	4	1	6	4	1	1
S. W.	160	111	67	59	1	6	1	5	4	6	4	2	18	4	5	3
W.	196	183	171	187	1	16	4	9	11	4	21	37	26	31	19	8
N. W.	159	181	259	297	12	24	32	28	24	43	48	33	13	25	7	8

Course.	Anspach.													Munich, 7 years.	Wurtzburg, 5 years.	Hamburg, 30 years.	Stuttgard.	Luneburg, 10 or 20 years. (?)	Cuxhaven, 10 or 20 years. (?)
		SEPARATE MONTHS OF 1843.																	
	1843.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.						
N.	59		2	5	5	10	8	9	2	9	0	8	1	6	11	381	20	16	31
N. E.	96		11	18	5	11	11	1	11	7	1	11	9	5	9	1130	60	31	27
E.	118		8	29	10	11	1	2	11	29	3	11	3	18	10	1339	99	35	49
S. E.	94		15	6	14	7	6	5	14	0	15	10	12	4	6	1134	6	32	36
S.	78		17	11	10	4	3	3	9	3	4	5	9	10	9	504	16	29	22
S. W.	116		11	6	8	8	9	10	8	1	29	21	5	20	16	2164	101	63	72
W	285		11	11	35	25	27	39	20	18	38	18	43	34	23	2696	51	97	56
N. W.	141		9	7	13	17	25	15	18	17	3	6	11	3	16	1600	12	62	72

[1] Date uncertain.

Winds in Germany.—*Continued.*

Course.	Peissenberg. 1781.	1783.	1784.	1785.	Separate months of 1785. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Erfurth. 5 years.[1]	1781.	1782.	1783.	1784.
North	60	20	37	34	3	3	5	6	2	4	2	1	1	2	4	1	5	173	125	34	59
N. N. E.		20	20	36	1	1	5	3	3	3	2	2	0	3	6	7			4		
N. E.	46	121	116	90	5	14	10	11	8	8	7	4	5	2	7	9	7	53	85	76	93
E. N. E.		68	70	63	2	2	7	3	14	6	3	2	6	1	3	14			0		
East	227	81	96	73	1	6	15	11	6	4	3	4	3	2	5	13	21	112	102	226	212
E. S. E.		10	15	20	2	0	0	0	0	2	1	1	2	3	6	3			6		
S. E.	30	50	85	72	15	7	5	4	5	4	3	0	9	3	7	10	5	37	118	87	85
S. S. E.		22	20	30	5	0	0	0	1	0	0	3	4	5	8	4			1		
South	70	90	48	62	7	2	2	2	6	8	2	7	4	6	9	7	4	247	142	15	104
S. S. W.		14	8	55	1	0	0	2	4	3	5	6	5	9	11	9			5		
S. W.	35	195	120	117	15	9	8	7	11	6	9	17	10	13	10	2	17	121	248	153	185
W. S. W.		26	22	39	0	0	2	0	1	2	2	16	4	8	3	1			10		
West	424	192	242	201	19	28	16	18	20	17	32	13	19	15	1	3	29	139	149	372	263
W. N. W.		30	20	57	1	1	1	1	3	6	8	9	8	12	2	5			0		
N. W.	36	83	84	69	3	7	8	9	2	10	6	4	6	6	5	3	12	44	78	126	91
N. N. W.		9	16	34	2	2	4	5	1	4	6	2	3	3	1	1			6		
Calm		63		43	11	2	5	8	6	3	2	2	1	0	2	1					

Course.	Uffenheim. 1843.	Separate months of 1843. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Neustadt, 1842 or 43. (?) Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.
N.	106	3	9	5	6	12	12	15	10	18	1	10	5	1	0	2	3	5	10	5	4	6
N. E.	24	0	2	2	1	4	6	2	0	1	1	5	0	4	1	9	1	7	6	8	9	5
E.	157	10	15	25	12	18	4	3	15	31	1	17	6	5	20	38	16	15	8	3	7	36
S. E.	82	9	9	11	3	8	7	4	10	0	12	3	4	16	8	10	5	7	8	1	3	0
S.	110	9	21	15	13	5	3	4	7	6	5	8	14	6	13	16	8	1	3	4	18	5
S. W.	98	4	8	2	7	9	12	3	11	0	18	20	4	15	13	4	16	18	12	9	4	0
W.	393	52	13	15	39	31	34	42	21	21	49	23	53	42	24	12	41	36	30	45	35	27
N. W.	97	6	5	4	9	6	12	20	7	13	6	4	5	4	5	2	0	4	13	18	3	11

Gunzenhausen.

Course.	1843.	Separate months of 1843. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	30	0	2	1	1	3	6	5	3	5	0	3	1
N. E.	3	0	0	0	0	0	1	2	0	0	0	0	0
E.	181	12	27	41	14	15	9	3	12	22	1	11	14
S. E.	73	4	6	3	0	5	7	5	6	5	9	18	5
S.	61	4	8	4	5	2	2	3	12	6	6	2	7
S. W.	55	6	3	4	8	7	2	3	2	0	6	8	6
W.	279	36	10	8	28	26	26	28	20	16	38	15	28
N. W.	48	0	0	1	4	4	7	13	7	6	2	3	1

[1] Date uncertain.

Winds in Germany.—*Continued.*

Herbipolis.[1]

Course.	1781.	1782.	1783.	1784.	1785.	Separate months of 1785. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	27	51	50	120	67	14	13	11	12	4	3	2	0	0	7	0	1
N. N. E.		13	6	0	35	0	0	2	11	13	2	2	0	0	0	1	4
N. E.	10	77	98	104	53	7	7	6	3	7	1	0	3	2	7	0	10
E. N. E.		18	22	9	23	2	5	0	2	2	0	0	1	0	1	3	7
East	126	96	153	98	78	9	2	7	2	9	0	0	16	15	11	1	6
E. S. E.		44	18	6	7	3	0	0	1	0	1	0	2	0	0	0	0
S. E.	116	102	66	30	48	9	1	7	6	1	0	1	5	7	4	3	4
S. S. E.		52	7	3	6	0	0	2	0	0	1	1	0	1	1	0	0
South	275	105	46	49	27	5	1	1	0	1	2	0	2	4	1	5	5
S. S. W.		42	22	6	17	0	1	2	0	3	0	1	5	2	1	0	2
S. W.	246	166	233	163	98	7	9	3	7	2	1	17	11	7	10	12	12
W. S. W.		41	31	20	51	1	2	1	3	9	15	14	1	0	0	1	4
West	238	134	190	293	322	17	23	28	24	24	26	33	36	34	23	34	20
W. N. W.		44	14	8	56	4	2	1	2	9	16	11	1	4	1	2	3
N. W.	32	76	111	147	133	15	9	19	10	4	17	2	7	8	13	20	9
N. N. W.		6	6	6	45	0	6	3	7	2	5	4	3	5	4	5	1

Tegern See.

Course.	1781.	1783.	1784.	1785.	Separate months of 1785. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Ingolstadt, 1 year.	Gottingen.[2]	1783.
North	288	238	65	39	0	8	3	4	6	1	9	4	1	2	1	0	31	10	45
N. N. E.		9	19	20	0	1	2	3	3	2	1	2	2	2	2	0	0		54
N. E.	76	71	53	39	2	3	3	3	9	2	3	2	6	1	3	2	64	10	113
E. N. E.		7	19	15	1	2	0	4	3	0	1	0	1	1	0	2	185		25
East	26	91	42	51	0	4	2	1	3	3	2	11	5	15	5	0	0	9	35
E. S. E.		6	31	116	6	0	7	3	4	9	10	12	17	23	14	11	78		41
S. E.	162	153	159	131	23	5	1	14	8	10	11	8	14	5	18	14	0	13	96
S. S. E.		39	96	57	12	7	6	3	10	5	1	6	0	3	1	3	51		67
South	160	241	122	71	16	6	14	2	7	6	2	4	3	0	5	6	0	17	55
S. S. W.		2	16	18	4	0	1	0	3	6	1	1	0	0	0	2	246		109
S. W.	107	90	34	48	14	3	1	2	1	8	3	2	1	0	6	7	0	16	105
W. S. W.		0	5	20	1	0	2	0	1	1	3	0	2	3	5	2	297		74
West	28	39	23	148	2	2	4	1	0	10	23	19	19	18	18	32	0	13	29
W. N. W.		2	9	53	1	1	4	3	4	6	6	12	5	1	5	10	112		65
N. W.	203	136	274	214	9	34	41	38	25	18	11	9	12	9	7	1	0	12	69
N. N. W.		76	140	55	9	11	3	11	6	4	5	1	2	2	0	1	26		69
Calm																	29		

Giengen an der Brenz.

Course.	1841.	Separate months of 1841. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	88	1	8	7	19	9	15	6	7	8	1	2	5
N. E.	101	8	14	3	18	11	3	4	8	12	7	5	8
E.	110	1	20	8	12	20	4	4	8	17	6	5	5
S. E.	33	8	4	2	1	3	0	2	2	2	3	0	6
S.	115	8	5	16	8	8	4	6	9	9	10	23	9
S. W.	259	37	10	18	5	17	13	23	12	16	37	35	36
W.	203	18	10	25	9	11	21	28	22	10	19	14	16
N. W.	167	12	13	14	18	14	30	19	22	16	4	2	3
Calm	9							1	3		1	2	2

[1] Wurtzburg (?)

[2] Date and number of years uncertain.

Winds in Germany.—*Continued.*

Giengen.

Course.	1841.	SEPARATE MONTHS OF 1841.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	89	1	8	7	20	10	14	7	6	6	2	2	6
N. E.	99	9	12	5	17	10	3	4	8	12	7	3	9
E.	112	1	20	8	12	20	4	3	9	17	8	3	7
S. E.	37	8	4	2	1	3	0	2	2	2	3	4	6
S.	117	8	5	16	8	8	5	6	9	10	10	23	9
S. W.	255	36	10	17	5	17	13	21	12	15	36	37	36
W.	202	18	10	24	9	11	21	29	22	10	19	12	17
N. W.	168	12	15	9	19	14	30	20	22	18	4	2	3

Hof.

Course.	1841.	SEPARATE MONTHS OF 1841.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	71	13	9	4	13	9	10	4	1	2	5	1	0
N. E.	88	1	19	6	16	14	2	4	7	8	3	4	4
E.	59	4	6	1	10	7	2	2	3	15	4	2	3
S. E.	196	8	24	17	15	29	12	9	18	22	13	11	18
S	111	14	5	19	9	7	6	7	8	15	4	12	15
S. W.	179	19	4	14	4	8	13	22	14	7	14	27	33
W.	246	23	8	20	15	12	2	35	22	12	38	27	13
N. W.	135	11	9	22	8	7	24	10	19	9	3	6	7

Carlsruhe.

Course.	1819.	1834.	1835.	TOTAL FOR THE SEPARATE MONTHS OF 1834 and 1835.											
				Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	78	61	68	7	5	8	29	11	13	11	11	10	11	7	6
N. E.	394	366	293	36	42	67	70	58	56	45	48	58	41	67	71
E.	16	25	79	10	4	7	4	3	12	17	10	8	8	16	5
S. E.	9	24	31	10	0	0	2	8	3	5	2	13	5	3	4
S.	13	32	33	5	5	2	3	6	3	12	2	2	9	8	8
S. W.	500	536	408	103	95	67	43	74	78	73	93	72	98	74	74
W.	66	13	137	7	10	23	16	18	10	19	12	10	10	4	11
N. W.	19	38	46	6	7	12	13	8	5	4	8	7	4	1	7

Winds in Germany.—*Continued.*

Mergentheim.

Course.	1841.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
		SEPARATE MONTHS OF 1841.											
N.	132	6	12	11	24	15	24	11	11	2	5	8	3
N. E.	85	8	15	10	16	2	8	3	5	1	0	9	8
E.	233	11	42	26	21	38	10	9	20	24	5	12	15
S. E.	30	2	0	1	2	2	4	0	4	3	5	6	1
S.	109	13	0	15	4	10	5	7	12	9	14	16	4
S. W.	157	34	9	8	11	12	10	27	7	8	11	9	15
W.	271	13	2	13	8	12	6	30	31	33	46	26	35
N. W.	68	6	4	9	4	2	11	6	3	10	7	4	2

Burglengenfield.

Course.	1843.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
		SEPARATE MONTHS OF 1843.											
N.	71	0	6	3	6	7	6	11	5	18	0	8	1
N. E.	1	0	0	0	0	0	0	0	0	0	0	0	1
E.	405	22	25	62	37	32	17	24	45	34	26	50	31
S. E.	57	16	15	0	2	4	2	2	4	0	8	3	1
S.	66	3	13	6	6	1	7	1	15	0	1	5	8
S. W.	15	2	1	1	1	1	0	2	2	1	2	0	2
W.	422	47	22	14	36	48	50	45	22	27	54	21	36
N. W.	47	3	2	7	2	0	8	8	0	9	2	3	3

Issny.

Course.	1841.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
		SEPARATE MONTHS OF 1841.											
N.	19	4	7	2	2	0	2	0	0	0	0	0	2
N. E.	37	0	3	3	5	7	7	2	3	0	1	3	3
E.	162	11	11	22	18	25	10	7	2	18	7	8	3
S. E.	76	5	12	9	4	3	2	6	6	13	5	3	8
S.	91	15	4	4	4	5	5	10	11	6	6	10	11
S. W.	268	24	13	19	22	17	27	32	14	13	30	24	33
W.	54	3	4	1	4	5	5	2	4	8	13	4	1
N. W.	15	0	2	2	1	0	2	2	2	2	0	1	1

Winds in Germany.—*Continued.*

Tutlingen.

Course.	1841.	Separate months of 1841.											
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	107	15	4	16	17	10	19	6	13	2	0	5	0
N. E.	95	0	23	6	6	12	14	7	7	12	0	0	8
E.	146	0	8	8	20	21	4	5	13	13	21	33	0
S. E.	13	0	0	2	4	1	3	0	0	3	0	0	0
S.	34	1	0	7	6	7	1	7	2	2	1	0	0
S. W.	207	44	6	21	7	14	8	9	13	19	22	19	25
W.	308	29	11	17	18	22	28	39	22	16	34	29	43
N. W.	185	4	32	16	12	6	13	20	23	23	15	4	17

Badenbach.

Course.	1842.	Separate months of 1842.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	29	5	0	1	6	1	4	3	2	2	2	3	0
N. E.	55	7	4	1	10	11	3	0	5	9	3	2	0
E.	8	0	0	0	0	1	0	1	6	0	0	0	0
S. E.	106	14	18	6	3	7	1	3	9	1	10	11	23
S.	12	0	0	1	0	0	2	3	0	3	1	2	0
S. W.	47	0	4	10	1	3	7	5	3	9	4	1	0
W.	19	0	0	1	0	1	6	1	0	0	2	6	2
N. W.	89	5	2	11	10	7	7	15	6	6	9	5	6

Schussenreid.

Course.	1841.	Separate months of 1841.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	53	6	1	6	4	6	0	0	10	18	1	0	1
N. E.	129	0	24	7	4	35	22	9	2	12	12	0	2
E.	51	0	2	0	0	0	0	0	1	2	15	30	1
S. E.	30	0	0	24	5	0	0	1	0	0	0	0	0
S.	33	6	2	9	4	4	0	1	0	1	0	6	0
S. W.	331	46	20	31	12	28	35	35	22	10	1	54	37
W.	269	12	0	3	51	11	23	12	23	35	52	0	47
N. W.	200	23	35	13	10	17	10	29	34	12	12	0	5

Winds in Holland and Belgium.

Franeker.

Course.	13 years.	PROPORTION FOR THE SEPARATE MONTHS. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	2943	210	111	370	263	456	355	450	223	201	53	101	150
N. E.	14322	2054	1104	1896	1608	1340	1454	583	772	864	597	969	1081
E.	3482	393	338	454	170	232	125	128	203	580	235	290	334
S. E.	17185	1912	1875	1401	967	1125	553	623	603	1680	2140	2222	2084
S.	4960	427	538	314	202	185	231	285	469	564	680	605	460
S. W.	34263	2580	3854	2150	2460	2186	2107	3427	3690	2797	3060	2818	3134
W.	9555	574	720	762	575	632	1348	1120	1000	824	812	643	545
N. W.	33293	1850	1460	2653	3755	3844	3827	3384	3040	2490	2423	2352	2215

Brussels.

Course.	1839.	1840.	1842, 43, and 1844.	1833 to 1842.	1772 to 1779.	PROPORTION FOR THE SEPARATE MONTHS FROM 1772 TO 1779. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	34	20	1036	50	15	2	0	2	1	3	4	1	0	1	0	0	1
N. N. E.	19	28	861	33													
N. E.	54	56	1507	104	6	1	0	1	1	1	1	0	1	0	0	0	0
E. N. E.	93	144	1688	60													
East	89	101	2485	56	21	2	1	4	4	1	1	0	3	2	1	1	1
E. S. E.	26	9	818	14													
S. E.	35	32	681	27	4	0	1	0	0	0	1	0	1	0	1	0	0
S. S. E.	20	17	562	20													
South	43	40	1469	37	13	1	2	1	0	1	0	0	0	1	3	2	2
S. S. W.	77	49	1997	68													
S. W.	158	105	3868	171	50	4	6	4	4	3	2	5	4	5	4	5	4
W. S. W.	158	158	3739	113													
West	185	221	2129	125	44	4	5	2	3	2	6	5	3	5	2	3	4
W. N. W.	75	71	1080	56													
N. W.	47	80	1192	56	7	0	0	0	1	2	1	2	1	0	0	0	0
N. N. W.	39	21	732	30													

Utrecht.

Course.	1842.	SEPARATE MONTHS OF 1842. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	29	0	1	1	5	2	3	6	3	3	2	3	0
N. E.	100	6	1	5	31	8	14	2	11	8	7	6	1
E.	111	21	3	2	20	12	9	5	12	11	2	11	3
S. E.	68	7	8	3	2	6	0	3	13	5	2	12	7
S.	32	3	2	2	0	1	1	2	1	6	0	3	11
S. W.	144	15	25	12	0	9	2	6	6	18	20	11	20
W.	150	8	14	17	1	13	19	22	10	5	16	10	15
N. W.	95	1	2	20	1	11	12	16	6	4	13	4	5

Winds in Holland and Belgium.—*Continued.*

Course.	Amsterdam, 54 years.	Louvain, 1844.	Mailand.	Alost. 1839.	Alost. 1840.	Ghent. 1839.	Ghent. 1840.	Ghent. 1844.	Breda. 1838.	Breda. 1839.	Breda. 1840.	Breda. 1841.	Breda. 1842.	Breda. 1843.
North	24½	57	7	53	51	50	49	96	47	54	36	28	27	80
N. N. E.	1	23		101	67	17	16	16	46	24	39	27	66	78
N. E.	30	125	13	21	20	82	72	60	120	114	48	42	101	100
E. N. E.	6½	58		76	102	51	49	33	55	66	26	19	35	32
East	48½	58	26	14	16	67	149	139	155	138	103	50	44	136
E. S. E.	6	14		31	59	27	24	20	39	32	11	13	6	16
S. E.	21	16	9	13	11	62	34	48	47	62	26	21	18	56
S. S. E.	7	15		39	68	27	29	25	33	38	11	20	4	26
South	24	42	4	26	34	99	121	128	59	82	25	24	35	84
S. S. W.	8½	16		65	87	70	86	37	68	50	31	63	69	130
S. W.	67	51	12	66	32	218	202	98	189	220	90	125	94	218
W. S. W.	12	107		214	255	64	104	32	124	134	61	83	59	64
West	54	333	20	63	48	148	164	129	200	230	138	93	98	262
W. N. W.	15	51		154	130	84	94	111	70	74	35	45	31	46
N. W.	31	88	9	54	35	89	106	79	102	96	44	32	24	74
N. N. W.	5	45		104	83	33	41	33	30	66	18	39	19	42

Winds in France.

Denainvilliers.

Course.	Montpelier, 37 years.	31 years.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
			PROPORTION FOR THE SEPARATE MONTHS.											
N.	74	95	4	5	6	14	11	9	7	5	8	8	12	6
N. E.	58	101	11	9	13	9	10	9	4	3	8	12	5	8
E.	52	21	4	3	1	1	1	0	0	1	3	2	2	3
S. E.	29	6	0	0	0	0	2	0	0	1	1	0	1	1
S.	31	121	10	13	8	5	8	8	10	12	9	10	11	17
S. W.	10	163	10	12	13	12	10	16	19	20	16	11	15	9
W.	35	7	0	0	1	2	0	1	2	1	0	0	0	0
N. W.	76	16	0	1	1	2	1	4	3	1	3	0	0	0

Marseilles.

Course.	1823.	1824.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.	1847.	1848.	Total.
N.	17	86	2	5	0	1	5	0	2	6	4	2	4	0	1	1	1	1	0	1	139
N. E.	0	0	0	5	1	4	2	2	3	2	1	5	15	6	1	5	2	5	2	1	62
E.	64	37	26	25	37	55	47	46	40	55	82	52	25	17	21	25	12	23	29	25	743
S. E.	31	36	58	58	35	35	50	50	50	38	28	39	48	50	46	69	70	67	41	57	956
S.	28	45	33	30	41	50	27	35	57	33	19	63	17	13	17	9	16	3	12	18	566
S. W.	15	9	38	37	34	31	18	31	10	32	18	30	16	22	21	11	6	20	38	34	471
W.	89	55	77	53	58	44	57	65	55	49	29	65	79	47	63	50	70	55	83	74	1217
N. W.	157	126	175	191	232	183	208	192	161	177	221	145	155	192	171	166	174	172	137	134	3469

Winds in France.—*Continued.*

Strasburg.

Course.	20 years.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
		PROPORTION FOR THE SEPARATE MONTHS.											
N.	98.68	6.34	4.81	8.94	9.50	12.06	13.34	8.47	10.41	8.03	6.59	4.81	5.38
N. E.	264.44	25.25	19.38	28.28	25.03	24.69	18.53	17.28	17.66	23.78	23.84	21.28	19.44
E.	61.09	5.03	3.84	4.47	6.37	6.28	5.44	5.44	4.84	6.06	5.63	3.53	4.16
S. E.	89.36	8.31	6.06	4.37	5.81	7.03	6.38	7.75	9.50	9.09	10.53	7.81	6.72
S.	309.09	30.75	30.31	22.03	20.22	20.81	16.31	24.16	23.09	21.81	27.38	34.06	38.16
S. W.	121.84	9.25	9.40	12.31	8.94	8.44	10.34	12.32	11.44	9.22	8.88	9.56	11.44
W.	44.09	1.94	3.22	3.72	3.38	3.78	4.90	12.94	5.94	3.90	3.15	2.72	2.50
N. W.	107.15	6.13	7.62	8.88	10.75	9.90	14.44	12.28	10.25	8.12	7.03	6.53	5.22

Paris.

Course.	1816 to 1826.	1827 to 1846.	1846.	1847.	1806 to 1847.	15 years.[1]	27 years.[1]	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
								TOTAL FOR THE SEPARATE MONTHS FROM 1806 TO 1845.											
North	483	658	28	27	1242	586	1589	111	90	120	138	114	131	97	93	97	76	58	62
N. N. E.					358			35	29	40	57	48	27	20	14	20	21	17	30
N. E.	378	811	59	54	1469	670	2432	120	77	189	127	118	122	92	92	120	88	93	118
E. N. E.					382			24	26	27	56	52	23	20	26	45	31	19	33
East	324	414	27	28	751	350	735	59	46	58	64	70	43	40	55	71	72	59	59
E. S. E.					239			24	20	20	21	20	19	12	15	20	16	25	27
S. E.	231	493	29	35	916	398	1170	98	82	57	62	79	47	48	37	62	94	91	95
S. S. E.					373			48	41	23	25	29	27	12	17	30	55	39	27
South	682	882	45	51	1725	892	1319	142	166	112	132	121	75	98	111	152	186	167	161
S. S. W.					649			52	66	56	47	51	44	53	49	52	61	60	64
S. W.	727	1317	94	58	2281	1043	3630	159	136	160	123	170	185	185	211	192	175	222	211
W. S. W.					701			58	52	48	32	59	65	94	70	49	48	57	69
West	853	1152	56	62	2055	1049	1265	140	145	159	129	132	190	230	245	135	148	153	131
W. N. W.					590			38	51	58	48	45	58	79	53	39	50	31	40
N. W.	335	1711	27	37	1200	516	1560	84	77	83	101	88	114	125	117	87	92	86	82
N. N. W.					281			24	25	24	33	38	24	25	19	22	16	14	17
Variable or calm		504		13	128			24	7	6	5	6	6	10	10	7	11	9	14

Course.	Cambray.			Dijon.															
								TOTAL FOR THE SEPARATE MONTHS OF 1845–46.											
	1847.	1848.	Total.	1845.	1846.	1847.	1848.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	117	147	264	45	56	53	36	13	11	6	5	11	0	3	9	11	12	10	10
N. E.	233	171	404	47	29	34	28	7	8	12	7	8	11	2	2	4	4	7	4
E.	95	80	175	30	60	57	48	4	6	7	6	4	15	13	4	14	4	7	6
S. E.	78	40	118	21	18	18	27	2	0	4	6	5	5	4	2	6	2	3	0
S.	188	191	379	85	78	63	85	15	8	11	15	6	4	13	16	18	18	20	19
S. W.	140	228	368	24	25	21	25	3	3	5	3	3	4	5	3	5	5	7	3
W.	167	164	331	99	77½	85	85	15½	16	13	17	22	20	20	21	0	11	5	16
N. W.	75	75	150	14	15½	34	32	2½	4	4	1	3	1	2	5	2	3	1	1

[1] Date not known.

Winds in France.—*Continued.*

Course.	Versailles.			Toulouse.			Metz.	Total for the separate months from 1835 to 1846.											
	1847.	1848.	Total.	1747 to 1756.	1839 to 1846.	1847.	1847.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	137	51	188	38	9.78	26	47	179	133	185	186	165	179	125	178	120	143	116	142
N. N. E.	185	137	322	0		3	22												
N. E.	141	138	279	25	5.27	5	14												
E. N. E.	24	74	98	0		3	15												
East	73	89	162	10	4.79	2	36												
E. S. E.	63	62	125	0		2	3												
S. E.	137	95	232	89	86.90	37	18												
S. S. E.	93	79	172	0		32	16												
South	136	172	308	6	7.91	47	31	186	233	180	179	200	186	240	187	245	223	249	223
S. S. W.	156	224	380	0		10	19												
S. W.	174	202	376	13	9.03	17	23												
W. S. W.	127	126	253	0		12	25												
West	161	213	374	95	112.04	39	56												
W. N. W.	174	145	319	0		39	17												
N. W.	156	122	278	89	73.03	75	11												
N. N. W.	68	71	139	0		16	12												
Calm or variable					227.05	168													

Course.	Saint Lo.				Rodez.				Total for the separate months from Oct. 1845 to Sept. 30, 1847.											
	1844.	1845.	1846.	Total.	Oct. 1845, to Sept. 1846.	Oct. 1846, to Sept. 1847.	1848.	Total.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	46	49	35	130	45	20	14	79	3	4	8	0	5	8	19	6	5	1	0	6
N. N. E.	53	28	25	106	1	5	0	6	0	0	1	2	0	0	0	0	0	0	2	1
N. E.	71	53	73	197	6	9	5	20	0	0	1	0	3	5	1	0	0	1	0	4
E. N. E.	37	35	26	98	0	3	0	3	0	1	0	0	2	0	0	0	0	0	0	0
East	34	32	30	96	10	10	4	24	0	3	2	1	2	1	2	2	5	0	1	1
E. S. E.	24	10	5	39	0	6	0	6	1	0	0	0	1	1	1	0	0	0	2	0
S. E.	49	15	25	89	76	75	71	222	25	8	13	8	18	11	10	2	8	12	31	5
S. S. E.	20	25	17	62	3	9	0	12	1	1	0	1	3	0	0	0	0	0	6	0
South	23	33	41	97	28	13	12	53	6	0	9	2	10	5	0	1	0	1	2	5
S. S. W.	41	26	34	101	0	3	0	3	0	0	1	0	0	0	0	0	0	0	2	0
S. W.	37	63	65	165	25	24	26	75	6	3	6	8	5	3	4	0	0	2	3	9
W. S. W.	47	44	50	141	2	10	0	12	0	0	4	1	3	0	1	0	0	0	0	3
West	61	72	78	211	115	22	53	190	9	15	4	20	5	14	12	20	11	8	7	12
W. N. W.	40	42	16	98	5	18	0	23	6	5	0	3	1	0	2	0	0	0	1	5
N. W.	38	43	29	110	49	34	145	228	5	13	11	13	4	12	6	0	1	6	3	9
N. N. W.	49	35	24	108	0	10	0	10	0	2	2	1	0	0	4	0	0	0	0	1
Calm or variable	200			200																

Winds in France.—*Continued.*

Course.	Bordeaux. 1847.	Bordeaux. 1848.	Bordeaux. Total.	Valognes, 1847.	La Chapelle, 1847.	Orange, 1835 to 1848.	Course.	Bordeaux. 1847.	Bordeaux. 1848.	Bordeaux. Total.	Valognes, 1847.	La Chapelle, 1847.	Orange, 1835 to 1848.
N.	86	74	160	46	34	21.6	S. W.	17	8	25	60	49	12.8
N. E.	28	18	46	30	33	5.0	W.	95	121	216	95	69	18.4
E.	60	39	99	51	38	10.7	N. W.	20	16	36	45	22	16.1
S. E.	5	10	15	5	15	13.1	Calm or variable					6	
S.	54	77	131	33	38	72.9							

Course.	Syam. 1846.	Syam. 1848.	Rouen. 1845.	Rouen. 1846.	Rouen. 1847.	Rouen. 1848.	Rouen. Total.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
								SEPARATE MONTHS OF 1845–46.											
North	80	81	5	40	41	9	95	3	4	3	5	7	3	0	4	1	0	6	9
N. N. E.	7	13	19	0	0	4	23	2	0	3	2	5	4	0	0	1	0	2	0
N. E.	11	7	55	41	61	19	176	3	8	8	12	13	11	4	8	11	6	5	7
E. N. E.	1	2	19	0	0	0	19	4	4	3	3	0	2	0	0	3	0	0	0
East	3	9	13	28	10	0	51	3	2	3	2	4	8	8	1	5	0	5	0
E. S. E.	0	0	4	0	0	0	4	0	0	0	1	2	0	0	0	1	0	0	0
S. E.	7	3	8	12	20	0	40	1	1	1	4	0	0	0	3	2	3	5	0
S. S. E.	3	6	8	0	2	1	11	1	0	2	2	0	1	0	1	1	0	1	0
South	55	39	14	53	39	5	111	3	6	10	5	5	2	11	5	4	9	5	2
S. S. W.	27	19	31	0	3	1	35	5	0	0	2	0	2	5	4	3	5	2	3
S. W.	52	56	48	114	103	18	283	19	4	8	6	8	12	12	14	19	25	23	12
W. S. W.	5	14	18	0	0	0	18	0	0	2	2	3	1	0	5	3	2	0	0
West	18	20	50	48	25	11	134	7	17	9	7	7	8	12	3	3	7	3	15
W. N. W.	2	1	30	0	7	3	40	0	2	2	3	3	4	6	9	0	0	0	1
N. W.	6	10	30	29	54	17	130	8	7	7	3	2	2	3	7	2	6	2	10
N. N. W.	10	16	13	0	0	0	13	3	1	1	1	3	0	1	0	0	0	0	3

St. Hyppolyte de Caton.

AVERAGE FOR THE SEPARATE MONTHS FROM 1837 TO 1849, INCLUSIVE.

Course.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	12.38	9.90	11.07	11.60	9.59	13.66	13.06	11.39	8.54	10.04	8.99	11.32
N. E.	7.23	6.60	6.23	6.92	5.38	5.66	3.48	4.85	5.62	6.63	5.66	7.46
E.	.15	.30	.92	.22	.29	.50	.39	.32	.46	.69	.64	.23
S. E.	.23	.77	.61	.69	2.00	1.28	.69	.70	1.62	1.24	.79	.54
S.	4.38	6.28	6.31	7.15	9.58	7.13	7.71	7.48	9.69	6.63	7.49	5.54
S. W.	.31	.30	.46	.33	1.32	.36	.28	.78	1.46	.69	.87	.54
W.	1.31	.70	.69	.32	.22	.20	.85	.93	.23	.77	1.63	.77
N. W.	5.01	3.15	4.70	2.77	2.62	1.20	4.54	4.55	2.38	4.31	3.93	4.70

Winds in France.—*Continued.*

Course.	Nancy. 6 years.	Nancy, proportion for the separate months: Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Montmorenci. 15 years.	Montmorenci, proportion for the separate months: Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	April 1, 1771, to April 1, 1772.
N.	5	0	0	1	1	1	2	0	0	0	0	0	0	67	6	5	7	7	7	6	7	6	4	4	4	4	761
N. E.	37	4	3	3	4	3	4	1	4	2	2	2	5	51	6	2	5	5	5	4	3	6	3	4	3	5	181
E.	4	0	0	0	1	0	0	0	0	1	1	0	1	39	4	4	4	3	3	2	2	4	3	3	3	4	401
S. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	12	1	1	1	1	1	1	0	1	1	2	1	1	71
S.	7	0	0	0	0	0	0	1	0	2	3	0	1	44	3	4	2	2	4	3	2	3	5	7	5	4	571
S. W.	35	2	5	1	1	4	2	4	2	3	4	4	3	60	4	7	5	4	4	4	5	4	6	6	6	5	261
W.	18	1	2	1	1	1	3	3	2	1	0	3	0	54	4	4	3	4	4	6	6	6	4	3	5	5	881
N. W.	5	1	0	2	0	0	0	0	0	0	1	1	0	45	3	3	3	4	4	5	4	5	3	3	5	3	521

Winds in France, Spain, and Portugal.

Course.	Massillia,[1] France. 1783.	1784.	1785.	Hafnia,[2] France. 1783.	1784.	1785.	Cantabria, Spain, 1 year.	Gibraltar, July, Aug., and October.	Oporto, Portugal. Mar.	April.
North	2	2	6	27	30	37	61	0	3	9
N. N. E.	0	0	1	14	12	35	12		0	0
N. E.	14	18	45	48	42	53	94	0	0	1
E. N. E.	0	0	0	16	38	10	5		0	0
East	6	8	5	30	85	45	93	61	2	3
E. S. E.	0	0	0	22	45	36	3		3	4
S. E.	515	492	517	53	84	79	25	4	4	0
S. S. E.	1	0	0	24	39	42	4		0	2
South	0	0	0	59	40	28	95	4	8	6
S. S. W.	0	0	0	26	32	35	19		3	2
S. W.	77	65	49	56	64	66	224	0	16	4
W. S. W.	0	0	0	27	61	46	26		6	2
West	22	60	53	80	98	86	184	0	3	1
W. N. W.	0	1	4	41	79	94	36		5	4
N. W.	409	425	380	84	138	126	163	11	7	13
N. N. W.	0	1	0	20	34	49	23		1	7
3-4?	0	136	73	108	182	110	39			

Winds in Italy.

Course.	Naples. 1842.	Naples, separate months of 1842: Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Padua. Time unknown.	1781.	1783.	1784.	1785.
N.	69	4	8	2	8	3	5	1	9	2	11	3	13	8	216	319	309	333
N. E.	176	26	26	13	11	8	10	6	10	9	16	13	28	7	169	122	135	132
E.	6	0	0	.0	0	0	2	0	0	1	0	1	2	28	146	121	133	177
S. E.	69	6	4	5	5	12	8	8	1	6	5	5	4	4	75	77	87	96
S.	52	3	1	5	6	5	5	11	5	5	4	2	0	7	50	40	64	201
S. W.	223	11	7	24	22	22	24	29	18	23	14	25	4	12	76	59	65	189
W.	28	1	0	5	0	3	0	1	4	3	3	5	3	21	149	184	145	138
N. W.	105	10	9	8	8	9	6	6	15	11	9	6	8	3	191	111	168	99
Calm																239		

[1] Marseilles. (?)

[2] Havre. (?)

Winds in Switzerland.

Mount St. Gothard.

Course.	1782.	1783.	1784.	1785.	Separate months of 1785. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Regensburg, 7 years.
North	9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	9
N. N. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
N. E.	3	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	12
E. N. E.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
East	8	6	1	17	0	1	0	0	0	0	0	0	6	4	5	1	13
E. S. E.	17	25	24	43	15	6	0	0	0	0	1	3	8	2	7	1	
S. E.	86	127	262	249	22	9	31	14	24	15	19	18	20	15	15	47	15
S. S. E.	129	106	18	6	0	4	0	0	0	0	0	0	0	0	1	1	
South	79	144	165	126	18	2	2	9	4	3	9	20	14	9	20	16	2
S. S. W.	89	39	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
S. W.	27	32	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8
W. S. W.	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
West	7	7	0	1	0	0	1	0	0	0	0	0	0	0	0	0	20
W. N. W.	200	67	3	17	3	5	2	1	0	1	2	0	0	2	1	0	
N. W.	345	502	574	585	30	57	54	64	60	68	60	47	35	56	34	20	21
N. N. W.	59	6	0	1	0	0	0	1	0	0	0	0	0	0	0	0	

Winds in Italy.

Rome.

Course.	1783.	1784.	1785.	Separate months of 1785. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Bologna, 1 year.
North	230	234	238	39	22	25	17	21	9	14	10	27	21	19	19	25
N. N. E.	136	108	150	17	5	11	31	5	16	12	9	7	10	13	14	16
N. E.	39	37	36	2	4	1	2	1	6	4	3	0	0	8	5	3
E. N. E.	25	31	25	2	3	1	1	1	2	1	1	1	4	5	3	108
East	21	19	13	0	2	1	1	1	0	1	2	0	3	1	1	180
E. S. E.	14	16	13	0	2	0	0	0	1	0	0	1	0	3	6	10
S. E.	33	42	54	4	3	2	3	4	4	4	3	6	3	9	9	0
S. S. E.	61	78	94	9	11	8	9	10	4	5	5	3	7	8	15	4
South	73	78	60	2	4	3	3	10	6	6	6	6	9	2	3	19
S. S. W.	36	40	31	4	1	6	0	2	2	1	5	4	5	1	0	10
S. W.	155	158	171	4	11	19	14	19	10	17	29	24	13	9	12	1
W. S. W.	115	129	96	3	6	8	3	8	19	16	12	9	8	2	0	145
West	25	34	41	0	2	2	5	3	8	10	4	0	1	4	2	470
W. N. W.	12	10	5	2	0	3	0	0	0	0	0	0	0	0	0	45
N. W.	35	38	33	4	6	0	4	5	2	2	2	3	3	2	0	2
N. N. W.	71	46	27	4	2	0	0	3	1	0	2	4	6	3	2	8
3–4 ?	11															

Winds in Italy.—*Continued.*

Parma.

Course.	1841.	Separate months of 1841. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	St. Zena, 1 year.	Genoa, March, 1843.
N.	133	16	2	12	24	11	7	7	14	11	10	9	10	9	30
N. E.	119	6	10	13	9	16	10	11	23	4	4	8	5	7	2
E.	201	6	23	11	18	20	19	17	15	25	27	5	15	53	17
S. E.	64	8	3	14	8	5	8	5	1	3	3	3	3	14	0
S.	31	2	1	0	4	2	4	4	1	5	5	2	1	16	4
S. W.	165	15	1	12	8	10	19	30	14	17	18	15	6	7	1
W.	130	10	8	8	8	13	11	12	6	9	8	21	16	13	8
N. W.	236	25	29	23	11	16	12	7	19	16	15	26	37	10	0

Winds at Constantinople, Turkey.

Course.	1840.	Parts of 1839 and 1841.	Average for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	3	12	½	0	0	0	1	0	0	0	0	0	0	6
N. N. E.	2	0	1	0	0	0	0	0	0	0	0	0	0	0
N. E.	447	263	26	36	30	40	35	41½	48	49	45	37	12½	33½
E. N. E.	12	10	1	1	7	1	0	0	0	0	0	0	0	1
East	13	2	0	2½	2	0	1	1	0	0	0	0	1½	½
E. S. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. S. E.	1	0	½	0	0	0	0	0	0	0	0	0	0	0
South	3	10	½	0	0	0	0	1	0	0	0	0	12	1
S. S. W.	0	4	0	0	0	0	0	0	0	0	0	0	6	0
S. W.	237	160	29½	17	20½	18	24½	15	14	13	15	25	25	18½
W. S. W.	4	1	2	0	0	0	0	0	0	0	0	0	1½	0
West	7	5	1	½	½	1	½	1	0	0	0	0	0	1½
W. N. W.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. W.	3	3	0	0	2	0	0	½	0	0	0	0	1½	0
N. N. W.	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Winds in Turkey in Asia, and on the Mediterranean Sea.

Course.	Smyrna. Jan.	Feb.	Mar.	April.	May.	June.	Sept.	Oct.	Nov.	Dec.	Trebizonde. 1836.	Separate months of the year. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Eastern part of the Mediterranean Sea, 3 years.
N.	1	0	5	3	0	0	7[2]	4	3	6	19	3	2	2	6	2	1	1	1	1	0	0	0	106
N. E.	6	4	3	11	4	8	2	10	10	16	5	0	0	0	4	0	0	1	0	0	0	0	0	196
E.	7	3	2	4	2	2	2	3	2	2	317	9	17	34	20	27	28	30 ?	25	27	36	31	33	23.3
S. E.	6	7	3	1	1	3	2	3	1	2	4	0	0	0	0	0	1	0	1	0	1	1	0	16
S.	6	12	9	3	6	2	6	4	5	1	55	22	13	0	1	1	0	0	3	1	0	8	6	33.6
S. W.	1	1	2	0	0	2	4	1	0	0	15	4	3	1	0	1	0	0	1	1	1	2	1	13.6
W.	0	0	0	0	0	5[1]	0	1	2	0	40	4	5	6	8	4	6	1	3	2	0	0	1	49.3
N. W.	1	0	1	4	0	3	2	0	0	0	246	20	18	19	21	27	24	29	26	17	13	11	21	26.3
Calm	1	1	0	1	0	0	2	5	6	2														

[1] Sea breeze.

[2] Three of these marked "Sea breeze."

Winds in Turkey in Asia.—*Continued.*

Course.	Jerusalem. 1846. May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jerusalem. 1847. Jan.	Feb.	April.	May.	June.	July.
North	2	4	3	7	21	10	8	6	5	7	2	6	4	1
N. N. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	1
N. E.	3	0	0	0	0	7	2	2	1	4	1	2	0	1
E. N. E.	0	0	0	0	0	0	3	7	5	0	2	0	0	0
East	3	1	0	0	0	1	2	7	6	0	3	1	0	0
E. S. E.	0	0	0	0	0	0	0	0	0	0	0	1	0	0
S. E.	1	2	0	0	0	0	0	0	0	0	0	0	1	0
S. S. E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S. S. W.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. W.	1	0	0	0	0	0	0	2	0	4	7	1	0	0
W. S. W.	0	0	0	0	0	0	0	0	1	0	0	0	0	0
West	4	2	4	4	1	0	5	2	2	5	1	9	1	4
W. N. W.	0	0	0	0	0	0	0	1	5	0	0	0	1	0
N. W.	7	17	24	20	8	12	10	3	5	8	14	11	22	24
N. N. W.	0	0	0	0	0	0	0	0	1	0	0	0	1	0

Course.	Bagdad. 1 year.	Separate months of the year. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
North	170	0	93	32	22	21	0	0	0	2	0	0	0
N. N. E.													
N. E.	28	0	3	10	0	0	0	0	0	0	0	15	0
E. N. E.													
East	6	0	0	0	0	4	0	0	0	0	0	2	0
E. S. E.													
S. E.	58	0	0	12	4	15	0	0	0	0	6	6	21
S. S. E.													
South	157	12	24	36	6	13	2	0	0	36	0	10	18
S. S. W.													
S. W.	354	0	0	28	70	57	13	0	91	61	26	0	8
W. S. W.	153	0	0	0	0	15	121	15	0	0	0	2	0
West	558	57	18	8	53	36	35	155	71	49	0	76	0
W. N. W.	57	0	0	0	0	3	0	0	0	0	0	6	48
N. W.	591	93	30	56	23	12	14	9	24	30	160	63	77
N. N. W.													

Course.	Bahmdun.[1] Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Nov.	Dec.	Beirut. Jan.	Feb.	March.	April.	May.	June.	Nov.	Dec.
N.	16	1	0	0	1	9	2	1	0	3	6	3	8	5	0	3	3	1½	2½
N. E.	0	0	0	1	0	0	0	1	0	2	1	1	0	1	1	½	0	2	1½
E.	1	1	2	3	3	0	0	0	0	1	3	0	0	0	0	½	0	1	1
S. E.	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	½	0	2½	4
S.	1	9	2	0	1	0	0	0	0	0	6	1	2	2	0	1	0	1½	1
S. W.	7	8	3	5	5[2]	7[2]	3[2]	0	2	4	8	18	10	5	6½	10½	20½[2]	12½	13
W.	1	5	7[2]	2½	1[2]	6[2]	1[2]	0	0	0	5	6	4	4	1½	11½	4[2]	2	2
N. W.	5	2	0	1½	0	2	0	2	0	1	0	0	4	4	0	3½	2½	0	5

Course.	Erzeroum. 1836.	Separate months of the year. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Bassora. Part of 1789.	Separate months. Feb.	Mar.	April.	May.	June.
N.	38	2	1	5	5	5	0	1	3	3	3	4	6	7	0	3	4	0	0
N. E.	27	7	1	2	2	0	3	0	3	2	1	0	6	27	0	16	8	3	0
E.	116	7	9	8	15	11	13	14	15	9	9	4	2	76	12	26	32	6	0
S. E.	17	3	2	0	5	0	3	2	0	0	0	2	0	14	6	0	4	4	0
S.	2	1	0	0	0	0	0	0	0	0	0	0	1	38	8	15	9	6	0
S. W.	11	0	2	0	3	0	3	0	0	0	0	3	0	38	23	2	8	5	0
W.	107	2	6	2	11	25	11	6	3	12	15	9	5	96	11	76	6	0	3
N. W.	56	1	1	8	4	6	3	4	3	3	15	6	2	329	12	22	10	108	177

[1] On Mount Lebanon—elevation 3,100 to 3,200 feet.

[2] About half of these were marked "Sea-breeze" in the original record.

Winds at Teflis, Georgia.

Course.	Part of 1844.	SEPARATE MONTHS. May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Course.	Part of 1844.	SEPARATE MONTHS. May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	111	16	18	9	15	6	5	16	26	S. W.	10	1	0	1	1	2	4	1	0
N. E.	17	3	2	0	1	1	2	0	8	W.	16	3	1	1	3	1	6	1	0
E.	44	5	7	12	4	6	7	2	1	N. W.	181	26	43	23	20	19	26	20	4
S. E.	70	7	3	15	14	18	9	4	0	Calm	228	19	14	25	24	25	32	35	54
S.	50	5	2	7	11	12	2	11	0										

Winds in Persia.

Ooroomiah.

Course.	Part of 1848–49.[1]	Dec. 1849, to Nov. 1850.	AVERAGE FOR THE SEPARATE MONTHS. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
North	21	24	1½	1	0	1½	2	4	1	2	8	0	5½	5	31½
N. by E.	13	24	½	1	½	1½	½	2	1	2	1	0	4	14	28
N. N. E.	4	3	½	0	0	½	1	0	0	0	0	0	½	2	4½
N. E. by N.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. E.	1	20	0	0	0	½	0	2½	1	8	3	0	1½	1	17½
N. E. by E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E. N. E.	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1
E. by N.	7	7	0	½	0	1	½	3	3	0	0	0	½	1	9½
East	7	15	1	1	½	1	½	½	1	3	4	1	1	2	16½
E. by S.	11	10	0	0	½	3½	½	1½	1	1	3	0	½	4	15½
E. S. E.	8	0	1½	½	0	0	0	2½	0	0	0	0	0	0	4½
S. E. by E.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. E.	4	146	5	2	7	6½	7	10½	17	14	11	18	8½	1	107½
S. E. by S.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. S. E.	68	5	11	6½	1½	6½	5½	5	0	0	1	1	0	1	39
S. by E.	38	18	2½	2½	6½	6½	4	½	0	1	1	4	1½	2	32
South	36	29	7½	2½	4	7	4	0	0	0	5	7	1	1	39
S. by W.	51	35	4	7	10	6	7½	1	5	2	2	5	0	1	50½
S. S. W.	37	19	6	7½	5	4	4½	½	0	0	1	0	0	0	28½
S. W. by S.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. W.	2	114	3	6½	7½	5	6	5	5	1	6	17	10	3	75
S. W. by W.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W. S. W.	30	19	4½	4½	5	1	7½	½	0	0	0	1	½	1	25½
W. by S.	79	87	9½	17½	18½	9	11½	4	3	0	4	5	3½	9	94½
West	59	272	20½	16½	16½	14½	14½	13	23	18	26	21	19½	18	221
W. by N.	22	70	2	2½	5	5	4	6½	11	5	2	4	7½	8	62½
W. N. W.	6	8	½	1	1½	1½	1	½	0	0	0	0	½	1	7½
N. W. by W.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. W.	37	129	4½	1½	2½	3½	4½	12½	16	31	9	9	19½	9	122½
N. W. by N.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. N. W.	48	7	3	3	½	4	4	11½	0	1	0	0	2½	2	31½
N. by W.	11	24	4	½	½	½	1½	3	0	2	3	0	2	7	24
Calm	0	1	½	0	0	0	0	0	0	0	0	0	0	0	½

[1] January 1 to June 18, 1848, and November, 1849.

NOTE.—I am indebted for the foregoing observations to Rev. Justin Perkins, who, in his letters accompanying them, dated February 19, and July 22, 1848, has given the following description of the place of observation, and of the local nfluences to which it is subject.

"My residence is on the north-eastern declivity of a high mountain. This location may, perhaps, affect the direction of the wind here somewhat, though probably not a great deal. There are, however, some important local causes

Winds in Persia and Siberia.

Course.	Tehran, Persia, 1850.				Tabreez, Persia, 1850.				Nijné Taguilsk. Ural Mountains.	
	Feb.	March.	April.	May.	Sept.	Oct.	Nov.	Dec.	1848.	1849.
North	12	4	4	1	2	5	2	0	26	14
N. N. E.	1	0	0	0	0	1	0	0	42	10
N. E.	11	6	5	4	8	2	0	0	125	124
E. N. E.	0	0	0	0	0	0	0	0	3	8
East	5	3	0	1	44	26	30	33	4	7
E. S. E.	0	0	0	0	2	1	0	1	4	7
S. E.	3	10	6	11	1	1	1	3	144	146
S. S. E.	0	0	0	0	1	1	0	0	17	33
South	2	8	4	19	0	7	7	9	31	25
S. S. W.	0	0	0	0	0	0	0	0	37	12
S. W.	17	28	7	32	4	1	1	3	221	225
W. S. W.	1	1	0	0	0	1	0	1	51	55
West	6	17	50	23	19	43	47	43	29	58
W. by N.	1	0	0	0	0	0	0	0	0	0
W. N. W.	0	0	1	0	0	0	0	0	50	79
N. W.	16	16	13	2	7	4	2	0	144	177
N. N. W.	8	0	0	0	1	0	0	0	37	12
Calm or variable	0	0	0	0	1	0	0	0	144	103

Catharinenburg, Siberia.[1]

Course.	1836.	1837.	TOTAL FOR THE SEPARATE MONTHS.											
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	168	236	14	15	11	78	55	38	53	49	33	30	18	10
N. E.	102	119	2	0	14	40	49	16	15	21	31	4	13	16
E.	130	145	2	6	12	11	25	29	30	49	37	11	50	13
S. E.	316	303	53	39	73	74	41	60	37	84	42	16	32	68
S.	277	195	92	20	31	28	24	41	28	58	54	33	22	41
S. W.	642	533	123	114	136	32	96	66	79	56	78	150	116	129
W.	608	767	129	125	111	130	100	88	129	68	99	150	113	133
N. W.	306	193	8	12	44	36	67	76	75	39	53	63	15	11
Calm	378	424	73	125	64	49	39	61	50	73	53	39	101	75

affecting the winds in this province, which I will here state. About once a month, ordinarily, we have a strong wind, often violent, from the *west*, which is the *simoom* or Samiel from the Arabian desert. It usually continues about three days; and though its noxious properties are much neutralized by its passage over a distance of hundreds of miles, and across the high snowy Koordish Mountains, it is still a *warm* wind (often *hot*) here, and very debilitating to men and animals. And it is often so dry and hot here, as to wither and crisp vegetables." . . . "There is ordinarily, particularly in summer, a morning breeze lasting two-thirds of the day, from the Lake of Ooroomiah, which is about fifteen miles east of us; and an evening breeze, continuing through the night, from the Koordish Mountains on the west." . . . . "We have also occasionally (once or more in the course of a month) a warm south wind from the hot plains of Mesopotamia, the nearest point of which is about a hundred miles distant; but this wind is distinct from the simoom that comes to us from the Arabian desert. At intervals of a few weeks, and sometimes oftener, we have also a cold invigorating wind from the north, which comes down from the mountains of Ararat."

"The daily lake and mountain breezes continue during the warm part of the year with great regularity, except when interrupted by the simooms, usually once in four, five, or six weeks. During this part of the year, there is also much uniformity in the *weather*, a cloud seldom appearing in the sky.

[1] Situated upon a plain, 813 feet above the level of the sea.

Winds in Siberia.—*Continued.*

Bogoslowsk.

Course.	1842.	SEPARATE MONTHS OF THE YEAR 1842.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	404	26	42	70	40	12	46	28	54	24	14	34	14
N. E.	518	4	88	34	56	0	36	88	104	72	22	2	12
E.	178	0	0	0	86	14	2	46	16	10	4	0	0
S. E.	198	0	16	12	26	16	6	36	4	6	20	50	6
S.	514	0	28	30	66	178	86	20	2	10	16	62	16
S. W.	736	8	2	50	38	104	122	42	16	94	110	102	44
W.	802	208	136	62	34	32	70	12	2	52	96	2	96
N W.	766	36	64	66	62	56	68	34	98	126	110	28	18
Calm	1524	214	72	172	72	84	44	186	200	86	104	200	290

Zlatouste.[1]

Course.	1837.	SEPARATE MONTHS OF THE YEAR.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	21	3	1	0	0	4	5	0	6	0	1	1	0
N. E.	28	1	0	0	1	7	3	1	6	5	3	1	0
E.	232	18	3	10	22	27	14	43	28	46	8	4	9
S. E.	385	34	18	47	38	48	56	26	38	32	11	22	15
S.	64	5	1	2	4	24	12	5	2	4	2	0	3
S. W.	65	8	1	9	2	19	5	3	13	2	3	0	0
W.	403	73	45	47	46	63	33	39	22	14	14	0	7
N. W.	1022	56	71	68	84	20	68	94	56	85	138	128	154
Calm	700	50	84	65	44	36	44	37	77	52	68	84	59

Barnoule.

Course.	1838.	SEPARATE MONTHS OF THE YEAR.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	261	30	24	23	35	26	18	15	11	27	44	8	0
N. E.	498	17	26	42	56	70	48	47	63	33	67	13	16
E.	31	2	0	0	0	1	0	4	11	4	3	2	4
S. E.	290	19	32	18	10	13	22	45	42	20	17	29	23
S.	274	19	24	29	20	21	20	14	14	5	20	28	60
S. W.	1000	80	76	89	53	68	95	94	46	118	47	119	115
W.	64	4	8	5	3	5	9	4	9	3	1	9	4
N. W.	182	6	3	7	27	28	11	8	38	16	16	15	7
Calm	319	70	31	35	36	16	17	17	14	14	33	17	19

[1] Elevation 1,200 feet, surrounded by mountains two or three thousand feet above the level of the sea.

Winds in Siberia.—*Continued.*

Nertchinsk.

Course.	1842.	SEPARATE MONTHS OF THE YEAR.											
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	109	5	9	6	11	21	18	10	4	9	11	4	1
N. E.	71	2	5	4	13	6	14	9	3	5	4	6	0
E.	62	0	15	0	11	1	9	3	10	4	2	7	0
S. E.	86	0	14	1	4	1	10	23	26	5	1	1	0
S.	715	10	19	4	2	3	4	11	3	8	3	3	1
S. W.	128	1	13	15	13	13	3	10	22	15	14	3	6
W.	284	19	71	18	31	20	8	15	12	14	21	48	7
N. W.	255	31	25	9	46	22	19	12	20	12	23	23	13
Calm	2064	676	501	129	49	37	35	93	86	48	45	145	220

Yacoutsk.

Course.	1833.	SEPARATE MONTHS OF THE YEAR.											
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	308	46	23	9	22	11	24	10	26	5	21	44	57
N. E.	143	1	5	0	13	15	30	25	50	0	2	0	2
E.	35	0	4	0	0	5	8	1	10	1	3	2	1
S. E.	32	0	0	2	0	9	5	2	2	0	10	1	1
S.	62	1	0	2	1	0	6	19	3	24	2	2	2
S. W.	89	2	7	18	4	17	10	9	5	10	2	3	2
W.	363	41	34	49	30	18	11	19	4	39	43	38	37
N. W.	322	23	14	18	41	48	23	31	21	32	32	21	18
Calm	106	10	15	26	9	1	3	8	3	9	9	9	4

Winds at Pekin, China.

Course.	1757.	1758.	1759.	1760.	1761.	1762.	1844.	SEPARATE MONTHS OF 1844.											
								Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	163	99	83	120	74	60	370	26	23	28	30	26	25	15	35	40	40	53	29
N. E.	92	76	122	82	92	97	276	15	21	16	16	27	38	26	33	23	25	15	21
E.	62	30	35	53	60	45	105	7	5	13	14	12	16	17	5	6	5	1	4
S. E.	70	55	84	38	82	99	233	9	6	27	27	25	34	28	30	19	20	7	1
S.	247	155	252	282	270	271	625	19	24	66	66	81	67	81	93	52	23	35	18
S. W.	23	31	11	20	21	15	448	34	46	39	40	36	28	61	43	39	32	27	23
W.	19	19	19	26	31	13	64	0	11	8	8	3	4	4	0	8	18	0	0
N. W.	45	41	74	92	62	101	623	106	70	34	33	42	30	15	9	48	66	51	119
Calm							464	63	54	28	17	20	22	28	23	23	45	79	62

Winds in Hindoostan.

Course.	Calcutta. 8 years.	Calcutta. Total for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	95	238	103	46	9	4	0	8	0	21	113	332	295
N. E.	79	132	122	75	33	29	30	20	73	91	113	128	126
E.	116	66	154	79	29	91	244	177	238	207	64	21	22
S. E.	143	53	75	176	163	226	159	258	226	266	81	25	10
S.	141	37	75	197	326	358	197	198	117	91	73	4	0
S. W.	181	74	117	281	284	209	250	230	246	232	165	29	14
W.	95	118	159	79	117	49	90	89	81	71	97	54	120
N. W.	150	283	196	67	38	33	30	20	20	21	294	407	414

Course.	Patna, Futtehpore, and on the Ganges. May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	6	0	3	0	2	0	0	13
N. E.								
E.	76	62	100	28	54	24	30	45
S. E.								
S.	1	1	1	6	0	0	0	0
S. W.								
W.	41	57	20	90	64	100	90	66
N. W.								

Duklum.

Course.	1826.	1827.	1828.	1829.	1830.	Total for different hours of the day. Sunrise.	9 to 10 o'cl'k A.M.	4 o'clock P.M.	10 to 11 o'cl'k P.M.	Total for the separate months. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N.	33	14	21	32	15	29	40	46	0	20	20	9	7	5	1	0	0	0	23	17	13
N. E.	32	19	15	22	55	23	57	62	1	26	17	5	10	12	1	0	0	0	25	28	19
E.	87	147	194	185	90	130	368	197	8	105	63	79	29	12	1	0	0	0	63	187	164
S. E.	43	29	8	12	11	20	40	41	0	13	12	1	0	8	5	0	0	0	9	9	46
S.	14	9	12	1	0	14	14	8	0	13	1	2	3	5	2	0	0	1	1	2	6
S. W.	159	6	13	40	87	55	113	130	7	2	3	3	6	52	87	101	19	26	4	1	1
W.	318	489	419	432	324	357	643	902	80	46	73	156	240	242	241	279	314	299	69	10	13
N. W.	16	14	53	18	21	27	33	51	11	8	14	14	12	35	1	0	0	0	9	7	23
Calm	359	341	320	305	395	847	452	304	117	219	221	178	129	77	81	52	126	114	259	171	142

Winds in Africa.

Course.	Tripoli. March.	April.	May.	June.	July.	Bassa Cove. Sept.	Oct.	Nov.	Cape Palmas. Dec.	Jan.	Coast of Sierra Leone and Liberia, May, 1840.
North	20	13	4	16	21	4	3	1	0	0	1
N. N. E.	0	2	1	1	1	0	0	0	0	0	0
N. E.	7	9	18	21	22	0	0	0	0	18	1
E. N. E.	1	1	12	5	12	0	0	0	0	0	1
East	8	11	30	21	27	0	6	0	0	0	1
E. S. E.	2	1	3	12	2	0	0	0	0	0	1
S. E.	7	9	10	9	5	0	2	0	0	3	5
S. S. E.	2	1	5	1	4	0	0	0	0	0	0
South	16	16	7	5	2	6	1	0	30	9	1
S. S. W.	2	3	0	0	0	33	0	0	9	0	1
S. W.	14	2	2	0	0	29	48	74	24	33	33
W. S. W.	3	7	1	0	0	0	0	0	9	0	7
West	10	15	3	2	2	9	9	4	0	15	3
W. N. W.	1	0	0	0	0	0	0	0	0	0	1
N. W.	20	19	15	13	13	3	1	0	0	6	9
N. N. W.	3	2	2	1	3	0	0	0	0	0	4
Calm	9	8	11	14	11	0	0	0	12	9	18

Winds at Islands in the Pacific and Indian Oceans.

Waioli, Sandwich Islands.

Course.	April 1, 1845, to April 1, 1846.	Separate months of 1842.											
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
N. E.	438	6	20	36	41	54	52	60	58	55	34	8	14
Variable	294	56	36	26	21	8	8	2	4	5	28	52	48

Course.	Oahu, Sandwich Islands, July, 1837.	Russell, New Zealand.					Pago-pago, Navigator's Islands.										Tananarivou, Madagascar, 1829.		
		April.	May.	June.	July.	Aug.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Jan.	Feb.	Mar.
North	0	2	2	0	1	4											0	2	0
N. N. E.	1	0	0	3	0	0											3	0	0
N. E.	13	0	3	2	2	1	5	3	7	0	1	1	3	0	8	0	12	4	13
E. N. E.	4	0	2	0	1	1											15	14	14
East	0	0	3	2½	0	0											48	68	71
E. S. E.	0	0	1	0	0	0											12	38	0
S. E.	1	1	2	1½	2	0	3	12	16	22	19	27	22	25	19	12	9	25	0
S. S. E.	0	0	2	0	0	0											0	0	0
South	0	0	2½	1½	1½	1											0	3	0
S. S. W.	0	0	1	0	3	0											0	0	0
S. W.	0	1	6½	11	10	1½	0	0	1	1	1	2	5	1	3	0	9	0	0
W. S. W.	0	0	1	0	0	1											0	0	0
West	0	0	3	6½	2½	3											12	0	0
W. N. W.	0	0	0	0	2½	0											6	0	0
N. W.	0	3	1	2	2	½	12	13	6	2	6	0	1	5	0	0	27	5	0
N. N. W.	0	0	0	0	0	0											3	6	21
Calm	2	0		0	0	0											24	3	31

The following series of wind-roses exhibits to the eye the relative predominance of the different winds as given in the preceding abstracts; the width of the shading in the circumference at different points of the compass being proportioned to the time during which winds from those points prevailed. In a few rare localities, and others where there are marked local disturbances, a map of the surrounding country is added, to show the cause of the disturbance.

SERIES C.

The following Tables show the mean direction[1] of the wind at each station, where observations have been taken for a complete year or more, and, in some few instances, for a shorter period. The stations are divided into five sections, and in each section they are arranged according to their latitudes, proceeding from north to south. The portions of the northern hemisphere embraced in each section are as follows, viz.:—

1st section. America, east of longitude 87°.
2d " The Atlantic Ocean and its Islands.
3d " Europe and Africa.
4th " Asia, and the Pacific Ocean.
5th " America, west of longitude 87°.

The fifth column shows the ratio of the *progressive* motion in the mean direction to the total distance travelled by the wind, being as the numbers in the column to 100.

SECTION I.

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
1	Igloolik	Melville Peninsula	N. 36° 18′ W.	42	1
2	Winter Island	near do.	N. 29 26 W.	42½	1
3	New Herrnhut	Greenland	N. 86 59 E.	32	1
4	Friederichthal, and at sea	Do. and Baffin's Bay	N. 21 39 E.?	45?	1⅓
5	Nos. 3 and 4 combined		N. 62 40 E.	19	2⅓
6	Nain	Labrador	N. 25 55 W.?	50	1/12
7	Michipicoton	Lake Superior	S. 18 57 W.	17½	1
8	St. John's (1840)	Newfoundland	S. 62 6 W.		1
9	Do. (1841)	Do.	S. 78 26 W.		1
10	Do. (1842)	Do.	S. 82 38 W.		1
11	Do. (1843)	Do.	S. 74 27 W.		1
12	No. 8 to No. 11, inclusive	Do.	S. 78 4 W.	18	4
13	Fort Kent	Maine	N. 62 45 W.	33	1
14	Fort Fairfield	Do.	S. 65 52 W.	57	1
15	Quebec	Lower Canada	S. 89 58 W.	31	7
16	Fort Brady (1823)	Michigan	S. 56 53 W.	16	1
17	Do. (1824)	Do.	S. 64 55 W.	24	1
18	Do. (1825)	Do.	S. 45 7 W.	21	1
19	Do. (1827)	Do.	N. 6 23 W.	12	1
20	Do. (1828)	Do.	S. 49 6 W.	5	1
21	Do. (1830)	Do.	N. 87 2 E.	5	1
22	No. 16 to No. 21, inclusive	Do.	S. 63 23 W.	9	6
23	Houlton (1829)	Maine	N. 13 30 E.	10	1
24	Do. (1830)	Do.	N. 23 15 E.	18	1

[1] In this table no allowance is made for the relative *force* of the different winds, the only element taken into account being their *duration* or *time of blowing*.

SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
25	Nos. 23 and 24 combined	Maine	N. 19° 38′ E.	14	2
26	Mackinaw (1826)	Michigan	S. 80 31 W.	6	1
27	Montreal (1836)	Lower Canada	S. 88 32 W.	50	1
28	Do. (1837)	Do.	N. 88 13 W.	45	1
29	Do. (1838)	Do.	N. 87 50 W.	39	1
30	No. 27 to 29, inclusive	Do.	N. 89 10 W.	44	3
31	Total of 10 stations	Lat. 45° to Lat. 50°	S. 81 7 W.	16	17$\frac{5}{12}$
32	Windsor	Nova Scotia	N. 49 48 W.	28	1
33	Malone (1839)	New York State	S. 80 1 W.	19	1
34	Do. (1840)	Do.	S. 73 3 W.	23	1
35	Do. (1842)	Do.	S. 83 31 W.	66	1
36	No. 33 to No. 35, inclusive	Do.	S. 80 26 W.	34	3
37	Eastport (1822)	Maine	S. 82 22 W.	29	1
38	Do. (1823)	Do.	S. 84 10 W.	26	1
39	Do. (1824)	Do.	S. 88 40 W.	27	1
40	Do. (1825)	Do.	S. 88 12 W.	28	1
41	Do. (1826)	Do.	S. 58 13 W.	28	1
42	No. 37 to No. 41, inclusive	Do.	S. 80 12 W.	26	5
43	Ogdensburg	New York State	S. 58 34 W.	29½	1
44	Plattsburg (1841)	Do.	S. 85 57 W.	27	1
45	Do. (1847)	Do.	N. 84 56 W.	23½	1
46	Do. (1841, 42, 47)	Do.	S. 76 46 W.	24½	3
47	Hampden (1844)	Maine	S. 80 31 W.	30	1
48	Do. (1845)	Do.	S. 77 27 W.	33	1
49	Do. (1846)	Do.	S. 68 68 W.	39	1
50	No. 47 to No. 49, inclusive	Do.	S. 77 15 W.	33	3
51	Potsdam	New York State	S. 66 59 W.	36	11
52	No. 37 to No. 51, inclusive	Lat. 44½° to Lat. 44¾°	S. 71 0 W.	29	26
53	Gouverneur	New York State	S. 76 24 W.	61½	7
54	Bath . (1832)	Maine	S. 65 45 W.		1
55	Do. . (1833)	Do.	N. 87 30 W.		1
56	Do. . (1834)	Do.	S. 65 45 W.		1
57	Do. . (1835)	Do.	S. 78 7 W.		1
58	Do. . (1836)	Do.	S. 77 54 W.		1
59	Do. . (1837)	Do.	S. 86 57 W.		1
60	Do. . (1838)	Do.	S. 87 7 W.		1
61	Do. . (1839)	Do.	S. 86 57 W.		1
62	Do. . (1840)	Do.	S. 81 59 W.		1
63	Do. . (1841)	Do.	S. 88 47 W.		1
64	No. 54 to No. 63, inclusive	Do.	S. 82 0 W.	26	10
65	Sackett's Harbor (1842)	New York State	S. 87 35 W.	19½	1
66	Watertown	Do.	S. 70 33 W.	33	1?
67	Lowville	Do.	S. 89 31 W.	23½	8
68	No. 54 to No. 67, inclusive	Lat. 43¾° to Lat. 44°	S. 76 46 W.	22½	19
69	Ellisburg	New York State	S. 64 56 W.	28½	6
70	Hanover	New Hampshire	N. 81 34 W.	34	3
71	Portland (1827)	Maine	S. 52 9 W.	21	1
72	Do. (1828)	Do.	S. 17 15 W.	28	1
73	Do. (1829)	Do.	S. 44 8 W.	30	1
74	Do. (1830)	Do.	S. 77 30 W.	31	1
75	No. 71 to No. 74, inclusive	Do.	S. 42 33 W.	29	4
76	Toronto	Upper Canada	N. 10 23 W.	4	2
77	Saco (1844)	Maine	N. 89 47 W.	22	1
78	Do. (1845)	Do.	N. 38 54 W.	24	1
79	Do. (1846)	Do.	N. 84 35 W.	20	1
80	No. 77 to No. 79, inclusive	Do.	N. 69 50 W.	20	3
81	Nos. 75, 76, 80, 518 comb'd	Lat. 43½° to Lat. 43¾°	S. 77 30 W.	20½	18

SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
82	Mexico	New York State	S. 57° 24′ W.	28½	2
83	Gaines	Do.	N. 72 13 W.	32	4
84	Granville	Do.	S. 88 9 W.	24½	4
85	Salem	Do.	S. 62 22 W.	23	3
86	Youngstown (1829–30) .	Do.	S. 77 37 W.	21	2
87	No. 82 to No. 86, inclusive	Lat. 43¼° to Lat. 43½°	S. 79 50 W.	24	15
88	Whitesboro'	New York State	S. 89 33 W.	27½	5
89	Dover (1835) . .	New Hampshire	N. 72 10 W.	30	1
90	Do. (1836) . .	Do.	N. 62 2 W.	17	1
91	Do. (1837) . .	Do.	S. 89 14 W.	15	1
92	Do. (1838) . .	Do.	N. 65 14 W.	16	1
93	Do. (1839) . .	Do.	S. 54 3 W.	5	1
94	Do. (1842) . .	Do.	N. 77 31 W.	18	1
95	No. 89 to No. 94, inclusive	Do.	N. 75 18 W.	16½	6
96	Lewistown	New York State	S. 45 58 W.	39½	2
97	Millville	Do.	S. 70 44 W.	26	5
98	Rochester	Do.	N. 89 32 W.	38	7
99	Utica	Do.	S. 61 41 W.	33½	12
100	Palmyra	Do.	S. 69 7 W.	26	1
101	Fairfield	Do.	N. 55 51 W.	26½	11
102	Cambridge	Do.	S. 42 40 W.	30½	11
103	Portsmouth (1827) . .	New Hampshire	S. 81 12 W.	22	1
104	Do. (1828) . .	Do.	S. 67 24 W.	23	1
105	Do. (1829) . .	Do.	S. 70 39 W.	25	1
106	Do. (1830) . .	Do.	S. 85 2 W.	14	1
107	No. 103 to No. 106, inclusive	Do.	S. 74 50 W.	21	4
108	Syracuse	New York State	S. 73 55 W.	40	1
109	Johnstown	Do.	N. 89 18 W.	40½	10
110	Henrietta	Do.	S. 52 57 W.	36	3
111	No. 88 to No. 110, inclusive	Lat. 43° to Lat. 43¼°	S. 73 15 W.	29	70
112	Onandaga	New York State	S. 67 8 W.	38	9
113	Pompey	Do.	S. 66 48 W.	52	16
114	Fayetteville	Vermont	N. 85 18 W.	38	2
115	Port Huron (1831 to 1835)	Michigan	S. 66 5 W.	24	5
116	Bridgewater	New York State	S. 84 41 W.	32½	4
117	Cazenovia	Do.	S. 87 52 W.	50	9
118	Canajoharie	Do.	N. 84 14 W.	27	3
119	Buffalo	Do.	S. 59 57 W.	52	2
120	Canandaigua	Do.	S. 62 50 W.	54	10
121	Middlebury	Do.	S. 72 31 W.	56	12
122	Hamilton	Do.	S. 79 50 W.	47½	10
123	Cherry Valley	Do.	S. 73 53 W.	46	9
124	Schenectady	Do.	N. 73 42 W.	29	4
125	Lansingburgh	Do.	S. 79 52 W.	34	12
126	Cayuga	Do.	S. 52 40 W.	26	6
127	No. 112 to No. 126, inclusive	Lat. 42¾° to Lat. 43°	S. 75 10 W.	40½	113
128	Watervleit (1831) . .	New York State	S. 86 37 W.	40	1
129	Williamstown (1816) . .	Massachusetts	N. 88 44 W.		1
130	Do. (1817) . .	Do.	S. 82 33 W.		1
131	Do. (1818) . .	Do.	S. 84 25 W.		1
132	Do. (1819) . .	Do.	N. 74 55 W.		1
133	Do. (1820) . .	Do.	N. 82 49 W.		1
134	Do. (1821) . .	Do.	N. 70 1 W.		1
135	Do. (1822) . .	Do.	N. 77 3 W.		1
136	Do. (1823) . .	Do.	N. 83 30 W.		1
137	Do. (1824) . .	Do.	N. 77 57 W.		1
138	Do. (1825) . .	Do.	N. 75 30 W.		1
139	Do. (1826) . .	Do.	N. 83 49 W.		1

SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
140	Williamstown (1827)	Massachusetts	N. 77° 52′ W.		1
141	Do. (1828)	Do.	S. 76 0 W.		1
142	Do. (1829)	Do.	N. 83 20 W.		1
143	Do. (1830)	Do.	N. 69 0 W.		1
144	Do. (1831)	Do.	N. 81 22 W.		1
145	Do. (1832)	Do.	N. 73 39 W.		1
146	Do. (1833)	Do.	S. 80 2 W.		1
147	Do. (1834)	Do.	N. 83 12 W.		1
148	Do. (1835)	Do.	S. 85 55 W.		1
149	Do. (1836)	Do.	N. 89 2 W.		1
150	Do. (1837)	Do.	N. 78 59 W.		1
151	Do. (1838)	Do.	N. 77 47 W.		1
152	No. 129 to No. 151, inclusive	Do.	N. 81 43 W.	29	23
153	Ipswich	Do.	N. 66 55 W.	41	1
154	Albany	New York State	S. 63 5 W.	30	12
155	Hartwick	Do.	S. 59 20 W.	43	9
156	Homer	Do.	S. 68 41 W.	50	6
157	Auburn	Do.	S. 74 55 W.	30	11
158	Prattsburg	Do.	S. 76 46 W.	47½	1
159	Springville	Do.	S. 85 14 W.	44	4
160	No. 128 to No. 159, inclusive	Lat. 42½° to Lat. 42¾°	S. 81 15 W.	38	68
161	Oxford	New York State	S. 88 38 W.	45½	9
162	Ithaca	Do.	S. 62 27 W.	13	7
163	Fredonia	Do.	S. 64 42 W.	40½	9
164	Detroit (1839)	Michigan	N. 73 10 W.	27	1
165	Do. (1840)	Do.	S. 88 28 W.	35	1
166	Do. (1841)	Do.	S. 75 40 W.	18	1
167	No. 164 to No. 166, inclusive	Do.	S. 89 0 W.	25	3
168	Waltham	Massachusetts	N. 71 34 W.	39	1
169	Greenville	New York State	N. 34 16 W.	8	1
170	Kinderhook	Do.	N. 62 18 W.	14	9
171	Amherst (1837)	Massachusetts	N. 82 29 W.	36	1
172	Do. (1838)	Do.	N. 72 45 W.	30	1
173	Do. (1839)	Do.	N. 70 25 W.	32	1
174	Do. (1840)	Do.	N. 76 3 W.	26	1
175	Do (1841)	Do.	N. 61 55 W.	26	1
176	No. 171 to No. 175, inclusive	Do.	N. 73 13 W.	30	5
177	Cambridge	Do.	S. 88 28 W.?	22	$1\frac{1}{2}$
178	Boston	Do.	N. 88 20 W.	25	1⅓
179	Worcester (1840)	Do.	N. 77 41 W.	35	1
180	Do. (1841)	Do.	N. 63 10 W.	32	1
181	Do. (1842)	Do.	N. 87 5 W.	41	1
182	Do. (1843)	Do.	N. 71 47 W.	41	1
183	Do. (1844)	Do.	N. 74 17 W.	37½	1
184	Do. (1845)	Do.	N. 74 59 W.	43	1
185	Do. (1846)	Do.	N. 55 40 W.		1
186	No. 179 to No. 185, inclusive	Do.	N. 73 29 W.	38	7
187	Delhi	New York State	S. 58 59 W.	29½	2
188	Hudson	Do.	S. 79 28 W.	3	8
189	No. 161 to No. 188, inclusive	Lat. 42¼° to Lat. 42½°	N. 89 15 W.	24	63¼
190	Cuba	New York State	N. 86 41 W.	32	3
191	Mendon (1842)	Massachusetts	S. 74 35 W.		1
192	Do. (1843–44)	Do.	S. 82 49 W.	31	2
193	Do. (1845–46)	Do.	S. 86 3 W.		2
194	No. 191 to No. 193, inclusive	Do.	S. 82 31 W.	35½	5
195	Provincetown	Do. (Cape Cod)	N. 73 13 W.?	20½	$1\frac{7}{12}$
196	Redhook	New York State	S. 82 13 E.	10½	8
197	Salisbury (1844)	Connecticut	N. 30 27 E.	3	1

SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
198	Salisbury (1845) .	Connecticut	N. 60° 9′ E.	9	1
199	Nos. 197 and 198 combined	Do.	N. 53 7 E.	6	2
200	No. 190 to No. 199, inclusive	Lat. 42° to Lat. 42¼°	S. 85 42 W.	11	19 7/12
201	Kingston	New York State	N. 69 10 W.	19	9
202	Silver Lake . . .	Pennsylvania	N. 84 24 W.	56	1¾
203	Smithport	Do.	S. 75 6 W.	33	1
204	Friend's School, Providence	Rhode Island	N. 81 35 W.	32	2 7/12
205	Brown University, do.	Do.	N. 86 33 W.	43	4
206	No. 201 to No. 205, inclusive	Lat. 41¾° to Lat. 42°	N. 87 0 W.	35½	18⅓
207	Brockville . . .	Indiana	S. 60 5 W.	34	3
208	Poughkeepsie . . .	New York State	S. 12 20 E.	11½	8
209	Meadville	Pennsylvania	S. 27 2 E.	5	1
210	New Bedford . . .	Massachusetts	S. 81 0 W.	26	16
211	Middletown (1834 and 1843)	Connecticut	N. 60 26 W.	43	11/12
212	Do. (1835) .	Do.	N. 51 49 W.	30	1
213	Do. (1836) .	Do.	N. 46 10 W.	33	1
214	No. 211 to No. 213, inclusive	Do.	N. 54 10 W.	35	2 11/12
215	Montgomery . . .	New York State	N. 84 25 W.	32	10
216	Fort Adams . . .	Rhode Island	S. 31 3 W.	11	1
217	No. 207 to No. 216, inclusive	Lat. 41½° to Lat. 41¾°	S. 79 30 W.	17	41 11/12
218	Fort Wolcott (1822) .	Rhode Island	S. 71 21 W.	33	1
219	Do. (1823) .	Do.	N. 88 35 W.	27	1
220	Do. (1824) .	Do.	S. 89 12 W.	28	1
221	Do. (1825) .	Do.	S. 84 55 W.	28	1
222	Do. (1826) .	Do.	S. 77 7 W.	24	1
223	Do. (1827) .	Do.	N. 67 51 W.	32	1
224	Do. (1828) .	Do.	N. 79 40 W.	26	1
225	Do. (1829) .	Do.	S. 78 33 W.	33	1
226	Do. (1830) .	Do.	N. 72 46 W.	26	1
227	Newport (1831, 32, 33)	Do.	S. 74 54 W.	37	1
228	Do. (1838) .	Do.	N. 87 17 W.	42	1
229	No. 218 to No. 228, inclusive	Do.	S. 89 2 W.	30	11
230	Franklin	Pennsylvania	N. 60 4 W.	47	1
231	New London (1827) .	Connecticut	S. 65 41 W.	18	1
232	Do. (1828) .	Do.	S. 36 44 W.	23	1
233	Nos. 231 and 232 combined	Do.	S. 49 55 W.	18	2
234	West Point (1827 to 1830)	New York State	N. 85 9 W.	18	4
235	Goshen	Do.	S. 60 33 W.	44	4
236	North Salem . . .	Do.	N. 62 47 W.	23	7
237	New Haven . . .	Connecticut	N. 65 7 W.	24½	4
238	Nantucket . . .	Massachusetts	N. 77 0 W.	23	4⅓
239	Hudson[1]	Ohio	S. 88 33 W.[1]	53?	7
240	No. 218 to No. 239, inclusive	Lat. 41¼° to Lat. 41½°	N. 86 30 W.	26	44⅓
241	Forty-nine different stations	New Eng., S. of Lat. 45°	N. 87 37 W.	26	78⅚
242	Mount Pleasant . .	New York State	N. 83 18 W.	20½	7
243	Newburgh . . .	Do.	S. 61 9 W.	23½	8
244	Easthampton . . .	Long Island, do.	S. 74 47 W.	9½	11
245	No. 241 to No. 244, inclusive	Lat. 41° to Lat. 41¼°	S. 76 45 W.	17½	26
246	Stroudsburg . . .	Pennsylvania	N. 75 35 W.?	31	⅚
247	Butler (1840) .	Do.	S. 55 47 W.		5/12
248	Do. (1841) .	Do.	S. 62 39 W.	26	1
249	Do. (1844–45) .	Do.	S. 52 58 W.	37	1
250	No. 247 to No. 249, inclusive	Do.	S. 56 59 W.	32	2 5/12
251	Oysterbay . . .	Long Island, N. Y.	S. 83 27 W.	15	2
252	Bloomingdale . . .	New York State	N. 58 52 W.	15	1
253	Newark	New Jersey	N. 66 53 W.	24	2
254	No. 246 to No. 253, inclusive	Lat. 40¾° to Lat. 41°	N. 87 54 W.	22	8¼
255	Deaf and Dumb Institute .	New York City	N. 58 58 W.	28	3

[1] Upper current.

SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
256	New York City (Fisher) .	New York City	S. 66° 56′ W.	21	10
257	Fort Columbus (1822 to '30)	Do.	S. 86 3 W.	19	9
258	Northumberland . .	Pennsylvania	N. 53 32 W.	10	$1\frac{5}{6}$
259	Easton (1848) . . .	Do.	N. 64 18 W.	17	1
260	Jamaica	Long Island, N. Y.	N. 70 32 W.	24	12
261	Flatbush	Do.	N. 75 57 W.	29	12
262	Mifflintown . . .	Pennsylvania	N. 57 50 W.	$31\frac{1}{2}$	$1\frac{3}{4}$
263	Pittsburg	Do.	N. 87 30 W.	23	1
264	Ebensburg . . .	Do.	S. 81 21 W.	47	1
265	Huntingdon . . .	Do.	West	41	1
266	No. 255 to No. 265, inclusive	Lat. $40\frac{1}{2}$° to Lat. $40\frac{3}{4}$°	N. 83 45 W.	27	$53\frac{7}{12}$
267	11 stations (1826) .	New York State	S. 68 38 W.	30	11
268	23 do. (1827) .	Do.	S. 86 15 W.	$31\frac{1}{2}$	23
269	29 do. (1828) .	Do.	S. 62 44 W.	35	29
270	28 do. (1829) .	Do.	S. 76 29 W.	35	28
271	34 do. (1830) .	Do.	S. 79 43 W.	27	34
272	34 do. (1831) .	Do.	S. 76 42 W.	$35\frac{1}{2}$	34
273	36 do. (1832) .	Do.	S. 69 33 W.	29	36
274	35 do. (1833) .	Do.	S. 74 50 W.	29	35
275	36 do. (1834) .	Do.	S. 80 12 W.	28	36
276	45 do. (1835) .	Do.	S. 72 53 W.	$33\frac{1}{2}$	45
277	39 do. (1836) .	Do.	S. 76 55 W.	$22\frac{1}{2}$	39
278	35 do. (1837) .	Do.	S. 85 2 W.	29	35
279	33 do. (1838) .	Do.	S. 85 56 W.	33	33
280	38 do. (1839) .	Do.	S. 85 16 W.	29	38
281	37 do. (1840) .	Do.	S. 80 7 W.	32	37
282	39 do. (1841) .	Do.	S. 88 0 W.	28	39
283	44 do. (1842) .	Do.	S. 79 29 W.	30	44
284	40 do. (1843) .	Do.	S. 87 34 W.	34	40
285	37 do. (1844) .	Do.	S. 82 16 W.	29	37
286	35 do. (1845) .	Do.	S. 81 21 W.	37	35
287	34 do. (1846) .	Do.	S. 83 43 W.	26	34
288	27 do. (1847) .	Do.	S. 77 1 W.	27	27
288 *a*	25 do. (1848) .	Do.	S. 81 26 W.	30	25
288 *b*	23 do. (1849) .	Do.	N. 88 24 W.	20	23
289	No. 267 to No. 288 *b*, incl've	Do.	S. 79 49 W.	30	797
290	72 stations[1] . . .	Do.	S. 79 8 W.	$31\frac{1}{2}$	362
291	Middletown . . .	New Jersey	S. 86 35 W.	22	4
292	Steubenville (1833) .	Ohio	N. 85 2 W.		1
293	Do. (1834) .	Do.	N. 83 14 W.		1
294	Do. (1835) .	Do.	S. 89 49 W.		1
295	Do. (1836) .	Do.	N. 78 17 W.		1
296	Do. (1837) .	Do.	S. 85 43 W.		1
297	Do. (1838) .	Do.	N. 81 20 W.		1
298	Do. (1839) .	Do.	N. 81 18 W.		1
299	Do. (1840) .	Do.	N. 82 52 W.		1
300	Do. (1841) .	Do.	N. 72 30 W.		1
301	Do. (1842) .	Do.	N. 77 52 W.		1
302	Do. (1843) .	Do.	N. 73 50 W.		1
303	Do. (1844) .	Do.	N. 70 59 W.		1
304	Do. (1845) .	Do.	N. 83 50 W.		1
305	Do. (1846) .	Do.	N. 75 43 W.		1
306	No. 292 to No. 305, inclusive	Do.	N. 80 58 W.	55	1
307	Harrisburg . . .	Pennsylvania	N. 82 56 W.	28	14
308	Newtown	Do.	N. 63 31 W.	33	$1\frac{3}{4}$
309	No. 291 to No. 308, inclusive	Lat. $40\frac{1}{4}$° to Lat. $40\frac{1}{2}$°	N. 79 7 W.	34	$20\frac{3}{4}$
310	Carlisle (1840) .	Pennsylvania	S. 89 30 W.	19	1
311	Trenton	New Jersey	S. 75 52 W.	17	6

[1] These stations include all the preceding but two, and seventeen additional ones.

SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
312	Lancaster	Pennsylvania	N. 81° 55′ W.	19	2
313	Bedford	Do.	S. 86 57 W.	45	1
314	Somerset (1841)	Do.	S. 74 40 W.	36	1
315	Do. (1845–46) .	Do.	S. 72 32 W.	37	1 1/3
316	Nos. 314 and 315 combined	Do.	S. 73 27 W.	36 1/2	2 1/3
317	No. 310 to No. 316, inclusive	Lat. 40° to Lat. 40 1/4°	S. 81 50 W.	30	12 1/3
318	Girard College . . .	Philadelphia	N. 74 5 W.	21	5
319	Franklin Institute (1831) .	Do.	S. 79 48 W.	53	1
320	Do. (1832) .	Do.	S. 64 27 W.	46	1
321	Do. (1833) .	Do.	S. 72 25 W.	48	1
322	Do. (1839) .	Do.	S. 81 44 W.	39	1
323	Do. (1841) .	Do.	S. 88 54 W.	36	1
324	Do. (1842) .	Do.	S. 75 3 W.	45	1
325	No. 319 to No. 324, inclusive	Do.	S. 75 4 W.	45	6
326	Uniontown . . .	Pennsylvania	S. 74 43 W.	48	11/12
327	Fort Mifflin (1823) .	Do.	N. 50 1 W.	15	1
328	Do. (1824) .	Do.	S. 31 57 W.	36	1
329	Nos. 227 and 328 combined	Do.	S. 54 30 W.	18	2
330	Gettysburg . . .	Do.	S. 87 2 W.	27	1 5/6
331	No. 318 to No. 330, inclusive	Lat. 39 3/4° to Lat. 40°	S. 80 20 W.	30	15 3/4
332	40 different stations . .	Pennsylvania	N. 88 15 W.	32	48 11/12
333	Newcastle	Delaware	S. 52 25 W.	28	1
334	Maryland Academy . .	Baltimore	S. 67 54 W.	4	1
335	Fort McHeury . . .	Do.	N. 59 6 W.	15 1/2	5
335 1/2	No. 333 to No. 335, inclusive	Delaware and Maryland	S. 74 48 W.	13 1/2	7
336	Marietta	Ohio	S. 68 23 W.	41	1
337	No. 333 to No. 336, inclusive	Lat. 39 1/4° to Lat. 39 1/2°	S. 71 35 W.	20	8
338	Annapolis	Maryland	S. 47 20 W.	16	1
339	Washington (1823) .	District of Columbia	N. 79 2 W.		1
340	Do. (1824) .	Do.	N. 86 31 W.		1
341	Do. (1825) .	Do.	N. 81 58 W.		1
342	Do. (1826) .	Do.	N. 56 59 W.		1
343	Do. (1827) .	Do.	N. 64 7 W.		1
344	Do. (1828) .	Do.	S. 51 44 W.		1
345	Do. (1829) .	Do.	S. 65 16 W.		1
346	Do. (1830) .	Do.	S. 85 55 W.		1
347	No. 339 to No. 346, inclusive	Do.	N. 86 43 W.	17	9
348	Washington (1831,2,3,4,5)	Do.	N. 83 41 W.	24	2/3
349	Do. (1838,39,40,41,42)	Do.	N. 81 52 W.	15	4
350	No. 339 to No. 349, inclusive	Do.	N. 85 12 W.	17	13 2/3
350 1/2	Nos. 338 and 350, combined	Do.	S. 71 39 W.	13	14 2/3
351	Bellona Arsenal . .	Near Richmond, Va.	S. 61 7 W.	15 1/2	1
352	Old Point Comfort (1826) .	Virginia	S. 28 19 E.	13	1
353	Do. (1827) .	Do.	S. 14 40 E.	13	1
354	Do. (1828) .	Do.	N. 70 23 W.	5	1
355	Do. (1829) .	Do.	N. 73 35 W.	14	1
356	Do. (1830) .	Do.	N. 59 50 W.	11	1
357	No. 352 to No. 356, inclusive	Do.	S. 43 15 W.	3	5
358	14 different stations . .	Del., Md., and E. Vir.	N. 89 1 W.	13	25 1/3
359	Nashville (1839–40) .	Tennessee	S. 74 31 W.	39	2
360	Do. (1841) .	Do.	S. 64 13 W.	29	1
361	Do. (1842) .	Do.	S. 40 0 W.	37	1
362	Do. (1843) .	Do.	S. 53 49 W.	24	1
363	Do. (1844) .	Do.	S. 51 26 W.	25	1
364	No. 359 to No. 363, inclusive	Do.	S. 57 20 W.	30	5
365	Chapel Hill (1845) .	North Carolina	S. 66 21 W.	10	1
366	Do. (1846) .	Do.	N. 60 2 W.	3	1
367	Nos. 365 and 366 combined	Do.	S. 76 5 W.	6	2

SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
368	Beaufort	North Carolina	S. 57° 19′ W.	13	2
369	Camden	South Carolina	N. 83 32 W.	22	1
370	Abbeville	Do.	N. 70 5 W.	8	2
371	Summerville	Georgia	N. 55 38 W.	15	1
372	Athens (1841 to 1844)	Do.	N. 65 12 W.	15	4
373	Do. (1845)	Do.	N. 71 27 W.	35	1
374	Nos. 372 and 373, combined	Do.	N. 67 30 W.	19	5
375	Fort Johnston (1822)	North Carolina	N. 68 7 W.	19	1
376	Do. (1823)	Do.	S. 68 16 W.	16	1
377	Do. (1824)	Do.	N. 78 15 W.	10	1
378	Do. (1825)	Do.	N. 48 41 W.	25	1
379	Do. (1826)	Do.	S. 87 3 W.	13	1
380	No. 375 to No. 379, inclusive	Do.	N. 75 32 W.	15	5
380½	Nos. 374 and 380, combined	Do.	N. 71 3 W.	17	10
381	Augusta, Arsenal (1826)	Georgia	S. 26 2 W.	28	1
382	Do. (1827)	Do.	S. 8 8 W.	9	1
383	Do. (1828)	Do.	N. 84 40 W.	21	1
384	Do. (1829)	Do.	N. 83 49 W.	14	1
385	Do. (1830)	Do.	S. 39 44 W.	23	1
386	Augusta (1840)	Do.	N. 81 28 E.	8	1
387	Do. (1841)	Do.	S. 75 0 E.	12	1
388	Do. (1842)?	Do.	North	1	1
389	Do. (1843)	Do.	S. 28 29 W.	27	1
390	No. 381 to No. 385, inclusive	Do.	S. 52 40 W.	16	5
391	No. 386 to No. 389, inclusive	Do.	S. 15 2 E.	8	4
392	No. 381 to No. 389, inclusive	Do.	S. 38 41 W.	9	9
393	Fort Moultrie, Charleston				1
	Harbor (1822)	South Carolina	S. 37 7 E.	29	1
394	Do. (1823)	Do.	S. 75 35 E.	31	1
395	Do. (1824)	Do.	S. 53 26 E.	26	1
396	Charleston (1831, 2, 3)	Do.	S. 6 54 E.		2
397	Do. (1834)	Do.	S. 28 30 E.		1
398	Do. (1837)	Do.	S. 84 22 E.		1
399	Do. (1841)	Do.	S. 62 22 E.		1
400	Do. (1844)	Do.	S. 31 32 E.		1
401	No. 393 to No. 395, inclusive	Do.	S. 55 53 E.	28	3
402	No. 396 to No. 400, inclusive	Do.	S. 40 0 E.	6½	6
403	No. 393 to No. 400, inclusive	Do.	S. 50 33 E.	14	9
404	Tuskeegee	Alabama	S. 69 13 E.	22½	1⅓
405	Savannah	Georgia	S. 50 42 E.	7	3
406	Oglethorpe Barracks (1834)	Near Savannah	S. 51 48 E.	9	1
407	St. Augustine (1825)	Florida	N. 68 43 E.	38	1
408	Do. (1826)	Do.	N. 48 21 E.	29	1
409	Do. (1828)	Do.	S. 64 33 E.	37	1
410	Do. (1830)	Do.	S. 81 52 E.	30	1
411	Do. (1835)	Do.	N. 24 17 E.	11	1
412	No. 407 to No. 411, inclusive	Do.	N. 79 19 E.	25	5
413	Fort King (1833)	Do.	S. 12 13 W.	7	1
414	Do. (1834)	Do.	S. 0 7 E.	38	1
415	Do. (1835)	Do.	S. 31 17 W.	5	1
416	No. 413 to No. 415, inclusive	Do.	S. 4 50 W.	17	3
417	Tampa Bay (1825)	Do.	S. 27 0 E.	15	1
418	Do. (1826)	Do.	S. 19 50 W.	21	1
419	Do. (1827)	Do.	S. 47 33 W.	37	1
420	Do. (1828)	Do.	S. 36 52 W.	25	1
421	Do. (1830)	Do.	N. 50 49 E.	9	1
422	Do. (1835)	Do.	N. 12 18 E.	33	1
423	No. 417 to No. 422, inclusive	Do.	S. 36 50 W.	11	6

SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
423½	No. 407 to No. 422, inclusive	Florida	S. 38° 4′ E.	10	14
424	Cape Florida	Do.	S. 47 59 E.	20	1
425	Carysford Reef	Do.	N. 82 25 E.	32	1
426	Indian Key	Do.	S. 89 44 E.	47	1
427	Tortugas Islands	Do.	N. 65 29 E.	48	1
428	Key West	Do.	N. 78 6 E.	38	4
429	No. 424 to No. 428, inclusive	Do.	N. 80 8 E.	35	8
430	Matanzas	Cuba	N. 60 39 E.	65	4
431	Turk's Island	Bahamas	N. 64 46 E. (?)	65	$\frac{1}{12}$
432	Pouce	Porto Rico	N. 50 2 E. (?)	64	$\frac{1}{12}$
433	No. 430 to No. 432, inclusive	West Indies	N. 60 31 E.	65	$4\frac{1}{6}$
434	Barbadoes	Do.	N. 84 33 E. (?)	89	$\frac{3}{4}$
435	Do. (Upper Current)	Do.	S. 4 22 W. (?)	30	$\frac{1}{6}$
436	Chagres and Porto Cabello	South America	N. 64 13 E. (?)	69	$\frac{1}{3}$

SERIES C. SECTION II.—**Atlantic Ocean and its Islands.**

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	Time embraced.
1	Eyafiord (1812–13)	Iceland	N. 86° 38′ W.	22	1 year.
2	Do. (1813–14)	Do.	N. 86 29 W.	10	1 do.
3	Nos. 1 and 2 combined	Do.	N. 86 35 W.	16	2 years
4	Reikiavik	Do.	N. 63 25 E. (?)	20?	7 months.
5[1]	At sea, lat. 55° to 60°	Atlantic Ocean	S. 64 55 W. (?)	32?	139 days.
6[1]	Do. 50° to 55°	Do.	S. 52 41 W.	23	1202 days.
7[1]	Do. 45° to 50°	Do.	S. 74 19 W.	27	2829 do.
8[1]	Do. 40° to 45°, lon. 0° to 45° W.	Do.	S. 73 8 W.	27	1708 do.
9[1]	Do. Do. 45° to 75° W.	Do.	S. 85 8 W.	19	3757 do.
10[2]	Do. north of lat. 40°	Do.	N. 87 4 W.	30	$6\frac{5}{6}$ years.
11	No. 5 to No. 10, inclusive	Do.	S. 79 20 W.	25	$33\frac{1}{2}$ do.
12	Terceira and vicinity	Azores	S. 67 30 W.	26	2 months.[3]
13	Fayal and vicinity	Do.	S. 55 11 W.	20	2 Do.[3]
14	St. Michaels and vicinity	Do.	S. 64 41 W.	20	2 Do.[3]
15	Total of five stations and vicinity	Do.	S. 63 21 W.	21	7 Do.[3]
16[2]	At sea, between lat. 36° and 40°	Atlantic Ocean	N. 84 20 W. (?)	$11\frac{1}{2}$	6 Do.
17[1]	Do. lat. 35° to 40°, lon. 0° to 45° W.	Do.	S. 44 26 W.	15	2590 days.
18[1]	Do. Do. Do. 45° to 75° W.	Do.	S. 84 0 W.	$18\frac{1}{2}$	4790 do.
19[2]	Do. lat. 30° to 36°	Do.	S. 57 2 W. (?)	8	4 months.
20	Hamilton?	Bermuda Islands	S. 45 48 W.	20	$3\frac{1}{2}$ years.
21	Ireland Isle	Do.	S. 51 14 W. (?)	2	4 months.
22	Funchal (1826)	Madeira Islands	N. 29 53 E.		1 year.

[1] Computed from Maury's Charts, 1st edition. The corrections made in the 2d edition have all been applied in Series B, and the more important ones also in this Series and in Series D. The others are so small as hardly to affect the results officially, so that a re-computation seemed unnecessary.

[2] These results were computed, and the corresponding drawings made, before the reception of Lieutenant Maury's Wind and Current Charts, which afford far more satisfactory data, and it is thought best now to retain them, as they appear to be, for the most part, correct.

[3] Observations at sea, in the vicinity, are combined with those taken for two months at the island in order to complete the year.

SERIES C. SECTION II.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	Time embraced.
23	Funchal (1827)	Madeira Islands	N. 31° 51′ E.	42	1 year.
24	Do. (1828)	Do.	N. 9 49 E.		Do.
25	Nos. 22, 23, and 24, combined . .	Do.	N. 23 50 E.	45	3 years.
26	No. 25 combined with Teneriffe . .	Do. and Canary Is.	N. 25 52 E.	46	$3\frac{1}{12}$ years.
27[1]	At sea, lat. 30° to 35° lon. 5° to 45° W.	Atlantic Ocean	S. 44 27 E.	10	1748 days.
28[1]	Do. Do. 45° to 75° W.	Do.	S. 31 35 W.	11	2564 do.
29[1]	Do. lat. 25° to 30°, lon. 15° to 45° W.	Do.	N. 62 53 E.	26	1622 do.
30[1]	Do. Do. 45° to 80° W.	Do.	S. 79 4 E.	28	1906 do.
31[2]	Do. lat. 20° to 30°	Do.	S. 86 1 E.(?)	22	4 months.
32[1]	Do. lat. 20° to 25°, lon. 15° to 45° W.	Do.	N. 50 20 E.	58	1331 days.
33[1]	Do. Do. 45° to 80° W.	Do.	N. 79 23 E.	55	1573 do.
34[1]	Do. lat. 15° to 20°, lon. 15° to 45° W.	Do.	N. 49 1 E.	77½	1332 do.
35[1]	Do. Do. 45° to 80° W.	Do.	N. 68 43 E.	77	1193 do.
36[2]	Do. lat. 10° to 20°	Do.	N. 70 51 E.(?)	84	2 months.
37[1]	Do. lat. 10° to 15°, lon. 15° to 45° W.	Do.	N. 57 25 E.	66	1850 days.
38[1]	Do. Do. 45° to 75° W.	Do.	N. 59 55 E.	82	662 do.
39[1]	Do. lat. 5° to 10°, lon. 10° to 55° W.	Do.	N. 80 32 E.	34	3339 do.
40[1]	Do. Do. 30° to 55° W.	Do.	N. 66 8 E.	58	1250 do.
41[2]	Do. lat. 0° to 10°	Do.	N. 79 56 E.(?)	85	1 month.
42[1]	Do. lat. 0° to 5°, lon. 15° to 55° W.	Do.	S. 60 2 E.	55	3005 days.
43[1]	Do. Do. 30° to 55° W.	Do.	N. 87 55 E.	66	1057 do.

SERIES C.—SECTION III.

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
1	Hecla Cove and vicinity .	Spitzbergen	N. 81° 13′ E.(?)	13	$\frac{5}{12}$
2	Archangel . . .	Russia	S. 47 42 W.	9	18
3	Holmia?	Sweden	N. 84 48 W.	12	3
4	St. Petersburg (1818) .	Russia	S. 85 21 W.	19	1
5	Do. (1830) .	Do.	S. 18 16 W.	34	1
6	Do. (1831) .	Do.	S. 43 41 W.	16	1
7	Do. (1832) .	Do.	S. 20 0 W.	24	1
8	Do. (1835–6) .	Do.	S. 14 9 W.	19	1
9	Do. (1836–7) .	Do.	S. 2 21 W.	8	1
10	Do. (date unknown) .	Do.	N. 67 30 W.	10	20
11	No. 4 to No. 10, inclusive	Do.	S. 85 45 W.	9	26
12	Petropolis (St. Petersburg)?	Do.	S. 61 29 W.	11	1
13	Spydburg	Norway	S. 86 57 E.	10	2
14	Stockholm . . .	Sweden	N. 85 2 W.	10½	4
15	Dorpat	Russia	S. 33 45 W.	20	1
16	Skagen	Denmark	S. 46 36 W.	20	9
17	Elgin	Scotland	S. 44 47 W.	44	3
18	Banff Castle . . .	Do.	S. 2 47 W.	12	1
19	Castle Toward . . .	Do.	S. 25 10 W.	10	2

[1] Computed from Maury's Charts, 1st edition. The corrections made in the 2d edition have all been applied in Series B, and the more important ones also in this Series, and in Series D. The others are so small as hardly to affect the results appreciably, so that a re-computation seemed unnecessary.

[2] These results were computed, and the corresponding drawings made, before the reception of Lieutenant Maury's Wind and Current Charts, which afford far more satisfactory data, and it is thought best now to retain them, as they appear to be, for the most part, correct.

SERIES C. SECTION III.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
20	No. 17 to No. 19, inclusive	Scotland	S. 38° 0′ W.	21	6
21	Wyburg	Denmark	S. 75 45 W.	27	1
22	Kinfaun's Castle . .	Scotland	S. 59 9 W.	24	12
23	Cluny Manse . . .	Do.	S. 81 3 W.	25	4
24	Nos. 22 and 23 combined .	Do.	S. 70 6 W.	24	16
25	Calton Hill . . .	Do.	S. 80 10 W.	24	10
26	Inchkeith	Do.	S. 71 38 W.	21	10
27	Cronberg	Sweden	N. 17 48 W.	9	1
28	Kasan	Russia	S. 10 18 E.	22½	1
29	Moscow	Do.	N. 57 33 W.	7	5
30	Copenhagen . . .	Denmark	S. 59 0 W.	16	50
31	Bronxholm . . .	Scotland	West	27	10
32	Carlisle	England	S. 56 31 W.	30	1
33	Londonderry . . .	Ireland	N. 88 31 W.	30	1
34	Nos. 32 and 33 combined .	Great Britain	S. 74 0 W.	29	2
35	Soendmor	Sweden (?)	S. 59 17 W.	17	12
36	Christiansae . . .	Denmark	S. 65 44 W.	18	8
37	Apenrade	Do.	N. 64 21 W.	8	9
38	Nos. 36 and 37 combined .	Do.	S. 80 30 W.	12	17
39	Goersdoff	Do. (?)	S. 78 18 W.	12½	2
40	Total of Sweden[1] . .		S. 50 0 W.[1]	20	
41	Total of Denmark[1] . .		S. 62 0 W.[1]	18	
42	Keswick	England	S. 44 21 W.	26	5
43	Konigsburg . . .	East Prussia	S. 71 25 W.[2]		?
44	Wilna	Russia	S. 59 26 W.	24	1
45	Pillau	East Prussia	S. 63 35 W.	18	18
46	Braunsburg . . .	Do.	S. 60 42 W.	41	1
47	Dantzic	Do.	S. 68 7 W.	11	15
48	Hoffmansgave . . .	Do.	S. 32 14 W.	20	4
49	Kendal	England	S. 69 17 W.	46	6
50	New Malton . . .	Do.	S. 69 5 W.	17	4
51	Isle of Man . . .	Irish Sea	S. 68 47 W.	2	9
52	Cuxhaven . . .	Hanover	N. 87 39 W.	18	15(?)
53	Stone Light-house . .	Germany (?)	S. 54 55 W.[2]		?
54	Nos. 52 and 53 combined .	Do.	S. 73 20 W.(?)	18½(?)	(?)
55	Hamburg	Do.	S. 78 39 W.	25	30
56	Lancaster (1816) . .	England	S. 35 9 W.		1
57	Do. (1817–18) .	Do.	S. 58 32 W.		1
58	Do. (1819) . .	Do.	S. 27 48 W.		1
59	Do. (1820) . .	Do.	S. 47 6 W.		1
60	Do. (1821) . .	Do.	S. 34 7 W.		1
61	Do. (date unknown) .	Do.	S. 34 58 W.	31	6
62	No. 56 to No. 60, inclusive	Do.	S. 40 11 W.	30	5
63	No. 56 to No. 61, inclusive	Do.	S. 37 34 W.	30	11
64	Manchester (1801) . .	Do.	S. 71 22 W.	26	1
65	Do. (1819) . .	Do.	S. 30 46 W.		1
66	Do. (1820) . .	Do.	S. 38 52 W.		1
67	Do. (1821) . .	Do.	S. 55 56 W.		1
68	Do. (date unknown) . .	Do.	S. 42 3 W.		3
69	No. 64 to No. 68, inclusive	Do.	S. 49 54 W.	35	7
70	Liverpool	Do.	N. 89 2 W.	17½	7
71	Nos. 63, 69, and 70 combined	Do.	S. 77 15 W.	27½	21
72	Luneburg	Hanover	S. 82 14 W.	29	15
73	Franeker	Holland	S. 81 29 W.	27	13
74	Mansfield Woodhouse .	England	S. 84 26 W.	37	10
75	Derby	Do.	S. 83 11 W.	20	2
76	Southwick . . .	Do.	S. 77 29 W.	23	11

[1] Kaemptz. [2] Dove.

SERIES C. SECTION III.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
77	Alderly Rectory . .	England	S. 21° 31′ W.	31	1
78	No. 75 to No. 77, inclusive	Do.	S. 56 10 W.	21½	14
79	Berlin	East Prussia	S. 78 17 W.	29	25[1]
80	Posen	Poland	S. 9 21 E.(?)	25(?)	⅓
81	Amsterdam . . .	Holland	S. 63 23 W.	16	54
82	Utrecht	Do.	S. 80 39 W.	13	1
83	Thetford	England	S. 40 40 W.	9	1
84	Delphen	Do. (?)	S. 60 24 W.	8	1
85	Cheltenham . . .	Do.	S. 34 55 W.	19	1
86	Bushy Heath . . .	Do.	S. 78 19 W.	17	7
87	High Wycombe . .	Do.	N. 85 14 W.	22	1
88	No. 83 to No. 87, inclusive	Do.	S. 63 40 W.	13	11
89	Mailand	Belgium	N. 61 4 E.	8	?
90	Cork	Ireland	N. 85 9 W.[2]	?	?
91	Sagan	East Prussia	S. 35 59 W.	22	5
92	Breda (1838 at 8 o'cl'k A.M.)	Belgium	S. 68 57 W.	16	1
93	Do. (1838 " 1½ do. P.M.)	Do.	S. 81 44 W.	18	1
94	Do. (1839 " 8 do. A.M.)	Do.	S. 53 25 W.	19	1
95	Do. (1839 " 2 do. P.M.)	Do.	S. 70 39 W.	11	1
96	Do. (1840 " 8 do. A.M.)	Do.	S. 73 40 W.	19	1
97	Do. (1840 " 2 do. P.M.)	Do.	S. 92 58 W.	23	1
98	Do. (1841 " 8 do. A.M.)	Do.	S. 62 43 W.	30	1
99	Do. (1841 " 2 do. P.M.)	Do.	S. 78 35 W.	34	1
100	Do. (1842 " 8 do. A.M.)	Do.	S. 95 10 W.	14	1
101	Do. (1842 " 2 do. P.M.)	Do.	S. 96 9 W.	15	1
102	Do. (1843 " 8 do. A.M.)	Do.	S. 63 8 W.	23	1
103	Do. (1843 " 2 do. P.M.)	Do.	S. 75 46 W.	20	1
104	No. 92 to No. 103, inclusive	Do.	S. 76 4½ W.	20	6
105	Nos. 82, 89, and 104 comb'd	Holland and Belgium	S. 83 25 W.	8½	7[1]
106	Gottingen . . .	Germany	S. 35 31 W.	9½	1
107	Do. (date unknown) .	Do.	S. 36 49 W.	12	?
108	London (1806 to 1818) .	England	N. 89 2 W.	16	13
109	Do. (date unknown) .	Do.	N. 88 13 W.	18	12
110	Greenwich (1800 to 1808) .	Do.	S. 8 31 W.	5	9
111	Do. (1841) . .	Do.	S. 59 25 W.	42	1
112	Do. (1842) . .	Do.	S. 61 44 W.	25	1
113	Nos. 111 and 112 combined	Do.	S. 60 14 W.	34½	2
114	Bristol	Do.	S. 17 19 W.	11	2
115	No. 108 to No. 114, inclusive	Do.	S. 63 0 W.	19	38(?)
116	Dusseldorff . . .	West Prussia	N. 11 35 W.	3	1
117	Ghent	Belgium	S. 65 36 W.	22	3
118	Louvain	Do.	N. 67 43 W.	35½	1
119	Brussels (1772 to 1779) .	Do.	S. 64 22 W.	39	8
120	Do. (1833 to 1844) .	Do.	S. 33 20 W.	10	12
121	Nos. 119 and 120 combined	Do.	S. 58 12 W.	24	20
122	Alost	Do.	N. 81 11 W.	29½	2
123	Nos. 116, 117, 118, 121, and 122 combined . .	Do. and West Prussia	S. 86 30 W.	20½	27
124	Stunbington . . .	England (?)	N. 67 35 W.	43	1
125	Gosport (1816 to 1820) .	Do.	N. 82 29 W.	13	5
126	Do. (date unknown) .	Do.	N. 88 19 W.	14	3
127	Nos. 125 and 126 combined	Do.	N. 85 30 W.	13½	8?
128	Sidmouth	Do.	S. 81 35 W.	17	2
129	Devonport (1841) . .	Do.	S. 79 19 W.	25	1
130	Do. (1842) . .	Do.	S. 71 33 W.	8	1
131	Nos. 129 and 130 combined	Do.	S. 77 24 W.	17	2
132	Nos. 124, 127, 128, and 131 combined . . .	Do.	West	23	10[1]

[1] Kaemptz. [2] Dove.

SERIES C. SECTION III.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
133	Erfurth (1781, 2, 3, and 4)	Germany	S. 55° 10′ W.	17	4
134	Do. (date unknown) .	Do.	S. 86 48 W.	20	5
135	Nos. 133 and 134 combined	Do.	S. 72 30 W.	18	9
136	Hof	Do.	S. 54 41 W.	23½	1
137	Nos. 135 and 136 combined	Do.	S. 63 30 W.	20½	10
138	Helston	England	S. 82 15 W.	15	?
139	Penzance (1819 to 1822) .	Do.	S. 69 35 W.	18	4
139½	Do. (date unknown) .	Do.	S. 62 46 W.[1]		4
140	Nos. 138 and 139 combined	Do.	S. 76 0 W.	16	4[2]
141	Total of England . .	Do.	S. 66 0 W.[1]	20	
142	Schoenthal	Austria	S. 41 8 W.	29	1
143	Prague	Bohemia	S. 56 17 W.	37	2
144	Wurtzburg	Bavaria	N. 80 39 W.	26	5
145	Herbipolis (Wurtzburg?) .	Do.	S. 66 45 W.	25	5
146	Uffenheim	Do.	S. 81 18 W.	28	1
147	No. 144 to No. 146, inclusive	Do.	S. 82 30 W.	26	11
148	Cambray	France	S. 66 24 W.	8	2
149	La Chapelle . . .	Do.	S. 77 38 W.	16	1
150	Hafnia (Havre ?) . .	Do.	N. 88 0 W.	14	3
151	Rouen	Do.	S. 82 45 W.	22	4
152	Valognes	Do.	N. 77 31 W.	26	1
153	No. 150 to No. 152, inclusive	Do.	N. 86 30 W.	20½	8
154	Manheim (1781, 84, and 85)	Germany	N. 58 28 W.	4	3
155	Do. (date unknown) .	Do.	N. 64 46 W.	3½	10
156	Nos. 154 and 155 combined	Do.	N. 61 24 W.	4	13
157	Mergentheim . . .	Do.	S. 89 30 W.	11	1
158	Anspach	Do.	N. 89 59 W.?	12	1½
159	Gunzenhausen . . .	Do.	S. 53 53 W.	20	1
160	Carlsruhe	Do.	S. 73 19 W.	13	3
161	No. 156 to No. 160, inclusive	Do.	S. 77 0 W.	13	16
162	Ratisbon	Do.	N. 27 20 W.	15	4
163	Giengen	Do.	S. 81 8 W.	27½	1
164	Do. on the Brenz . .	Do.	S. 81 50 W.	28	1
165	Ingolstadt	Do.	S. 40 30 W.	24	1
166	St. Andex	Do.	N. 85 21 W.	39	5
167	Stuttgard	Do.	S. 35 27 E.	7	?
168	No. 162 to No. 167, inclusive	Do.	S. 82 0 W.	19	12[2]
169	Paris (1815 to 1826) . .	France	S. 66 20 W.	23	12
170	Do. (date unknown) .	Do.	S. 65 4 W.	21	15
171	Do. do.	Do.	S. 79 15 W.	12	27
172	Do. (1827 to 1845) .	Do.	S. 71 7 W.	19	19
173	Do. (1846) . .	Do.	S. 50 29 W.	18	1
174	Do. (1847) . .	Do.	S. 56 24 W.	13	1
175	Do. (1806 to 1847) .	Do.	S. 66 39 W.	20	42
176	Versailles	Do.	S. 70 47 W.	17	2
177	Nos. 175 and 176 combined	Do.	S. 68 33 W.	18½	44
178	Montmorenci . . .	Do.	N. 48 11 W.	14	15
179	Saint Lo	Do.	N. 57 39 W.	11	3
180	Nos. 178 and 179, combined	Do.	N. 52 20 W.	12½	18
181	Nancy	Do.	N. 79 38 W.	15	6
182	Metz	Do.	N. 83 19 W.	12½	1
183	Strassburg	Do.	S. 47 20 E.	13	20
184	No. 181 to No. 183, inclusive	Do.	S. 76 30 W.	6	27
185	Schoessl (?) . . .	Russia	N. 46 44 W.	30	2[2]
186	Lougan	Do.	S. 63 6 E.	17	2(?)
187	Schussenreid . . .	Germany (?)	S. 89 26 W.	44	1
188	Badenbach . . .	Do. (?)	N. 32 6 E.	3½	1
189	Burglengenfield . . .	Do. (?)	S. 58 53 W.	2	1

[1] Dove. [2] Kaemptz.

SERIES C. SECTION III.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
190	Munich	Germany	S. 59° 24′ W.	31	7
191	No. 187 to No. 190, inclusive	Do. (?)	S. 78 0 W.	18½	10
192	Vienna	Austria	N. 68 14 W.	20	1
193	Denainvilliers . . .	France	S. 30 27 W.	14	31
194	Monachium (?) . . .	Russia (?)	S. 66 45 W.	27	1
195	Tutlingen	Germany	N. 72 21 W.	35	1
196	Peissenberg . . .	Do.	S. 80 19 W.	15	4
197	Tegern See . . .	Do.	N. 33 29 W.	6	4
198	Regensburg . . .	Switzerland	N. 30 53 W.	16	7
199	Issny	Germany	S. 2 30 W.	39	1
200	No. 195 to No. 199, inclusive	Lat. 47¾° to Lat. 48°	S. 79 0 W.	12½	17
201	Buda	Austria	N. 65 47 W.	31	4
202	Divio (?)	Do. (?)	S. 81 37 W.	15	2
203	Graetz	Do.	S. 75 58 E.[1]	?	1
204	19 stations . . .	Southern Germany	S. 82 4 W.	20	19[2]
205	Total of Germany . .		S. 76 0 W.[2]	18	?
206	Do. of Russia and Hungary		N. 87 0 W.[2]	17	?
207	Do. of France and Netherl'ds		S. 88 0 W.[2]	13	?
208	Mount St. Gothard . .	Switzerland	N. 82 56 W.	26	4
209	Dijon	France	S. 55 20 W.	10	4
210	Syam	Do.	S. 87 27 W.	22	2
211	Nos. 209 and 210 combined	Do.	S. 78 0 W.	15½	
212	Bordeaux	Do.	N. 63 21 W.	18	2
213	Padua	Italy	N. 4 53 W.	24	4
214	Kerk	Russia (?)	N. 84 50 W.	20	2
215	Parma	Italy	N. 23 31 W.	19	2
216	St. Zeno	Do. (?)	S. 77 4 E.	34	1
217	Bologna	Do.	N. 87 13 W.	34	1
218	No. 215 to No. 217, inclusive	Do.	N. 36 0 W.	5	4
219	Rodez	France	S. 88 51 W.	24	3
220	Orange	Do.	S. 15 45 W.	33	14
221	St. Hyppolite . . .	Do.	N. 5 15 E.	33	13
222	Montpelier . . .	Do.	N. 9 8 E.	31	37(?)
223	No. 219 to No. 222, inclusive	Do.	N. 38 20 W.	10	64(?)
224	Toulouse (1747 to 1756) .	Do.	N. 64 32 W.	26	10
225	Do. (1839 to 1846) .	Do.	N. 84 1 W.	37	8
226	Do. (1847) . .	Do.	S. 83 19 W.	21	1
227	No. 224 to No. 226, inclusive	Do.	N. 81 11 W.	27	19
228	Massilia (Marseilles?) .	Do. (?)	S. 3 39 E.	8	33
229	Marseilles	Do.	N. 67 20 W.	36	21
230	Nos. 181 and 182 combined	Do.	N. 79 48 W.	34	24
231	Cantabria	Spain (?)	S. 87 52 W.	31	1
232	Rome	Italy	N. 52 17 W.	14	3
233	Constantinople . . .	Turkey	N. 47 19 E.	27	1 7/12
234	Oporto	Portugal	S. 84 35 W.?	34	1/6
235	Naples	Italy	N. 83 28 W.	11	1
236	Mafra	Portugal (??)	N. 3 0 E.	84	4
237	Gibraltar and vicinity .	Spain	N. 38 18 E.	23	11/12
238	Tripoli	Barbary	N. 50 3 E. ?	24½	5/12
239	Liberia and Sierra Leone .	Western Africa	S. 44 44 W.?	65	½

[1] Dove. [2] Kaemptz.

SERIES C. SECTION IV.—**Eastern Europe, Asia, and the Pacific Ocean.**

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
1	Yacoutsk	Siberia	N. 45° 20′ W.	48	1
2	Bogoslowsk . . .	Do. (Ural Mountains)	N. 83 21 W.	20	1
3	Tobolsk	Do.	S. 67 00 W.[1]	?	10
4	Nijné Taguilsk . . .	Do.	S. 75 26 W.	37	2
5	Catharinenburg . .	Do.	S. 63 54 W.	32	2
6	Zlatouste	Do.	N. 59 23 W.	26	1
7	Barnoule	Siberia	S. 35 3 W.	19	1
8	Iluluk	Aleutian Islands	S. 54 15 W.	25	1¾
9	Nertchinsk . . .	Siberia	N. 72 56 W.	19	1
10	Teflis	Georgia	N. 17 30 W.?	21	⅔
11	Trebizonde . . .	Asia Minor	N. 37 40 E.	23	1
12	Erzeroom	Armenia	N. 5 33 W.	20	1
13	Pekin (1757 to 1762) .	China	S. 22 4 E.	32	6
14	Do. (1844) . . .	Do.	S. 74 22 W.	11½	1
15	Smyrna	Asia Minor	N. 85 58 E. ?	29	⅚
16	Tabreez	Persia	S. 62 43 W.?	6?	⅓
17	Ooroomiah . . .	Do.	S. 75 5 W.	40	1 7/12
18	Tehran	Do.	S. 77 34 W.?	42?	⅓
19	Mediterranean Sea . .	Eastern part	N. 24 39 E.	49	3
20	Beirut	Syria	S. 68 32 W.	53	⅔
21	Bahmdun	Do. (Mt. Lebanon)	S. 84 51 W.?	32	11/12
22	Bagdad	On the Euphrates	N. 84 49 W.	65	1
23	Jerusalem . . .	Palestine	N. 26 12 W.	62	1⅙
24	Bassora	Near m'th of Euphrates	N. 37 29 W.?	7	5/12
25	Sundry stations . . .	On the Ganges	N. 82 10 W.?	10	⅔
26	Calcutta	Hindoostan	S. 26 21 W.	13	8
27	Waioli	Sandwich Islands	North-east	60	1
28	Oahu	Do.	N. 51 57 E. ?	81	1/12
29	Duklum	Hindoostan	S. 89 7 W.	26	5

SERIES C. SECTION V.—**America, West of Longitude 87°.**

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
1	Melville Island . . .	Arctic Ocean	N. 20° 42′ W.	44	1
2	Port Bowen . . .	Near Barrow's Straits	N. 63 6 E.	27½	1
3	Victoria Harbor . .	Boothia Felix	N. 17 30 W.	30	½
4	Sheriff's Harbor . .	Do.	N. 61 13 W.	23	1
5	Felix Harbor . . .	Do.	N. 26 2 W.	23	1
6	No. 3 to No. 5, inclusive .	Do.	N. 34 55 W.	24	2½
7	Fort Franklin . . .	Great Bear Lake	N. 70 30 E.	25	1⅔
8	Fort Enterprise . .	100 miles north of Great Slave Lake	N. 39 54 E.	14	1
9	Fort Reliance . . .	Great Slave Lake	N. 72 15 E.?	15½	⅝
10	Sitka	Russian America	S. 55 37 E.	24	1
11	Norway House (1841) .	On Nelson's River	N. 8 22 W.	5	1
12	Do. (1842) .	Do.	N. 84 39 W.	2	1
13	Do. (1843) .	Do.	N. 25 48 W.	18	1
14	Do. (1844) .	Do.	N. 39 21 W.	32	1
15	Do. (1845) .	Do.	N. 3 59 W.	8	1
16	Do. (1846) .	Do.	N. 79 50 W.	4	1
17	Do. (1847) .	Do.	S. 77 51 E.	7	1
18	No. 11 to No. 17, inclusive .	Do.	N. 27 26 W.	8	7

[1] Dove.

SERIES C. SECTION V.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
19	Fort Vancouver	Oregon	S. 15° 37′ E.	41	1
20	Fort Snelling (1822)	Iowa	N. 49 14 W.	22	1
21	Do. (1824)	Do.	S. 68 22 W.	31	1
22	Do. (1825)	Do.	S. 59 0 W.	22	1
23	Do. (1826)	Do.	S. 54 15 W.	58	1
24	Do. (1827)	Do.	S. 57 28 W.	42	1
25	Do. (1828)	Do.	S. 68 48 W.	41	1
26	Do. (1829)	Do.	S. 62 34 W.	45	1
27	Do. (1830)	Do.	S. 66 54 W.	43	1
28	No. 20 to No. 27, inclusive	Do.	S. 66 9 W.	36	8
29	Green Bay (1822)	Wisconsin	S. 55 4 W.	24	1
30	Do. (1823)	Do.	S. 57 8 W.	15	1
31	Do. (1824)	Do.	S. 59 59 W.	11	1
32	Do. (1825)	Do.	S. 71 15 W.	15	1
33	Do. (1826)	Do.	S. 70 43 W.	29	1
34	Do. (1827)	Do.	S. 85 27 W.	29	1
35	Do. (1828)	Do.	S. 50 37 W.	2	1
36	Do. (1829)	Do.	S. 18 2 W.	16	1
37	Do. (1830)	Do.	S. 2 28 W.	18	1
38	No. 29 to No. 37, inclusive	Do.	S. 55 52 W.	15	9
39	Fort Winnebago (1831, 32, 35, and 36)	Do.	S. 57 6 W.	20½	4
40	Prairie du Chien (1822)	Do.	N. 82 26 W.	19	1
40½	Do. (1823)	Do.	N. 84 12 W.	13	1
41	Nos. 40 and 41, combined	Do.	N. 83 9 W.	16	2
42	Fort Atkinson (1841–42)	Iowa	N. 82 0 W.	37	2
43	Nos. 41 and 42, combined	Wisconsin and Iowa	N. 82 21 W.	22½	4
44	Fort Laramie	Missouri Territory	Westerly		
45	Sundry stations[1]	Oregon and California, north of lat. 38°	S. 49 36 W.	13	
46	Chicago (1833 to 1836)	Illinois	N. 56 31 W.	12	4
47	Council Bluffs (1822)	On the Missouri River	N. 61 23 W.		1
48	Do. (1823)	Do.	S. 6 55 W.		1
49	Do. (1824)	Do.	S. 25 49 E.		1
50	Do. (1825)	Do.	S. 8 11 W.		1
51	Do. (1826)	Do.	N. 80 54 W.		1
52	No. 47 to No. 51, inclusive	Do.	S. 17 35 W.	8	5
53	Nos. 46 and 52 combined	Do.	S. 85 21 W.	6	9
54	Rock Island (1827)	Near Stephenson, Ill.	S. 64 6 W.	13	1
55	Do. (1828)	Do.	S. 1 19 W.	20	1
56	Do. (1829)	Do.	S. 6 3 E.	7	1
57	Do. (1830)	Do.	S. 15 41 W.	14	1
58	No. 54 to No. 57, inclusive	Do.	S. 18 30 W.	12	4
59	Bloomington (1840)	Iowa	N. 42 17 W.	34	1
60	Do. (1843)	Do.	N. 78 19 W.	24	1
61	Do. (1844, 5, and 6)	Do.	S. 84 26 W.	25	3
62	No. 59 to No. 61, inclusive	Do.	N. 78 30 W.	24½	5
63	Nos. 58 and 62 combined	On the Mississippi	S. 59 24 W.	16	9
64	Sundry stations[1]	Platte River	S. 54 52 E.	2	
65	Fort Leavenworth (1831 to 1834)	Indian Territory	S. 16 55 W.	27	4
66	St. Louis (1827)	Missouri	S. 55 18 W.	29	1
67	Do. (1828)	Do.	S. 47 41 W.	13	1
68	Do. (1829)	Do.	S. 5 33 W.	6	1
69	Do. (1830)	Do.	S. 14 6 W.	22	1
70	No. 66 to No. 69, inclusive	Do.	S. 36 43 W.	12	4
71	Fort Wayne	Arkansas	S. 2 29 E.	16	2
72	Fort Gibson (1828)	Indian Territory	S. 54 18 E.		1

[1] Fremont's Exploring Tour.

SERIES C. SECTION V.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
73	Fort Gibson (1829) .	Indian Territory	S. 65° 51′ E.		1
74	Do. (1830) .	Do.	S. 62 26 E.		1
75	No. 72 to No. 74, inclusive .	Do.	S. 59 58 E.	47	3
76	Fort Smith . . .	Do.	S. 9 31 W.	15½	3
77	Little Rock (1840) .	Arkansas	S. 58 58 W.	4	1
78	Fort Towson (1833 to 1840)	On Red River, Ind. Ter.	S. 17 48 W.	29	8
79	Sundry stations . .	Calif'nia, S. of lat. 38°	S. 54 26 W.	30	
80	Vicksburg (1841) .	Mississippi	N. 56 26 E.	11	1
81	Do. (1840 and 42)	Do.	N. 59 8 E.	10½	2
82	Nos. 80 and 81 combined .	Do.	N. 58 28 E.	10½	4
83	Natchez (1825) .	Do.	S. 54 4 E.	16	1
84	Do. (1826) .	Do.	S. 21 51 E.	21	1
85	Do. (1827) .	Do.	S. 39 36 E.	22	1
86	Do. (1828) .	Do.	S. 49 20 E.	20	1
87	Do. (1829) .	Do.	S. 43 12 E.	23	1
88	Do. (1830) .	Do.	S. 0 58 W.	21	1
89	Do. (1831) .	Do.	S. 28 58 E.	14	1
90	Do. (1832) .	Do.	S. 61 48 E.	13	1
91	Do. (1833) .	Do.	S. 54 47 E.	11	1
92	Do. (1834) .	Do.	S. 33 42 E.	9	1
93	Do. (1835) .	Do.	S. 28 54 E.	9	1
94	Do. (1836) .	Do.	S. 17 0 E.	12	1
95	Do. (1837) .	Do.	S. 28 30 E.	3	1
96	Do. (1838) .	Do.	S. 20 20 E.	1	1
97	Do. (1839) .	Do.	S. 0 56 E.	11	1
98	Do. (1840) .	Do.	S. 22 1 E.	14	1
99	Do. (1841) .	Do.	S. 24 8 E.	20	1
100	No. 83 to No. 99, inclusive .	Do.	S. 31 2 E.	13	17
101	Nos. 82 and 100 combined .	Do.	S. 70 15 E.	8½	21
101½	Fort Jesup (1823) .	Louisiana	S. 0 33 E.	27	1
102	Do. (1824) .	Do.	S. 68 17 E.	25	1
103	Do. (1825) .	Do.	S. 86 40 E.	21	1
104	Do. (1826) .	Do.	N. 75 32 E.	17	1
105	Do. (1827) .	Do.	S. 84 45 E.	26	1
106	Do. (1828) .	Do.	S. 87 3 E.	15	1
107	Do. (1829) .	Do.	N. 63 20 W.	10	1
108	Do. (1830) .	Do.	N. 75 19 W.	16	1
109	No. 101 to No. 108, inclusive	Do.	S. 56 54 E.	10	8
110	Mobile	Alabama	S. 18 15 E.	17	1
110½	Do.	Do.	S. 23 32 E.	21	1
111	Nos. 110 and 110½ combined	Do.	S. 21 10 E.	19	2
112	Spring Hill College . .	Near Mobile, Ala.	N. 51 34 E.	3	1
113	No. 110 to No. 112, inclusive	Alabama	S. 24 11 E.	11	3
114	Baton Rouge (1822) .	Louisiana	S. 17 36 W.	6	1
115	Pensacola (1822) .	Florida	S. 9 31 E.		1
116	Do. (1823) .	Do.	S. 10 4 E.		1
117	Do. (1824) .	Do.	S. 55 18 W.		1
118	Do. (1826) .	Do.	S. 41 43 W.		1
119	Do. (1827) .	Do.	S. 25 38 W.		1
120	Do. (1828) .	Do.	S. 37 9 W.		1
121	Do. (1829) .	Do.	S 0 47 W.		1
122	No. 115 to No. 121, inclusive	Do.	S. 23 48 W.	19	7
123	Petite Coquille[1] (1827) .	Louisiana	S. 67 41 E.	24	1
124	Do. (1828) .	Do.	S. 49 57 E.	8	1
125	Do. (1829) .	Do.	N. 3 15 E.	20	1
126	Do. (1830) .	Do.	N. 40 48 E.	20	1
127	No. 123 to No. 126, inclusive	Do.	N. 64 37 E.	12	4
128	Fort Pike	Do.	N. 88 0 E.	14	4

[1] Same as Fort Pike.

SERIES C. SECTION V.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
129	Fort Wood . . .	Louisiana	S. 86° 3′ E.	5	3
130	New Orleans (1826) .	Do.	N. 53 30 E.	19	1
131	Do. (1836) .	Do.	N. 10 35 E.	7	1
132	Do. (1840) .	Do.	S. 34 47 E.	14	1
133	Do. (1841) .	Do.	S. 45 15 E.	4	1
133½	Do. (1842) .	Do.	S. 49 16 W.	13	1
134	No. 130 to No. 134, inclusive	Do.	S. 73 52 E.	4½	5
135	Nos. 114, 127, 128, 129, and 135 combined . .	Do.	S. 87 0 E.	6½	17
136	Fort Jackson . . .	Do.	S. 62 50 E.	29	1
137	Galveston	Texas	S. 58 54 E?	38	1/12
138	Yucatan	Mexico	North-east		
139	Mazatlan	Do. (west coast)	N. 37 8 W.??	28	1/6

SUPPLEMENT TO SERIES C.

The following, mostly for fractions of a year, were added after the foregoing tables were completed.

SECTION I.

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
437	Addison	Maine	S. 74° 1′ W. ?	19?	[1]
438	Machias	Do.	N. 87 48 W.??	13½??	[1]
439	Owl's Head . . .	Do.	N. 79 5 W. ?	34?	[1]
440	Steuben	Do.	S. 57 42 W. ?	17?	[1]
441	South Thomaston . .	Do.	S. 68 54 W. ?	13?	[1]
442	South-west Harbor . .	Do.	N. 76 46 W.??	7??	[1]
443	Vinal Haven . . .	Do.	S. 62 2 W. ?	17?	[1]
444	Charlestown . . .	New Hampshire	N. 36 12 W. ?	26?	[1]
445	Keene	Do.	N. 69 47 W. ?	43?	[1]
446	Peterboro' . . .	Do.	N. 63 12 W.??	47??	[1]
447	Bennington . . .	Vermont	N. 46 25 W. ?	49?	[1]
448	Grafton	Do.	N. 78 24 W. ?	31?	[1]
449	Cabotville	Massachusetts	N. 72 30 W.??	23??	[1]
450	Medfield	Do.	N. 82 27 W.??	41??	[1]
451	Northampton . . .	Do.	N. 70 58 W.?	37?	[1]
452	Framingham . . .	Do.	N. 80 6 W.?	42?	[1]
453	Dartmouth . . .	Do.	N. 73 3 W.?	10?	[1]
454	Newburyport . . .	Do.	N. 69 5 W.?	38?	[1]
455	Little Compton . . .	Rhode Island	S. 82 43 W.??	9??	[1]
456	Point Judith . . .	Do.	S. 66 28 W.??	41??	[1]
457	Leonardsville . . .	New York State	N. 84 40 W.??	26??	[1]
458	Lockport	Do.	S. 68 22 W.?	37?	[1]
459	Bethlehem . . .	Pennsylvania	S. 70 43 W.??	26??	[1]
460	Cochranville . . .	Do.	S. 86 12 W.??	22??	[1]
461	Coudersport . . .	Do.	S. 83 7 W.?	26?	[1]
462	Beaver	Do.	N. 63 27 W.?	44?	[1]
463	Bellefonte	Do.	N. 69 46 W.?	33?	[1]
464	Cannonsburg . . .	Do.	N. 71 55 W.?	41?	[1]
465	Erie	Do.	S. 81 42 W.??	33??	[1]
466	Germantown . . .	Do.	N. 49 37 W.??	47??	[1]
467	Greenhill	Do.	S. 79 53 W.??	54??	[1]
468	Indiana	Do.	S. 73 44 W.?	73?	[1]

[1] A fraction of a year.

SUPPLEMENT TO SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
469	Haverford	Pennsylvania	N. 53° 47′ W.?	37?	[1]
470	Lewistown	Do.	N. 77 49 W.?	37?	[1]
471	Norristown	Do.	N. 86 5 W.?	53?	[1]
472	Pottsville	Do.	N. 67 33 W.?	48?	[1]
473	Port Carbon	Do.	N. 55 14 W.?	29?	[1]
474	Reading	Do.	N. 58 5 W.?	51?	[1]
475	Rose Cottage	Do.	S. 79 6 W.??	28??	[1]
476	Warren	Do.	S. 55 20 W.?	43?	[1]
477	Wilkesbarre	Do.	N. 57 48 W.??	24??	[1]
478	West Chester	Do.	N. 71 57 W.?	32?	[1]
479	York	Do.	N. 55 21 W.??	45??	[1]
480	Cape May	New Jersey	N. 72 15 W.??	33??	[1]
481	Newark	Delaware	N. 75 52 W.?	39?	[1]
482	Isthmus	Maryland	N. 51 4 W.?	17?	[1]
483	Gosport	Virginia	S. 41 14 W.?	7?	[1]
484	West Brunswick . .	Do.	S. 85 15 W.?	34?	[1]
485	Whitemarsh Island . .	Georgia	S. 60 7 W.?	22?	[1]
486	Apalachicola	Florida	S. 16 52 W.??	11??	[1]
487	Arendale	Alabama	S. 73 51 W.??	21??	[1]
488	Greenville	Tennessee	S. 66 57 W.?	58?	[1]
489	Knoxville	Do.	S. 76 35 W.?	35?	[1]
490	Danville	Kentucky	S. 66 49 W.?	53?	[1]
491	Louisville	Do.	S. 65 46 W.??	33??	[1]
492	Paris	Do.	S. 70 40 W.??	58??	[1]
493	Springdale	Do.	S. 39 6 W.??	23??	[1]
494	Bardstown	Do.	S. 74 36 W.?	46?	[1]
495	Ashtabula	Ohio	N. 89 47 W.?	35?	[1]
496	Cambridge	Do.	S. 75 56 W.??	43??	[1]
497	Chillicothe	Do.	S. 77 59 W.?	37?	[1]
498	Cincinnati	Do.	N. 82 47 W.?	49?	[1]
499	Columbus	Do.	S. 89 3 W.?	39?	[1]
500	Dayton	Do.	N. 78 11 W.?	62?	[1]
501	Granville	Do.	S. 48 34 W.?	50?	[1]
502	Lancaster	Do.	S. 60 39 W.?	44?	[1]
503	Lebanon	Do.	S. 62 10 W.?	40?	[1]
504	New Athens	Do.	S. 86 14 W.?	34?	[1]
505	Ravenna	Do.	S. 60 13 W.??	44??	[1]
506	Sandusky	Do.	S. 58 6 W.?	33?	[1]
507	Zanesville	Do.	S. 85 15 W.?	39?	[1]
508	Brookville	Indiana	N. 81 27 W.?	39?	[1]
509	Greencastle	Do.	S. 68 28 W.?	37?	[1]
510	Greensburg	Do.	S. 60 31 W.?	36?	[1]
511	Winnamac	Do.	S. 82 23 W.?	61?	[1]
512	Presq' Isle	Michigan	N. 66 29 W.?	42?	[1]
513	Ann Arbor	Do.	N. 87 8 W.??	33??	[1]
514	Somerville	New York	S. 61 37 W.	30	1
515	Amenia	Do.	N. 77 51 W.	15½	1
516	Newbury (1840 to 1849) .	Vermont	N. 83 50 W.	31	10
517	Do. (1823 to 1849) .	Do.	N. 62 9 W.	16	27
518	Biddeford	Maine	S. 78 32 W.	19	1
519	Houlton	Do.	S. 65 44 E.	9	14
520	Eastport	Do.	S. 58 46 W.	25	12
521	Portland	Do.	S. 66 14 W.	27	10
522	Portsmouth	New Hampshire	S. 42 4 W.	36½	14
523	Boston	Massachusetts	N. 74 36 W.	20	5
524	Fort Wolcott	Rhode Island	S. 53 11 W.	36½	14
525	New London	Connecticut	N. 85 26 W.	17	7
526	Litchfield	Do.	N. 81 32 W.	23½	3

[1] A fraction of a year.

SUPPLEMENT TO SERIES C. SECTION I.—*Continued.*

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
527	Sackett's Harbor . .	New York	S. 85° 12′ W.	43	2
528	Youngstown . . .	Do.	N. 82 42 W.	25	6
529	Watervliet . . .	Do.	S. 74 1 W.	28	11
530	West Point . . .	Do.	N. 84 23 W.	18	16
531	Fort Columbus . . .	Do.	S. 79 46 W.	11½	19
532	Fort Wood . . .	Do.	S. 60 27 W.	26	2
533	Rouse's Point . . .	Do.	S. 49 50 W.	16	1
534	Plattsburgh Barracks . .	Do.	S. 72 30 W.	19	2
535	Buffalo do. . .	Do.	S. 47 1 W.	32	2
536	Watertown . . .	Do.	S. 67 7 W.	31	4
537	Alleghany Arsenal . .	Pennsylvania	N. 80 48 W.	21	7
538	Carlisle Barracks . .	Do.	N. 83 1 W.	19	2
539	Fort McHenry . . .	Maryland	N. 68 29 W.	16	12
540	Annapolis . . .	Do.	S. 50 10 W.	6½	5
541	Washington . . .	District of Columbia	N. 77 32 W.	8½	12
542	Fort Washington . .	Maryland	S. 28 2 W.	44½	2
543	Old Point Comfort . .	Virginia	S. 76 14 E.	2	17
544	Fort Johnson . . .	North Carolina	S. 69 7 W.	9	10
545	Fort Moultrie . . .	South Carolina	S. 61 29 E.	13	10
546	Augusta Arsenal . .	Georgia	S. 52 24 W.	18	14
547	Oglethorpe Barracks . .	Do.	S. 11 42 W.	5	2
548	Nos. 46 and 534 combined .	New York	S. 74 38 W.	24	5
549	Nos. 119 and 535 combined	Do.	S. 55 1 W.	43	4
550	Nos. 263 and 537, combined	Pennsylvania	N. 84 20 W.	22	8
551	St. Augustine . . .	Florida	S. 89 9 E.	23	13
552	Tampa Bay . . .	Do.	S. 45 33 E.	7	12
553	Key West Barracks . .	Do.	N. 70 27 E.	54½	3
554	Fort King . . .	Do.	S. 14 42 W.	16	5
555	Cedar Keys . . .	Do.	S. 6 43 E.	6	1
556	Mackinac	Michigan	N. 65 45 W.	20	8
557	Fort Brady . . .	Wisconsin	N. 49 6 W.	4	18
558	Fort Gratiot . . .	Michigan	S. 79 39 W.	21	9
559	Detroit Barracks . .	Do.	S. 25 19 W.	17	3
560	Nos. 167 and 559 combined	Do.	S. 63 54 W.	18	6
561	Dearbornville . . .	Do.	S. 61 53 W.	47	1
562	Nos. 428 and 553 combined	Florida	N. 73 36 E.	46	7
563	Nos. 32 and 533 combined	Lat. 44° 57′ to 45°	N. 77 50 W.	17½	2
564	Easton	Pennsylvania	N. 85 19 W.	24½	3
565	Seneca Falls . . .	New York	S. 78 33 W.	40	1
566	Chillicothe . . .	Ohio	N. 58 18 W.	40	1
567	Burlington . . .	Vermont	S. 32 57 W.	11	1
568	Nos. 53 and 567 combined	Lat. 44¼ to 44½	S. 69 34 W.	31	8
369	Nightingale Hall[1] . .	South Carolina	S. 14 59 E.	1	1

[1] Not represented on the plates.

SUPPLEMENT TO SERIES C.—SECTION V.

No.	Name of Station.	Where situated.	Mean direction of Wind.	Rate of Progress.	No. of years embraced.
140	La Grange College . .	Alabama	S. 15° 4′ E.?	18?	[1]
141	Mount Vernon	Do.	N. 19 49 W.?	30?	[1]
142	Attakepas	Louisiana	S. 12 34 W.??	47??	[1]
143	Frank's Island . . .	Do.	N. 87 43 E.??	44??	[1]
144	Washington	Arkansas	S. 4 1 W.??	35??	[1]
145	Mount Atlas	Tennessee	S. 74 52 W.?	58?	[1]
146	New Concord	Kentucky	S. 43 42 W.??	46??	[1]
147	Rensalaer	Indiana	S. 49 18 W.??	29??	[1]
148	Shawneetown	Illinois	N. 54 25 W.??	38??	[1]
149	Juliet	Do.	S. 52 25 W.?	37?	[1]
150	Macomb	Do.	N. 82 47 W.??	30??	[1]
151	Upper Alton	Do.	N. 67 20 W.??	44??	[1]
151½	Athens	Do.	S. 61 49 W.	31	1
152	Jacksonville	Do.	S. 50 31 W.?	34?	[1]
153	Lac qui parle	Iowa	N. 2 59 W.??	22??	[1]
154	Turkey River	Do.	S. 41 14 W.??	54??	[1]
155	East Troy	Wisconsin	N. 54 30 W.??	68??	[1]
156	Prairie du Chien . . .	Do.	S. 77 53 W.	26	14
157	Fort Winnebago . . .	Do.	N. 56 6 W.	14½	10
158	Fort Snelling	Minnesota	S. 42 24 W.	24	20
159	Green Bay	Michigan	S. 44 0 W.	15	18
160	Rock Island	Illinois	S. 43 8 W.	12	8
161	St. Louis	Missouri	S. 55 0 W.	17	10
162	Little Rock	Arkansas	S. 48 56 W.	6	2
163	Fort Towson	Do.	S. 17 26 W.	24	10
164	Fort Leavenworth . .	Indian Territory	S. 18 56 W.	23½	11
165	Fort Gibson	Do.	S. 47 38 E.	3	15
166	Fort Jesup	Louisiana	N. 22 41 E.	5	20
167	Baton Rouge	Do.	S. 31 34 E.	12	7
168	New Orleans Barracks .	Do.	N. 9 23 W.	10	5
169	Eutaw (lower current) .	Alabama	N. 2 52 E.	3	1
170	Do. (upper current) .	Do.	S. 84 2 W.	35	1
171	Nos. 169 and 170 combined	Do.	S. 88 7 W.	17	1

[1] Fractions of a year.

The following series of maps exhibits to the eye the results contained in the preceding tabular series, and shows by means of the *straight* arrows the mean direction and rate of progress of the wind in the different regions of the northern hemisphere, as explained on page 9. The direction of the arrow shows the direction of the resultant, and its length the ratio of the progressive to the total motion of the wind, the unit being one inch. That is, if the wind were to blow constantly in one direction, so that the whole motion would be progressive, it would be represented by an arrow an inch in length.

An interrogation point affixed to an arrow denotes that it is doubtful, either in regard to *direction* or *length*, and a double one that it is exceedingly so. One affixed to a dot or number shows that the *locality* is doubtful. The chief source of uncertainty in the resultants represented by the arrows is the fewness of the observations from which they were deduced. The numbers on the maps correspond with those in the series, and will serve as references.

Plate VII. affords a general synopsis of the whole hemisphere. Every resultant that is at all reliable is represented upon it, either singly, or in combination with others in those sections of country where the stations are too numerous to allow each to be distinctly represented by separate arrows. And in combining different stations, care has been taken to select those having nearly the same latitude, since the investigations show that difference of latitude affects the resultants more than difference of longitude. As thus condensed, a single arrow, in some cases, represents observations for more than a century.

Plate VIII. contains the United States on a larger scale, sufficient to allow all the separate resultants to be exhibited, except in the Eastern and Middle States, where the stations are so numerous that the scale of the map is yet too small to allow them to be represented except in combination as before. This section is drawn upon a still larger scale on Plate IX. Plate X. contains Western Europe on an enlarged scale.

DEDUCTIONS AND REMARKS.

1. In the arctic regions of North America, lying within the polar circle, the mean direction of the wind is about N. N. W. and well defined. This is seen on Plate VII. The arrows, at six out of the seven stations (all except Port Bowen), are nearly parallel, and of a length indicating a progressive motion of about 40 per cent. of the entire distance travelled by the wind. This is a greater ratio than exists in any other part of the world, except within the limits of the trade winds. But it must be borne in mind that it is the *relative*, and not the *absolute* progressive motion, that is here considered. The latter may be, and probably is small; so small as to induce Parry and Barrow to believe that a *perfect calm* exists at the north pole.

2. Between the parallels of latitude 60° and 66° there appears to be a belt of easterly or north-easterly winds. The observations at Great Bear Lake, Great Slave Lake, and Fort Enterprise (Plate VII., Nos. 7, 8, and 9), in the interior of British America indicate this; as also those at the two stations in Greenland, and at Reikiavik in Iceland. At Sitka, in Russian America (No. 10), which is a little farther south, the mean direction is also easterly, and it is not improbable that the southern limit of this belt, instead of coinciding with a parallel of latitude, follows some such course as is represented by the dotted line on Plate VII. and others, viz. a less circle having its pole at about lat. 84° and lon. 105° west from Greenwich. Such a circle, drawn at a distance of 28° 20′ from its pole, passes north of all the stations in the eastern hemisphere except Spitzenbergen (see Plate I.), and it is remarkable that there too the mean direction of the wind is easterly, if we may rely on the observations taken by Parry during the few months that he spent there. The observations which have been taken at Alten, in Lapland, and at Hammerfest, in Norway, should show the same result, if the above limit is correctly assigned.

3. Passing south of this circle, we find a zone or belt of westerly winds, about 23½° in breadth, entirely encircling the globe, and having the pole of its southern as well as its northern limit near the point before mentioned, viz. in latitude 84° north, and longitude 105° west. This zone, which is exhibited in full on Plates I. and VII., and in detached portions on Plates VIII., IX., and X., embraces the southern portion of British America, all of the United States except the extreme southern part, nearly the whole of Europe, and most of the northern half of Asia, and at all the stations from which observations have been obtained, throughout this entire region, and the corresponding parts of the Atlantic and Pacific Oceans, the mean direction of the wind is westerly, with very few exceptions. This will appear from the following more particular statements.

4. Out of two hundred and fifty-one stations in North America, east of the Mississippi, and situated within this belt, all but six have the mean direction of the wind westerly. (See Plates VIII. and IX.) These six are Houlton in Maine, Salisbury in Connecticut, Redhook and Poughkeepsie in New York, Meadville in Pennsylvania, and La Grange College in Alabama, and it is noticeable that three of these places, viz. Salisbury, Redhook, and Poughkeepsie, are within thirty-five miles of each other, and in a region which Plate III. shows to be characterized by strong local disturbances, while La Grange College is located near the limit which divides the westerly from the equatorial winds, and, moreover, the mean direction of its winds was computed from only eight months' observations—a period too short to be relied on. So that the only undoubted and unexplained exceptions are Houlton and Meadville. Out of the 245 stations, at which the mean direction is westerly, at all but 14 it is from some point between N. W. and S. W., and at 210 of them it is within 35° of a due west point, as may be seen by the following statement:—

Within	5°	of due west,	39	stations; viz.	15	on the north side and	24	on the south side.
"	10	"	70	"	33	"	37	"
"	15	"	100	"	45	"	55	"
"	20	"	132	"	60	"	72	"
"	25	"	159	"	70	"	89	"
"	30	"	186	"	80	"	106	"
"	35	"	210	"	90	"	120	"
"	40	"	222	"	96	"	126	"
"	45	"	231	"	100	"	131	"

The 14 exceptions among the westerly directions are as follows:—

Within	50°	of due west,	5	stations; viz.	0	on the north side and	5	on the south side.
"	55	"	8	"	1	"	7	"
"	60	"	10	"	2	"	8	"
"	65	"	12	"	4	"	8	"
"	75	"	13	"	4	"	9	"
"	80	"	14	"	5	"	9	"

It is worthy of notice that, in all these exceptions,[1] the rate of progress is small, and, as a general fact, the farther the mean direction at any place deviates from the ordinary direction in the region where that place is situated, the less is the progressive motion; a fact that will be apparent by inspecting Plates VII. to X., and noticing the shortness of the irregular arrows. Thus, the average rate for all the 251 stations mentioned above is 30 per cent., while for the 14 exceptions among

[1] The winds at Toronto (one of these fourteen exceptions, and the greatest of them all) are very remarkable, and deserve special notice, as they were observed hourly, or bi-hourly, both by day and by night, for two years, with the utmost care, and with the most perfect instruments. And yet, the results are widely at variance with those which we find elsewhere in the same region, the mean direction being, as stated in the Table, N. 10° 23′ W., and the rate of progress only 6 per cent.; both indicating the existence of some powerful disturbing influence there. It is true that this result has reference only to time, but if we make the computation from the distance actually travelled, though it in some measure relieves the difficulty, it by no means removes it, as will be shown hereafter.

the westerly directions it averages but 18 per cent., and for the six where the direction is easterly it averages only 10 per cent., viz.:—

Houlton,	9 per cent.	Poughkeepsie,	11½ per cent.
Salisbury,	6 "	Meadville,	5 "
Redhook,	10½ "	La Grange College,	18 "

5. On the Atlantic Ocean, the mean direction of the wind, in the zone we are considering, is more southerly, but more uniform than in the United States. Of the 16 resultants (see Plate VII.), all are westerly, and the entire range between them is but 51° 14′, viz. from N. 84° 20′ W. to S. 44° 26′ W. The rate of progress is less than in the United States, being but 20 per cent. of the whole distance travelled by the wind.

6. Out of 142 stations lying in this zone in Europe, 117 have the mean direction from some point between N. W. and S. 30° W., and most of them are comprised within much narrower limits. (See Plates VII. and X.) Of the 25 exceptions, 13 still have the prevailing direction westerly, leaving but 12 out of 142 in which it is easterly, viz., Spydburg[1] in Norway, Posen in Poland, Mailand in Belgium, Stuttgard and Badenbach in Germany, Strasburg, St. Hyppolyte and Montpelier in France, Graetz in Austria, St. Zeno in Italy, Kasan on the Volga, in eastern Russia, and Lougan in southern Russia, north of the Black Sea. Several of these stations are not very far from the southern limit of westerly winds, and at some others the irregularity may, perhaps, be accounted for from geographical peculiarities. Thus, Posen is situated on the Wartha, where it runs almost due north, and the mean direction of its winds coincides very nearly with that of the stream. The same is true of Banff Castle (one of the twenty-five exceptions), situated on the Deveron in the north of Scotland. The effect of valleys in modifying the direction of the wind is strikingly exhibited at most of the stations on the Hudson and Mohawk Rivers in the State of New York. (Compare Plates III. and IX.)

7. There are but eight stations in Asia situated in the zone under consideration, and at all these the mean direction is westerly. (See Plate VII.)

8. In that part of the zone which crosses the Pacific Ocean, we have but one station, viz. Iluluk, one of the Aleutian Islands, and there, too, we find the mean direction westerly. (See Plate VII.) The testimony of navigators in the North Pacific[2] rather corroborates this result, and I have no doubt that the investigations of Lieutenant Maury will do the same.[3]

9. On the American continent, west of the Mississippi, there appears to be more diversity in the mean direction of the wind, yet here it is westerly at 16 stations out of 20, from which observations have been obtained. The most peculiar feature in this region is the line of southerly winds on the western borders of Arkansas and Missouri. It seems to form a kind of connecting link between the winds of this zone and the south-easterly ones that we find south of it, and, in some degree,

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[1] The locality of this station is very doubtful.

[2] Mitchell's Article in Journal of Science and Arts, vol. xix. p. 254.

[3] I am not without hope of obtaining Lieutenant Maury's results before these sheets go to press, and if so, they will be inserted on Plate VII.

to favor an idea that has been advanced, that there is a vast eddy extending from the western shore of the Gulf of Mexico to the eastern shore of the Atlantic—that the easterly trade-winds of the Atlantic Ocean, when they strike the American Continent, veer northwardly and then toward the north-east, and thus recross the Atlantic and follow down the coast of Portugal and Africa till they complete the circuit. Though, on the whole, the evidence is against this theory.

We wait with interest for the results of the investigations, now going on under the auspices of the Smithsonian Institution, in Oregon, California, and the territories west of the United States. When they shall be received, no doubt this article will require modification.

10. Near the limits which divide this zone from the polar winds on the north, and from the equatorial on the south (particularly the latter), the progressive motion is very small. The reader will notice the shortness of the arrows in South Carolina, Georgia, Alabama, Mississippi, and other places along the line, as compared with those farther north, on Plates VII. and VIII. The same thing is very noticeable on the Atlantic Ocean, and, in some degree, in Europe. The only material exception in the latter is Mafra, in Portugal, and it is exceedingly doubtful whether that place is properly located. And not only is the progressive motion small, but the direction is very uncertain. The different results obtained at Augusta and Savannah, in Georgia, in different years, could hardly be more diversified, and those of the upper and lower currents at Eutaw, Alabama (Nos. 169 and 170), are almost directly opposite each other. In Pekin, too, in China, which is near the line, the results obtained by the French missionaries in the last century, differ entirely from those of the recent Russian ones, as shown by the two arrows at that place on Plate VII.

11. The progressive motion is less in Europe than in America, as may readily be seen by comparing the length of the arrows.

12. There seems to be some approach to parallelism between the mean direction of the wind in any part of the belt, and the direction in which that part of the belt runs, so that the mean directions incline to make a constant angle with meridians drawn through the pole of the belt.[1] Thus, the winds are more southerly in the eastern part of the Atlantic than in the western part—more so in western Europe than in America or Asia. In eastern Siberia it is even north-westerly, if we may rely upon the results at Yacoutsk and Nertchinsk, and the prevailing testimony of navigators seems to be that the winds of the extreme North Pacific are also north-westerly, though the observations at Iluluk, south of Behring's Strait, do not indicate it.

The following table shows the latitudes at which the limits of this zone cross the different meridians, at intervals generally of 10°; the direction in which they run reckoned eastwardly, and the region of country, &c., where they cross.

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[1] This remark is thrown out rather as a conjecture, which future observations may or may not verify.

Longitude.	SOUTHERN LIMIT OF POLAR WINDS.		
	Latitude.	Direction.	Place of crossing.
80° W.	56° 20′	S. 84° 40′ W.	Hudson's Bay
70 W.	56 57	S. 82 45 W.	Labrador
60 W.	57 42	S. 81 2 W.	Off the coast of Labrador
50 W.	58 37	S. 79 36 W.	S. W. of Cape Farewell
40 W.	59 36	S. 78 29 W.	S. E. of do.
30 W.	60 40	S. 77 43 W.	Atlantic Ocean
20 W.	61 45	S. 77 19 W.	Do. (off S. coast of Iceland)
10 W.	62 46	S. 77 19 W.	Do.
0	63 46	S. 77 43 W.	Do.
10 E.	64 42	S. 78 29 W.	Coast of Norway
20 E.	65 31	S. 79 36 W.	Sweden
30 E.	66 14	S. 81 2 W.	Lapland
40 E.	66 47	S. 82 45 W.	Do.
50 E.	67 12	S. 84 40 W.	Arctic Ocean
60 E.	67 31	S. 86 44 W.	Do.
70 E.	67 39	S. 88 54 W.	Siberia
75 E.	67 40	West	Do.
80 E.	67 39	N. 88 54 W.	Do.
90 E.	67 31	N. 86 44 W.	Do.
100 E.	67 12	N. 84 40 W.	Do.
110 E.	66 47	N. 82 45 W.	Do.
120 E.	66 14	N. 81 2 W.	Do.
130 E.	65 31	N. 79 36 W.	Do.
140 E.	64 42	N. 78 29 W.	Do.
150 E.	63 46	N. 77 43 W.	Do.
160 E.	62 46	N. 77 19 W.	Do.
170 E.	61 45	N. 77 19 W.	Kamtschatka
180	60 40	N. 77 43 W.	Sea of do.
170 W.	59 36	N. 78 29 W.	Do.
160 W.	58 37	N. 79 36 W.	Bristol Bay (near Alaska)
150 W.	57 42	N. 81 2 W.	Off the coast of Rus. America
140 W.	56 57	N. 82 45 W.	Do.
130 W.	56 20	N. 84 40 W.	British America
120 W.	55 55	N. 86 44 W.	Do.
110 W.	55 41	N. 88 54 W.	Do.
105 W.	55 40	West	Do.
100 W.	55 41	S. 88 54 W.	Do. (near Lake Winnipeg)
90 W.	55 55	S. 86 44 W.	Western shore of Hudson's Bay

NORTHERN LIMIT OF EQUATORIAL WINDS.		
Latitude.	Direction.	Place of crossing.
32° 47′	S. 86° 47′ W.	South Carolina
33 20	S. 85 38 W.	Atlantic Ocean
34 1	S. 84 36 W.	Do.
34 53	S. 83 45 W.	Do.
35 49	S. 83 5 W.	Do.
36 51	S. 82 37 W.	Do. (near Azores)
37 54	S. 82 23 W.	Do.
38 55	S. 82 23 W.	Off coast of Portugal
39 57	S. 82 37 W.	Spain
40 55	S. 83 5 W.	Mediterranean Sea
41 47	S. 83 45 W.	Turkey
42 33	S. 84 36 W.	Black Sea
43 10	S. 85 38 W.	Do. (eastern part)
43 39	S. 86 47 W.	Caspian Sea
43 59	S. 88 2 W.	Independent Tartary
44 9	S. 89 20 W.	Do.
44 10	West	Do.
44 9	N. 89 20 W.	Chinese Tartary
43 59	N. 88 2 W.	Do.
43 39	N. 86 47 W.	Do.
43 10	N. 85 38 W.	Do.
42 33	N. 84 36 W.	China
41 47	N. 83 45 W.	Sea of Japan
40 55	N. 83 5 W.	Do.
39 57	N. 82 37 W.	Pacific Ocean
38 55	N. 82 23 W.	Do.
37 54	N. 82 23 W.	Do.
36 51	N. 82 37 W.	Do.
35 49	N. 83 5 W.	Do.
34 53	N. 83 45 W.	Do.
34 1	N. 84 36 W.	Do.
33 20	N. 85 38 W.	Do.
32 47	N. 86 47 W.	Do.
32 23	N. 88 2 W.	Do. (off coast of California)
32 11	N. 89 20 W.	California
32 10	West	New Mexico
32 11	S. 89 20 W.	Texas
32 23	S. 88 2 W.	Mississippi

13. Passing south of the zone we have last been considering, we find that, contiguous to it, the winds in the United States and upon the Atlantic Ocean, are, on the whole, easterly, yet quite irregular, and having a very small progressive motion. This is seen by the shortness of the arrows in Louisiana, Texas, Florida, and the southern parts of South Carolina, Georgia, Alabama, and Mississippi (Plate VIII.), and also at Nos. 27, 29, 30, and 31 on Plate VII. Nos. 25 and 236 are exceptions, and will be spoken of below.

14. Farther south, we fall in with the well known north-easterly trade-winds, all characterized by long arrows, showing a decided prevalence, yet more so between latitude 10° and 25° than nearer the equator.

15. In the eastern parts of the Atlantic Ocean, near the coasts of Africa, and upon the Mediterranean Sea, also in Barbary, the winds seem to incline toward the Great Desert. This is seen on Plate VII. at all the stations in Spain, Southern France, Italy, and on the Mediterranean as far east as Constantinople (No. 233); and Smyrna (No. 15); also at Tripoli (No. 238); at Liberia (No. 239); at the Madeira Islands (No. 25); and on the Atlantic at No. 42. At No. 39 the direction is not materially changed, but the progressive motion is very much reduced, indicating a counteracting force in the direction of the Desert. It is also well known that all along the coast of Guinea south and south-west winds prevail. It was remarked by Dr. Halley, that, "in the southern parts of Italy, a south-east wind blows more frequently than any other;" but our observations from Rome and Naples indicate nothing of the kind, but rather the contrary. Our observations from Tripoli (No. 238) may not be altogether trustworthy, as they embrace a period of only five months, but the time was a tolerably fair mean for the year, in regard to temperature, viz. from March to July inclusive, and the results harmonize very well with No. 19, which represents four years' observations. At Fezzan, 300 miles south of Tripoli, the winds are said to be northerly in winter and southerly in summer.

16. In South-western Asia, the winds are so irregular as to defy all attempts to reduce them to system, from any data now in my possession. The north-west winds at Jerusalem[1] (No. 23), and the westerly ones at Bagdad (No. 22), are nearly as uniform as the "trades," while at Constantinople[2] and Trebizonde (Nos. 233 and 11), the mean direction is north-easterly, at Teflis and Erzeroom (Nos. 10 and 12), nearly north, at Beirut and on Mount Lebanon (Nos. 20 and 21), also at Tabreez, Tehran, and Ooroomiah[3] (Nos. 16, 17, and 18), westerly; at Smyrna (No. 15), east; and at Bassora (No. 24), hardly in any direction. At Aleppo, it is said to be north-west, but I have no observations from that place. (See Appendix O.)

17. The three stations in Hindoostan all show a feeble prevalence of westerly or south-westerly winds, although situated in latitudes proper for the "trades," and although the tracks of storms in the adjacent seas are generally from south-east toward north-west.[4]

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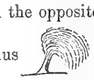
[1] In a letter to the author, from Rev. J. F. Lanneau, who long resided in Syria and Palestine, he remarks as follows, in relation to the north-west winds in the "hill country" of Judea: "So uniformly prevalent is the north-wester, that the olive-trees in the interior, situated so as to feel their constant influence, are inclined toward the south-east, and their branches checked in the opposite direction by its power, so that in some cases three-fourths or more of them are on that side, thus . This is very strikingly noticed immediately around Jerusalem."

[2] Rev. H. G. O. Dwight, to whom I am indebted for the observations on the winds at this place, makes the following remarks in relation to them: "There can be no doubt of the fact that the wind here, as a general thing, blows either from the north-east or from the south-west. A wind direct from either of the four cardinal points, never continues long in Constantinople. During the fifteen or sixteen years that I have been here, I have noticed that our prevailing wind in summer is north-east. Indeed, from July to October, it is so constantly and regularly from that quarter, as to be almost a monsoon."

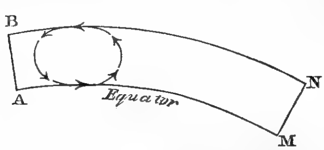
[3] See the remarks on the winds at this place in Series B.

[4] Piddington.

18. On the whole, do not the results in Series C authorize us to lay down the following, as a general description of the winds of the northern hemisphere? 1st. That from high northern latitudes the winds proceed in a southerly direction, but veer toward the west, as they approach a limit ranging from about latitude 56° on the western continent to about latitude 68° on the eastern, where they become irregular and disappear. The area of the zone occupied by these winds is about 11,800,000 square miles. 2d. That farther south there is a belt of westerly winds, less than 2000 miles in breadth, entirely encircling the earth; the westerly direction being clearly defined in the middle of the belt, but gradually disappearing as we approach the limits on either side. The area of this zone is estimated to be about 25,870,000 square miles. 3d. That south of the zone last named, the mean direction of the wind is easterly. This area is estimated to contain 60,760,000 square miles.[1]

Theoretical Considerations.

In looking for the causes of winds, there are two which are obvious; 1st, the diurnal revolution of the earth upon its axis, and 2d, the unequal distribution of heat over different parts of its surface; and we apprehend that these two, taken conjointly, are sufficient to account for all the leading observed phenomena. Dr. Halley, in a paper read before the Royal Society in 1686, undertook to explain the phenomena of the trade-winds, by taking into account only the latter cause; or at least introducing the former only so far as it affects the temperature of places near the equator at different hours of the day. His view (as explained by Professor Mitchell in his article already referred to) was, that the rarefaction of the air over the spot where the sun is vertical, and the continual motion of this spot westward by the diurnal motion of the earth, generated a series of vortices, moving westward below and eastward above, and that the lower parts constituted the trade-winds.



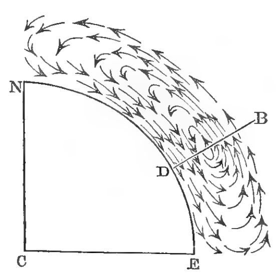
According to his views, the motion would be as in the accompanying figure, in which A M N B represents a section of the atmosphere resting on the equator A M, as seen from the north side, and the different arrows show the direction in which the air is supposed to move.

Others, on the contrary, have maintained that the mere rotation of the earth on its axis, combined with its annual revolution round the sun, is sufficient to account for the leading phenomena of winds, without any aid from heat. If at one and the same time the entire atmosphere were reduced to a perfect calm all over the surface of the earth, and if the temperature were everywhere the same, they have supposed that mere cosmical influences, such as we have named, would, in some unexplained way, create just such currents as

[1] Professor Dove, of Berlin, maintains that there are but two systems, viz. our 1st and 3d. See his Letter to Col. Sabine, published in the Report of the British Association for 1845.

now exist. To both these doctrines there are, however, insuperable objections,[1] and a correct theory can be obtained only by combining the two, for both must certainly operate, according to well-known physical laws, and unless neutralized cannot fail of producing their appropriate effects. It was by thus combining them that Hadley succeeded in satisfactorily accounting for the trade-winds, more than a century ago, and it remains to show that the same principles may be generalized so as to explain each of the three systems, which, according to our investigations, exist.

The rarefaction of the air near the equator, by heat, will cause it to rise, and give place to the colder, and, therefore, heavier air of the temperate and polar regions. The amount of this influence can be calculated, and it is found to be commensurate with the effects observed. If no other cause then existed, we should have a regular vortex, extending from the equator to the pole, as represented in the accompanying figure, in which E represents a point on the equator; N the north pole; C the centre of the earth; B D a line drawn through the centre of the vortex, and the several arrows the direction in which the air moves.



If the air were equally dense in all parts of the vortex, and its velocity the same, the centre of the vortex must be over that parallel of latitude which bisects the northern hemisphere, viz. the parallel of 30°. South of this parallel, the air must ascend, and north of it, it must descend. In point of fact, the centre must be a little farther north, since the descending currents are colder and more condensed than the ascending ones, and consequently must occupy less space, but the difference is not material. The result would be, a constant current along the surface of the earth from the poles toward the equator, while the air which ascended at the equator would flow back again toward the poles. As applied to the northern hemisphere, the lower current would be from north to south, and the upper from south to north.

But if we now take the rotation of the earth into account, it will modify these motions. As the heated air at the equator rises, and attempts to flow northerly toward the pole, it crosses successive parallels of latitude, whose easterly motion, by virtue of the earth's diurnal revolution, is continually diminishing. But the air, retaining the easterly motion which it had at the equator, and consequently moving more rapidly in that direction than the places over which it passes, has a *relative* motion, as from the west, which, combined with its northerly motion, carries it toward the north-east, and finally toward the east. On the same principles, the lower current must continually veer more and more toward the west, as it approaches the equator.

When we reflect that it is over 6,000 miles from the equator to the pole, while one-half of the entire atmosphere lies within seven miles of the surface of the

[1] See Appendix.

earth, we see that it must be quite impossible for the upper and lower currents to flow in opposite directions, one upon the other, for so great a distance, without intermingling. Each must communicate to the other its own motion by friction, and it will be only near the northern and southern extremities of the vortex, that they will be kept distinct, and each have its own proper motion. In other words, there must be a system of equatorial winds at the south, a system of polar ones at the north, and a system of blended ones between. Let us notice the necessary characteristics of each system separately.

The lower current of the equatorial system proceeding southerly, and at the same time veering toward the west, constitutes the trade-winds, and it is probable that at the limit where the upper current becomes blended with the lower, no inconsiderable part of it folds under itself, and returns toward the equator, thus contributing to augment the strength of the "trades." This limit we suppose to be that which defines the northern boundary of the equatorial winds on Plates I. and VII.

On the same principles, the cold surface wind of the arctic regions must commence to flow southerly—must veer toward the west like the trade-winds, and for the same reason—and finally become blended with the winds of the intermediate system; thus defining the southern limits of the polar winds.

In this intermediate system of blended winds, the mean direction must be the result of two opposite motions, the upper current tending to move eastward, and the lower westward. It is easy to see, however, that the former must prevail; for it has nothing to contend against but the friction of the latter, while the latter has not only this same friction, but also that of the earth's surface, both conspiring to destroy its motion westward. As a consequence, westerly winds must prevail in this zone, though with less uniformity than exists in the other two.[1]

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[1] I am aware that it may be urged as an objection to this view, that both the causes which are supposed to determine the lower current toward the south-west, "operate with greater energy between the parallels of 30° and 60°, than within the actual limits of the trade winds." (Mitchell.) But it should be noticed, 1st, that even if this were true, the causes which determine the upper current are increased in the same ratio, and it is on the *difference* of the two only, that the mean direction depends. And 2d, that the objection itself is not well founded, so far as one of the causes is concerned; for, according to our views, the zone of westerly winds lies wholly in the northern half of the vortex, where there could be no permanent ascending currents, as at the equator, to create trade winds.

It may be farther objected, that the theory here advocated requires an excess of northerly over southerly winds in the temperate regions, so as to dispose of the current coming down from high northern latitudes. We admit it, and are we sure that there is not? It is true that, *in respect to time*, the mean direction of the wind in those parts of the zone that have been most fully studied (viz. the United States, Western Europe, and the Atlantic Ocean), is from a point somewhat to the south of west. But are we sure that it is not compensated by north-westerly winds over Asia and the North Pacific? This is a question of fact, to be determined by observation. Thus far the indications are, that there is such a compensation, and we await with interest the results of Lieutenant Maury's investigations in that quarter of the globe to settle the question. Furthermore, are we sure that even in the parts of the zone first referred to, more air passes northward than southward? On this point Professor Dove, of Berlin, has the following remarks, in a letter to Colonel Sabine, published in the Report of the British Association for 1845: "But the air which passes over the parallel, coming from the equator, brings with it a higher temperature, which it gradually parts with as it flows over the surface of the earth, and which it cannot, therefore, bring back with it, Thus we find that theory harmonizes perfectly with fact, both as it respects the direction and the constancy of the winds *regarded as systems.* Let us now examine a few minor details.

1. The facts mentioned in our fifteenth deduction have long been known, and have been usually, and I suppose correctly, accounted for by ascribing them to the rarefaction of the air over the Great Desert. Some additional facts, confirmatory of this idea, will be mentioned as we proceed.

2. The winds at the stations in South-western Asia, having of themselves but a feeble tendency to flow in one direction rather than another, owing to their proximity to the dividing line between two systems of winds, appear to be controlled entirely by the strong local influences to which they are subject, and for which that region is remarkable. This may account for their irregularity, alluded to above in our sixteenth deduction.

3. May not the less progressive motion of the wind in Europe than in the United States (mentioned as our eleventh deduction), be accounted for by the higher temperature of the former? Just as a burning building increases the strength of the wind on the side from which it blows, and diminishes it on the opposite side.

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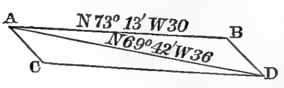
when it passes the same parallel on its return toward the equator. Now, colder air occupies less space than warm air, and therefore the current of air flowing from the pole to the equator is narrower than when it flows from the equator to the pole. If the beds in which these opposite currents flow are shifting ones, the same station will necessarily be oftener in a southerly than in a northerly current (in the northern hemisphere), and the proportion of southerly wind will in the course of a year exceed that of the northerly. Moreover, the southerly winds bring with them a quantity of vapor, with which they are continually parting in the form of rain and other precipitations; the returning northern dry winds do, indeed, bring back the same mass of *air*, but without its aeriform companion, which, having now assumed the form of a liquid, no longer contributes to raise the column of mercury in the barometer."

On considering the above-described alterations to which the atmosphere is subjected, on its passage from and return to the equator, we see that throughout the temperate zone the *mean direction* of the wind may be from the equator, converted by the rotation of the earth into a south-westerly direction in the northern, and a north-westerly in the southern hemisphere.

Professor Loomis seems to view the subject in a similar light. (See his articles on the Meteorology of Hudson, Ohio, published in the American Journal of Science and Arts.)

SERIES D.

This Series of Tables shows the mean direction of the wind, and the rates of its progress, for each month of the year, at the several places and sections of country mentioned, and hence the annual curve which it describes.[1] At a few places, there is added also the average number of days that the winds from the different points of compass prevail in each month; and, at a number of others, the direction and amount of the forces which deflect the wind from its mean annual direction. The method by which the latter were found was as follows: It was assumed that if there were no forces to deflect the winds, the mean direction and rate of progress would be the same for each month of the year, and equal to one-twelfth of the mean annual progress. If, therefore, according to the usual method of applying the "parallelogram of forces," we make the progress in any month the diagonal of a parallelogram, and one-twelfth of the mean annual progress one of the sides, either of the contiguous sides will represent the deflecting force, both in quantity and direction. Thus, for example, at Amherst, Massachusetts, the resultant for January is N. 69° 42′ W. 36, and for one-twelfth of the mean for the year, measured on the same scale, N. 73° 13′ W. 30. Draw A B in the direction N. 73° 13′ W. and make its length 30. Also draw A D in the direction N. 69° 42′ W. and make its length 36. Complete the parallelogram, and the side A C or B D will show the direction and amount of the deflecting force, viz. N. 52° 47′ W. 6.32. For the most part, the deflecting forces are merely approximations, determined, with tolerable accuracy, by construction upon a large scale, though in a few cases they were computed trigonometrically.



[1] In computing the annual curves, it became necessary to fix upon some general principle, upon which to compare and combine the observations taken at different places, and I adopted that of allowing equal weight to the observations of each month, without reference to the manner in which they were taken. There is no doubt that more reliance should be placed upon observations taken several times a day and recorded for sixteen or thirty-two points of the compass, than upon those taken less frequently and recorded less minutely, but it was difficult to decide how much.

SERIES D.

No. 1.—Melville Island, Arctic Ocean.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 7° 8′ W.	54
February	N. 16 5 W.	60½
March	N. 14 22 W.	70
April	N. 9 55 E.	47
May	N. 12 49 W.	43
June	N. 56 8 W.	20
July	N. 34 16 W.	21
August	N. 64 17 W.	28
September	N. 29 48 W.	58
October	N. 37 40 W.	60
November	N. 17 37 W.	75
December	N. 10 51 E.	22½
The year	N. 20 42 W.	44

No. 2.—Port Bowen, Arctic Ocean.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 72° 41′ E.	63
February	N. 70 11 E.	65
March	N. 66 13 E.	34
April	N. 78 11 E.	46½
May	N. 35 43 E.	24
June	S. 71 35 E.	24
July	S. 89 28 W.	41
August	N. 4 8 W.	54
September	S. 88 42 W.	18
October	N. 73 53 E.	43
November	S. 77 38 E.	24
December	N. 81 42 E.	50
The year	N. 63 6 E.	27½

No. 3.—Boothia Felix, Arctic Ocean.—3 stations.

2½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 47° 28′ W.	28
February	N. 45 21 W.	21
March	N. 50 16 W.	23
April	N. 36 41 W.	35
May	N. 28 48 W.	30
June	N. 71 56 W.	26
July	N. 11 33 E.	35
August	N. 21 11 W.	35
September	N. 32 18 W.	35
October	N. 54 1 W.	32
November	N. 1 43 E.	19½
December	N. 44 34 W.	17
The year	N. 34 55 W.	24

No. 4.—Igloolik, Arctic Ocean.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 19° 25′ W.	50
February	N. 32 3 W.	83
March	N. 46 1 W.	78
April	N. 43 5 W.	83
May	N. 83 32 W.	11
June	N. 33 28 W.	51
July	S. 77 6 E.	21½
August	N. 12 31 W.	33
September	N. 20 41 W.	8
October	N. 82 5 E.	19
November	N. 62 28 W.	47
December	N. 61 45 W.	40
The year	N. 36 18 W.	42

No. 5.—Winter Island, Arctic Ocean.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 25° 29′ W.	81
February	N. 34 59 W.	62
March	N. 43 0 W.	73
April	N. 27 9 W.	23½
May	N. 29 57 W.	56
June	N. 10 51 W.	11
July	N. 4 17 W.	23
August	S. 89 37 W.	41
September	S. 23 12 E.	3½
October	N. 10 9 E.	54
November	N. 13 20 W.	50½
December	N. 28 31 W.	57
The year	N. 29 26 W.	42½

No. 6.—Baffin's Bay (northern part).

3 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January		
February		
March		
April		
May		
June		
July	N. 6° 30′ E.	32
August	S. 72 16 E.	7½
September	S. 21 20 E.	11
October		
November		
December		

SERIES D.—*Continued.*

No. 7.—Arctic regions of North America.[1] 7 stations.

5¾ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 27° 32′ W.	45
February	N. 32 22 W.	44
March	N. 38 47 W.	47
April	N. 28 49 W.	41
May	N. 28 9 W.	33
June	N. 50 5 W.	25
July	N. 11 37 E.	13
August	N. 55 28 W.	24
September	N. 30 42 W.	16½
October	N. 28 20 W.	30
November	N. 20 16 W.	36
December	N. 27 29 W.	31

No. 8.—Arctic regions of North America.[2] 8 stations.

6¾ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 13° 32′ W.	37
February	N. 18 5 W.	37
March	N. 31 55 W.	39
April	N. 16 5 W.	33½
May	N. 21 7 W.	29
June	N. 45 14 W.	17
July	N. 10 43 W.	18
August	N. 44 48 W.	25
September	N. 37 2 W.	24
October	N. 14 27 W.	28½
November	N. 14 32 W.	34
December	N. 12 4 W.	29½

No. 9.—Fort Franklin, Great Bear Lake.

1¾ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 7° 11′ E.	34
February	N. 3 53 W.	32
March	N. 74 51 E.	32
April	S. 77 8 E.	51
May	S. 79 37 E.	55½
June		
July	S. 63 42 E.	46
August	S. 83 56 E.	41
September	N. 18 10 E.	30
October	N. 32 41 E.	10
November	N. 18 17 E.	23
December	N. 16 42 W.	27½
The year	N. 70 30 E.?	25?

No. 10.—Fort Enterprise.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 79° 1′ W.	23
February	N. 26 45 E.	30
March	N. 36 6 W.	8
April	N. 40 2 E.	36
May	S. 49 45 E.	46
June	Easterly	60
July	Westerly	6
August	Neutral	0
September	Neutral	0
October	Easterly	12
November	Easterly	18
December	Westerly	30
The year	N. 39 54 E.?	14

No. 11.—Fort Reliance, Great Slave Lake.

8 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 69° 48′ W.	18
February	N. 13 13 E.	10
March	N. 19 38 E.	9
April	N. 49 20 E.	25½
May	N. 76 51 E.	66
June		
July		
August		
September		
October	S. 64 28 E.	60
November	N. 66 23 E.	30
December	N. 65 21 E.	22

No. 12.—N. W. British America.[3]—3 stations.

3½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 25° 20′ W.	18
February	N. 6 32 E.	25
March	N. 62 8 E.	17
April	N. 77 0 E.	36½
May	S. 85 18 E.	56
June[4]	S. 71 40 E.	51
July	S. 63 42 E.	46
August	S. 83 56 E.	41
September	N. 18 10 E.	30
October	N. 74 8 E.	23
November	N. 36 57 E.	23
December	N. 30 6 E.	24

[1] Nos. 1, 3, 4, 5, and 6 combined. [2] No. 1 to No. 6, inclusive. [3] Nos. 9, 10, and 11 combined.

[4] No observations were reported for this month, and the resultant here recorded is merely estimated by taking the mean between May and July. (See data, pages 31 and 32.)

SERIES D.—*Continued.*

No. 13.—Eyafiord, Iceland.

2 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 61° 43′ W.	56
February	S. 89 37 W.	42
March	S. 68 2 W.	30
April	S. 77 55 W.	40½
May	N. 10 37 W.	27
June	N. 18 18 W.	36½
July	N. 23 55 E.	35
August	N. 47 53 E.	24½
September	S. 26 24 W.	22
October	S. 62 18 E.	22
November	S. 45 26 W.	19
December	S. 74 59 W.	44
The year	N. 86 35 W.	16

No. 14.—Reikiavik, Iceland.

7 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January		
February		
March		
April		
May	N. 59° 22′ E.	34
June	N. 45 53 E.	7
July	N. 55 34 E.	14
August	S. 22 53 E.	27
September	S. 87 5 E.	40
October	N. 22 53 E.	54
November	N. 34 36 E.	42½
December		

No. 15.—Iceland.[1]—2 stations.

2 YEARS AND 7 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 61° 43′ W.	56
February	S. 89 37 W.	42
March	S. 68 2 W.	30
April	S. 77 55 W.	40½
May	N. 15 20 E.	24
June	N. 13 34 W.	25
July	N. 28 58 E.	27
August	N. 80 19 E.	16
September	S. 26 12 E.	15
October	N. 63 57 E.	22
November	N. 19 31 W.	3
December	S. 74 59 W.	44

No. 16.—New Herrnhut, Greenland.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 71° 41′ E.	51
February	S. 63 27 E.	59
March	N. 81 53 E.	87
April	N. 51 14 E.	10
May	N. 57 15 E.	32
June	N. 47 40 W.	21
July	S. 42 12 W.	19
August	N. 61 29 W.	12
September	S. 83 37 W.	42
October	S. 15 9 E.	46
November	N. 88 2 E.	81
December	N. 64 56 E.	73½
The year	N. 86 59 E.	32

No. 17.—Friederichthal, Greenland.

7 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	North	84
February	N. 13° 41′ W.	53½
March	N. 19 50 E.	20
April	S. 12 5 E.	56
May		
June		
July		
August		
September		
October	North	100
November	N. 6 24 E.	63
December	S. 1 51 W.	88

No. 18.—Baffin's Bay (southern part.)

9 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January		
February		
March		
April		
May		
June	S. 48° 28′ W.	42
July	N. 43 53 W.	8
August	S. 88 17 W.	19
September	N. 59 52 W.	6
October		
November		
December		

[1] Nos. 13 and 14 combined.

SERIES D.—*Continued.*

No. 19.—Southern Greenland and vicinity.[1] 3 stations.

2½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 25° 50′ E.	56
February	N. 54 30 E.	24
March	N. 71 0 E.	48
April	S. 23 0 E.	25
May	N. 57 15 E.	32
June	S. 22 0 W.	14
July	N. 35 0 W.	9
August	N. 43 45 W.	2½
September	N. 78 40 E.	6½
October	N. 12 0 E.	29
November	N. 54 30 E.	55
December	S. 48 30 E.	42½
The year	N. 62 40 E.	19

No. 20.—Nain, Labrador.

11 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 28° 30′ W.	78
February	N. 36 21 W.	61
March	N. 0 51 W.	79
April	N. 26 46 W.	76½
May	N. 7 40 E.	48
June	N. 1 35 E.	44
July		
August	N. 67 21 W.	57
September	N. 17 28 E.	23
October	N. 53 9 W.	46
November	N. 53 19 W.	35
December	N. 59 22 W.	83
The year	N. 25 55 W.?	50?

No. 21.—Norway House, Hudson's Bay Territory.

7 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 69° 17′ W.	16
February	N. 5 27 W.	16
March	N. 1 19 E.	14
April	N. 29 7 E.	14
May	N. 57 37 E.	9
June	S. 12 43 E.	10
July	S. 86 7 W.	4
August	S. 88 9 W.	20
September	N. 67 29 W.	12
October	N. 10 16 W.	26
November	N. 8 50 E.	15
December	N. 65 1 W.	7
The year	N. 27 26 W.	8

No. 22.—Sitka, Russian America.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 88° 13′ E.	23
February	S. 36 36 E.	51
March	N. 64 45 E.	40
April	S. 78 56 E.	22
May	S. 6 18 W.	30
June	S. 56 42 W.	8
July	S. 75 50 W.	18
August	S. 34 8 E.	21
September	S. 59 9 E.	35
October	S. 60 2 E.	47
November	S. 72 48 E.	34
December	S. 53 5 E.	44
The year	S. 55 37 E.	24

No. 23.—St. Johns, New Foundland.

4 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Deflecting forces. Am't.
Jan.	N. 87° 52′ W.	33	N. 72 ° W.	15
Feb.	N. 47 55 W.	28	N. 1 W.	18
March	N. 41 12 W.	22	N. 15 E.	17
April	S. 59 0 W.	24	S. 7 E.	8
May	N. 84 22 E.	24	N. 82 E.	44
June	S. 47 56 W.	24	S. 22 E.	16
July	S. 43 23 W.	52	S. 24½ W.	36
Aug.	S. 43 57 W.	34	S. 10 W.	22
Sept.	S. 63 30 W.	27	S. 24½ W.	9
Oct.	S. 68 9 W.	14	S. 84 E.	8
Nov.	N. 17 1 W.	25	N. 25 E.	33
Dec.	S. 78 58 W.	27	S. 82 W.	6
The year	S. 78 4 W.	18		

No. 25.—Hampden, Maine.

3⅔ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Deflecting forces. Am't.
Jan.	N. 72° 3′ W.	42	N. 18 ° W.	22
Feb.	N. 75 51 W.	47	N. 34 W.	22
March	S. 82 24 W.	36	N. 60 W.	6
April	S. 85 41 W.	38	N. 59 W.	8
May	S. 37 3 W.	31	S. 40 E.	22
June	S. 54 9 W.	36	S. 6 E.	15
July	S. 34 3 W.	42	S. 15 E.	30
Aug.	S. 36 30 W.	30	S. 35 E.	22
Sept.	S. 71 58 W.	35	S. 19 W.	5
Oct.	S. 70 41 W.	26	N. 75 W.	7
Nov.	N. 77 37 W.	37	N. 10½ W.	16
Dec.	N. 75 46 W.	45	N. 29½ W.	22

[1] Nos. 16, 17, and 18 combined. Determined approximately by construction.

SERIES D.—*Continued.*

No. 24.—Average duration of winds in each month, between the parallels of latitude 45° and 50°, deduced from observations taken at ten different stations, in Iowa, Wisconsin, Michigan, Canada, and Maine, for a joint period of $17\frac{5}{12}$ years.

Months.	N.	N. N. E.	N. E.	E. N. E.	E.	E. S. E.	S. E.	S. S. E.	S.	S. S. W.	S. W.	W. S. W.	W.	W. N. W.	N. W.	N. N. W.	Calm.	Mean direction.	Rate of Progress.	No. of days.
January . . .	4.17	.11	2.66	.08	2.89	.00	3.95	.21	2.71	.33	2.35	.34	5.58	.25	4.87	.37	.13	N. 58° 40′ W.	14	31.00
February . .	2.81	.60	2.41	.21	2.54	.07	3.39	.15	1.74	.34	2.23	.12	4.52	.56	5.91	.34	.30	N. 47 43 W.	19	28.24
March . . .	3.19	.84	3.43	.23	2.73	.03	5.01	.12	2.04	.15	2.82	.43	3.94	.37	5.07	.20	.40	N. 24 37 W.	9	31.00
April . . .	2.16	.55	2.15	.10	2.43	.10	4.56	.36	2.43	.26	4.35	.39	4.81	.28	5.00	.07	.00	S. 69 34 W.	15½	30.00
May . . .	1.56	.96	3.23	.12	3.75	.27	5.72	.20	1.57	.12	3.75	.30	5.00	.04	4.21	.20	.00	S. 12 27 W.	3	31.00
June . . .	1.68	.24	2.61	.03	2.67	.18	4.29	.33	2.85	.48	4.14	.36	6.15	.33	3.27	.15	.24	S. 51 31 W.	18	30.00
July . . .	1.50	.09	1.68	.09	1.53	.00	3.42	.15	2.67	.66	6.72	.72	7.11	.21	3.99	.03	.43	S. 64 3 W.	37	31.00
August . . .	1.98	.24	2.76	.03	1.71	.00	3.87	.06	2.97	.30	7.11	.42	6.24	.15	2.97	.00	.19	S. 56 43 W.	28	31.00
September . .	2.10	.48	2.79	.12	1.44	.03	4.17	.09	3.24	.39	4.74	.33	4.83	.51	4.65	.09	.00	S. 69 58 W.	20	30.00
October . . .	2.68	.56	2.44	.19	1.87	.08	3.96	.16	3.02	.44	5.46	.16	4.59	.27	5.08	.04	.00	S. 70 59 W.	19½	31.00
November . .	2.86	.65	2.96	.22	3.54	.14	3.26	.11	2.43	.07	3.31	.45	4.26	.28	5.27	.07	.12	N. 50 56 W.	11	30.00
December . .	3.01	.47	2.60	.08	3.37	.03	3.88	.47	2.06	.33	4.10	.75	3.34	.22	5.38	.64	.27	N. 69 50 W.	10	31.00

No. 26.—Amherst, Massachusetts.

5 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
January	N. 69° 42′ W.	36	N. 53° W.	6
February	N. 63 34 W.	35	N. 12 E.	6
March	N. 53 39 W.	41	N. 15 W.	17
April	N. 55 2 W.	33	N. 16 E.	11
May	N. 85 9 W.	22	S. 33 E.	10
June	S. 67 5 W.	22	S. 22 E.	20
July	S. 70 47 W.	37	S. 18 W.	23
August	S. 88 34 W.	26	S. 5 E.	10
September	S. 76 54 W.	16	S. 47 E.	19
October	N. 78 53 W.	30	S. 53 W.	5
November	N. 55 19 W.	41	N. 20 W.	16
December	N. 57 2 W.	47	N. 34 W.	21
The year	N. 73 13 W.	30		

No. 27.—Nantucket, Massachusetts.

4½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
January	N. 66° 45′ W.	37	N. 51° W.	15
February	N. 75 9 W.	31	N. 62 W.	10
March	N. 28 10 W.	32	N. 19 E.	24
April	S. 82 53 W.	20	S. 4½ W.	8
May	S. 51 59 W.	30	S. 1 W.	24
June	S. 35 59 W.	34	S. 1 W.	34
July	S. 67 39 W.	39	S. 37 W.	25
August	S. 60 47 W.	7	S. 61 E.	19
September	N. 3 44 W.	13	N. 70½ E.	22
October	N. 72 57 W.	25	N. 33 W.	4
November	N. 43 52 W.	41	N. 9 W.	25
December	N. 55 11 W.	36	N. 30 W.	18
The year	N. 77 0 W.	23		

No. 28.—Average duration of winds in each month, in the New England States, south of latitude 45°, deduced from observations taken at forty-nine different stations, for a joint period of $78\frac{5}{6}$ years.

Months.	N.	N. N. E.	N. E.	E. N. E.	E.	E. S. E.	S. E.	S. S. E.	S.	S. S. W.	S. W.	W. S. W.	W.	W. N. W.	N. W.	N. N. W.	Calm.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Deflecting forces. Am't.	No. of days.
Jan.	3.55	.10	2.77	.10	1.18	·08	1.95	.10	1.68	.16	4.61	.15	3.73	.30	9.95	.29	.30	N. 56° 49′ W.	38	N. 20° W.	24	31.00
Feb.	2.66	.19	2.50	.09	1.19	.13	1.81	.09	2.07	.12	4.27	.15	3.52	.16	8.71	.12	.46	N. 59 2 W.	30	N. 2 E.	15	28.24
Mar.	2.68	.09	3.13	.09	1.52	.05	2.67	.09	3.07	.08	4.76	.03	3.42	.08	8.72	.13	.39	N. 64 31 W.	26	N. 9 E.	12	31.00
April	2.18	.20	3.77	.03	2.32	.02	3.00	.02	3.41	.14	5.58	.12	2.62	.08	6.35	.13	.03	N. 89 57 W.	14	East	12	30.00
May	1.74	.15	3.15	.09	1.93	.16	3.46	.06	4.56	.32	6.75	.16	3.15	.16	4.94	.12	.15	S. 48 15 W.	21	S. 34½ E.	19	31.00
June	1.42	.11	2.09	.13	1.60	.08	2.90	.12	4.37	.19	8.04	.53	2.97	.13	5.07	.06	.19	S. 51 46 W.	32	S. 1 W.	23	30.00
July	1.44	.08	1.79	.04	1.28	.03	2.70	.06	5.18	.18	10.07	.31	3.43	.06	4.16	.12	.07	S. 47 8 W.	41	S. 6½ W.	29	31.00
Aug.	1.80	.14	3.04	.13	1.62	.08	3.30	.09	5.22	.19	7.77	.18	2.66	.05	4.46	.10	.23	S. 40 51 W.	25½	S. 34 E.	24	31.00
Sept.	2.39	.19	3.44	.18	1.72	.08	2.71	.15	3.68	.27	6.05	.30	2.83	..19	5.39	.21	.22	S. 76 15 W.	17½	S. 62 E.	12	30.00
Oct.	2.32	.05	2.92	.08	1.43	.02	2.48	.07	3.77	.09	6.83	.08	3.39	.09	7.16	.20	.02	S. 84 16 W.	26	S. 2 E.	4	31.00
Nov.	2.91	.17	2.92	.09	1.28	.13	1.98	.04	1.79	.10	5.07	.17	3.44	.19	9.33	.23	.16	N. 61 8 W.	34	N. 13 W.	18	30.00
Dec.	3.22	.09	2.95	.08	1.25	.11	1.73	.06	1.83	.04	4.96	.05	4.04	.17	10.23	.17	.02	N. 59 3 W.	39	N. 20 W.	21	31.00
Total.	29.04	1.46	33.89	1.02	17.82	.99	29.65	.86	38.67	1.65	73.51	1.98	40.22	1.63	89.00	1.83	2.02	N. 87 37 W.	26			365.24

SERIES D.—*Continued.*

No. 29.—Pompey, New York. 16 years.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	S. 70° 50′ W.	45½	N. 28° E.	8
Feb.	S. 71 31 W.	53	N. 24 W.	5
March	S. 66 0 W.	50	N. 85 E.	2
April	S. 66 17 W.	38	N. 68 E.	14
May	S. 65 39 W.	52	S. 34 E.	1
June	S. 55 16 W.	55½	S. 6 E.	18
July	S. 64 5 W.	69	S. 55 W.	17
Aug.	S. 69 14 W.	57	N. 82 W.	5
Sept.	S. 63 30 W.	58	S. 31 W.	6
Oct.	S. 61 32 W.	53	S. 11 E.	6
Nov.	S. 68 19 W.	52	N. 21½ W.	1
Dec.	S. 70 33 W.	47	N. 33½ E.	6
The year	S. 66 48 W.	52		

No. 30.—New York State.—72 stations. 362 years.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	S. 87° 51′ W.	33	N. 46° W.	6
Feb.	S. 89 23 W.	32½	N. 16 W.	7
March	S. 82 56 W.	31	N. 28 W.	3
April	N. 82 59 W.	22	N. 42½ E.	12
May	S. 71 12 W.	28	S. 4 E.	5
June	S. 67 36 W.	34	S. 23 W.	9
July	S. 67 27 W.	43	S. 35½ W.	12
Aug.	S. 76 21 W.	33	S. 66 W.	5
Sept.	S. 72 28 W.	33	S. 27 W.	6
Oct.	S. 69 21 W.	38	S. 35½ W.	8
Nov.	S. 89 7 W.	31	N. 16 W.	6
Dec.	S. 88 57 W.	33	N. 36 W.	6
The year	S. 79 8 W.	31½		

Proportion of winds in each month, in the State of New York, being the sums of the observations taken at fifty-five different stations for a joint period of 360 years.

Months.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Mean direction.	Rate of Progress.
January	1141½	805	411	681	1738	1938½	1976½	2466	S. 87° 51′ W.	33
February	960½	750	400	685½	1540½	1673	1930½	2330½	S. 87 6 W.	33
March	1018½	725	498	765½	1924½	1804	1923½	2520½	S. 82 55 W.	31
April	1230½	1071½	626	785½	1600½	1540½	1671½	2208	N. 82 41 W.	22
May	1090	869½	536½	895	1996½	1984	1822	1949½	S. 71 24 W.	28
June	878	651	430	826	1979	2229	1985½	1946½	S. 67 38½W.	34
July	827	482½	316	661½	2016½	2775	2274½	1986½	S. 67 27 W.	43
August	1124½	777	388½	711½	1979	2308	1993	2059½	S. 76 21 W.	33
September	982½	733	398	787	1854	2267	1915	2008½	S. 72 30 W.	33
October	1098	759	439	876½	2155½	2231	1857	2078½	S. 69 21 W.	38
November	1162	828	490½	685½	1621½	1887	2042	2319½	S. 89 7 W.	31
December	1245	876	452	648	1680½	2093	2187	2382½	S. 88 57 W.	33
Total	12758	9327½	5385½	9008½	22086	24730	23578	26256	S. 78 59 W.	31½

No. 31.—New York City. 10 years.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 66° 58′ W.	37	N. 31° W.	27
Feb.	N. 56 7 W.	24	N. 5 W.	23
March	S. 77 39 W.	22	S. 4 W.	3
April	S. 59 51 W.	29	S. 37½ W.	8
May	S. 39 46 W.	25	S. 20 E.	13
June	S. 38 16 W.	48	S. 20 W.	32
July	S. 26 0 W.	39	S. 3 E.	28
Aug.	S. 19 43 W.	28	S. 23½ E.	22
Sept.	S. 1 25 W.	14	S. 70½ E.	19
Oct.	S. 87 54 W.	19	N. 3 E.	8
Nov.	S. 89 5 W.	31	N. 60 W.	15
Dec.	N. 45 44 W.	23	N. 5 E.	24
The year	S. 66 56 W.	21		

No. 32.—New Jersey and Pennsyl'a.—57 stations. 63 years.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 77° 47′ W.	26	N. 22° E.	5
Feb.	N. 75 49 W.	33½	N. 34 W.	9
March	N. 81 10 W.	25	N. 41 E.	4
April	S. 89 48 W.	14	S. 86 E.	14
May	S. 84 23 W.	28	S. 14 W.	5
June	S. 77 33 W.	30	S. 8 W.	7
July	S. 78 53 W.	33	S. 33½ W.	9
Aug.	S. 58 26 W.	19	S. 44 E.	15
Sept.	N. 84 28 W.	24	N. 42½ E.	3
Oct.	N. 85 25 W.	32	N. 60 W.	4
Nov.	N. 76 6 W.	32	N. 20 W.	8
Dec.	N. 73 58 W.	36	N. 31½ W.	11

SERIES D.—*Continued.*

Average duration of winds, in each month, in the State of Pennsylvania, deduced from observations taken at forty different stations, for an aggregate period of forty-eight years and eleven months.

Months.	N.	N. N. E.	N. E.	E. N. E.	E.	E. S. E.	S. E.	S. S. E.	S.	S. S. W.	S. W.	W. S. W.	W.	W. N. W.	N. W.	N. N. W.	Calm.	Resultant.	Rate of Progress.	No. of days.
January	1.17	.47	2.53	.28	1.97	.11	2.73	.17	1.26	.30	4.49	.44	5.41	.79	5.97	.27	2.64	N. 80° 52′ W.	28	31
February	1.13	.24	1.94	.17	1.45	.14	2.02	.06	1.04	.15	4.31	.53	4.94	.57	6.42	.31	2.58	N. 78 5 W.	38	28
March	1.72	.49	2.27	.15	1.85	.11	2.36	.12	1.62	.32	4.63	.51	5.45	.61	5.66	.18	2.95	N. 82 58 W.	30	31
April	1.63	.45	2.56	.18	2.19	.09	3.04	.23	2.20	.35	4.29	.35	4.64	.58	5.01	.34	1.87	S. 89 9 W.	20	30
May	1.16	.28	1.83	.21	1.34	.19	2.61	.29	1.96	.54	4.84	.37	4.97	.70	6.29	.54	2.88	S. 88 45 W.	33	31
June	1.24	.10	1.61	.11	1.47	.20	2.45	.13	2.03	.27	4.88	.45	5.20	.59	5.18	.30	3.79	S. 83 31 W.	33	30
July	1.21	.19	1.41	.11	1.46	.11	1.91	.27	2.01	.44	5.12	.54	6.52	.93	4.89	.22	3.66	S. 82 32 W.	41	31
August	1.13	.22	1.91	.14	2.18	.36	2.78	.25	2.59	.18	4.97	.34	5.42	.63	3.55	.19	4.16	S. 64 10 W.	26	31
September	1.47	.18	1.43	.15	2.05	.10	1.98	.34	2.20	.23	3.84	.33	5.33	.63	5.45	.37	3.92	N. 89 3 W.	31	30
October	1.39	.12	1.53	.05	1.58	.15	2.42	.13	1.78	.37	4.40	.48	6.00	.55	6.44	.45	3.16	N. 88 24 W.	37	31
November	1.48	.14	1.55	.18	1.96	.05	1.84	.09	1.30	.19	3.76	.47	6.84	.74	6.19	.43	2.79	N. 79 3 W.	39	30
December	1.64	.28	2.03	.11	1.71	.06	1.89	.10	1.26	.21	4.36	.77	6.39	.85	6.60	.24	2.50	N. 79 10 W.	44	31
Total	16.37	3.16	22.60	1.84	21.21	1.67	28.03	2.18	21.25	3.55	53.89	5.58	67.11	8.17	67.65	3.84	36.90	N. 88 15 W.	32	365

No. 33.—Girard College, Philadelphia.

5 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
January	N. 49° 20′ W.	29½	N. 9° W.	13
February	N. 65 47 W.	32½	N. 52 W.	12
March	N. 64 28 W.	20	N. 30 E.	3
April	N. 6 55 E.	8	N. 85 E.	21
May	S. 78 36 W.	23	S. 15 W.	11
June	S. 58 5 W.	29	S. 11½ W.	21
July	S. 58 38 W.	27	S. 9 W.	20
August	S. 30 53 W.	10	S. 45 E.	21
September	N. 42 10 W.	16	N. 56 E.	11
October	N. 71 50 W.	31	N. 65 W.	10
November	N. 54 15 W.	36	N. 31 W.	18
December	N. 60 30 W.	36	N. 43 W.	16
The year	N. 74 5 W.	21		

No. 34.—Fort McHenry, near Baltimore.

5 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
January	N. 31° 0′ W.	35	N. 11½° W.	22
February	N. 55 38 W.	31	N. 49 W.	18
March	N. 18 41 E.	9	N. 86 E.	17
April	N. 55 26 E.	18½	N. 87 E.	27
May	S. 18 32 W.	18	S. 17 E.	25
June	S. 71 57 W.	15	S. 3½ W.	13
July	S. 55 8 W.	41	S. 34 W.	38
August	S. 59 22 W.	13½	S. 4 E.	16
September	S. 82 47 W.	19	S. 32 W.	13
October	N. 40 34 W.	16½	N. 15 E.	5
November	N. 21 46 W.	26	N. 9 E.	17
December	N. 41 17 W.	45	N. 32 W.	30
The year	N. 59 6 W.	15½		

No. 35.—Average duration of winds in each month, in Delaware, Maryland, and Eastern Virginia, deduced from observations taken at fourteen different stations, for an aggregate period of 25⅓ years.

Months.	N.	N. N. E.	N. E.	E. N. E.	E.	E. S. E.	S. E.	S. S. E.	S.	S. S. W.	S. W.	W. S. W.	W.	W. N. W.	N. W.	N. N. W.	Calm.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Deflecting forces. Am't.	No. of days.
Jan.	2.81	.02	4.73	.01	1.46	.00	2.49	.05	1.56	.03	4.69	.01	3.29	.08	8.82	.03	.92	N. 47° 47′ W.	27	N. 20° W.	18	31.00
Feb.	1.78	.00	4.53	.00	1.36	.02	2.47	.07	1.44	.03	5.11	.03	2.46	.07	7.93	.04	.90	N. 56 32 W.	21	N. 15½ W.	12	28.24
March	2.05	.01	4.65	.00	2.28	.00	4.13	.01	2.19	.01	5.28	.02	2.92	.06	7.13	.05	.21	N. 64 25 W.	12	N. 15 E.	6	31.00
April	1.65	.00	4.61	.00	2.75	.00	4.13	.04	2.81	.00	5.14	.00	2.05	.01	6.81	.00	.00	N. 77 23 W.	5	N. 75 E.	6	30.00
May	1.15	.04	4.48	.00	2.32	.00	5.79	.04	4.05	.00	5.61	.00	2.50	.00	4.60	.03	.39	S. 1 29 W.	14½	S. 41 E.	18	31.00
June	1.10	.00	3.94	.01	2.30	.00	4.65	.01	3.42	.02	7.23	.00	2.58	.00	4.39	.00	.35	S. 26 26 W.	18	S. 16 E.	17	30.00
July	1.05	.01	3.75	.00	1.02	.00	4.69	.00	3.63	.00	9.37	.00	2.48	.00	4.97	.00	.03	S. 41 41 W.	27	S. 10 W.	19	31.00
Aug.	1.85	.01	4.87	.00	1.61	.00	5.16	.01	3.07	.00	7.31	.00	2.63	.00	4.35	.01	.12	S. 31 20 W.	13	S. 26 E.	13	31.00
Sept.	2.29	.00	5.90	.00	2.00	.00	3.51	.00	3.14	.00	6.07	.00	1.94	.00	4.79	.01	.35	S. 87 21 W.	3	S. 88 E.	10	30.00
Oct.	2.07	.00	5.50	.00	1.73	.00	3.46	.00	2.65	.00	5.63	.02	2.55	.00	7.39	.00	.00	N. 55 33 W.	12	N. 21 E.	6	31.00
Nov.	1.96	.00	3.96	.00	1.41	.00	2.59	.01	2.32	.00	5.91	.00	3.01	.00	8.50	.04	.29	N. 70 58 W.	25	N. 51 W.	12	30.00
Dec.	2.17	.00	4.88	.00	1.12	.03	2.55	.05	2.16	.00	5.98	.00	2.58	.00	9.40	.08	.00	N. 86 57 W.	23	N. 85 W.	10	31.00

SERIES D.—*Continued.*

No. 36.—Washington City, D. C.

8 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 66° 24′ W.	20
February	N. 51 14 W.	20
March	N. 30 54 W.	15
April	N. 64 12 W.	20
May	S. 25 12 W.	17
June	S. 53 20 W.	17
July	S. 55 18 W.	25½
August	S. 45 42 W.	9
September	N. 11 16 W.	10½
October	N. 88 6 W.	16
November	N. 76 34 W.	30
December	N. 85 52 W.	25
The year	N. 85 12 W.	17

No. 37.—Old Point Comfort, Virginia.

5 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 21° 33′ W.	32
February	N. 9 55 E.	7
March	S. 66 18 W.	5
April	S. 1 16 E.	12
May	S. 60 25 E.	23
June	S. 8 37 E.	25
July	S. 6 40 W.	34
August	S. 14 9 W.	17½
September	N. 34 1 E.	18
October	N. 17 25 W.	20
November	N. 85 3 W.	14
December	N. 74 58 W.	15
The year	S. 43 15 W.	3

No. 38.—Chapel Hill, North Carolina.

2 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 78° 8′ W.	32
February	N. 71 28 W.	22
March	S. 68 42 W.	12
April	S. 30 16 E.	17
May	S. 43 27 E.	18
June	S. 63 15 W.	21
July	S. 16 42 E.	9
August	S. 86 59 E.	14
September	N. 27 56 E.	19
October	N. 31 6 E.	17
November	S. 84 49 W.	16
December	N. 84 35 W.	21
The year	S. 76 5 W.	6

No. 39.—Nashville, Tennessee.

5 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 39° 41′ W.	30
February	S. 65 22 W.	22
March	S. 70 35 W.	21
April	S. 57 38 W.	41
May	S. 57 29 W.	38½
June	S. 45 1 W.	49
July	S. 39 18 W.	27
August	S. 20 31 W.	25
September	S. 34 30 W.	18
October	S. 81 13 W.	27
November	S. 62 42 W.	23
December	S. 60 59 W.	39½
The year	S. 57 20 W.	30

No. 40.—North Carolina, north of latitude 35°, and Tennessee.—7 stations.

5 5-6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	S. 69° 53′ W.	29	N. 61° W.	6
Feb.	S. 82 5 W.	17	N. 21½ E.	10
March	S. 76 46 W.	20	N. 8 E.	7
April	S. 46 30 W.	29	N. 6 W.	8
May	S. 62 19 W.	29	S. 62 W.	4
June	S. 54 51 W.	45½	S. 46 W.	21
July	S. 31 59 W.	20	S. 58 E.	13
Aug.	S. 15 23 W.	19	S. 81 E.	18
Sept.	S. 56 21 W.	21½	East	5
Oct.	N. 83 47 W.	15	N. 27 E.	14
Nov.	S. 69 20 W.	32	N. 89 W.	10
Dec.	S. 68 6 W.	32	S. 87 W.	9

No. 41.—Latitude 34° to 35° in North Carolina, Georgia, Alabama, and Arkansas.—5 stations.

8 5-6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Directions.	Am't.
Jan.	N. 66° 39′ W.	21	N. 23° W.	8
Feb.	N. 59 54 W.	24	N. 23 W.	12
March	S. 69 19 W.	22	S. 40 W.	14
April	S. 40 51 W.	13½	S. 22 E.	14
May	S. 55 8 W.	21	S. 1 E.	11
June	S. 19 23 W.	28	S. 13 E.	28
July	S. 39 48 W.	35	S. 15 W.	28
Aug.	S. 86 57 W.	21	S. 70 W.	5
Sept.	N. 28 11 W.	9	N. 64 E.	13
Oct.	N. 0 27 W.	24	N. 33 E.	28
Nov.	N. 53 31 W.	18	N. 8 W.	12
Dec.	N. 36 19 W.	23	N. 11 W.	26

SERIES D.—*Continued.*

No. 42.—Augusta, Georgia.

5 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	S. 73° 25′ W.	18½	N. 47° W.	7
Feb.	N. 58 2 W.	20½	N. 12 W.	21
March	S. 30 42 W.	24	S. 2 E.	11
April	S. 39 47 W.	38	S. 15 W.	11
May	S. 28 59 W.	30	S. 9 W.	17
June	S. 54 8 W.	21	West	4
July	S. 26 55 W.	43	S. 9 W.	31
Aug.	S. 24 46 E.	18	S. 74 E.	23
Sept.	S. 41 3 E.	5	N. 76 E.	17
Oct.	N. 25 27 W.	21	N. 12 E.	27
Nov.	S. 61 48 W.	31	S. 72½ W.	15
Dec.	S. 79 44 W.	16	N. 20 W.	7
The year	S. 52 40 W.	16		

No. 43.—Lat. 33° to 34° in Georgia and Alabama.[1] 4 stations.

5½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 86° 49′ W.	16
February	N. 67 51 W.	19
March	S. 45 2 W.	22
April	S. 39 47 W.	38
May	S. 28 59 W.	30
June	S. 54 8 W.	21
July	S. 26 55 W.	43
August	S. 24 46 E.	18
September	S. 41 3 E.	5
October	N. 25 27 W.	21
November	S. 64 16 W.	29
December	S. 79 44 W.	16

No. 44.—Average duration of winds in each month, between the parallels of latitude 32° and 33°, deduced from observations taken at nine different stations in South Carolina, Georgia, Alabama, and Mississippi, for an aggregate period of 8⅙ years.

Months.	N.	N. N. E.	N. E.	E. N. E.	E.	E. S. E.	S. E.	S. S. E.	S.	S. S. W.	S. W.	W. S. W.	W.	W. N. W.	N. W.	N. N. W.	Calm.	Mean direction of Wind.	Rate of Progress.	No. of days.
Jan.	3.06	.08	5.53	.12	3.55	.12	2.04	.12	3.80	.45	3.22	.00	3.31	.53	3.96	.49	.62	N. 0° 7′ W.	8	31.00
Feb.	3.01	.35	2.32	.07	2.28	.04	2.10	.04	4.54	.20	3.00	.11	4.00	.20	4.05	.07	1.86	S. 83 50 W.	30	28.24
March	2.53	.23	4.01	.24	1.98	.30	5.00	.17	3.74	.58	2.62	.37	3.97	.16	3.73	.24	1.13	S. 9 53 W.	5	31.00
April	2.21	.00	3.37	.14	4.26	.14	6.69	.14	5.33	.00	3.29	.00	1.11	.00	1.68	.00	1.64	S. 46 17 E.	32½	30.00
May	2.88	.17	3.86	.19	3.36	.26	4.28	.63	4.93	.26	3.84	.19	1.94	.07	2.25	.19	1.70	S. 38 11 E.	17	31.00
June	.84	.03	2.73	.11	3.33	.24	4.95	.58	5.44	.39	3.59	.28	3.97	.15	2.20	.00	1.17	S. 4 56 E.	27	30.00
July	1.83	.00	2.30	.00	3.05	.13	5.60	.17	4.46	.27	5.03	.40	4.60	.03	2.13	.00	1.00	S. 10 12 W.	25	31.00
Aug.	1.58	.21	4.19	.13	4.45	.09	5.39	.59	5.72	.18	2.40	.24	1.81	.24	2.11	.12	1.55	S. 47 44 E.	27	31.00
Sept.	2.83	.10	6.23	.10	6.40	.57	3.47	.00	3.23	.30	2.47	.10	2.16	.00	.97	.00	1.07	N. 89 57 E.	30	30.00
Oct.	4.25	.11	5.00	.96	6.07	.25	2.97	.57	1.90	.00	1.21	.25	2.17	.00	3.51	.14	1.64	N. 54 0 E.	29	31.00
Nov.	2.14	.07	5.15	.00	2.99	.00	2.70	.04	1.77	.24	2.63	.31	4.80	.36	2.99	.02	3.79	N. 22 26 W.	8	30.00
Dec.	5.79	.21	5.12	.00	3.84	.17	3.47	1.65	2.60	.00	1.98	.00	2.15	.00	2.61	.00	1.41	N. 58 4 E.	20½	31.00

No. 45.—Latitude 31° to 32° in Alabama, Mississippi, and Louisiana.—5 stations.

13 1-6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 23° 5′ E.	4
February	S. 55 13 E.	8
March	S. 18 39 E.	12
April	S. 27 34 E.	7
May	S. 11 30 E.	21
June	S. 10 49 E.	29
July	S. 9 39 E.	13½
August	N. 87 18 E.	10
September	N. 61 23 E.	27
October	N. 49 35 E.	19
November	N. 17 44 E.	7
December	N. 51 10 E.	12

No. 46.—Latitude 30° to 31° in Florida, Alabama, and Louisiana.—8 stations.

23 1-6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 51° 52′ E.	11
February	N. 81 11 E.	5
March	S. 21 42 E.	13½
April	S. 11 21 W.	22½
May	S. 18 11 W.	24
June	S. 30 50 W.	33
July	S. 37 44 W.	24
August	S. 18 21 W.	8
September	S. 72 53 E.	20
October	N. 56 45 E.	22
November	N. 28 47 E.	7
December	N. 44 48 E.	17

[1] This is the same as No. 42, with the addition of six months' observations at other stations.

SERIES D.—*Continued.*

No. 47.—Latitude 29° to 30° in Florida, Louisiana, and Texas.—6 stations.

8½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 58° 18′ E.	8
February	S. 38 16 E.	16
March	S. 57 7 E.	21
April	S. 51 18 E.	15
May	S. 45 7 E.	24
June	S. 44 9 E.	28
July	S. 35 43 E.	33
August	S. 28 35 E.	25
September	S. 81 49 E.	31½
October	N. 58 51 E.	33
November	N. 45 49 E.	17
December	N. 64 49 E.	16

No. 48.—St. Augustine, Florida.

4 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	N. 9° 27′ E.	26	N. 62° W.	33
Feb.	S. 78 53 E.	25	S. 21 W.	12
March	S. 81 52 E.	27	S. 9 E.	8
April	S. 74 32 E.	35	S. 19½ E.	16
May	S. 65 12 E.	43	S. 22 E.	23
June	S. 85 29 E.	30	S. 16 E.	7
July	S. 61 5 E.	38½	S. 16 E.	24
Aug.	S. 54 48 E.	28	S. 19½ W.	22
Sept.	N. 76 42 E.	50	N. 69 E.	22
Oct.	N. 57 26 E.	56	N. 32 E.	31
Nov.	N. 37 58 E.	26½	N. 38 W.	21
Dec.	N. 56 13 E.	24	N. 47 W.	12
The year	N. 79 19 E.	25		

No. 49.—Fort King and Cedar Keys, Florida.

6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 2° 28′ E.	12
February	S. 39 25 W.	12
March	S. 26 12 E.	25
April	S. 55 9 W.	30
May	S. 50 53 W.	19
June	S. 10 4 W.	38
July	S. 5 51 E.	39
August	S. 0 52 E.	21½
September	S. 41 27 E.	17
October	N. 29 50 E.	13
November	N. 41 48 E.	1½
December	N. 56 36 E.	4

No. 50.—Tampa Bay, Florida.

11 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 9° 17′ E.	10
February	S. 86 14 E.	12
March	S. 51 17 W.	12
April	S. 30 23 W.	10
May	S. 3 56 E.	14
June	S. 18 33 E.	26
July	S. 8 21 E.	35
August	S. 19 58 E.	29
September	S. 80 46 E.	25
October	N. 66 14 E.	22
November	N. 55 2 E.	15
December	N. 27 20 E.	13

No. 51.—Key West, Florida.

4 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 68° 32′ E.	39
February	N. 54 32 E.	37
March	N. 61 49 E.	46
April	S. 81 55 E.	27
May	S. 76 44 E.	40
June	S. 61 50 E.	23
July	S. 61 3 E.	53
August	S. 55 38 E.	30
September	N. 84 59 E.	46
October	N. 47 44 E.	53
November	N. 58 48 E.	68
December	N. 40 53 E.	50
The year	N. 78 6 E.	38

No. 52.—Florida Reefs, lat. 24° to 26°.—5 stations.

8 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	N. 61° 2′ E.	31	N. 58½° W.	18
Feb.	N. 47 2 E.	30	N. 54½ W.	24
March	N. 68 32 E.	45	N. 2 E.	11
April	S. 75 12 E.	26	S. 54 W.	21
May	S. 61 1 E.	39	S. 15½ W.	27
June	S. 58 7 E.	27	S. 40½ W.	30
July	S. 57 20 E.	61	S. 14 E.	41
Aug.	S. 51 55 E.	34	S. 32 W.	32
Sept.	N. 84 16 E.	21	S. 79 W.	21
Oct.	N. 47 1 E.	47	N. 16 W.	27
Nov.	N. 58 7 E.	60	N. 19 E.	27
Dec.	N. 33 23 E.	40	N. 35½ W.	32
The year	N. 80 8 E.	35		

SERIES D.—*Continued.*

No. 53.—Matanzas, Cuba.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 49° 57′ E.	49
February	N. 29 0 E.	68
March	N. 51 11 E.	42
April	N. 51 0 E.	59
May	N. 50 7 E.	77
June	N. 45 0 E.	42
July	N. 45 0 E.	41
August	N. 56 36 E.	46
September	N. 47 44 E.	29
October	N. 34 41 E.	89
November	N. 45 0 E.	92
December	N. 40 46 E.	62
The year	N. 60 39 E.	65

No. 54.—West Indies, Latitude 18° to 23°.[1]

1 1-6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 50° 44′ E.	57
February	N. 29 0 E.	68
March	N. 59 47 E.	54
April	N. 51 0 E.	59
May	N. 50 7 E.	77
June	N. 45 0 E.	42
July	N. 45 0 E.	41
August	N. 56 36 E.	46
September	N. 47 44 E.	29
October	N. 34 41 E.	89
November	N. 45 0 E.	92
December	N. 40 46 E.	62
The year	N. 60 31 E.	65

No. 55.—Barbadoes and the Northern Coast of South America.[2]—4 stations.

1 1-6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 67° 13′ E.	83
February	N. 71 55 E.	91
March	N. 77 36 E.	91
April	N. 81 35 E.	21
May	S. 66 6 E.	93
June	S. 83 33 E.	94
July	N. 78 13 E.	43
August	N. 85 48 E.	82
September	S. 88 5 E.	77
October	N. 88 5 E.	88
November	N. 72 49 E.	61
December	N. 68 15 E.	97
The year	N. 82 40 E.	84

No. 56.—Fort Wood, Louisiana.

3 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 43° 20′ W.	6½
February	S. 23 49 E.	5
March	S. 13 48 W.	26
April	South	3
May	S. 23 49 W.	11½
June	S. 7 5 E.	31½
July	S. 47 55 E.	31
August	N. 58 11 W.	10
September	N. 72 34 E.	36
October	N. 42 14 E.	27
November	N. 1 41 E.	15
December	N. 7 3 W.	36
The year	S. 86 3 E.	5

No. 57.—Western Reserve College, Hudson, Ohio.[3]

7 YEARS.

Months.	9 O'CLOCK A. M.		3 O'CLOCK P. M.	
	Mean direction of Wind, as indicated by the motion of the clouds.	Rate of Progress.	Mean direction of wind, as indicated by the motion of the clouds.	Rate of Progress.
January	S. 79° 50′ W.	51	S. 76° 44′ W.	52
February	S. 85 31 W.	56	S. 84 36 W.	58
March	N. 83 0 W.	42	N. 86 13 W.	49
April	S. 86 17 W.	41	N. 89 4 W.	48
May	S. 87 11 W.	46	S. 85 24 W.	49
June	N. 89 40 W.	47	S. 86 30 W.	52
July	N. 79 44 W.	49	N. 84 31 W.	48
August	N. 77 40 W.	37	N. 89 37 W.	31
September	N. 81 15 W.	37	S. 87 17 W.	39
October	S. 89 23 W.	47	N. 86 28 W.	53
November	S. 81 50 W.	41	S. 80 58 W.	48
December	S. 85 59 W.	45	S. 85 9 W.	48
The year	S. 89 57 W.	52	S. 87 18 W.	54

[1] Same as No. 53, with the addition of two months' observations at other islands.

[2] These results are obtained from observations for nine months at Barbadoes, three months at Porto Cabello, Venezuela, one month at Chagres, New Grenada, and twenty-six days at sea near the coast.

[3] The mean directions are copied from Professor Loomis's article in the Journal of Science and Arts. The numbers in the columns headed "Rate of Progress," express the ratio that the resultants bear to the sum of the winds, *after being resolved in the direction of the cardinal points*, and are somewhat less than if they had been computed from the original observations.

SERIES D.—*Continued.*

No. 58.—Steubenville, Ohio.

14 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 83° 54′ W.	49
February	N. 82 49 W.	53
March	N. 78 3 W.	58
April	N. 79 37 W.	49
May	N. 80 3 W.	50
June	N. 84 52 W.	55
July	N. 88 44 W.	51
August	N. 78 57 W.	57
September	N. 75 58 W.	59
October	N. 81 3 W.	53
November	N. 80 14 W.	51
December	N. 76 49 W.	53
The year	N. 80 58 W.	55

No. 59.—State of Ohio.—17 stations.

28 7-12 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	S. 77° 42′ W.	47	S. 5° E.	12
Feb.	S. 89 8 W.	51	S. 48 W.	5
March	N. 86 5 W.	50	N. 70 W.	3
April	N. 81 7 W.	43	N. 48 E.	6
May	N. 84 26 W.	41	N. 76 E.	6
June	S. 84 38 W.	48	S. 10½ W.	7
July	N. 86 12 W.	52	N. 78 W.	5
Aug.	N. 82 39 W.	44	N. 36 E.	5
Sept.	N. 84 28 W.	40	N. 76 E.	7
Oct.	N. 85 18 W.	49	N. 63 W.	3
Nov.	N. 89 6 W.	50	S. 65 W.	4
Dec.	N. 83 5 W.	50	N. 41 W.	5

No. 60.—No. 59 exclusive of No. 58. 16 stations.

14⅞ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 65° 26′ W.	46
February	S. 83 46 W.	50
March	S. 89 25 W.	45
April	N. 83 44 W.	40
May	N. 89 9 W.	34
June	S. 77 57 W.	42
July	N. 82 39 W.	51
August	N. 86 58 W.	33
September	S. 87 2 W.	23
October	S. 87 14 W.	44
November	S. 82 2 W.	50
December	S. 87 8 W.	44

No. 61.—Lat. 41° to 45° in Michigan, Wisconsin, and Iowa.—13 stations.

42 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 79° 52′ W.	32
February	S. 87 10 W.	33
March	N. 89 59½W.	21
April	N. 89 14 W.	13
May	S. 36 41 W.	16
June	S. 45 25 W.	23
July	S. 49 59 W.	22
August	S. 42 26 W.	21
September	S. 53 40 W.	21
October	S. 62 15 W.	27
November	N. 85 28 W.	26
December	S. 85 7 W.	26

No. 62.—Indiana and Illinois, north of lat. 39°. 14 stations.

13¾ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 61° 49′ W.	30
February	N. 88 3 W.	30
March	S. 59 30 W.	19½
April	N. 29 31 W.	10
May	S. 43 12 W.	5
June	S. 49 39 W.	24
July	S. 58 26 W.	22
August	S. 21 30 W.	9
September	N. 50 41 W.	4
October	S. 63 35 W.	19
November	S. 78 11 W.	30
December	S. 49 37 W.	23

No. 63.—Lat. 37° to 39° in Kentucky, Illinois, and Missouri.—11 stations.

5¾ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 72° 43′ W.	36
February	S. 83 47 W.	34
March	N. 79 18 W.	26½
April	S. 49 10 W.	27
May	S. 89 16 W.	27
June	S. 55 34 W.	47
July	N. 88 21 W.	11½
August	S. 19 40 W.	49
September	S. 55 46 W.	14
October	N. 58 29 W.	12
November	N. 87 49 W.	8
December	S. 60 50 W.	10
The year	S. 67 30 W.	23

SERIES D.—*Continued.*

No. 64.—Fort Leavenworth, on the Missouri.

4 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 88° 9′ W.	21
February	N. 86 23 W.	15
March	S. 25 2 W.	27
April	S. 17 14 W.	32
May	S. 6 40 W.	42
June	S. 3 30 W.	54½
July	S. 3 54 E.	57
August	S. 4 7 E.	40
September	S. 1 3 E.	30
October	S. 42 51 W.	21
November	S. 40 31 W.	28
December	N. 59 44 W.	4
The year	S. 36 43 W.	12

No. 65.—Fort Towson, on Red River.

8 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 34° 1′ W.	17
February	S. 65 42 W.	22
March	S. 31 11 W.	26
April	S. 6 40 W.	31
May	S. 5 33 W.	47
June	S. 4 53 W.	49
July	S. 6 21 W.	56
August	S. 13 38 W.	40
September	S. 5 13 W.	17
October	S. 47 37 W.	16
November	S. 44 46 W.	28
December	S. 27 5 W.	21
The year	S. 17 48 W.	29

No. 66.—Washington, Arkansas, combined with No. 65.—2 stations.

8 5-12 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 34° 1′ W.	17
February	S. 65 42 W.	22
March	S. 31 11 W.	26
April	S. 6 40 W.	31
May	S. 5 33 W.	47
June	S. 10 23 W.	49
July	S. 6 57 W.	55
August	S. 7 44 W.	37½
September	S. 14 1 E.	18
October	S. 35 57 W.	19
November	S. 44 46 W.	28
December	S. 27 5 W.	21

No. 67.—Forts Gibson, Smith, and Wayne.[1] 3 stations.

8 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 61° 8′ E.	10
February	S. 46 13 E.	20
March	S. 46 45 E.	18
April	S. 24 52 E.	23
May	S. 29 20 E.	60
June	S. 31 31 E.	66½
July	S. 33 44 E.	37
August	S. 40 28 E.	34
September	S. 79 40 E.	31½
October	S. 70 43 E.	18
November	N. 2 6 W.	19
December	S. 8 57 W.	2

No. 68.—Fort Vancouver, Oregon.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 52° 58′ E.	54
February	S. 9 14 W.	27
March	S. 18 44 E.	23½
April	S. 2 32 W.	31
May	S. 25 45 W.	46
June	S. 7 20 W.	39
July	S. 16 2 W.	35
August	S. 18 57 W.	58
September	S. 12 5 E.	59
October	S. 24 10 E.	49
November	S. 51 27 E.	70½
December	S. 47 47 E.	66
The year	S. 15 37 E.	41

No. 69.—Hamilton, Bermudas.

3½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 52° 17′ W.	15
February	S. 72 16 W.	16½
March	S. 82 29 W.	38
April	S. 51 39 W.	23
May	S. 38 22 W.	30
June	S. 34 20 W.	55
July	S. 9 43 W.	43
August	S. 25 14 E.	44
September	S. 20 54 E.	16
October	N. 59 49 E.	30
November	N. 17 49 W.	18
December	S. 89 29 W.	29
The year	S. 45 48 W.	20

[1] Near the N. W. corner of Arkansas.

SERIES D.—*Continued.*

No. 70.—Ireland Isle, Bermudas.

4 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .		
February . .		
March . . .		
April . . .		
May . . .		
June . . .		
July . . .		
August . . .	S. 6° 47′ W.	41
September . .	S. 9 37 W.	17
October . .	N. 35 22 E.	28½
November . .	N. 38 13 W.	35
December . .		

No. 71.—Bermuda Islands.—2 stations.

3 5-6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	N. 52° 17′ W.	15	North	23
Feb.	S. 72 16 W.	16½	N. 16° W.	8
March	S. 82 29 W.	38	N. 70 W.	25
April	S. 51 39 W.	23	N. 67½ W.	3
May	S. 38 22 W.	30	S. 25½ W.	12
June	S. 34 20 W.	55	S. 30 W.	38
July	S. 9 43 W.	43	S. 15 E.	30
Aug.	S. 17 57 E.	42	S. 42 E.	38
Sept.	S. 14 42 E.	16	S. 83 E.	20
Oct.	N. 51 51 E.	29	N. 50 E.	55
Nov.	N. 27 56 W.	23	N. 3½ E.	34
Dec.	S. 89 29 W.	29	N. 49 W.	21

No. 72.—North Atlantic Ocean, Lat. 50° to 55°.

1202 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	S. 45° 57′ W.	23	S. 38½° E.	3
Feb.	S. 40 14 W.	33	S. 14 W.	11
March	S. 31 58 W.	28	S. 20 E.	10
April	S. 17 40 W.	17	S. 80 E.	13
May	S. 4 45 E.	10	N. 80 E.	20
June	S. 35 5 W.	25½	S. 26 E.	8
July	S. 65 29 W.	36	S. 87 W.	14
Aug.	S. 67 16 W.	33	N. 83 W.	12
Sept.	S. 43 1 W.	18	N. 86 E.	6
Oct.	S. 6 5 E.	13	N. 87 E.	20
Nov.	S. 87 22 W.	34	N. 51 W.	20
Dec.	N. 85 17 W.	36	N. 45 W.	24
The year	S. 52 41 W.	23		

No. 73.—North Atlantic Ocean, Lat. 45° to 50°.

2829 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	S. 60° 25′ W.	32
February . .	S. 52 59 W.	28
March . . .	S. 78 59 W.	23
April . . .	S. 86 42 W.	18
May . . .	S. 59 28 W.	17
June . . .	S. 63 36 W.	34
July . . .	S. 78 32 W.	32
August . . .	S. 81 45 W.	33
September . .	S. 65 31 W.	19
October . . .	N. 82 13 W.	27
November . .	N. 89 8 W.	33
December . .	S. 72 52 W.	41
The year . .	S. 74 19 W.	27

No. 74.—North Atlantic Ocean, Lat. 40° to 45°, Lon. from Greenwich, 45° to 75°.

3757 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	N. 73° 28′ W.	22	N. 8° 20′ W.	8
Feb.	N. 51 48 W.	32	N. 13 41 W.	21
Mar.	S. 82 8 W.	16	S. 79 33 E.	3
April	N. 86 53 W.	19	N. 19 27 E.	3
May	S. 56 29 W.	15	S. 48 16 E.	10
June	S. 52 10 W.	35	S. 20 20 W.	22
July	S. 50 32 W.	34	S. 0 55 W.	20
Aug.	S. 18 52 W.	22	S. 33 47 E.	23
Sept.	N. 68 44 W.	16	N. 33 56 E.	9
Oct.	N. 67 33 W.	23	N. 12 29 W.	10
Nov.	N. 68 51 W.	26	N. 21 22 W.	12
Dec.	N. 82 22 W.	24	N. 38 27 W.	6
The year	S. 85 8 W.	19		

No. 75.—North Atlantic Ocean, Lat. 40° to 45°, Lon. from Greenwich 0° to 45°.

5424 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	S. 57° 49′ W.	43	S. 30° W.	19
Feb.	S. 72 6 W.	38	S. 63 W.	11
March	N. 79 24 W.	32	N. 22 W.	14
April	S. 70 0 W.	25	S. 68 W.	3
May	S. 83 53 W.	31	N. 50 W.	7
June	S. 68 4 W.	33	S. 40 W.	7
July	S. 14 34 W.	30	S. 40 E.	28
Aug.	S. 48 8 W.	21	S. 57 E.	12
Sept.	N. 17 15 W.	6	N. 61 E.	25
Oct.	N. 78 53 W.	31	N. 18 W.	14
Nov.	S. 71 46 W.	35	S. 64 W.	8
Dec.	N. 86 59 W.	31	N. 27 W.	11
The year	S. 73 8 W.	27		

SERIES D.—*Continued.*

No. 76.—North Atlantic Ocean, Lat. 35° to 40°, Lon. from Greenwich 45° to 75°.

4790 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	N. 86° 22′ W.	32	N. 74° 6′ W.	14
Feb.	N. 56 24 W.	28	N. 18 33 W.	18
March	N. 76 10 W.	29	N. 48 4 W.	13
April	N. 75 6 W.	16	N. 26 29 E.	7
May	S. 43 3 W.	12	S. 55 49 E.	14
June	S. 50 40 W.	29½	S. 14 35 W.	17
July	S. 45 2 W.	36	S. 16 39 W.	25
Aug.	S. 24 1 W.	21	S. 29 37 E.	20
Sept.	S. 68 4 W.	5	S. 89 59 E.	14
Oct.	N. 11 32 E.	4	N. 83 47 E.	19
Nov.	N. 76 40 W.	30	N. 50 56 W.	14
Dec.	N. 64 30 W.	30	N. 30 27 W.	17
The year	S. 84 0 W.	18½		

No. 77.—North Atlantic Ocean, Lat. 35° to 40°, Lon. from Greenwich, 0° to 45°.

2590 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	S. 57° 13′ W.	24½
February . .	S. 55 7 W.	30
March . . .	S. 79 21 W.	7
April . . .	S. 72 57 W.	10
May . . .	N. 64 44 W.	12
June . . .	S. 56 51 W.	16
July . . .	S. 45 33 W.	24
August . .	S. 37 22 W.	20
September . .	S. 44 38 W.	7
October . .	S. 26 48 W.	11
November . .	S. 9 30 E.	35
December . .	S. 40 56 W.	9
The year . .	S. 44 26 W.	15

No. 78.—Atlantic Ocean, North of Lat. 36°.[1]

7 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	N. 58° 57′ W.	16
February . .	N. 77 20 W.	32
March . . .	N. 81 14 W.	27
April . . .	S. 89 41 W.	46
May . . .	N. 84 8 W.	26½
June . . .	S. 67 37 W.	34
July . . .	S. 87 31 W.	42
August . .	N. 88 41 W.	46
September . .	N. 77 37 W.	38
October . .	N. 78 47 W.	38
November . .	N. 88 33 W.	23
December . .	S. 82 15 W.	30
The year . .	N. 87 34 W.	30

No. 79.—North Atlantic Ocean, Lat. 30° to 35°, Lon. from Greenwich, 5° to 45°.

1749 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	S. 46° 8′ E.	12
February . .	S. 2 47 E.	25
March . . .	S. 27 53 E.	9½
April . . .	S. 1 29 W.	31
May . . .	N. 88 32 E.	8
June . . .	N. 30 9 W.	1
July . . .	N. 32 35 E.	22½
August . .	S. 76 13 E.	11½
September . .	N. 14 40 E.	13
October . .	N. 45 21 E.	8
November . .	S. 21 58 E.	29
December . .	S. 42 25 E.	26
The year . .	S. 44 27 E.	10

No. 80.—North Atlantic Ocean, Lat. 30° to 35°, Lon. from Greenwich, 45° to 75°.

2564 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	S. 80° 10′ W.	16	N. 56° 27′ W.	12
Feb.	S. 79 16 W.	30	N. 80 59 W.	24
March	S. 73 19 W.	21	N. 76 54 W.	15
April	S. 49 3 W.	11	N. 49 44 W.	3
May	S. 62 43 E.	14	N. 80 48 E.	18
June	S. 22 27 W.	29	S. 16 58 W.	18
July	S. 8 41 E.	35	S. 23 38 E.	28
Aug.	S. 7 11 E.	19	S. 40 38 E.	13
Sept.	S. 49 8 E.	19	S. 81 23 E.	20
Oct.	N. 85 7 E.	18	N. 65 17 E.	26
Nov.	S. 84 32 W.	10	N. 63 46 W.	9
Dec.	N. 81 21 W.	29	N. 59 4 W.	27
The year	S. 31 35 W.	11		

No. 81.—North Atlantic Ocean, Lat. 25° to 30°, Lon. from Greenwich, 15° to 45°.

1622 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.	
			Direction.	Am't.
Jan.	N. 78° 26′ E.	19	S. 18° W.	9
Feb.	N. 43 35 E.	11	S. 76 W.	16
March	N. 80 19 E.	3	S. 60 40′ W.	24
April	N. 79 39 E.	8	S. 55 46 W.	19
May	N. 67 39 E.	8	S. 60 42 W.	18
June	N. 42 48 E.	35	N. 5 E.	15
July	N. 44 35 E.	67	N. 30 E.	45
Aug.	N. 53 11 E.	61	N. 45 E.	38
Sept.	N. 62 36 E.	33	N. 61 32 E.	7
Oct.	N. 73 31 E.	27	S. 28 E.	5
Nov.	N. 78 50 E.	20	S. 15½ W.	9
Dec.	S. 70 27 E.	38	S. 24 E.	27
The year	N. 62 53 E.	26		

[1] The results in this table do not include those in any of the preceding ones, being computed from entirely different data. All the others, from No. 72 to No. 90 inclusive, were obtained from data contained in Lieutenant Maury's valuable Wind and Current Charts of the North Atlantic, a copy of which did not reach me till after this table had been computed from data previously in my possession, and the sheets made ready for the press.

SERIES D.—*Continued.*

No. 82.—North Atlantic Ocean, Lat. 25° to 30°, Lon. from Greenwich, 45° to 80°.

2906 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 42° 50′ E.	15	N. 46° 46′ W.	24
Feb.	N. 55 7 E.	10	N. 60 0 W.	22
March	N. 74 23 E.	3	N. 76 3 W.	25
April	N. 78 31 E.	25	N. 15 16 W.	11
May	S. 63 52 E.	43	S. 39 11 E.	18
June	S. 43 17 E.	44	S. 5 42 E.	27
July	S. 67 2 E.	57	S. 55 52 E.	30
Aug.	S. 74 51 E.	47	S. 68 42 E.	19
Sept.	S. 81 43 E.	35	N. 87 50 E.	7
Oct.	S. 69 14 E.	39	S. 46 28 E.	12
Nov.	N. 66 16 E.	45	N. 30 20 E.	16
Dec.	N. 70 26 E.	2	N. 76 51 W.	26
The year	S. 79 4 E.	28		

No. 83.—North Atlantic Ocean, Lat. 20° to 25°, Lon. from Greenwich, 15° to 45°.

1334 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 64° 9′ E.	38	S. 24½° W.	23
Feb.	N. 56 50 E.	53	S. 21½ E.	8
March	N. 26 6 E.	21	S. 62 W.	39
April	N. 43 0 E.	51½	S. 88 W.	10
May	N. 45 34 E.	67	N. 20 E.	10
June	N. 48 49 E.	74	N. 45 22′ E.	19
July	N. 37 45 E.	85	N. 10 E.	28
Aug.	N. 42 1 E.	84	N. 20 E.	26
Sept.	N. 51 8 E.	71	N. 64½ E.	15
Oct.	N. 57 58 E.	50	S. 8 W.	11
Nov.	N. 67 7 E.	53	S. 14½ E.	19
Dec.	N. 65 9 E.	59	S. 27 E.	17
The year	N. 55 20 E.	58		

No. 84.—North Atlantic Ocean, Lat. 20° to 25°, Lon. from Greenwich, 45° to 80°.

1573 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 65° 29′ E.	35	N. 76½° W.	24
Feb.	N. 75 53 E.	50½	N. 72 W.	5
March	N. 72 33 E.	37½	N. 84 W.	18
April	N. 82 4 E.	46	S. 66 1′ W.	9
May	N. 80 1 E.	65	N. 83 28 E.	10
June	N. 80 42 E.	65	N. 87 51 E.	10
July	N. 78 24 E.	81	N. 76 18 E.	26
Aug.	N. 72 6 E.	76	N. 53 E.	24
Sept.	N. 83 0 E.	54	S. 3 W.	4
Oct.	S. 68 49 E.	55	S. 5½ W.	31
Nov.	N. 79 1 E.	52	S. 85 38 W.	3
Dec.	N. 69 52 E.	57	North	13
The year	N. 79 23 E.	55		

No. 85.—North Atlantic Ocean, Lat. 15° to 20°, Lon. from Greenwich, 45° to 80°.

1190 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 64° 21′ E.	78	N. 7° 40′ W.	8
Feb.	N. 58 25 E.	86	N. 6 W.	17
March	N. 67 21 E.	75	N. 52 30 W.	4
April	N. 77 27 E.	64	S. 36 W.	20
May	N. 68 21 E.	84	N. 64 23 E.	7
June	N. 60 20 E.	95	N. 24 15 E.	23
July	N. 62 25 E.	87½	N. 21 45 E.	15
Aug.	N. 70 38 E.	80	S. 38 E.	5
Sept.	N. 83 32 E.	73	S. 2 W.	20
Oct.	N. 83 49 E.	70	S. 8 W.	18
Nov.	N. 75 48 E.	72	S. 7 W.	12
Dec.	N. 61 5 E.	73	N. 40 30 W.	10
The year	N. 68 43 E.	77		

No. 86.—North Atlantic Ocean, Lat. 15° to 20°, Lon. from Greenwich, 15° to 45°.

1332 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 50° 42′ E.	75	S. 1° 32′ W.	3
Feb.	N. 46 48 E.	71	S. 74 8 W.	7
March	N. 49 29 E.	68	S. 45 27 W.	8
April	N. 49 28 E.	80	N. 60 56 E.	3
May	N. 43 50 E.	81	N. 35½ W.	7
June	N. 42 8 E.	90	N. 3½ E.	16
July	N. 41 26 E.	99	N. 14 E.	23
Aug.	N. 40 49 E.	75	N. 54 W.	11
Sept.	N. 54 14 E.	76	S. 15 E.	9
Oct.	N. 54 50 E.	67	S. 13 W.	13
Nov.	N. 60 50 E.	78	S. 37½ E.	15
Dec.	N. 58 5 E.	75	S. 16 E.	13
The year	N. 49 1 E.	77½		

No. 87.—North Atlantic Ocean, Lat. 10° to 15°, Lon. from Greenwich, 45° to 75°.

662 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 55° 0′ E.	87	North	10
Feb.	N. 52 12 E.	90	N. 3½° E.	15
March	N. 58 14 E.	87	N. 20 E.	12
April	N. 59 59 E.	83	N. 65½ E.	1
May	N. 63 8 E.	89	S. 79 E.	8
June	N. 51 50 E.	96	N. 12 E.	22
July	N. 56 49 E.	89	S. 25½ E.	7
Aug.	N. 65 14 E.	85	S. 67 E.	10
Sept.	N. 82 29 E.	55	S. 25½ W.	38
Oct.	N. 73 52 E.	67	S. 17 W.	24
Nov.	N. 57 37 E.	89	N. 27 E.	11
Dec.	N. 54 38 E.	74	N. 72½ W.	13
The year	N. 59 55 E.	82		

SERIES D.—*Continued.*

No. 88.—North Atlantic Ocean, Lat. 10° to 15°, Lon. from Greenwich, 15° to 45°.

1850 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	N. 55° 30′ E.	85	N. 21° 2′ E.	7
Feb.	N. 54 41 E.	81	N. 26 58 W.	4
March	N. 55 51 E.	89	N. 37 30 E.	9
April	N. 56 44 E.	88	N. 44 19 E.	7
May	N. 49 14 E.	90	N. 2 0 E.	15
June	N. 55 0 E.	75	N. 84 23 W.	6
July	N. 57 2 E.	42	S. 59 4 W.	38
Aug.	N. 49 18 E.	17	S. 61 W.	47
Sept.	N. 46 6 E.	23	S. 63 W.	59
Oct.	N. 69 20 E.	55	S. 28½ W.	29
Nov.	N. 68 54 E.	78	S. 9½ E.	18
Dec.	N. 61 33 E.	78	S. 9 W.	13
The year	N. 57 25 E.	66		

No. 89.—North Atlantic Ocean, Lat. 5° to 10, Lon. from Greenwich, 10° to 55°.

3339 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.[1] Direction.	Am't.
Jan.	N. 47° 5′ E.	65	N. 17° W.	25
Feb.	N. 44 56 E.	72	N. 9 W.	27
March	N. 45 3 E.	74	N. 7 W.	29
April	N. 44 50 E.	82	N. 10 E.	36
May	N. 55 38 E.	69	N. 18½ E.	15
June	S. 89 1 E.	30	S. 43 W.	33
July	S. 7 1 E.	45	S. 36 W.	86
Aug.	S. 4 59 W.	71	S. 26 W.	104
Sept.	S. 8 26 W.	58	S. 28 W.	94
Oct.	S. 38 2 E.	30	S. 36 W.	61
Nov.	S. 82 15 E.	55	S. 1½ E.	32
Dec.	N. 60 25 E.	52	N. 86 W.	9
The year	N. 80 32 E.	34		

No. 90.—North Atlantic, Lat. 0° to 5°.

3005 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.[1] Direction.	Am't.
Jan.	S. 81° 46′ E.	53	S. 56° W.	17
Feb.	N. 83 31 E.	54	N. 70 W.	15
March	N. 63 13 E.	52	N. 43½ W.	30
April	N. 52 18 E.	56	N. 35½ W.	39
May	S. 89 59 E.	48	S. 81 W.	17
June	S. 47 45 E.	69	S. 19½ W.	50
July	S. 37 17 E.	82	S. 14 W.	70
Aug.	S. 20 52 E.	84	S. 24 W.	87
Sept.	S. 20 15 E.	79	S. 25½ W.	86
Oct.	S. 38 0 E.	72	S. 20 W.	65
Nov.	S. 58 28 E.	80	S. 2 E.	45
Dec.	S. 68 23 E.	56	S. 28½ W.	28
The year	S. 60 2 E.	55		

No. 91.—Funchal, Island of Madeira.

2 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces.[1] Direction.	Am't.
Jan.	N. 9° 43′ E.	11	S. 24° W.	35
Feb.	N. 6 3 W.	45	S. 84 W.	25
March	N. 18 28 E.	43	S. 62½ W.	5
April	N. 18 38 E.	31	S. 31 W.	19
May	N. 11 2 E.	52	N. 47 W.	11
June	N. 14 18 E.	50	N. 54½ W.	7
July	N. 28 29 E.	62	N. 54 E.	16
Aug.	N. 48 17 E.	96	N. 75 E.	54
Sept.	N. 24 46 W.	27	S. 61 W.	34
Oct.	N. 37 43 E.	47	S. 68 E.	16
Nov.	N. 8 49 E.	50	N. 32 W.	17
Dec.	N. 30 22 E.	63	N. 3 E.	25
The year	N. 23 50 E.	45		

No. 92.—Azores and vicinity.[2]—6 stations.

581 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 81° 41′ W.	19
February	S. 52 13 W.	73
March	N. 17 35 E.	53
April	S. 15 4 W.	35
May	N. 72 20 W.	22
June	N. 45 5 W.	16
July	N. 45 5 W.	16
August	S. 50 15 W.	35
September	S. 44 10 W.	41
October	S. 41 38 W.	48
November	S. 15 58 W.	56
December	N. 21 37 W.	26
The year	S. 63 21 W.	21

No. 93.—Gibraltar and vicinity.[3]

586 DAYS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 39° 52′ W.	16
February		
March	N. 2 40 W.	79
April	S. 78 10 W.	12
May	N. 12 30 E.	15
June	S. 89 24 W.	39½
July	N. 74 10 E.	44
August	N. 86 48 E.	54
September	N. 16 20 W.	22
October	N. 67 55 E.	27
November	N. 61 37 E.	92
December	S. 84 35 E.	36
The year	N. 38 18 E.	23

[1] In computing these deflecting forces, the mean annual direction of the wind in the same latitude in *mid ocean* was taken as the standard of comparison, on account of the influence of the Great Desert, which affects the annual results all along the African coast in these latitudes, as may be readily seen by inspecting the length and position of the arrows on Plate XIII.

[2] These results are obtained from observations taken at five different islands for a joint period of 205 days, and on board ships in the vicinity for 376 days.

[3] These results are obtained from observations taken at Gibraltar for 76 days, and on board ships in the vicinity of the straits for 510 days.

SERIES D.—*Continued.*

No. 94.—St. Petersburg, Russia.

5 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 40° 16′ W.	38
February	S. 16 48 W.	38
March	S. 5 3 E.	35
April	S. 20 49 E.	22
May	N. 65 49 W.	6
June	N. 4 7 W.	3
July	S. 62 54 W.	17
August	S. 34 23 W.	10½
September	S. 30 17 W.	12
October	S. 1 52 W.	32
November	S. 18 19 E.	35
December	S. 1 13 W.	33½

No. 95.—Cronberg, Sweden.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 84° 28′ E.	41
February	S. 31 57 W.	14
March	N. 85 33 W.	50
April	N. 62 57 E.	77
May	N. 35 43 E.	33
June	N. 74 7 W.	24
July	N. 87 26 W.	35
August	N. 60 33 E.	25
September	S. 64 37 W.	9
October	S. 65 11 W.	22
November	N. 50 25 W.	30½
December	N. 45 33 W.	23½
The year	N. 17 48 W.	9

No. 96.—Dantzic, Prussia.

13 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 50° 24′ W.	
February	S. 19 0 W.	
March	S. 84 20 W.	
April	N. 69 7 W.	
May	N. 38 30 W.	
June	N. 41 31 W.	
July	N. 72 38 W.	
August	S. 82 43 W.	
September	S. 71 46 W.	
October	S. 37 16 W.	
November	S. 54 47 W.	
December	S. 48 1 W.	
The year	S. 68 7 W.	11

No. 97.—Berlin, Prussia.

11 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 48° 26′ E.	24
February	S. 40 14 W.	36
March	S. 67 27 W.	45
April	S. 70 54 W.	50
May	S. 60 54 W.	21
June	West	57
July	N. 80 29 W.	95½
August	West	84
September	S. 78 20 W.	58
October	S. 22 28 W.	37½
November	S. 7 47 W.	21½
December	S. 45 0 W.	33
The year	S. 78 17 W.	29

No. 98.—Posen, Poland (combined with No. 97).

11¾ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 77° 43′ E.	42
February	S. 37 38 W.	42
March	S. 53 37 W.	21
April	S. 70 54 W.	50
May	S. 60 54 W.	21
June	West	57
July	N. 80 29 W.	95½
August	West	67½
September	S. 77 57 W.	58½
October	S. 41 13 W.	50
November	S. 21 13. W.	26
December	S. 41 21 W.	31

No. 99.—Carlsruhe, Baden, Germany.

2 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 47° 58′ W.	34½
February	S. 56 7 W.	35
March	N. 59 23 W.	15
April	N. 0 45 W.	29
May	S. 76 31 W.	14½
June	S. 74 33 W.	9
July	S. 44 26 W.	16
August	S. 63 59 W.	23
September	S. 51 17 W.	5½
October	S. 46 50 W.	30
November	S. 48 59 E.	6
December	S. 78 57 W.	6
The year	S. 73 19 W.	17

SERIES D.—*Continued.*

No. 100.—Average duration of winds in each month, in Germany, deduced from observations taken at nineteen different stations, for an aggregate period of 19⅗ years.

Months.	N.	N. N. E.	N. E.	E. N. E.	E.	E. S. E.	S. E.	S. S. E.	S.	S. S. W.	S. W.	W. S. W.	W.	W. N. W.	N. W.	N. N. W.	Calm.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Deflecting forces. Am't.
Jan.	1.72	.19	2.49	.18	2.07	.42	3.93	.40	2.27	.19	7.47	.05	6.30	.19	2.52	.42	.19	S. 51° 28′ W.	28	S. 18° E.	11
Feb.	1.94	.15	3.75	.23	4.24	.12	2.98	.17	1.92	.15	4.35	.17	3.67	.20	3.74	.43	.03	N. 48 56 W.	2	N. 79 E.	18
Mar.	1.90	.28	3.57	.33	5.03	.13	2.41	.17	2.65	.13	4.68	.15	4.42	.19	4.56	.39	.01	N. 77 47 W.	5	N. 78 E.	14
April	3.42	.40	3.84	.20	3.86	.17	1.83	.07	1.67	.10	3.00	.07	6.34	.28	4.00	.62	.13	N. 36 23 W.	20	N. 21 E.	19
May	2.38	.50	4.33	.43	4.61	.17	2.27	.22	1.49	.18	4.66	.27	5.70	.35	3.06	.28	.10	N. 47 3 W.	8	N. 60½ E.	15
June	3.18	.25	2.84	.15	1.83	.23	1.44	.17	1.24	.22	4.79	.43	6.58	.72	5.28	.55	.00	N. 68 55 W.	35	N. 43 W.	20
July	1.99	.12	1.79	.12	1.72	.27	1.51	.08	1.63	.20	5.87	.63	8.97	.51	5.21	.33	.05	N. 89 24 W.	44	N. 85 W.	25
Aug.	1.66	.08	2.35	.12	3.78	.39	2.37	.33	2.54	.48	4.72	.43	6.85	.46	4.24	.12	.08	S. 73 7 W.	21	S. 15 W.	4
Sept.	1.94	.07	2.90	.21	5.42	.48	2.08	.20	2·08	.30	4.03	.21	5.91	.31	3.68	.16	.02	S. 87 7 W.	8	N. 83 E.	11
Oct.	.79	.12	1.71	.29	2.59	.72	2.81	.21	1.68	.45	6.57	.32	9.54	.34	2.63	.21	.02	S. 63 56 W.	36	S. 43 W.	19
Nov.	1.54	.25	2.51	.20	4.04	.48	2.90	.30	2.82	.28	6.92	.23	5.08	.27	1.84	.27	.07	S. 31 31 W.	21	S. 27 E.	18
Dec.	1.03	.48	3.04	.61	2.55	.29	3.54	.21	1.91	.30	6.29	.23	7.76	.43	2.07	.20	.06	S. 76 51 W.	27	S. 60 W.	6
Total.	23.49	2.89	35.12	3.07	41.74	3.87	30.07	2.53	23.90	2.98	63.35	3.19	77.12	4.25	42.83	3.98	.86	S. 82 4 W.	20		

No. 101.—Franeker, Holland.

13 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January . . .	S. 38° 49′ W.	8
February . . .	S. 37 20 W.	34
March . . .	N. 60 59 W.	16
April . . .	N. 64 32 W.	33
May . . .	N. 61 21 W.	33
June . . .	N. 63 42 W.	45
July . . .	N. 88 46 W.	50
August . . .	S. 82 43 W.	46½
September . . .	S. 62 4 W.	25
October . . .	S. 49 17 W.	33
November . . .	S. 45 55 W.	15
December . . .	S. 46 27 W.	24
The year . . .	S. 81 29 W.	27

No. 102.—Brussels, Belgium.

8 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January . . .	S. 74° 48′ W.	30½
February . . .	S. 47 19 W.	68
March . . .	S. 60 7 W.	8
April . . .	S. 77 38 W.	13
May . . .	N. 62 26 W.	32
June . . .	N. 60 3 W.	41
July . . .	S. 83 35 W.	77
August . . .	S. 45 0 W.	23
September . . .	S. 61 34 W.	53
October . . .	S. 25 30 W.	66
November . . .	S. 45 0 W.	71
December . . .	S. 66 42 W.	55½
The year . . .	S. 64 22 W.	39

No. 103.—Holland and Belgium.—3 stations.

28 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Deflecting forces. Am't.
January	S. 59° 58′ W.	15	N. 89° E.	16
February	S. 46 56 W.	47	S. 12 W.	24
March	N. 78 54 W.	11	N. 59 E.	21
April	N. 63 46 W.	21	N. 29 E.	20
May	N. 61 38 W.	32	N. 1½ E.	24
June	N. 61 26 W.	43	N. 17 W.	31
July	S. 88 21 W.	59½	N. 79 W.	30
August	S. 73 54 W.	34	S. 74 W.	4
September	S. 60 36 W.	34½	S. 10 W.	8
October	S. 38 33 W.	44	S. 4 E.	26
November	S. 44 9 W.	32	S. 24 E.	16
December	S. 51 47 W.	37	S. 2 W.	14

No. 104.—Elgin, Scotland.

3 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January . . .	S. 46° 18′ W.	50½
February . . .	S. 50 21 W.	61
March . . .	S. 49 34 W.	54
April . . .	S. 51 37 W.	33
May . . .	N. 70 23 W.	31
June . . .	S. 82 8 W.	27
July . . .	S. 44 17 W.	43
August . . .	S. 46 17 W.	39
September . . .	S. 12 55 W.	48½
October . . .	S. 45 7 W.	58
November . . .	S. 23 12 W.	66
December . . .	S. 40 18 W.	48
The year . . .	S. 44 47 W.	44

SERIES D.—*Continued.*

No. 105.—Great Britain.—5 stations.

16½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.	Deflecting forces. Direction.	Am't.
Jan.	S. 66° 36′ W.	20	S. 29½° E.	4
Feb.	S. 51 19 W.	35	S. 18½ W.	19
March	S. 70 53 W.	8	N. 83 E.	12
April	N. 58 53 W.	10	N. 53 E.	15
May	N. 74 2 W.	5	N. 70 E.	16½
June	N. 69 33 W.	25	N. 12 W.	13
July	N. 87 49 W.	38	N. 72 W.	18
Aug.	S. 84 34 W.	37	N. 89 W.	16
Sept.	S. 37 42 W.	10½	S. 73 E.	15
Oct.	S. 57 57 W.	21	S. 23 E.	7
Nov.	S. 77 28 W.	24	S. 63½ W.	3
Dec.	S. 68 59 W.	26	S. 37 W.	6

No. 106.—London, England.[1]

12 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 86° W.	
February	S. 63 W.	
March	N. 20 W.	
April	N. 12 E.	
May	S. 51 E.	
June	N. 65 W.	
July	N. 89 W.	
August	N. 86 W.	
September	S. 77 W.	
October	S. 51 W.	
November	S. 88 W.	
December	S. 89 W.	
The year	N. 89 2′ W.	16

No. 107.—Northern France.[2]—7 stations.

116 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 83° 54′ W.	5
February	S. 66 52 W.	17
March	N. 56 48 W.	10
April	N. 11 2 W.	13
May	N. 37 9 W.	11
June	N. 52 27 W.	15
July	S. 62 54 W.	30½
August	S. 79 20 W.	21
September	S. 6 17 W.	14
October	S. 26 21 W.	21
November	S. 41 2 W.	22
December	S. 37 11 W.	11

No. 108.—Paris, France.

40 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 50° 55′ W.	14½
February	S. 59 4 W.	20½
March	N. 76 7 W.	13½
April	N. 51 42 W.	10
May	S. 79 26 W.	11
June	N. 83 0 W.	27
July	S. 85 49 W.	37
August	S. 79 27 W.	34½
September	S. 53 46 W.	17
October	S. 37 29 W.	24
November	S. 39 25 W.	30
December	S. 39 15 W.	24

No. 109.—Mount St. Gothard, Switzerland.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 17° 47′ E.	20
February	N. 47 35 W.	49
March	S. 54 47 W.	26
April	N. 52 58 W.	52
May	N. 49 52 W.	38
June	N. 47 44 W.	59½
July	N. 55 43 W.	40
August	S. 87 56 W.	20
September	S. 23 19 E.	8½
October	N. 49 33 W.	36
November	S. 8 50 W.	12
December	S. 30 27 E.	49
The year	N. 82 56 W.	26

No. 110.—Parma and Genoa, Italy.

13 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 48° 42′ W.	34
February	N. 6 36 E.	34
March	N. 11 22 E.	32
April	N. 20 37 E.	25
May	N. 9 21 E.	23
June	S. 65 35 W.	1½
July	S. 47 31 W.	15
August	N. 4 42 E.	36
September	N. 21 38 W.	7
October	N. 9 47 E.	4
November	N. 63 48 W.	47
December	N. 38 32 W.	44

[1] Copied from Kaemptz's Meteorology.

[2] An inspection of the data on pages 96 and 100, from which this table is computed, will show that no great reliance can be placed on the results, less so, probably, than in those at Paris alone (No. 108).

SERIES D.—*Continued.*

No. 111.—Rome and Naples, Italy.

2 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 11° 7′ E.	35
February	N. 14 53 E.	29
March	S. 89 16 W.	21
April	N. 35 50 W.	14
May	S. 51 51 W.	25
June	S. 61 33 W.	17
July	S. 47 28 W.	35
August	S. 45 1 W.	43
September	S. 74 28 W.	25
October	N. 34 48 W.	14
November	N. 40 35 W.	5
December	N. 35 49 E.	36

No. 112.—Vienna and Schoenthal, Austria.

2 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 78° 24′ W.	45
February	N. 73 47 E.	39
March	S. 50 50 W.	24
April	N. 20 35 W.	17
May	N. 5 18 W.	20
June	N. 83 7 W.	35
July	N. 86 48 W.	50
August	S. 65 48 W.	27
September	S. 51 7 W.	13
October	S. 37 40 W.	46
November	S. 34 48 W.	35
December	S. 42 4 W.	30

No. 113.—Graetz, Austria.[1]

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 41° 56′ E.	
February	S. 52 35 E.	
March	S. 80 55 E.	
April	S. 77 1 E.	
May	69 13 E.	
June	N. 69 57 E.	
July	S. 49 32 E.	
August	S. 56 53 E.	
September	S. 66 54 E.	
October	S. 85 23 E.	
November	S. 82 37 W.	
December	S. 14 36 E.	
The year	S. 75 58 E.	

No. 114.—Lougan, Southern Russia.

2 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 23° 9′ E.	13
February	S. 24 59 W.	15
March	S. 63 29 E.	45
April	S. 69 46 E.	32
May	S. 71 46 E.	37
June	N. 44 18 W.	14
July	N. 86 24 E.	7
August	S. 25 33 W.	5
September	S. 88 13 E.	44
October	S. 81 44 E.	17
November	S. 4 10 E.	13
December	S. 70 50 E.	21

No. 115.—Turkey, Asia Minor, Armenia, and Georgia.—5 stations.

5 1-6 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 83° 12′ E.	21
February	S. 74 21 E.	21
March	N. 40 17 E.	26
April	N. 36 36 E.	32
May	N. 8 57 W.	17
June	N. 19 19 E.	24
July	N. 44 2 E.	33
August	N. 42 22 E.	36
September	N. 36 30 E.	20
October	N. 17 23 E.	19
November	S. 59 34 W.	5
December	N. 27 38 E.	4

No. 116.—Syria.—2 stations.

19 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 50° 49′ W.	55
February	S. 67 14 W.	50½
March	S. 84 14 W.	32
April	S. 46 9 W.	42½
May	S. 72 37 W.	52
June	S. 78 56 W.	58
July		
August		
September		
October		
November	S. 34 8 W.	41
December	S. 51 24 W.	32
Total	S. 77 38 W.?	40½

[1] Copied from some source not now recollected.

SERIES D.—*Continued.*

No. 117.—Jerusalem, Palestine.

17 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 0° 35′ W.	44
February	N. 39 50 W.	59
March		
April	N. 50 44 W.	44
May	N. 40 54 W.	52
June	N. 39 36 W.	80
July	N. 46 2 W.	92
August	N. 40 38 W.	90
September	N. 14 2 W.	91½
October	N. 6 11 W.	78½
November	N. 38 28 W.	62
December	N. 36 57 E.	47
The year	N. 26 12 W.	62 ?

No. 118.—Bagdad (on the Euphrates).

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 66° 23′ W.	83
February	N. 21 53 W.	59
March	N. 74 30 W.	30
April	S. 80 11 W.	66
May	S. 65 48 W.	54
June	S. 73 59 W.	93½
July	N. 89 48 W.	98
August	S. 72 43 W.	86
September	S. 63 45 W.	71
October	N. 54 14 W.	87
November	N. 69 5 W.	66
December	N. 69 3 W.	56
The year	N. 84 49 W.	65

No. 119.—Bassora (head of Persian Gulf).

5 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January		
February	S. 44° 16′ W.	39
March	N. 76 24 W.	36
April	S. 88 0 E.	27
May	N. 46 12 W.	72
June	N. 45 41 W.	100
July		
August		
September		
October		
November		
December		

No. 120.—Ooroomiah, Persia.

19 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 44° 25′ W.	49
February	S. 60 2 W.	64
March	S. 56 30 W.	64
April	S. 44 7 W.	43
May	S. 56 56 W.	50
June	N. 62 36 W.	34
July	S. 70 46 W.	48
August	N. 56 21 W.	43
September	S. 84 35 W.	28
October	S. 44 37 W.	53½
November	N. 88 57 W.	43
December	N. 51 25 W.	47½

No. 121.—Northern Persia.—3 stations.

27 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 44° 25′ W.	49
February	S. 86 54 W.	36
March	S. 62 33 W.	56
April	S. 74 40 W.	49
May	S. 46 48 W.	55
June	N. 62 36 W.	34
July	S. 70 46 W.	48
August	N. 56 21 W.	43
September	N. 81 32 W.	22
October	S. 56 49 W.	35
November	S. 85 43 W.	32
December	N. 74 16 W.	25

No. 122.—Persia and Mesopotamia.—5 stations.

44 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 86° 34′ W.	50
February	N. 78 39 W.	34
March	S. 76 49 W.	41
April	S. 74 18 W.	35
May	S. 74 55 W.	46
June	N. 73 19 W.	68
July	S. 83 38 W.	71
August	N. 88 55 W.	59
September	S. 77 7 W.	38
October	N. 83 20 W.	44
November	N. 81 44 W.	43
December	N. 71 37 W.	34

SERIES D.—*Continued.*

No. 123.—Patna, Futtehpore, and on the Ganges, Hindoostan.

8 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January		
February		
March		
April		
May	N. 81° 52′ E.	28
June	S. 78 41 E.	4
July	N. 88 34 E.	65
August	S. 84 28 W.	50
September	N. 78 41 W.	8
October	West	61
November	West	50
December	N. 58 14 W.	17

No. 124.—Calcutta, Hindoostan.[1]

8 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 23° W.	44
February	N. 37 W.	15
March	S. 10 W.	38
April	S. 17 W.	61
May	S. 12 E.	63
June	S. 10 E.	45
July	S. 12 E.	52
August	S. 25 E.	42
September	S. 31 E.	40
October	N. 46 W.	31
November	N. 19 W.	71
December	N. 25 W.	73
The year	S. 26 W.	13

No. 125.—Duklum, Hindoostan.

5 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 75° 36′ E.	18
February	N. 4 15 W.	5
March	N. 78 16 W.	19
April	N. 85 57 W.	50
May	S. 88 6 W.	62
June	S. 77 46 W.	72½
July	S. 78 29 W.	83
August	S. 87 39 W.	71
September	S. 86 30 W.	72
October	N. 13 30 E.	8
November	N. 80 36 E.	46
December	N. 88 54 E.	42
The year	S. 89 7 W.	26

No. 126.—Western Siberia (near Ural M'ts.). 3 stations.

4 YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 66° 32′ W.	41
February	S. 87 32 W.	35
March	S. 72 51 W.	29
April	N. 63 11 W.	14½
May	S. 56 53 W.	25
June	S. 75 54 W.	24
July	N. 70 10 W.	20
August	N. 27 8 W.	4
September	N. 80 10 W.	19
October	N. 88 9 W.	48
November	S. 72 43 W.	24
December	S. 78 40 W.	33

No. 127.—Barnoule, Siberia.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	S. 41° 9′ W.	23
February	S. 22 15 W.	27
March	S. 32 56 W.	23
April	N. 23 53 W.	13
May	N. 37 46 W.	8
June	S. 38 42 W.	23
July	S. 6 54 W.	24
August	N. 69 31 E.	7
September	N. 53 58 E.	29
October	N. 24 14 E.	16
November	S. 34 29 E.	53
December	S. 22 33 W.	62
The year	S. 35 3 W.	19

No. 128.—Nertchinsk, Siberia.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January	N. 66° 20′ W.	6
February	S. 83 31 W.	10
March	S. 89 47 W.	17
April	N. 52 6 W.	35
May	N. 54 17 W.	31½
June	N. 4 54 E.	23½
July	S. 27 27 W.	6
August	S. 33 51 W.	11
September	S. 87 5 W.	18
October	N. 68 23 W.	36
November	N. 71 3 W.	24
December	N. 76 23 W.	8½
The year	N. 72 56 W.	19

[1] Copied from Kaemptz's Meteorology.

SERIES D.—*Continued.*

No. 129.—Yacoutsk, Siberia.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	N. 43° 45′ W.	68
February . .	N. 44 43 W.	52
March . . .	N. 85 37 W.	59
April . . .	N. 43 6 W.	64
May . . .	N. 48 29 W.	45
June . . .	N. 2 2 W.	37½
July . . .	N. 50 0 W.	29
August . .	N. 19 39 E.	58½
September . .	S. 87 5 W.	56
October . .	N. 58 7 W.	53
November . .	N. 44 3 W.	66
December . .	N. 35 36 W.	66
The year . .	N. 45 20 W.	48

No. 130.—Pekin, China.

1 YEAR.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	N. 50° 22′ W.	35
February . .	N. 68 55 W.	28
March . . .	S. 18 12 W.	20
April . . .	S. 17 20 W.	20
May . . .	S. 10 46 W.	19
June . . .	S. 30 7 E.	17
July . . .	S. 1 28 W.	36
August . .	S. 9 5 E.	30
September . .	S. 85 15 W.	13
October . .	N. 48 37 W.	25
November . .	N. 43 32 W.	21
December . .	N. 40 43 W.	44
The year . .	S. 74 22 W.	11½

No. 131.—Tripoli, Northern Africa.

5 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .		
February . .		
March . . .	N. 71° 22′ W.	15
April . . .	N. 42 58 W.	14
May . . .	N. 75 9 E.	41
June . . .	N. 60 15 E.	45
July . . .	N. 47 50 E.	52½
August . . .		
September . .		
October . .		
November . .		
December . .		

No. 132.—Liberia, Sierra Leone, and vicinity.[1]

1½ YEARS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	S. 55° 43′ W.	36
February . .	N. 73 45 W.	38
March . . .	N. 54 31 W.	49
April . . .	S. 76 57 W.	51
May . . .	S. 61 9 W.	46
June . . .	S. 9 8 W.	77½
July . . .	S. 2 25 W.	77½
August . . .	S. 2 15 E.	91
September . .	S. 40 57 W.	81
October . .	S. 47 58 W.	70
November . .	S. 47 40 W.	96
December . .	S. 26 37 W.	80
The year . .	S. 39 43 W.	54

No. 133.—Sandwich Islands.[2]—2 stations.

13 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	North-easterly	10
February . .	Do.	36
March . . .	Do.	58
April . . .	Do.	66
May . . .	Do.	87
June . . .	Do.	87
July . . .	N. 48° 21′ E.	88
August . .	North-easterly	93½
September . .	Do.	92
October . .	Do.	55
November . .	Do.	13
December . .	Do.	23

No. 134.—Navigator's Islands (Pago-pago).

10 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	N. 9° 32′ W.	43
February . .	N. 26 34 E.	11
March . . .	S. 75 58 E.	39
April . . .	S. 42 8 E.	80
May . . .	S. 45 0 E.	48
June . . .	S. 42 53 E.	90
July . . .	S. 39 34 E.	68
August . .	S. 42 8 E.	64½
September . .	S. 59 45 E.	65½
October . .	S. 45 0 E.	100

[1] These results are obtained from three months' observations at Bassa Cove, two months at Cape Palmas, and eleven months along the coast of Sierra Leone and Liberia.

[2] These results are obtained from observations taken at Oahu for one month, and at Waioli for one year. At the latter station, all the winds were recorded either as North-east or "Variable."

SERIES D.—*Continued.*

No. 135.—Madagascar (Tananarivou).

3 MONTHS.

Months.	Mean direction of Wind.	Rate of Progress.
January . .	N. 62° 5′ E.	28
February . .	S. 82 42 E.	79
March . . .	N. 71 53 E.	53

By combining in succession the resultants for the several months at any place, as given in the preceding series of tables, a general outline is obtained of the track pursued by the wind in the course of a year. The results, at a considerable number of places, are exhibited in Plates VII., VIII., and X. Each of the twelve parts, into which the curve is divided, shows the mean path of the wind in the corresponding month, the curve commencing in all cases with January, and ending with December.

It is obvious that much more extensive data would be needed, to secure accuracy in the form of the annual curve, than in the mean annual direction merely; and hence it was not thought worth while to exhibit in the plates any results based on less than three years' observations, except in a few rare localities. The numbers at the origin of the curves correspond with those in Series D, and may serve as references.

In order to render the form of the curves more distinct to the eye, they are drawn on a scale four times larger than the arrows which represent the mean annual directions, as may, in most cases, be seen by comparing the distance between the two extremities of any curve with the straight arrow for the same place. A few of the curves, however, are not computed from the same data as the mean annual direction, one embracing a greater number of years than the other, which produces slight discrepancies in the results.

In some few instances, where the general form of the curve was obvious, and where combining the results of two or three successive months would cancel irregularities, it has been done, and the tracks for the separate months preserved by means of dotted lines. As, for example, in the curve for Jerusalem (Plate VII. No. 117), the tracks for the months of November and December are united.

DEDUCTIONS AND REMARKS.

1. Plates VII., VIII., and X. *disclose a system of winds on each side of the Atlantic Ocean possessing monsoon features.* If we represent the mean annual tracks by drawing straight lines from one extremity of each annual curve to the other, we perceive that on the western side of the Atlantic, the actual track falls south of these lines in the fore part of the year, and north of it in the latter part; and that on the eastern side the curvature is generally in the opposite direction. Out of thirty-five curves on the western side, in British America, the Eastern United States, and the western half of the Atlantic, there are but two exceptions; and both of these are between the parallels of latitude 31° and 33°, just on the limit which divides the equatorial winds from the westerly ones.

On the eastern side of the Atlantic, there is a general similarity in the form of the curves, yet by no means so great as on the western side. At sea, we perceive it only between the parallels of latitude 15° and 40°; but on land, all the curves show it, more or less, except that for St. Petersburg on the north, and that for Rome and Naples on the south. The opposite curvature of the latter, also that for Madeira, and the two at sea, south of latitude 10°, will be adverted to hereafter.

2. On the western side, the monsoon character of the winds is much more strongly marked *near the sea-coast* than in the *interior of the country.* Thus, on Plate VIII., the curvature is greater in the New England States (No. 28) than in the State of New York (No. 30) or Pennsylvania (No. 32). Compare, also, the curve for Pompey, in the interior of New York State (No. 29), with the curves east of it, all of which are for places nearer the sea-coast; or No. 40, which is derived from observations taken mostly at Nashville, in Tennessee,[1] with Nos. 33, 34, 35, 36, 37, or 41 near the coast. No. 37 is remarkable—almost equal to the monsoons of India, as may be seen by comparing it with the latter on Plate VII. In Ohio (Nos. 57, 58, and 59), the monsoon feature does not appear to exist at all, though there seems to be slight traces of it still farther west (Nos. 61, 62, and 63).

3. On the western side of the Atlantic, there appears to be considerable uniformity in the *time of the year* when the curves cross the mean annual path, particularly in the zone of westerly winds. Starting from the 1st of January, all the latter, both on sea and land, fall to the right or south of the line that represents the mean

[1] Five years at Nashville, two at Chapel Hill, in North Carolina, and ten months at other places.

direction, recross that line for the most part (thirteen curves out of twenty) in July, and continue on the north side till the end of the year. Four curves cross a little earlier, in June, and of the remaining three, the two at the extreme north (Newfoundland and Canada) cross in August, and the one at the extreme south, near the southern limit of the system, in May. The time seems to vary somewhat with the latitude and the trending of the adjacent coast.

Of the four curves on the limit between the equatorial and westerly systems (Plate VIII. Nos. 44, 45, 71, and 80), two do not cross the line of mean direction at all, but lie to the right of it for the whole year; and the other two cross it in August, lying to the right before and to the left afterwards.

Of the easterly winds of the equatorial system, those north of about latitude 24° (Plate VIII. Nos. 46, 47, 48, 50, 51, 52, and 82), cross the line of mean direction in April, May, or June, and those farther south (Plate VII. Nos. 84, 85, and 87) in October. The latter are at sea, and may possibly be affected by the proximity of the coast of South America.

4. On the eastern side of the Atlantic there is less uniformity in the time of crossing, though (not including the exceptions already named), it is on an average considerably earlier. Out of eighteen curves (Plates VII. and X.), one crosses in February, one in March, four in April, five in May, two in June, one in July, one in September, and three do not cross it at all, but lie to the south for the whole year. One of these three is at St. Petersburg, in Russia, another at Elgin, in the north of Scotland, and the other at sea (No. 77), on the limit between the equatorial and westerly systems, thus agreeing with its neighbors (Nos. 71 and 80) on the western side of the Atlantic. The curve for the stations in Austria (No. 92) might very properly be added to this list, as it lies south of the line of mean direction over eleven months in the year.

5. The curvature in India and China is the same as in the westerly system on the west side of the Atlantic, while that in Western Siberia corresponds to those of the European stations, so far as it can be said to have any character at all.

6. The stations east of the Mediterranean Sea are as devoid of law or agreement, in the form of the curves described by their winds, as they were shown to be in regard to the mean direction of their winds.

Theoretical Considerations.

The causes of the peculiarities, in the inflection of the curves we have been considering, are more clearly seen by analyzing them in the manner described in the introduction to the foregoing series (D). By thus detaching the deflecting forces from those which determine the mean annual direction of the wind, the law at once becomes apparent that on the sea-coast, and even for some hundreds of miles from it, both on sea and land, the deflecting forces are directed towards the land, in the warmer parts of the year, and towards the sea, in the colder; a most convincing proof (if any more were needed) of the influence of heat in the production of winds, and that, too, upon an extensive scale.

Plates XI. and XII. show the truth of the law just stated more clearly than any verbal explanations. The directions and lengths of the arrows show the directions and amounts of the forces which deflect the wind from its mean annual direction in the several months of the year. These arrows are drawn on a scale twelve times greater than those which represent the mean annual directions, in Plates VII. to X. inclusive; but as the latter represent the mean progress of the wind for the *entire year*, while the mean *monthly* progress, if there were no deflection, would be only one-twelfth as great, both may be regarded, for the purpose of comparison, as drawn *on the same scale.* So that the length of an arrow on one of those plates, is to the length of one for the same place on Plate XI. or XII., as the force which determines the mean annual direction of the wind is to that which deflects it in the particular month to which the latter arrow relates; and the length of the corresponding portion of the curve (increased threefold, because the curves are drawn upon a less scale)[1] is proportional to the resultant of the two forces. Thus, for example, at Hampden, in Maine, the force which determines the mean annual direction, the deflecting force in the month of January, and the resultant of the two, are to each other as the numbers 33, 22, and 42; and by measuring the arrow, No. 50, on Plate VIII., that for January on Plate XI., No. 25, and the first division of the curve No. 25, on Plate VIII., increased threefold, it will be seen that their lengths are to each other in the ratio of these numbers.

Now, if with the light of these explanations we examine Plate XI., we shall notice that the arrows point with great uniformity toward the land in the warmer months, and toward the sea in the colder. The cause is to be found in the difference of the temperature of the two. It is well known that the surface of large bodies of water, and particularly the ocean, is much more uniform in its temperature throughout the year than that of land, and consequently must be colder in summer and warmer in winter. Hence, we may account for the monsoon character of the winds on the opposite shores of the Atlantic, just as we do for the well known phenomena of land and sea breezes on the sea-coast; the only difference being that the former are on a more extensive scale.

These views are confirmed, when we examine particular localities and sections of country. The decrease in the curvature of the curves, as we recede from the sea-shore, has been already adverted to, the examples mentioned being 29, 30, 32, and 40, on Plate VIII., as compared with places near the coast. If we now look at the same numbers on Plate XI., we shall see by the shortness of the arrows that the deflecting forces, though conformable to the theory, are much less than at places nearer the sea.[2] The absence of the monsoon character in the winds of Ohio is probably to be ascribed to the fact that that State lies directly between the ocean and the great lakes, so that the latter, being nearer, neutralize the influence of the

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[1] It would be more convenient for comparison if all could be drawn on the same scale, *i. e.* if the curves could be drawn upon a scale three times larger than they are; but they could not in that case be represented upon the maps without making the latter of unwieldy size.

[2] No. 30 should properly be placed farther west, as the places whose results it represents are scattered pretty uniformly over the southern half of the State of New York.

former. The same reason does not exist in the States farther west, and accordingly we find, even there, slight traces of the oceanic influence, as already remarked.

That the lakes are capable of exerting considerable influence upon the direction of the surface-wind, is proved from the fact that at the Western Reserve College, in Ohio, some twenty-five miles south of Lake Erie, the mean direction is uniformly more northerly by several degrees in the afternoon than in the forenoon, as may be seen by the following statement.[1]

Months.	9 o'clock A. M.	3 o'clock P. M.	More northerly in the afternoon by
January	S. 71° 32′ W.	S. 82° 34′ W.	+ 11° 2′
February	S. 79 41 W.	S. 86 17 W.	+ 6 36
March	N. 75 20 W.	N. 68 28 W.	+ 6 52
April	N. 78 12 W.	N. 59 50 W.	+ 18 22
May	N. 85 19 W.	N. 61 44 W.	+ 23 35
June	S. 81 55 W.	N. 77 6 W.	+ 4 49
July	N. 84 50 W.	N. 61 45 W.	+ 23 5
August	N. 81 41 W.	N. 48 24 W.	+ 33 17
September	S. 69 33 W.	N. 75 15 W.	+ 35 12
October	S. 73 19 W.	N. 89 29 W.	+ 17 12
November	S. 70 14 W.	S. 82 52 W.	+ 12 38
December	S. 82 20 W.	N. 87 11 W.	+ 10 29
The year	S. 83 46 W.	N. 77 7 W.	+ 19 7

The peninsular form of South-western Europe no doubt prevents the full development there of the general law we have been discussing; yet we have already had proof of its existence in the general similarity of form in the annual curves (Plate X.). We can see traces of it also in the deflecting forces (Plate XII. Nos. 80, 83, and 85). In all three, the arrows for June, July, and August point toward the land, and those for the colder months generally toward some neighboring body of water. No. 80, being so nearly equidistant between the North Sea, the Baltic, the Mediterranean, and the Bay of Biscay, shows more irregularity. No. 72 ought to afford evidence of the law, and I am unable to account for its failure to do so. No. 75 fails also, which is not surprising, since over half of the observations from which it was computed were taken more than 1200 miles from the nearest point in Europe, and so nearly in the middle of the Atlantic as not to feel the influence we are speaking of.

The peculiar curvature at Rome and Naples (Plate VII. No. 3), is easily explained. Both places are near a sea-coast, whose general direction is from N. W. to S. E., and have in their rear the range of the Apennines, running nearly in the same direction, and rising to an elevation of several thousand feet. The mean direction of the wind for the two places is from W. N. W. to E. S. E., which, combined with deflecting forces acting at right angles with the coast (landward in summer, and seaward in winter) must plainly give us a curve of the same general form as that which we find to be actually described.

Nos. 81, 83, 86, and 91 (Plates VII. and XII.) have caused me much perplexity. The arrows for the warmer months evidently indicate a point of rarefaction situated

[1] Loomis on the Meteorology of Hudson, Ohio, published in the American Journal of Science and Arts.

to the *south* or *south-west*, and yet, all the observations from which they were computed were taken within a few hundred miles of the African coast and Desert of Sahara, a region the annual range of whose temperature must be exceedingly great. The only way in which I can account for a fact so astonishing, is by supposing the deflecting forces at these numbers to be secondary to the influence which we see so strongly marked in Nos. 88, 89, and 90. Let us, then, first devote our attention to these.

The intense heat of the Great Desert rarefies the air exceedingly from June to October, inclusive, and hence the arrows of unparalleled length (Plate XII.) pointing toward it during those months, the longest being longer than that which represents the most uniform of the trade-winds in the ratio of 104 to 89. The influence of this rarefaction is sufficient to curve the powerful current of the trade-winds in the manner exhibited on Plate VII. Nos. 89 and 90, and to produce the not less remarkable change in No. 88, holding the current back and retarding it, so that its progressive motion in the *three* months of July, August, and September united hardly exceeds that during any *one* of the colder months of the year. But while this is so, the trades on the western side of the Atlantic are pursuing nearly their regular track, being but slightly affected by these influences. As a consequence, the latter must leave, as it were, a partial vacuum behind them, which is filled by air flowing in from the north-east and south-east. This will account for the seeming anomaly of having a somewhat strong deflecting force directed toward mid-ocean in the hottest part of the year, as in the numbers above referred to. And yet it may be very naturally asked, Why does not the air from these parts supply the Great Desert *directly*, instead of taking a circuitous route to supply the region that supplies it? A question which, I confess, it seems difficult to answer.

The following table, and Plate XIII. will assist in affording a clear idea of the winds off the west coast of Africa during the warmer months. The arrows show the mean direction and progress of the wind in each square of 5°, for the months of July, August, and September, the months when the influence of the Desert is greatest. The numbers affixed to the arrows show the number of observations from which they were computed, as contained in Maury's Pilot Chart of the North Atlantic:—

Longitude.	Lat. 0° to 5°.			Lat. 5° to 10°.			Lat. 10° to 15°.			Lat. 15° to 20°.			Lat. 20° to 25°.		
	Mean direction of Wind.	Rate of Progress.	No. of Obs.	Mean direction of Wind.	Rate of Progress.	No. of Obs.	Mean direction of Wind.	Rate of Progress.	No. of Obs.	Mean direction of Wind.	Rate of Progress.	No. of Obs.	Mean direction of Wind.	Rate of Progress.	No. of Obs.
10° to 15° W.	S. 2° 55′ E.	89	446	S. 12° 0′ W.	88½	179									
15 20 W.	S. 12 41 E.	86	1262	S. 4 7 W.	82	1273	S. 85° 7′ W.	36	47	N. 19° 39′ E.	60	15	N. 21° 50′ E.	73	21
20 25 W.	S. 34 25 E.	90	529	S. 8 5 W.	71	1034	N. 2 12 E.	14½	626	N. 32 8 E.	76	456	N. 29 29 E.	81	304
25 30 W.	S. 49 50 E.	82	221	S. 11 40 W.	41	385	N. 62 42 E.	35	504	N. 38 51 E.	81	476	N. 36 22 E.	84	396
30 35 W.	S. 58 26 E.	79	196	S. 0 55 E.	40½	224	N. 69 36 E.	39	247	N. 51 46 E.	87	192	N. 47 57 E.	84	243
35 40 W.	S. 45 9 E.	84	203	S. 46 39 E.	17	269	N. 57 15 E.	40	300	N. 55 1 E.	85½	149	N. 61 42 E.	89	163
40 45 W.	S. 52 42 E.	88½	123	S. 58 2 E.	36	262	N. 54 47 E.	52	287	N. 65 31 E.	88	156	N. 68 4 E.	87	90
45 50 W.	S. 69 28 E.	76	19	N. 89 42 E.	54	99	N. 63 31 E.	81	184	N. 67 41 E.	72	251			.

SERIES E.

The following tables show the average relative force and velocity of winds from the different points of compass. At five of the stations, viz. Toronto, Girard College, Devonport, Greenwich, and Sturbington, the pressure was obtained in pounds per square foot, by means of an anemometer; and the velocity computed therefrom by Rouse's Table. At the other stations, the force was merely estimated, and represented by numbers, ordinarily from 0 to 10, 0 denoting a calm, and 10 a hurricane, and the velocity computed according to the following scale, which has been adopted at the Smithsonian Institution:—

SCALE OF WINDS.

No.	Miles per hour.	Force in pounds per square foot.	Character.	No.	Miles per hour.	Force in pounds per square foot.	Character.
1	2	.02	Very light breeze.	6	45	10.00	Gale.
2	4	.08	Gentle breeze.	7	60	18.00	Strong gale.
3	12½	.75	Fresh wind.	8	75		Violent gale.
4	25	3.00	Strong wind.	9	90		Hurricane.
5	35	6.00	High wind.	10	100		Most violent hurricane.

Toronto, Canada.

Course.	By Osler's Anemometer.							By estimation.[1]					Velocity in miles per hour.[2]		No. of miles travelled.	
	Time in hours.			Pressure in pounds per square foot.				Time in hours.			Pressure in lbs. per foot.					
	1841.	1842.	Total.	1841.	1842.	Total.	Average.	1841.	1842.	Total.	Total pressure for 1841–42.	Average.	Anemometer.	Estimation.	Anemometer.	Estimation.
North	795	450	1245	543.1	512.8	1055.9	.84	826	679	1505	771.9	.512	12.88	10.24	16036	15411
N. N. E.	348	333	681	222.0	341.3	564.3	.83	116	83	199	90.4	.454	12.80	9.56	8717	1902
N. E.	330	208	538	164.3	202.5	366.8	.68	434	254	685	376.6	.547	11.61	10.56	6246	7265
E. N. E.	310	470	780	131.6	317.6	449.2	.58	116	186	302	288.1	.954	10.82	13.79	8440	6165
East	460	519	979	324.0	428.4	752.4	.77	506	673	1179	946.9	.803	12.32	12.61	12061	14867
E. S. E.	395	278	673	135.7	295.9	433.6	.64	66	28	94	52.8	.562	11.29	10.67	7598	1003
S. E.	326	333	659	235.0	137.8	372.8	.57	362	281	643	283.8	.441	10.74	9.41	7078	6051
S. S. E.	301	264	565	49.3	51.4	100.7	.18	166	140	306	116.1	.379	5.92	8.67	3348	2653
South	315	373	688	86.6	103.0	189.6	.28	342	646	988	418.0	.423	7.51	9.19	5167	9080
S. S. W.	363	547	910	178.7	254.9	433.6	.48	116	92	208	138.6	.666	9.86	11.50	8973	2392
S. W.	305	448	753	204.5	578.1	782.6	1.04	444	582	1026	608.4	.593	14.47	10.92	10896	11204
W. S. W.	282	346	628	228.6	752.2	980.8	1.56	170	113	283	252.6	.893	17.63	13.30	11072	3764
West	384	356	740	315.7	297.6	613.3	.83	326	350	676	485.1	.718	12.80	11.91	9472	8051
W. N. W.	326	400	726	539.5	418.9	958.4	1.32	34	65	99	130.3	1.316	16.24	16.21	11790	1605
N. W.	357	412	769	503.1	668.6	1171.7	1.52	636	605	1241	950.9	.766	17.40	12.29	13381	15252
N. N. W.	413	513	926	385.0	886.0	1271.0	1.37	416	380	796	758.8	.953	16.53	13.78	15307	10969
Calm	2669	2409	5078					2596	2474	5060						

[1] Some of these observations were taken hourly, and others bi-hourly, and to obtain a proper average for the entire years, they have all been reduced to hourly observations by doubling the number of bi-hourly ones, together with the corresponding pressures.

[2] By Rouse's Table.

SERIES E.—*Continued.*

	Anemometer.	Estimation.
Total number of miles travelled in the two years at Toronto	155579	117634
Average rate per hour	8.98	7.69
Do. in mean direction	1.49	.72

Course.	Boothia Felix.—3 stations. 2½ years.			Cambridge, Mass. 10 months.		
	No. of Obs.	Sums of numbers representing forces.	Mean force.	No. of Obs.	Sums of numbers representing forces.	Mean force.
North	2548½	8586	3.37	35	48½	1.39
N. by E.	125	640	5.12	8	12¾	1.59
N. N. E.	1116	2917	2.61	39	65½	1.68
N. E. by N.	202	528	2.61	8	14	1.75
N. E.	765	1735	2.26	89	147	1.65
N. E. by E.	63	143	2.26	5	10	2.00
E. N. E.	123	277	2.25	15	21½	1.43
E. by N.	55	230	4.18	8	9	1.12
East	679	1284	1.89	19	19	1.00
E. by S.	49	82	1.67	5	8	1.60
E. S. E.	149	378	2.53	6	11½	1.92
S. E. by E.	35	89	2.54	0	0	?
S. E.	715	1253	1.75	38	55¾	1.47
S. E. by S.	29	59	2.03	0	0	?
S. S. E.	398	819	2.05	3	6	2.00
S. by E.	130	338	2.60	6	6½	1.08
South	1749	3102	1.77	70	123½	1.76
S. by W.	153	341	2.22	5	9	1.80
S. S. W.	645	1562	2.42	57	96¾	1.70
S. W. by S.	45	127	2.82	5	13½	2.70
S. W.	1345	3199	2.37	221	342	1.55
S. W. by W.	32	106	3.31	14	23	1.64
W. S. W.	385	1107	2.87	17	21½	1.26
W. by S.	77	207	2.68	12	17½	1.46
West	1203	2851	2.36	62	91	1.47
W. by N.	107	355	3.31	6	12½	2.08
W. N. W.	493	1317	2.67	10	20	2.00
N. W. by W.	59	162	2.74	10	10½	1.05
N. W.	1783½	4732	2.65	135	246½	1.83
N. W. by N.	224	919	4.10	9	16½	1.83
N. N. W.	2738	12534	4.57	61	105½	1.73
N. by W.	524	2324	4.43	4	5	1.25

Course.	North Carolina.—3 stations. 2 1-6 years.			Hudson, Ohio. Mean force.		Bermudas. One year.		
	No. of Obs.	Sums of numbers representing forces.	Mean force.	Part of 1838 and 1840.	1841.	No. of Obs.	Sums of numbers representing forces.	Mean force.
North	375	529	1.41	1.83	2.42	912	3830	4.20
N. by E.	7	9	1.29	2.38	2.39	84	396	4.71
N. N. E.	60	82	1.37	2.00	2.40	96	456	4.75
N. E. by N.	0	0	?	1.80	2.38	60	216	3.60
N. E.	319	442	1.39	2.14	2.33	552	2064	3.74
N. E. by E.	0	0	?	2.00	2.00	0	0	?
E. N. E.	42	48	1.14	1.87	1.73	24	72	3.00
E. by N.	6	6	1.00	1.78	1.80	0	0	?

SERIES E.—*Continued.*

Course.	North Carolina.—3 stations. 2 1-6 years. No. of Obs.	Sums of numbers representing forces.	Mean force.	Hudson, Ohio. Mean force. Part of 1838 and 1840.	1841.	Bermudas. One year. No. of Obs.	Sums of numbers representing forces.	Mean force.
East	377	437	1.16	2.00	2.00	396	1366	3.45
E. by S.	2	2	1.00	2.20	2.12	24	60	2.50
E. S. E.	18	19	1.06	1.62	1.79	24	120	5.00
S. E. by E.	0	0	?	1.62	2.10	24	120	5.00
S. E.	158	171	1.08	1.47	1.87	720	2354	3.27
S. E. by S.	0	0	?	1.00	1.75	84	324	3.86
S. S. E.	20	24	1.20	1.62	1.56	252	960	3.81
S. by E.	5	4	.80	1.40	2.15	36	84	2.33
South	337	405	1.20	1.50	2.21	152	593	3.90
S. by W.	10	11	1.10	1.64	1.89	204	1044	5.12
S. S. W.	85	118	1.39	1.87	1.72	276	900	3.26
S. W. by S.	3	3	1.00	2.00	1.31	240	1092	4.55
S. W.	423	585	1.38	2.06	2.00	1404	5954	4.24
S. W. by W.	4	5	1.25	1.84	2.12	72	168	2.33
W. S. W.	50	60	1.20	2.12	2.28	252	1081	4.29
W. by S.	10	11	1.10	2.25	2.58	36	115	3.20
West	440	639	1.45	2.41	2.50	492	1624	3.30
W. by N.	6	6	1.00	2.75	2.91	132	444	3.36
W. N. W.	15	20	1.33	2.84	2.97	192	839	4.37
N. W. by W.	1	1	1.00	2.60	3.13	0	0	?
N. W.	249	415	1.67	2.65	3.04	312	1441	4.62
N. W. by N.	0	0	?	2.04	2.82	72	252	3.50
N. N. W.	19	21	1.11	2.29	2.75	264	1188	4.50
N. by W.	2	2	1.00	2.36	2.25	156	733	4.70

Southern Maine, New Hampshire, and Vermont.—13 stations.

39 MONTHS.

Course.	Number of zeros.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Number of sixes.	Number of sevens.	Total number of observations.	Total numbers representing forces.	Mean forces.	Total number of miles.	Mean velocity in miles per hour.
North	0	146	148	115	37	1	1	0	448	946	2.11	3326½	7.43
N. N. E.	0	11	16	10	1	1	0	0	39	82	2.10	271	6.95
N. E.	1	325	214	123	41	13	5	1	723	1388	1.92	4809½	6.65
E. N. E.	0	1	2	0	0	1	0	0	4	10	2.50	45	11.25
East	0	95	50	25	18	5	0	0	193	367	1.90	1327½	6.88
E. S. E.	0	1	3	1	0	2	0	0	7	20	2.86	96½	13.79
S. E.	9	242	149	90	35	21	9	1	556	1116	2.01	4289	7.71
S. S. E.	0	3	3	1	1	3	0	0	11	31	2.82	160½	14.59
South	0	142	90	43	27	5	2	0	309	596	1.93	2121½	6.87
S. S. W.	0	9	5	10	10	1	0	0	35	94	2.69	448	12.80
S. W.	0	567	382	150	48	12	0	0	1159	2033	1.75	6157	5.31
W. S. W.	0	13	10	4	1	0	0	0	28	49	1.75	141	5.04
West	0	265	292	156	62	11	1	0	787	1626	2.07	5628	7.15
W. N. W.	0	4	8	8	5	1	0	0	26	69	2.65	300	11.54
N. W.	42	532	362	377	144	22	1	0	1480	3079	2.09	11681½	7.89
N. N. W.	0	21	14	24	0	4	0	0	63	141	2.24	538	8.54
Total	52	2377	1748	1137	430	103	19	2	5868	11647	1.98	41340½	7.04
Add calms									625	0	.00	0	.00
Total including calms									6493	11647	1.79	41340½	6.37

SERIES E.—*Continued.*

Massachusetts, Rhode Island, and Connecticut.—11 stations.[1]

30 MONTHS.

Course.	Number of zeros.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Number of sixes.	Number of sevens.	Total number of observations.	Total numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.
North	14	143	124	38	5	0	0	1	325	532	1.64	1456	4.48
N. N. E.	0	13	35	27	3	0	0	0	78	176	2.26	578½	7.42
N. E.	15	130	95	46	18	4	0	0	308	550	1.79	1820	5.91
E. N. E.	0	21	49	24	1	0	0	0	95	195	2.05	563	5 93
East	15	167	85	26	3	0	0	0	296	427	1.44	1089	3.68
E. S. E.	0	11	21	7	0	1	0	0	40	79	1.98	228½	5.71
S. E.	8	64	44	19	12	4	0	0	151	277	1.83	989½	6.55
S. S. E.	0	11	13	1	1	0	0	0	26	44	1.69	111½	4.29
South	7	117	72	31	9	1	1	0	238	401	1.69	1221½	5.13
S. S. W.	0	22	32	12	2	0	0	0	68	130	1.91	372	5.47
S. W.	21	241	221	98	28	1	1	0	611	1100	1.80	3392	5.55
W. S. W.	0	28	47	67	4	0	0	0	146	339	2.32	1181½	8.09
West	25	449	263	89	34	1	0	0	861	1383	1.61	3972½	4.61
W. N. W.	0	35	59	19	5	0	0	0	118	230	1.95	668½	5.67
N. W.	32	273	199	113	27	7	0	0	651	1153	1.77	3706½	5.70
N. N. W.	0	16	31	10	2	0	0	0	59	116	1.97	331	5.61
Total	137	1741	1390	627	154	19	2	1	4071	7132	1.75	21681½	5.33
Add calms	.	.	.	.	.	.	.	.	110	0	0.00	0	0.00
Total including calms	.	.	.	.	.	.	.	.	4181	7132	1.71	21681½	5.18

Mean force at Amherst and Williams Colleges, Massachusetts, for one year each, viz.:—

	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.
Amherst (1849)		1.3		1.4		1.4		1.5
Williams (1838)	2.33	2.34	3.15	2.74	3.29	2.87	3.71	3.23

New York State.—11 stations.

16 MONTHS.

Course.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Number of sixes.	Number of sevens.	Number of eights.	Number of nines.	Total number of observations.	Total of numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.
North	158	64	20	7	2	0	0	0	0	251	384	1.53	1067	4.25
N. N. E.	1	1	0	0	0	0	0	0	0	2	3	1.50	6	3.00
N. E.	135	53	29	11	7	6	0	1	0	242	451	1.86	1709½	7.06
E. N. E.	0	0	0	0	0	0	0	0	0	0	0	?	0	?
East	48	44	12	18	5	5	2	1	0	135	321	2.38	1467	10.87
E. S. E.	0	0	0	0	0	0	0	0	0	0	0	?	0	?
S. E.	140	74	42	20	3	0	0	1	0	280	517	1.85	1781	6.36
S. S. E.	0	0	1	0	0	1	0	0	0	2	9	4.50	57½	28.75
South	149	68	54	13	3	0	0	0	1	288	523	1.82	1765	6.13
S. S. W.	3	0	0	0	0	0	0	0	0	3	3	1.00	6	2.00
S. W.	261	171	79	48	35	16	9	8	6	633	1484	2.34	7018½	11.09
W. S. W.	7	0	0	0	0	0	0	0	0	7	7	1.00	14	2.00
West	227	119	38	26	23	13	6	3	3	458	969	2.12	4300	9.39
W. N. W.	3	4	2	1	1	0	0	0	0	11	26	2.36	107	9.73
N. W.	343	258	145	54	15	1	0	2	5	823	1652	2.01	6050½	7.35
N. N. W.	2	0	0	0	0	0	0	0	0	2	2	1.00	4	2.00
Total	1477	856	422	198	94	42	17	16	15	3137	6351	2.02	25353	8.08
Add calms	.	.	.	.	.	.	.	.	.	88	0	.00	0	.00
Total including calms	.	.	.	.	.	.	.	.	.	3225	6351	1.97	25353	7.86

[1] Cambridge, Amherst, and Williams Colleges not included.

SERIES E.—*Continued.*

Course.	New Jersey and Pennsylvania.—15 stations.[1] 38 months.[1] Number of zeros.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Number of sixes.	Number of sevens.	Total number of observations.	Total of numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.	Somerset, Penn. Mean force. 8 months. Lower current.	Upper current.
North	1	173	59	53	23	4	0	0	313	562	1.80	1960½	6.26	1.08	1.17
N. N. E.	0	3	7	6	0	0	0	0	16	35	2.19	109	6.81	1.00	1.00
N. E.	4	260	69	37	10	1	1	0	382	560	1.47	1592½	4.17	1.50	1.67
E. N. E.	0	4	10	1	0	0	0	0	15	27	1.80	60½	4.03	1.56	3.00
East	4	194	65	35	7	1	0	0	306	462	1.51	1299½	4.25	1.33	2.50
E. S. E.	0	8	1	2	0	0	0	0	11	16	1.45	45	4.09	1.00	1.58
S. E.	4	109	43	30	17	2	4	0	209	387	1.85	1444	6.91	1.28	1.18
S. S. E.	0	10	6	2	1	0	0	0	19	32	1.68	94	4.95	2.00	1.00
South	5	229	87	68	23	9	0	0	421	744	1.77	2551	6.06	1.38	1.47
S. S. W.	0	6	15	5	1	1	0	0	28	60	2.14	194½	6.95	1.43	1.00
S. W.	4	367	138	90	29	3	0	1	632	1051	1.66	3305	5.23	1.43	1.33
W. S. W.	1	18	8	3	3	0	0	0	33	55	1.67	181½	5.55	1.57	1.61
West	6	953	314	134	54	20	5	0	1486	2329	1.57	7118	4.12	1.56	1.23
W. N. W.	0	17	13	11	8	5	1	0	55	139	2.53	643½	11.70	1.53	1.37
N. W.	7	369	169	165	91	18	2	0	821	1668	2.03	6478½	7.89	1.79	1.28
N. N. W.	0	10	11	10	0	1	0	0	32	67	2.10	224	7.00	2.20	1.67
Total	36	2730	1015	652	267	65	13	1	4779	8194	1.71	27301	5.71	1.47	1.32
Add calms and variable . . .									468	0	.00	0	.00		
Total including calms and variable . .									5247	8194	1.56	27301	5.20	1.02	1.01

Girard College, Philadelphia.

Course.	1843. No. of hours.	No. of miles travelled.	Miles per hour.	1844. No. of hours.	Sums of forces.	Mean force.	Number of miles travelled in the separate months of 1843. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
North	357	1509	4.23	426	330.73	.78	0	50	106	61	51	15	119	46	548	160	176	177
N. N. E.	311	1471	4.73	326	235.80	.70	0	41	56	147	8	0	74	96	486	190	241	132
N. E.	435	2168	4.98	310	240.16	.77	0	53	74	378	28	10	85	218	624	128	245	325
E. N. E.	582	5155	8.86	516	235.47	.46	51	522	1024	711	401	0	28	289	1446	94	115	474
East	317	1328	4.19	346	275.71	.80	7	4	30	44	257	3	7	205	386	98	60	227
E. S. E.	189	972	5.14	198	95.19	.48	186	56	7	31	52	0	0	205	38	64	246	87
S. E.	176	605	3.44	265	92.19	.35	28	4	39	32	55	8	12	47	119	8	223	30
S. S. E.	199	1183	5.94	255	171.03	.67	4	25	232	30	166	17	23	182	230	41	218	15
South	287	1179	4.11	521	266.12	.51	209	62	68	0	95	28	61	241	196	53	139	27
S. S. W.	579	2974	5.14	700	393.87	.56	84	74	60	13	250	149	205	389	717	627	393	13
S. W.	792	3494	4.41	761	391.64	.51	139	27	149	0	42	656	425	180	541	358	592	385
W. S. W.	502	2095	4.17	412	193.48	.47	94	68	57	0	19	375	79	108	234	440	487	134
West	465	3037	6.53	440	438.70	.99	217	161	742	10	66	93	73	122	125	728	575	125
W. N. W.	939	9328	9.92	630	778.21	1.24	886	2640	703	348	394	225	155	147	128	1411	1508	783
N. W.	712	6349	8.92	713	701.66	.98	673	180	763	475	60	196	89	377	260	1355	1051	870
N. N. W.	598	4727	7.91	503	450.87	.90	151	236	703	315	52	13	210	155	375	308	846	1363

Total distance travelled in 1843 . . . . 47574 miles.
Average rate per hour . . . . 6.39 do.
Do. in mean direction . . . . 2.24 do.

[1] Somerset and Girard College not included.

SERIES E.—*Continued.*

Delaware, Maryland, and Eastern Virginia.—5 stations.

24 MONTHS.

Course.	Number of zeros.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Number of sixes.	Total number of observations.	Total of numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.
North	1	205	58	37	12	0	0	313	480	1.53	1405½	4.49
N. N. E.	0	0	0	0	0	0	0	0	0	0?	0	0?
N. E.	0	153	80	51	14	0	0	298	522	1.75	1613½	5.41
E. N. E.	0	2	0	0	0	0	0	2	2	1.00	4	2.00
East	0	72	37	12	12	0	0	133	230	1.73	742	5.58
E. S. E.	0	0	0	1	0	0	0	1	3	3.00	12½	12.50
S. E.	0	91	48	24	8	0	1	172	297	1.73	919	5.34
S. S. E.	0	6	3	1	0	0	0	10	15	1.50	36½	3.65
South	0	88	79	27	55	61	1	311	858	2.76	4384½	14.10
S. S. W.	0	2	2	0	1	1	1	7	21	3.00	117	16.71
S. W.	0	463	221	103	41	1	0	829	1383	1.67	4157½	5.01
W. S. W.	0	0	2	2	0	0	0	4	10	2.50	33	8.25
West	1	208	108	49	15	4	0	385	651	1.70	1976½	5.13
W. N. W.	0	2	2	8	2	1	0	15	43	2.87	197	13.13
N. W.	0	271	167	105	91	20	2	656	1396	2.13	5587½	8.52
N. N. W.	0	5	0	4	0	0	0	9	17	1.89	60	6.67
Total	2	1568	807	424	251	88	5	3145	5928	1.88	21246	6.76
Add calms .	.	.	.	.	.	.	.	268	0	.00	0	.00
Total including calms .	.	.	.	.	.	.	.	3413	5928	1.44	21246	6.23

Georgia, Alabama, Mississippi, and Northern Florida.—12 stations.[1] — Savannah, Georgia.

67 MONTHS.[1] — 6 MONTHS.

Course.	Number of zeros.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Number of sixes.	Number of sevens.	Number of eights.	Total number of observations.	Total of numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.	Savannah: Number of obs.	Savannah: Sums of forces.	Savannah: Mean force.
North	9	220	245	178	52	15	3	0	0	722	1545	2.14	5614	7.78	61	93	1.52
N. N. E.	0	8	15	12	4	1	0	0	0	40	95	2.37	361	9.02	8	10	1.25
N. E.	1	176	192	155	50	11	2	4	0	591	1320	2.23	5023½	8.50	34	55	1.62
E. N. E.	0	1	2	7	2	0	0	0	0	12	34	2.83	147½	12.29	14	31	2.21
East	1	161	223	68	17	3	7	2	0	482	950	1.97	3030	6.29	50	82	1.64
E. S. E.	0	4	6	5	0	0	0	0	0	15	31	2.07	94½	6.30	33	43	1.30
S. E.	3	297	291	137	27	6	1	1	0	763	1441	1.89	4463½	5.85	27	37	1.37
S. S. E.	0	12	4	4	0	0	0	0	0	20	32	1.60	90	4.50	16	28	1.75
South	0	193	410	268	49	8	1	0	0	929	2059	2.23	6926	7.49	134	194	1.45
S. S. W.	0	17	15	2	2	0	0	0	0	36	61	1.69	169	4.69	8	14	1.75
S. W.	0	235	303	199	32	8	2	4	0	783	1646	2.10	5579½	7.13	40	61	1.52
W. S. W.	0	34	27	10	5	0	0	0	0	76	138	1.82	426	5.61	18	25	1.39
West	3	583	266	148	55	22	4	7	7	1095	2018	1.84	7353	6.72	60	71	1.18
W. N. W.	0	12	19	9	0	0	0	0	0	40	77	1.92	212½	5.31	8	9	1.12
N. W.	1	357	229	108	25	10	0	0	0	730	1289	1.77	3956	5.42	20	27	1.35
N. N. W.	0	8	3	0	2	0	0	0	0	13	22	1.69	78	6.00	5	8	1.60
Total	18	2318	2250	1310	322	84	20	18	7	6347	12758	2.01	43524	6.86	536	788	1.47
Add calms	.	.	.	.	.	.	.	.	.	580	0	.00	0	.00			
Total including calms	.	.	.	.	.	.	.	.	.	6927	12758	1.84	43524	6.28			

[1] Not including Savannah.

SERIES E.—*Continued.*

Ohio.—13 stations.[1]

68 MONTHS.[1]

Course.	Number of zeros.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Number of sixes.	Number of sevens.	Number of eights.	Number of nines.	Total number of observations.	Total of numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.
North	61	286	187	92	41	3	2	0	0	0	672	1127	1.68	3751	5.60
N. N. E.	3	19	24	13	4	1	0	0	0	0	64	127	1.98	434½	6.79
N. E.	29	311	221	82	23	10	0	0	0	0	676	1141	1.69	3485	5.16
E. N. E.	0	34	16	14	6	2	0	0	0	0	72	142	1.97	527	7.32
East	14	270	126	54	21	5	2	0	0	0	492	805	1.64	2523	5.13
E. S. E.	0	18	13	6	0	0	0	0	0	0	37	62	1.68	163	4.41
S. E.	12	301	176	50	7	2	0	0	0	0	548	841	1.53	2188	3.99
S. S. E.	2	28	17	3	0	0	0	0	0	0	50	71	1.42	163½	3.27
South	68	566	237	104	26	3	3	1	0	1	1009	1505	1.49	4488	4.45
S. S. W.	5	58	49	30	2	1	0	0	0	0	145	259	1.79	777	5.36
S. W.	70	976	829	357	113	24	4	0	1	1	2375	4318	1.72	13810½	5.81
W. S. W.	0	43	66	52	8	5	1	0	0	0	175	394	2.25	1420	8.11
West	65	1040	858	365	144	48	17	3	0	0	2540	4790	1.89	16364½	6.44
W. N. W.	6	37	67	42	20	5	1	0	1	0	179	416	2.32	1668	9.32
N. W.	33	497	483	279	106	31	16	2	1	0	1448	2997	2.07	11096½	7.66
N. N. W.	0	13	21	22	13	1	1	0	0	0	71	184	2.59	790	11.13
Total	368	4497	3390	1565	534	141	47	6	3	2	10553	19179	1.82	63649½	6.31
Add calms											435	0	.00	0	.00
Total including calms											10988	19179	1.75	63649½	5.79

Kentucky and Tennessee.—9 stations.

29 MONTHS.

Course.	Number of zeros.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Total number of observations.	Total of numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.
North	0	145	28	16	0	0	189	249	1.32	602	3.19
N. N. E.	0	9	4	3	0	0	16	26	1.62	71½	4.47
N. E.	0	131	20	5	0	0	156	186	1.19	404½	2.59
E. N. E.	2	10	6	0	0	0	18	22	1.22	46	2.56
East	1	138	20	4	0	0	163	190	1.17	407	2.50
E. S. E.	0	9	3	0	0	0	12	15	1.25	30	2.50
S. E.	1	153	35	12	1	0	202	263	1.30	622	3.08
S. S. E.	0	17	3	0	0	0	20	23	1.15	46	2.30
South	5	251	95	28	12	8	399	613	1.54	1817	4.55
S. S. W.	1	59	26	21	2	0	109	182	1.67	535½	4.91
S. W.	3	769	272	60	11	0	1115	1537	1.38	3654	3.28
W. S. W.	1	20	6	9	4	0	40	75	1.87	277½	6.94
West	10	642	258	96	8	3	1017	1493	1.47	3831	3.77
W. N. W.	0	13	9	1	0	0	23	34	1.48	74½	3.24
N. W.	0	279	96	30	7	0	412	589	1.43	1492	3.62
N. N. W.	0	23	7	7	0	0	37	58	1.57	161½	4.36
Total	24	2668	888	292	45	11	3928	5555	1.41	14072	3.58
Add calms							352	0	.00	0	.00
Total including calms							4280	5555	1.30	14072	3.29

[1] Hudson not included.

SERIES E.—*Continued.*

Indiana, Illinois, Michigan, Wisconsin, and Iowa.—11 stations.

26 MONTHS.

Course.	Number of zeros.	Number of ones.	Number of twos.	Number of threes.	Number of fours.	Number of fives.	Number of sixes.	Number of eights.	Number of nines.	Total number of observations.	Total of numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.
North	5	72	50	18	19	21	5	0	1	191	446	2.34	2099	10.99
N. N. E.	0	3	1	0	0	0	0	0	0	4	5	1.25	10	2.50
N. E.	0	182	93	49	32	6	8	0	0	370	721	1.95	2718½	7.35
E. N. E.	0	1	0	0	0	0	0	0	0	1	1	1.00	2	2.00
East	0	93	34	24	6	6	2	0	0	165	299	1.81	1072	6.50
E. S. E.	0	3	1	0	0	0	0	0	0	4	5	1.25	10	2.50
S. E.	0	127	122	52	15	5	1	0	0	322	618	1.92	1987	6.17
S. S. E.	0	1	1	0	0	0	0	0	0	2	3	1.50	6	3.00
South	1	219	125	57	19	10	5	0	0	436	796	1.83	2701½	6.20
S. S. W.	0	7	4	0	0	0	0	0	0	11	15	1.36	30	2.73
S. W.	5	558	346	111	59	9	0	0	0	1088	1864	1.71	5682½	5.22
W. S. W.	0	2	2	2	0	0	0	0	0	6	12	2.00	37	6.17
West	3	306	291	114	36	15	3	0	0	768	1467	1.91	4764	6.20
W. N. W.	0	2	1	0	0	0	0	0	0	3	4	1.33	8	2.67
N. W.	0	278	172	118	73	18	1	1	0	661	1372	2.08	5294	8.01
N. N. W.	0	3	0	0	0	0	0	0	0	3	3	1.00	6	2.00
Total	14	1857	1243	545	259	90	25	1	1	4035	7631	1.89	26427½	6.55
Add calms										169	0	.00	0	.00
Total including calms										4204	7631	1.82	26427½	6.29

Course.	Ponce, Porto Rico. 1 month.			Turk's Island, Bahamas. 1 month.			Porto Cabello, Venezuela. 3 months.					Sturbington, England. 1 year.[1]		
	Number of obs.	Total of numbers representing forces.	Total number of miles.	Number of obs.	Total of numbers representing forces.	Mean force.	Number of obs.	Total of numbers representing forces.	Mean force.	Total number of miles.	Mean velocity in miles per hour.	Number of hours.	Miles per hour.	Integral effect.
North	91	92	185	22	46	2.09	46	61	1.33	174	3.78	42	10.3	432
N. N. E.	0	0	0	6	11	1.83	2	3	1.50	6	3.00	354	10.6	2328
N. E.	31	42	107½	53	101	1.91	190	333	1.75	982½	5.17	317	14.2	4468
E. N. E.	2	7	37½	26	57	2.19	13	11	.85	27	2.08	147	17.0	2491
East	74	110	397	34	82	2.41	142	183	1.39	485	3.42	75	12.6	948
E. S. E.	0	0	0	20	41	2.05	0	0	?	0	?	68	12.5	854
S. E.	26	47	162	20	36	1.80	59	50	.85	136	2.31	81	8.6	699
S. S. E.	0	0	0	2	2	1.00	14	14	1.00	29	2.07	77	14.6	1125
South	1	1	2	3	3	1.00	48	39	.81	100½	2.09	136	13.3	1811
S. S. W.	0	0	0	0	0	?	6	5	.83	11	1.83	149	18.7	2787
S. W.	0	0	0	2	2	1.00	48	50	1.04	121	2.52	265	21.8	5773
W. S. W.	0	0	0	0	0	?	0	0	?	0	?	609	17.0	10227
West	2	2	4	1	1	1.00	25	29	1.16	67½	2.70	383	17.0	6836
W. N. W.	0	0	0	0	-0	?	2	2	1.00	4	2.00	877	18.5	16301
N. W.	1	1	2	10	14	1.40	23	31	1.35	93	4.04	412	16.2	6695
N. N. W.	0	0	0	3	5	1.67	0	0	?	0	?	298	10.1	3011
Calms	3	0	0				11	0	0	0	0			

Total number of miles travelled in the year at Sturbington	66786
Average rate per hour	15.56
Do. in mean direction	7.62

[1] By Foster's Anemometer.

SERIES E.—*Continued.*

Course.	Inchkeith, Scotland, 10 years.						Calton Hill, Scotland, 10 years.						
	Light airs.	Breezes.	Gales and storms.	Total number of obs.	Total number of miles.	Mean velocity in miles per hour.	Moderate and calm.	Brisk and sharp.	High.	Very high.	Total number of obs.	Total number of miles.	Mean velocity in miles per hour.
N.	26	105	21	152	2047	13.47	61	10	17	5	93	1117	12.00
N. E.	68	90	47	205	3151	15.37	122	13	21	2	158	1274	8.06
E.	334	345	60	739	6818	9.23	381	41	45	4	471	3152	6.69
S. E.	104	109	11	224	1793	8.00	131	11	14	2	158	1017	6.44
S.	96	165	31	292	3247	11.12	85	2	17	7	111	1145	10.32
S. W.	42	181	116	339	7114	20.99	310	44	178	98	630	12410	19.70
W.	275	807	289	1371	21625	15.77	444	57	235	62	798	13068	16.38
N. W.	44	157	16	217	2378	10.96	207	37	143	57	444	8824	19.87
Variable	101	12	0	113	322	2.85	588	48	119	34	789	7761	9.84
Total	1090	1971	591	3652	48495	13.27	2329	263	789	271	3652	49768	13.63

Devonport, England.

Course.	1841.[1]					1842.[1]					Number of miles travelled.[2]			
	Number of hours.	Sums of forces.	Mean force.	Miles per hour.	Number of miles travelled.	Number of hours.	Sums of forces.	Mean force.	Miles per hour.	Number of miles travelled.	1841.	1842.	1843.	Mean.
North	400	68.7	2.29	21.50	8600	479	32.0	1.00	14.26	6829	751.5	267.0	429.5	482.7
N. N. E.	106	12.0	3.00	24.70	2618	255	47.5	1.40	16.87	4289	433.0	515.0	306.0	418.6
N. E.	267	89.0	1.85	19.40	5179	430	43.8	1.50	17.40	7482	471.5	444.5	396.5	437.5
E. N. E.	80	16.4	1.82	19.23	1538	170	19.5	1.02	14.40	2448	131.0	760.3	296.0	395.7
East	430	700.0	3.50	26.50	11395	468	70.5	1.24	15.87	7427	688.5	1390.5	908.0	995.7
E. S. E.	231	44.0	1.33	16.40	3952	340	17.5	.73	12.19	4144	105.5	97.0	200.0	134.1
S. E.	590	341.5	2.37	21.70	12803	622	191.0	1.68	18.47	11488	77.0	101.5	81.5	86.7
S. S. E.	273	133.0	1.68	18.47	5042	500	232.0	2.55	23.00	11500	258.0	215.0	215.5	229.5
South	780	593.0	2.50	22.54	17581	680	519.3	3.05	25.00	17000	2998.2	3229.8	1478.5	2568.8
S. S. W.	390	289.0	2.22	21.24	8283	360	152.3	2.10	20.66	7437	2880.0	2108.5	2757.5	2582.0
S. W.	772	707.8	2.83	23.98	18512	635	564.0	3.36	26.12	16586	284.5	171.0	122.5	192.7
W.S.W.	320	179.2	2.21	21.20	6784	270	182.8	2.57	22.80	6156	17.5	16.0	5.0	12.8
West	780	390.0	2.20	21.10	16458	435	196.5	1.93	19.77	8599	697.5	309.5	180.5	395.8
W.N.W.	530	149.5	1.77	18.96	10048	460	309.5	3.86	27.80	12788	317.5	588.0	522.5	476.0
N. W.	1390	413.3	2.65	23.18	32220	1000	542.0	3.98	28.40	28400	220.5	184.5	203.0	202.7
N. N. W.	330	82.7	1.80	19.12	6309	464	42.3	1.24	15.90	7377	401.5	210.0	165.0	258.8

	By Osler's Anemometer.
Total number of miles travelled in 1841 and 1842	327272
Average rate per hour	21.48
Do. in mean direction	4.84

[1] By Osler's Anemometer.

[2] By Whewell's Anemometer.

SERIES E.—*Continued.*

Course.	Greenwich, England. 1841. Number of hours.	Sums of forces.	Mean force.	Miles per hour.	No. miles travelled.	Greenwich, England. 1842. Number of hours.	Sums of forces.	Mean force.	Miles per hour.	No. miles travelled.	Oporto, Portugal. 1 month. Total number of observations.	Total of numbers representing forces.	Total number of miles.	Tripoli, Barbary. 5 months. Number of obs.	Sums of numbers representing forces.	Mean force.
North	418	404.5	2.00	20.56	8594	482	174.5	1.47	17.28	8329	12	22	100½	74	136	1.84
N. N. E.	136	81.5	2.00	20.16	2768	168	78.0	1.14	15.22	2557	0	0	0	5	12	2.40
N. E.	420	72.7	1.48	17.34	4161	454	153.7	1.35	16.56	7518	1	1	2	77	165	2.14
E. N. E.	234	430.7	3.65	27.23	6371	210	93.7	1.53	17.63	3702	0	0	0	31	90	2.90
East	204	43.3	1.88	19.54	3987	438	68.0	1.17	15.42	6754	5	14	86	97	224	2.31
E. S. E.	74	3.5	.87	13.33	986	62	1.2	.42	9.20	570	7	7	14	20	56	2.80
S. E.	78	4.7	.68	11.75	916	30	20.0	2.22	21.24	637	4	4	8	40	90	2.25
S. S. E.	136	137.0	1.93	19.80	2692	46	68.5	1.70	18.59	855	2	6	37	13	29	2.23
South	508	403.7	2.16	20.94	10637	480	139.0	1.61	18.10	8688	14	27	137	46	101	2.20
S. S. W.	684	1104.0	2.64	23.17	15848	432	400.0	1.71	18.63	8048	5	8	33	5	11	2.20
S. W.	1196	1191.7	2.45	22.31	26682	916	1244.0	2.58	22.90	20976	20	40	186½	18	41	2.28
W. S. W.	808	889.5	2.37	21.70	17541	792	819.0	2.35	21.85	17805	8	8	16	11	39	3.54
West	798	321.5	2.00	20.16	16087	538	224.0	2.33	21.76	11706	4	4	8	32	55	1.72
W. N. W.	220	118.7	1.88	19.54	4298	118	102.5	2.93	24.40	2879	9	13	51	1	2	2.00
N. W.	200	136.2	2.47	22.40	4480	86	64.0	2.20	21.14	1818	20	47	237	80	159	1.99
N. N. W.	164	197.7	2.40	22.00	3608	142	102.0	1.79	19.00	2698	8	33	212	11	32	2.91

Total number of miles travelled in the two years 235196
Average rate per hour 20.15
Do. in mean direction 7.25

SUMMARY.

Place of observation.	Number of stations.	Mean force of wind.[1]	Mean velocity of wind in miles per hour.
Boothia Felix	3	2.44	
Toronto (by anemometer)	1	.61	8.98
Do. (by estimation)	1	.44	7.69
Southern Maine, New Hampshire, and Vermont	13	1.79	6.37
Cambridge, Massachusetts	1	1.62	
Williams College, Massachusetts	1	3.17	
Massachusetts, Rhode Island, and Connecticut	11	1.71	5.18
New York State	11	1.97	7.86
New Jersey and Pennsylvania	15	1.56	5.20
Girard College, Pennsylvania	1	.72	6.39
Somerset, Pennsylvania	1	1.02	
Delaware, Maryland, and Eastern Virginia	5	1.44	6.23
North Carolina	3	1.34	
Savannah, Georgia	1	1.47	
Georgia, Alabama, Mississippi, and Northern Florida	12	1.84	6.28
Tennessee and Kentucky	9	1.30	3.29
Ohio	13	1.75	5.79
Indiana, Illinois, Michigan, Wisconsin, and Iowa	11	1.82	6.29
Porto Cabello, Venezuela	1	1.29	3.55
Pouce, Porto Rico	1	1.31	3.88
Turk's Island, Bahamas	1	1.99	
Bermudas	1	3.45	
Inchkeith, Scotland	1		13.27
Calton Hill, Scotland	1		13.63
Sturbington, England	1		15.56
Greenwich, England	1	1.37	20.15
Devonport, England	1	1.46	21.48
Oporto, Portugal	1	1.96	9.41
Tripoli, Barbary	1	2.21	

[1] For Toronto, Girard College, Greenwich, and Devonport, the force in this column is expressed in pounds of pressure per square foot; for all the other places, it is expressed in terms of the numbers 0, 1, 2, 3, &c., 0 denoting a calm, and 10 a hurricane, except that, for Boothia Felix and Bermuda, the maximum is 12 instead of 10.

SERIES F.

THE following table is designed to elucidate the last of the series of questions proposed at the outset of this discussion, and shows the effect of combining the element of *force*, or *velocity*, with that of *time*, in computing the mean direction of the wind. The question itself is a highly important one, for since the real point that we wish to arrive at is the mean direction and amount of the actual motion, or transfer, of the air that passes over any given place or section of country, it is obvious, that if there is a difference in the velocity of winds from the different points of compass, or over different sections of country, such as to materially affect the results that would be obtained if it were always and everywhere the same, all the computations in the foregoing pages must require correction, if they be not rendered in great measure worthless; for they were all made on the assumption that the velocity was uniform, or, which is the same thing, without any reference to the velocity. And not only so, but nearly all the observations that have ever been taken, both by land and sea, must be thrown aside (for in very few of them has the force of the wind been recorded), and the whole work of observation must be commenced anew.

The question admits of being considered under two aspects: 1st, in regard to the effect of difference in the mean velocities of winds *from the different points of compass*, which obviously might affect both the direction and amount of the resultant, at any given place of observation; and 2d, a difference in the *mean velocity of the whole, in different regions or sections of country*, which might affect the amount of the resultant, but not its direction. Viewed in either aspect, the question is one that can be determined only by observation and experiment. We can know nothing about it *à priori*. Difference of velocity may produce a very great effect upon the mean resultant, or very little, or none at all.

As, in the absence of anemometers, different meteorologists have employed different measures for the velocity of the wind, some making use of the numbers themselves which represent the forces,[1] instead of interpreting them into miles per hour, as is done at the Smithsonian Institution, it seemed best, in examining the question, to compare the results by each of these methods, with those for time only. The data for the computations are contained in the columns of Series E, headed respectively "Total Number of Observations," or Number of Hours;" "Sums of Forces," or "Total of Numbers representing Forces;" and "Integral Effect," or "Total Number of Miles;" and, for convenience of comparison, the resultants, both in regard to direction and amount, are placed in parallel columns. In order to express the ratio for time only, in terms of force and velocity, I first found, as in former tables, the ratio that it bore to the total of the winds observed at the stations (which must evidently hold true, whatever be the measure adopted for the velocity),

[1] See Prof. Loomis's articles on the Meteorology of Hudson, Ohio, published in the American Journal of Science and Arts.

and then multiplied the total force and distance by this ratio. Farther, as some of the resultants were computed from a greater number of observations than others, it became necessary to reduce them to a common standard, so as to render them capable of comparison. This was effected by dividing each resultant by the number of observations from which it was computed.

Place of observation.	Number of stations.	Direction of resultant.			Amount of resultant.				Ratio of resultant to total winds, being as the Nos. in this column to 100.
		Time.	Force.	Distance.	In terms of force.[1]		In miles per hour.		
					Time.	Force.	Time.	Distance.	
Boothia Felix . . .	3	N. 35° 10′ W.	N. 27° 10′ W.	— — —	.71	1.15	—	—	29
Toronto (by anemometer) . . .	1	N. 10 23 W.	N. 41 53 W.[2]	N. 34° 29′ W.	.04	.18	.54	1.49	6
Toronto (by estimation) . . .	1	N. 21 30 W.	N. 21 21 W.[2]	N. 12 47 W.	.04	.08	.69	1.23	9
Southern Maine, New-Hampshire, and Vermont . . .	13	N. 71 42 W.	N. 66 56 W.	N. 63 22 W.	.47	.54	1.66	1.89	26
Cambridge, Mass. .	1	S. 87 21 W.	S. 87 37 W.	— — —	.44	.47	—	—	27
Williams College, do.	1	N. 77 47 W.	N. 79 39 W.	— — —	.98	1.01	—	—	31
Massachusetts, Rhode Island, and Connecticut . .	11	N. 77 31 W.	N. 78 6 W.	N. 78 49 W.	.53	.55	1.61	1.68	31
New York State .	11	N. 85 56 W.	N. 88 17 W.	S. 81 35 W.	.61	.68	2.44	3.04	31
New Jersey and Pennsylvania . .	15	N. 85 8 W.	N. 73 12 W.	N. 80 5 W.	.55	.66	1.82	2.19	35
Girard College, Pennsylvania (1843) .	1	N. 68 58 W.	— — —	N. 54 20 W.	—	—	1.53	2.24	24
Do. do. (1844) .	1	S. 89 37 W.	N. 63 16 W.	— — —	.13	.24	—	—	18
Delaware, Maryland, and East. Virginia	5	S. 87 47 W.	S. 83 24 W.	S. 77 8 W.	.40	.55	1.81	1.98	29
North Carolina .	3	S. 88 5 W.	N. 74 9 W.	— — —	.10	.17	—	—	7
Savannah, Georgia .	1	S. 5 21 E.	S. 21 24 E.	— — —	.29	.29	—	—	20½
Georgia, Alabama, Mississippi, and Northern Florida . .	12	S. 62 57 W.	S. 57 1 W.	S. 66 13 W.	.24	.23	.82	.73	13
Tennessee and Kentucky . . .	9	S. 65 6 W.	S. 65 13 W.	S. 64 13 W.	.59	.68	1.48	1.77	45
Ohio . . .	13	S. 77 12 W.	S. 82 42 W.	S. 85 57 W.	.68	.77	2.26	2.73	39
Athens, Illinois .	1	S. 61 49 W.	S. 65 50 W.	S. 70 53 W.	—	—	.99	1.17	31
Indiana, Illinois, Michigan, Wisconsin, and Iowa . .	11	S. 69 0 W.	S. 75 47 W.	S. 87 14 W.	.63	.62	1.97	1.94	34½
Porto Cabello, Venezuela . . .	1	N. 76 25 E.	N. 59 1 E.	N. 57 24 E.	.54	.70	1.49	2.05	42
Pouce, Porto Rico .	1	N. 50 3 E.	N. 62 47 E.	N. 71 10 E.	.84	.86	2.48	3.14	64
Turk's Isl'd, Bahamas	1	N. 64 46 E.	N. 66 3 E.	— — —	1.29	1.41	—	—	65
Bermudas . .	1	S. 37 11 W.	S. 75 41 W.	— — —	.79	.66	—	—	23
Inchkeith, Scotland .	1	S. 71 38 W.	— — —	S. 79 21 W.	—	—	2.79	5.02	21
Calton Hill, do. .	1	S. 80 10 W.	— — —	S. 83 10 W.	—	—	3.27	6.43	24
Sturbington, England	1	N. 67 35 W.	— — —	N. 76 48 W.	—	—	6.69	7.62	43
Greenwich, do. (1841)	1	S. 59 25 W.	— — —	S. 61 30 W.	—	—	—	—	42
Do. do. (1842)	1	S. 61 44 W.	— — —	S. 63 0 W.	—	—	—	—	25
Do. for the two years	1	S. 60 14 W.	S. 52 38 W.	S. 62 24 W.	.47	.74	6.95	7.25	34½
Devonport, England (1841) . .	1	S. 79 19 W.	— — —	S. 78 30 W.	—	—	5.46	5.50	25
Do. do. (1842)	1	S. 71 33 W.	— — —	S. 70 41 W.	—	—	1.69	4.18	8
Do. for the two years	1	S. 77 24 W.	S. 54 39 W.	S. 75 9 W.	.25	.39	3.65	4.84	17
Oporto, Portugal .	1	S. 84 35 W.	N. 77 44 W.	N. 68 38 W.	.67	.64	3.20	3.09	34
Tripoli, Barbary .	1	N. 50 3 E.	N. 60 10 E.	— — —	.54	.62	—	—	24½

[1] For Toronto, Girard College, Greenwich, and Devonport, the force in this column is expressed in pounds of pressure per square foot; for all other places, it is expressed in terms of the numbers 0, 1, 2, 3, &c., 0 denoting a calm, and 10 a hurricane, except that, for Boothia Felix and Bermuda, the maximum is 12 instead of 10.

[2] Computed from the published abstracts, in which the force on pressure is resolved in the four cardinal directions.

The modifications occasioned by introducing the element of force, or velocity, may perhaps be more clearly seen in the following table, which is deduced from the preceding one, and shows the difference of the resultants, both in direction and amount, from what they are when computed from time only. In the columns headed "Difference in Direction of Resultant," the sign + denotes that the direction is farther to the right than it would be if computed from time only, and the sign —, that it is farther to the left. In those headed "Difference per cent. in Amount of Resultant," the sign + denotes that it is greater than if computed from time only, and the sign —, that it is less.

Place of observation.	Difference in direction of resultant.		Difference in amount of resultant.	
	Force.	Distance.	Force.	Distance.
Boothia Felix	+ 8° 0′		+ 62	
Toronto (by anemometer)	— 31 30	— 24° 6′	+ 350	+ 176
Do. (by estimation)	+ 0 9	+ 8 43	+ 100	+ 78
Southern Maine, New Hampshire, and Vermont	+ 4 46	+ 8 20	+ 15	+ 14
Cambridge, Massachusetts	+ 0 16		+ 7	
Williams College, Do.	— 1 52		+ 3	
Massachusetts, Rhode Island, and Connecticut	— 0 35	— 1 18	+ 4	+ 4
New York State	— 2 21	— 12 29	+ 11½	+ 24½
New Jersey and Pennsylvania	+ 11 56	+ 5 3	+ 20	+ 20
Girard College, Pennsylvania (1843)		+ 14 38		+ 46
Do. do. (1844)	+ 27 7		+ 86	
Delaware, Maryland, and Eastern Virginia	— 4 23	— 10 39	+ 37½	+ 9½
North Carolina	+ 17 46		+ 70	
Savannah, Georgia	— 16 3		0	
Georgia, Alabama, Mississippi, and Northern Florida	— 5 56	+ 3 16	— 4	— 11
Tennessee and Kentucky	+ 0 7	— 0 53	+ 15	+ 19½
Ohio	+ 5 30	+ 8 45	+ 13	+ 21
Athens, Illinois	+ 4 1	+ 9 4	+ 13	+ 18
Indiana, Illinois, Michigan, Wisconsin, and Iowa	+ 6 47	+ 18 14	— 1½	— 1½
Porto Cabello, Venezuela	— 17 24	— 19 1	+ 30	+ 37½
Pouce, Porto Rico	+ 12 44	+ 21 7	+ 2½	+ 27
Turk's Island, Bahamas	+ 1 17		+ 9	
Bermudas	+ 38 30		— 16½	
Inchkeith, Scotland		+ 7 43		+ 80
Calton Hill, do.		+ 3 0		+ 97
Sturbington, England		— 9 13		+ 14
Greenwich, do.	— 7 36	+ 2 10	+ 57½	+ 4
Devonport, do.	— 22 45	— 2 15	+ 56	+ 33
Oporto, Portugal	+ 17 41	+ 26 47	— 4½	— 3½
Tripoli, Barbary	+ 10 7		+ 15	

In the series of wind-roses on Plate XIII., the width of the shading, in different parts of the circumference, is proportional to the average force of the winds from those directions, as given in Series E. The arrows exhibit to the eye the direction and amount of most of the resultants contained in Series F, No. 1 being that for time, No. 2 for force, and No. 3 for distance.

An inspection of the foregoing tables and plate shows very clearly that, as a general thing, *the difference in the velocity of the winds from different points of compass* affects the resultant but slightly, either in direction or amount. This is especially true, when observations, taken at a considerable number of stations, are combined, so as to neutralize the effect of local influences, to which almost every single station is more or less subject, causing the velocity of winds from certain points of compass to be greater or less than naturally belongs to them. The only apparent exception is in North Carolina, and there it is only apparent, for twenty-four out of the twenty-six months' observations reported came from one place. If we combine all the places in the United States, at which the velocity has been estimated by the use of the numbers 0, 1, 2, 3, &c., the mean resultant obtained from the actual distances is S. 87° 44′ W. 1.74 miles per hour; while, if we take the same observations, and give the same mean velocity to each, it is S. 85° 59′ W. 1.53 miles per hour—a difference of only 1° 45′ in direction, and 21 hundredths of a mile in amount. . . . Nor is there any uniformity in the operation of this slight influence of velocity on the mean direction. If we look over the list, we notice that in some cases it makes it more northerly, and in others more southerly; though it almost invariably increases the amount more or less; showing that the mean velocity of air moving in the same direction as the main current, is, on the whole, a little greater than of that moving in the opposite direction. This is what we should expect; for, in the case of any local disturbance or eddy in the atmosphere, the velocity of those parts which move in the same direction as the main current is equal to the *sum* of the two motions, while, in the opposite parts, it is equal only to the *difference.*

We can obtain light upon the remaining inquiry, viz.: *the effect of difference in the mean velocity of the wind in different countries or parts of the country,* from the general summary at the end of Series E. The only effect of this difference is, as has already been remarked, to increase or diminish the *amount* of the resultant, without altering its direction. Other things being equal, the amount of the resultant must obviously be exactly proportional to the mean velocity of the wind; so that it is necessary only to compare the velocities, as given in the table just referred to. Turning to it, we perceive that, while the mean velocity of the entire United States is about six miles[1] per hour, there could hardly exist a greater diversity in the geographical distribution of the parts of it where the velocity exceeds or falls short of the mean. Is it not, therefore, more natural to refer the difference to local influences, or errors of observation, and to conclude that, on the whole, there is, throughout the United States, no great difference of velocity?

But if we now cross the Atlantic, and compare American with European observations, there seems to be a remarkable difference between the velocity there and here. If the observations are to be relied on, and there is no apparent reason why they are not, the velocity there is very much greater. We see it not only at those places where the velocity was merely estimated; but at Greenwich and Devonport, in England, as compared with Toronto and Girard College, in this country, at all of which places it was accurately measured with instruments of the same construction, Osler's anemometer being used at them all, and yet the records show the velocity to be nearly three times greater at the former two places than at the latter two. This difference of velocity, if it really exists, will more than compensate for the less ratio that the progressive motion of the winds in Europe bears to the total motion, formerly adverted to, so as, on the whole, to make the progressive motion greater there than in the United States.

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[1] More strictly 5.8 miles.

APPENDIX.

A.

No doubt materials exist, if they could be collected together, for a far more thorough investigation of the laws of atmospheric circulation in the northern hemisphere than I have been able to give in this memoir. In a letter from Mr. Kuppfer, Superintendent of the magnetic observations in Russia, to Sir John Herschel, dated May 25, 1845, it is stated that the meteorological archives of the Academy of Sciences, at St. Petersburg, contained, at that date, collections of observations from seventy-five different stations in the Russian empire, while all that I have been able to obtain amounts to but about a dozen, and the names of five more; and, for aught I know, my collections from some other countries may be proportionably meagre, compared with existing materials. Series of meteorological observations (some of them very valuable) have been taken, and no doubt preserved, at all the following places; and might not some of those who have them in charge, do a useful service to the cause of science, by giving them greater publicity?

Name of station.	Observer.
Lesser Slave Lake, British America	Mr. McDougal.
Fort William, do. do.	Mr. McKenzie.
Fort Coulogne, do. do.	Mr. Severight.
Halifax, Nova Scotia	Merchants' Reading Room.
Waterville, Maine, U. S. A.	Professor Keely.
Brunswick, do. do.	Professor Cleaveland.
Pembroke, New Hampshire, U. S. A.	
Concord, do. do.	J. Farmer.
Epping, do. do.	W. Plumer.
Lynn, Massachusetts, do.	
Salem, do. do.	Dr. Holyoke.
Woonsocket, Rhode Island, do.	Mr. Green.
Hartford, Connecticut, do.	W. W. Turner.
West Greenfield, Pennsylvania, do.	S. Campbell.
Charlotteville, Virginia, do.	E. T. Tayloe.
Robertville, South Carolina, do.	Dr. Smith.
Brunswick, Georgia, do.	J. Bancroft.
Huntsville, Alabama, do.	Dr. Allan.
Cahawba, do. do.	Mr. West.[1]
Portsmouth, Ohio, do.	Dr. Hempstead.
New Harmony, Indiana, do.	D. D. Owen.
Lexington, Kentucky, do.	
Nassau, Bahamas	J. C. Lees.
Santa Cruz, West Indies	Dr. Tuckerman.

[1] In possession of E. Pickens, Selma, Alabama.

Name of station.	Observer.
Alten, Lapland	J. F. Cole.
Hammerfest, Norway	
Christiana, do.	J. R. Crowe.
Helsingfors, Sweden	Mr. Nervander.
Upsal, do.	
Baltischport, Russia	Mr. Kalk.
Nicolaieff, do.	
Koursk, do.	Mr. Semenoff.
Taganrog, do.	O. Trebinsky.
Nigereytagnilsk, do. (Ural Mountains)	A. Demidoff.
Edinburgh, Scotland	
Inverness, do.	
Kingussie, do.	
Makerstown, Kelso, Scotland	J. A. Brown.
Kew, England	
Bensberg, Westphalia, Prussia	
Gotha, Saxony	
Leipsic, do.	
Heidelberg, Baden	
Marburg, Hesse Cassel	
Breslau, Silesia	Dr. Boguslawski.
Senftenberg, Austria	
Cadiz, Spain	Mr. Cerquero.
Le Caire	Mr. Alger.
Port Arthur[1]	J. Lempriere.
Cairo, Egypt	Mr. Lambert.
River Niger, Africa[1]	
Algiers, do.	Mr. Aimé.
Simla, Himmaleh Mountains	J. H. Boileau.
Lucknow, Hindoostan[1]	R. Wilcox.
Bombay, do.[1]	G. Buist.
Cochin, do.[1]	
Penang,[1]	J. B. Taylor.
Singapore, Farther India[1]	C. M. Elliott.
Aden, Arabia	
Cape of Good Hope[1]	Lieutenant Wilmot.
St. Helena[1]	Captain Lefroy.
Van Dieman's Land	
Antarctic Expedition[1]	Ross and Crozier.
Ross Bank[1]	Captain Ross.

B.

Extract from a letter from Donald Ross, Esq., Norway House:—

"I may as well mention that this post is situated on a branch of the 'Sea River,' or, more properly speaking, the Nelson River, about twenty miles due north from where it leaves the great Lake Winnipeg, and is, as near as I can judge, about four hundred feet above the level of the sea.

It may be somewhat curious to notice that, although the winds here blow from the South for a greater number of days during the year, than from any other single quarter of the compass, yet the Northerly wind, together with the N. E. and N. W., very far exceeds the Southerly, S. E. and S. W., so that, in reality, the North may be considered as the most prevailing wind; neither the East nor the West prevails much at any season of the year."

[1] In the archives of the Royal Society, London.

C.

Extract from a letter from J. M. Batchelder, Esq., Saco, Maine, accompanying his observations:—

"This place is situated on the Saco River, three miles from the ocean, from whence we have the south wind, which, you will observe, is the prevailing one during the summer months. There are frequently local currents down the valley of the river; but I think that the observations are, in the main, correct."

D.

For a description of the meteorological stations in the State of New York, see the reports of the Regents of the University of that State, as made annually to the legislature.

E.

Lafayette College, where the observations for Easton, Pennsylvania, were taken, is situated on an abrupt bank of the Delaware River, nearly 200 feet above its surface, and distant from it not more than one-fourth of a mile. There is no local cause that can materially affect the direction of the wind, unless it be the Blue Mountains, which are about twenty miles off.

Extract from a letter from George Mowry, Esq., Somerset, Pennsylvania, accompanying his observations:—

"The locality of Somerset is about half way between the Alleghany and Laurel Hill, which mountains run nearly north-east and south-west. There is no other table-land between us and Laurel Hill; but a few miles south and east of us, Negro Ridge lies, flattened down to within fifty or sixty feet of the level of Somerset;—farther south-west, toward the Maryland line, it is a considerable mountain. You are right in your inference that we are at the head of a branch of Youghiogeny; and, on a close inspection of a good map, you will observe that the waters flow north and south from us—consequently we are situated on some of the highest table-land in the State."

G.

Extract from a letter from Professor McCay, Athens, Georgia, accompanying an abstract of his observations:—

"I do not think there is any local cause for our winds. There are no mountains within sixty or seventy miles—no regular ridges for a still greater distance. The country is undulating, with no changes of elevation amounting to five hundred feet, in a circle around of fifty miles. The river near us is very small. Its course very irregular, sweeping round us in a semicircular course. Other streams near us have a general course to the south-east—nearly south."

H.

Extract from a letter from the Rev. H. G. O. Dwight, Constantinople, Turkey, accompanying his observations:—

"In regard to my record of the winds, I must say, that if I had been situated where I had a high vane to guide me, the table would probably have shown some slight veerings to the east or west, which do not now appear. There is, however, no doubt of the fact, that the wind here, as a general thing, blows either from the north-east or the south-west. A wind, from either of the four cardinal points, never continues long in Constantinople. During the fifteen or sixteen years that I have been here, I have noticed that our prevailing wind in summer, is north-east. Indeed, from July to October it is so constantly and regularly from that quarter as to be almost a monsoon; and during that period, the nights are very apt to be calm. The wind begins to blow gently soon after sunrise, and it increases until, say two o'clock, when it not unfrequently blows very strong, and then gradually dies away, and, soon after sunset, it becomes calm again. During the prevalence of this wind *in summer*, the atmosphere is usually clear, or, at least, there are only flying clouds, without rain; but, in winter, the north wind always brings clouds and rain. When the south wind blows in summer, it is usually a mere land breeze, and I have often myself observed, in passing up the Bosphorus on a summer's day, when the wind is south-west at the entrance of the Bosphorus into the Sea of Marmora, it is north-east at the northern end of the same strait, *i. e.* as it issues from the Black Sea. I have known it to blow all day thus in opposite directions, the two winds meeting at the middle of the strait where it was perfectly calm.

"One fact you will probably notice from my table, and that is, that there is far more southerly wind in winter than in summer. And this leads me to say a word in reference to your question, whether I know of any local cause, besides the direction of the straits, that would affect the wind? About seventy or eighty miles south of us is the high range of Mount Olympus (not Thessalian, but Bithynian), whose summit is at least eight thousand feet above the sea level; and, of course, in winter, it is covered with an immense mass of snow. This has been supposed to be the chief cause of our having so much southerly wind in winter. I do not give this as my opinion, however, but I simply state the fact of such a mountain being in such a relative position to the capital, and also an inference that has been drawn from that fact. I have always noticed that our coldest weather in winter comes when the southerly wind first begins to blow, which I account for on the supposition that such a wind brings first over us the frozen atmosphere of Olympus, and other high ranges of mountains in the interior. But if the wind continues two or three days (and it sometimes does *two or three weeks* uninterruptedly in winter), it is sure to bring mild and almost summer weather. The barometer here invariably sinks with a southerly wind, and the rain point is much higher with a northerly than with a southerly wind. I have sometimes noticed an alarming fall in the barometer, but I soon learned not to anticipate any unusual storm from that, if the wind was just coming from the south or south-west. Our heaviest blows, and our most copious rains, ordinarily come just as the wind is changing from a southerly to a northerly direction.

"As you are interesting yourself in the study of the winds, I will just mention one more fact, though an isolated one. (I wish I had more of them.) Three years ago, I was in Smyrna, in the autumn, when we had one of the most dreadful gales I have experienced on these shores. It came in the night, and blew for four or five hours, I think, with the greatest violence, so that much damage was done to the shipping. I took particular notice of the wind, and found that the same gale had been felt, if possible, still more severely in Constantinople, though somewhat later, *i. e.* two or three hours, perhaps; and an observant sea captain of my acquaintance, who happened to be off this port at the time, informed me that the wind here was from the south-west, *i. e.* directly opposite that in Smyrna. I must say, however, that as I took no note of it at the time, I am not positively certain it was *later* at Constantinople. It may have been so much *earlier* instead of later, though my strong impression is that my first statement is correct. The main point, however, to which my mind was directed, was the fact that in the same gale the wind blew from opposite quarters at Smyrna and at Constantinople. The distance between the two cities, by sea, is estimated at about 350 miles, though by an air line it must be considerably less."

I.

Extract from a letter from Rev. S. H. Calhoun, Mount Lebanon, Syria, accompanying his observations at Smyrna and Bahmdûn:—

"In the summer of 1844, I removed to Syria" (*i. e.* from Smyrna, Asia Minor), "and as you will see by the continuance of sheet No. 1, and the whole of sheet No. 2, was at a village named Bahmdûn, situated S. S. E. from Beirut, and near the Damascus road. Its elevation I suppose to be between thirty-one and thirty-two hundred feet, on Mount Lebanon." * * *

"Sheet No. 3 contains the records of Dr. De Forest's observations at Beirut. You will see that his observations for April, May, and June, 1843, were made at an elevation of 213 1-6 feet above the sea, and the succeeding ones at an elevation of about 80 feet."

K.

Extract from a letter from Rev. N. Benjamin, accompanying a collection of observations at Trebizond:—

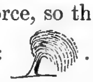
"The prevailing winds at Trebizond are north-west winds and easterly winds. The sirocco also sometimes prevails. Rain storms, which are very frequent, are almost invariably with a wind blowing from the north-west. The clear and pleasant weather was almost as uniformly with an easterly wind, and I also quite generally observed, that the barometer was lower with an east wind when quite clear, than with a north-west or a north wind accompanied by an obscured sky, and even with rain. So that we had often the extraordinary phenomenon, of the barometer rising as the storm was coming on, and standing very high during a protracted rain, and sinking on the return of clear weather." * * * * *

"I have not been able to form any satisfactory conclusions in regard to the local causes which affect the direction of the winds at Trebizond, and can only say that the whole country in the rear of that place is mountainous to an unusual degree."

L.

Extract from a letter from Rev. J. F. Lanneau:—

"There are, however, some general remarks which my long residence in Syria and the Holy Land enables me to make concerning the direction of the wind, and other topics alluded to in your letter, and which may be of some interest to you.

"The whole of Palestine is intersected by a chain of hills, or small mountains, rising to an elevation of nearly three thousand feet, and extending north and south nearly midway between the Mediterranean and the Jordan. On the sea-coast, the wind generally blows 'off the land,' or from the east and south-east during the night, and follows the sun, as the day advances, toward the south, south-west, and west, and perhaps one-third of the time continuing on to north and north-west, increasing toward sunset, and, shortly after, dying away to a calm, which lasts until about midnight, when the land-breeze again commences. At Jerusalem, however, and in the hill country of Judea, the direction of the winds is almost always from the north-west during winter and summer, except when the Shileak, the Arabic term for the wind commonly known elsewhere as the Sirocco, or east wind, blows from the desert. So uniformly prevalent is the north-wester, that the olive trees in the interior, situated so as to feel its constant influence, are inclined toward the south-east, and their branches checked in their opposite direction by its force, so that, in some cases, three-fourths, or more of them, are on that side, thus: . This is very strikingly noticed immediately around Jerusalem.

"And this leads me to an obvious answer to one of your questions, viz.: 'Are there any local influences that would affect the direction of the wind?' I have always thought the position of Jerusalem, and that whole region, with the immense evaporation from the Dead Sea, and the Arabian desert to the south-east of it, must be the physical cause of the north-west direction of the wind the greater portion of the year, while the deep gorge in the mountains, extending all the way from the valley of Jehoshaphat and Hinnom to the Dead Sea, occasions a stronger current over the Holy City and the Mount of Olives. The Arabs have a saying, that Jerusalem is the most windy place in the world, the centre of the earth, and thus attracting all the wind there, &c. During the winter, the south-west wind on the coast, and the north-west wind in the interior, generally accompany a rain, though occasionally there is a shower from the south-east. A north wind on the sea-coast always drives away rain, but it is generally a very chilly and uncomfortable one, and is considered by the natives as unwholesome. The rainy season commences about the 1st or 15th of October, and continues until the middle of April. Sometimes a few showers fall in September and May."

M.

For an extract from a letter of the Rev. Justin Perkins, Ooroomiah, Persia, accompanying his observations at that place, see pages 104 and 105.

In regard to the winds at Tabreez, he remarks as follows:—

"At Tabreez, across the lake, which is about seventy miles distant from us (in a direct line), and nearly east from Ooroomiah, there is daily a strong wind from the Caspian Sea, which is about one hundred and fifty miles north-east of that city. This wind is very invigorating."

N.

. Extract from a letter from the same, accompanying observations from Tehran, Persia:—

"Properly to understand these phenomena, it may be well that you have in mind the local situation of Tehran. I will copy a reference to its situation, penned on the spot when I visited it several years ago. 'The local situation of Tehran renders its situation extremely warm, and hemmed in as it is on the north and east by naked mountains, which tower some 5000 or 6000 feet above it in the rear, and the vast extent of arid land in the two opposite directions, reflecting the heat in summer like a burning desert, the city cannot be otherwise than like a great oven during the warm months of the year, not taking into account at all its relative elevation, which is much less than that of Tabreez, and other cities of Azerbijon.'

"I may add to this notice that the Caspian Sea, lying some seventy or eighty miles north of Tehran, though separated from it by a lofty range of mountains, doubtless affects the character and direction of its winds, and still more probably, the immense salt desert that skirts the plain of Tehran, some fifty miles south-east of the town."

O.

When these sheets were first sent to the Smithsonian Institution for publication, the observations from Tehran and Tabreez had not been received, and those previously received from Ooroomiah, gave the mean direction a good deal more southerly. This addition of three new stations, at which the direction of the wind is westerly, may lead us to question whether the southern limit of the zone of westerly winds should not be altered so as to include this region of country.

P.

The reception of Lieutenant Maury's Charts of the North Pacific Ocean, after the entire completion, as was supposed, of the foregoing manuscript, and the kind aid of Mr. Solon Albee, a fellow college officer, in discussing them, and making the necessary computations, has enabled me to add, as an appendix to Series C, Section IV, the following list of resultants, deduced from an aggregate of more than one hundred and sixty-five years' observations. Owing to the probable monsoon character of the winds near the coast, or say within six hundred miles of it, the resultants for each of the several months were computed separately, and from them the mean for the year; but, in mid-ocean, where there was no reason to apprehend any influence of that kind, such precaution was deemed unnecessary, and the resultants were obtained by simply resolving the traverse of all the winds reported, without reference to the time of the year in which they were taken.

The almost entire want of observations during the colder months of the year, north of latitude 40°, necessarily renders the results near the coast doubtful, and in the vicinity of Sitka and Fort Vancouver, the deficiency was supplied by using observations at those places.

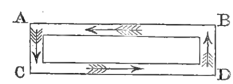
No.	North Latitude.		West Longitude.		Mean direction of Wind.	Rate of Progress.	No. of Observations.
31	55° to	60°	130° to	150°	S. 40° 58′ E.	21½	15633
32	55	60	150	165	S. 62 24 W.?	32	3006
33	50	55	125	145	N. 85 9 W.?	35	6937
34	50	55	145	155	S. 63 12 W.?	28	14347
35	50	55	155	165	S. 41 43 W.?	20	6682
36	45	50	120	145	N. 77 48 W.?	44	2180
37	45	50	145	155	S. 73 11 W.	42	2271
38	45	50	155	165	S. 88 48 W.	34	1989
39	40	45	120	140	N. 64 7 W.	26	1201
40	40	45	140	150	S. 78 29 W.	30	1395
41	40	45	150	165	S. 72 27 W.	26	2425
42	35	40	120	135	N. 19 5 W.	34	4066
43	35	40	135	150	N. 52 41 E.	15	2982
44	35	40	150	165	S. 41 28 W.	13	3588
45	30	35	115	125	N. 28 34 W.	65	1672
46	30	35	125	135	N. 18 56 E.	45	2925
47	30	35	135	150	N. 81 57 E.	30	3873
48	30	35	150	165	S. 44 34 E.	20	7366
49	25	30	105	125	N. 14 51 W.	37½	1766
50	25	30	125	135	N. 36 9 E.	64	1117
51	25	30	135	150	N. 48 6 E.	46	1425
52	25	30	150	165	N. 77 0 E.	48	6606
53	20	25	105	125	N. 28 41 W.	57	3780
54	20	25	125	135	N. 33 40 E.	82	717
55	20	25	135	150	N. 59 16 E.	75	960
56	20	25	150	165	N. 66 2 E.	68	9245
57	15	20	90	110	N. 18 0 W.	37½	1833
58	15	20	110	120	N. 22 9 E.	60	838
59	15	20	120	135	N. 36 7 E.	85	764
60	15	20	135	150	N. 54 8 E.	84	2046
61	15	20	150	165	N. 62 37 E.	72	4656
62	10	15	85	100	N. 28 14 E.	37	944
63	10	15	100	110	N. 39 2 E.	37	1078
64	10	15	110	120	N. 46 2 E.	46	863
65	10	15	120	135	N. 41 28 E.	73	1198
66	10	15	135	150	N. 50 43 E.	86	1569
67	10	15	150	165	N. 65 32 E.	85	2482
68	5	10	75	90	S. 71 54 W.	22	1430
69	5	10	90	105	S. 51 39 E.	47	1826
70	5	10	105	120	S. 42 33 E.	47	2271
71	5	10	120	135	S. 81 51 E.	53	1960
72	5	10	135	150	S. 89 38 E.	57	1612
73	5	10	150	165	S. 89 18 E.	65	3268
74	0	5	75	90	S. 6 18 E.	66½	14358
75	0	5	90	95	S. 18 59 E.	71	7078
76	0	5	95	100	S. 22 38 E.	48	2572
77	0	5	100	105	S. 38 27 E.	84	1617
78	0	5	105	110	S. 39 44 E.	91	1306
79	0	5	110	115	S. 46 42 E.	84	1373
80	0	5	115	120	S. 52 13 E.	84	1816
81	0	5	120	125	S. 56 30 E.	89	2408
82	0	5	125	130	S. 60 31 E.	84	1782
83	0	5	130	135	S. 62 22 E.	82	1566
84	0	5	135	140	S. 75 15 E.	86	968
85	0	5	140	145	S. 78 30 E.	75	447
86	0	5	145	150	S. 79 27 E.	76	738
87	0	5	150	155	S. 69 48 E.	71	1156
88	0	5	155	160	S. 69 4 E.	84	1481
89	0	5	160	165	S. 75 37 E.	81	770

Q.

As Dr. Halley's theory of winds is revived, and advocated with a good deal of ability, in Professor Mitchell's paper, referred to on pages 134 and 138, we will point out some of what we conceive to be objections to it.

1. As applied to the trade-winds, it is entirely inadequate to produce the effects observed. It is on the ocean that the trade-winds are most uniform, and most fully developed. Let us see, then, what the effect would be, if the equatorial parts of the earth were entirely covered with water.

Suppose A B D C to be a section of one of the vortices of Dr. H., or Professor M. (seen from the north side, and drawn in the form of an oblong, instead of an ellipse, for convenience of calculation), in which the lower current moves westward from C toward D, and the upper eastward from B toward A; and let its horizontal length be 100 miles (which is, we presume, as much as they would desire, since the vortices are spoken of as being of "moderate dimensions"), and its height two miles.



Now, the extreme diurnal range of temperature on the surface of that part of the ocean does not ordinarily exceed 1° F., and the difference between the two extremities of the vortex could not amount to $\frac{1}{1000}$ of 1°. Air expands about $\frac{1}{480}$ of its bulk for each degree that its temperature is raised; consequently, the difference in the specific gravity of the columns at the ends of the vortex (A C and B D) would hardly amount to $\frac{1}{480000}$ of the weight of either, or $\frac{1}{4896000}$ of the weight of the air in the entire circuit. But it is this difference only which constitutes the moving force, while the quantity of matter to be moved is the air of the whole circuit. Hence, according to well known principles in mechanical philosophy, the velocity communicated is $\frac{1}{48960000}$ of that with which a body would fall freely, and is precisely the same as that of a body descending on an inclined plane, whose height is to its length as 1 to 48960000. Such an inclination, amounting to no more than about $\frac{1}{800}$ of an inch in a mile, would be insufficient to give the slightest appreciable motion to a fluid placed upon it.

Professor M. attempts to meet this objection by the following remark: "That it (the cause in question) is adequate to the creation of a considerable wind, is proved from the fact that it is upon this that the other, or permanent temperature, depends, and that it is what determines the existence of two winds; the land and sea-breezes blowing in opposite directions every twenty-four hours." But neither of these facts seems to be relevant. The tendency of water to resist *sudden changes* in its temperature, in no way interferes with the *accumulation* of heat in the equatorial regions, and it is on this that the higher temperature of those parts depends. And in regard to land and sea-breezes, it must be borne in mind, that the diurnal change of temperature on land, is at least thirty times greater than on water.

2. We cannot understand how Halley's theory accounts for the westerly winds that prevail beyond the limits of the trades. The following is the explanation, as given by Professor M., after remarking that the explanation of the trade-winds

"applies to such parallels of latitude only as have the amount of heat communicated to the portions of air lying north and south of them nearly the same, or along which the point of greatest heat, or of heat very little below the greatest, may be supposed to travel from east to west. If," he proceeds, "the excess of heat on one side be moderately increased, the plane of the vortex will be inclined in that direction; but if the excess become considerable, as through the greater part of the temperate zone, the equilibrium will be established in a totally different way. Thus, with regard to the United States, the point of greatest heat first passes south of us, and an impulse is given to the under strata of the atmosphere in that direction, and when, some time afterwards, the columns in the meridians west of us come to be expanded, the air that should have supplied the eastern or trade-wind having passed off toward the equator, the upper or western current descends to the earth, creating a westerly wind, or rather, by the composition of motions in consequence of its mingling with the current that is proceeding southward, a north-west wind, which may be regarded as the *natural* wind of the parts of the globe lying on the north side of the equator beyond the thirtieth parallel. The same reasoning applies to the other hemisphere. As, however, the natural and gentle flow of the air in this direction is interrupted by evaporation, condensation, and other causes, the result is simply a predominance in those latitudes of winds from the west, and the direction of the pole, over those from opposite quarters."

This whole reasoning appears to me obscure and unsatisfactory.

3. The theory fails to account for the system of easterly winds which seems to exist in high northern latitudes; for, if the above reasoning is sound for the temperate regions, it will apply just as well all the way to the poles.

4. The cause which Professor M. disregards *must exist*, and he makes no provision for it. We do *certainly know* that a body in motion tends to retain its motion; and that if air, partaking of the easterly motion of the earth due to a higher latitude, were, without any change in its motion, transferred to the equator, it must have a relative motion as from the east. All this we should know even without observation or experiment, and if this cause does not produce appreciable effects, it is incumbent to show how it is neutralized.

The purely cosmical theory, on the other hand, runs to the opposite extreme, and disregards the influence of heat altogether. The views of those who advocate it may, if I understand them, be thus expressed. The absolute motion of a place at midnight, say they, is equal to the *sum* of the annual and diurnal motions of the earth, while, at noon, it is equal only to the *difference*; and hence, that the air, tending to preserve a uniform motion, travels slower than the earth in the former case, and faster in the latter. But the same reasoning would apply if the earth had no annual motion. The place would then move in one direction at midnight, and in the opposite one at noon, making the difference the same as now. We all know that a pail of water whirled around on board a steamboat or railroad car, when the latter was in rapid motion, would present the same phenomena as when at rest. The whole matter is easily understood by recurring to the first principles of central forces. Motion in a circular orbit is neither accelerated nor retarded by a force directed toward the centre of the orbit. Nor will a common motion, communicated both to the centre and to the revolving body, affect their position relatively to each other. Now, in the case of the atmosphere, the motion in opposite directions just spoken of, is caused solely by the force of gravity, which retains the air about the earth, and prevents it from flying off in a tangent, by virtue of its centrifugal force, but has no effect whatever upon its horizontal motion, nor any tendency to change the relative position of a place on the earth's surface and the superincumbent air. A musket-ball, discharged horizontally with a velocity of about five miles per second, would, if the air were removed, travel round the earth with a uniform velocity, and yet would move in opposite directions at opposite points of its orbit. Nor would its relative position in regard to the surface of the earth be in any way affected by the revolution of the earth around the sun.

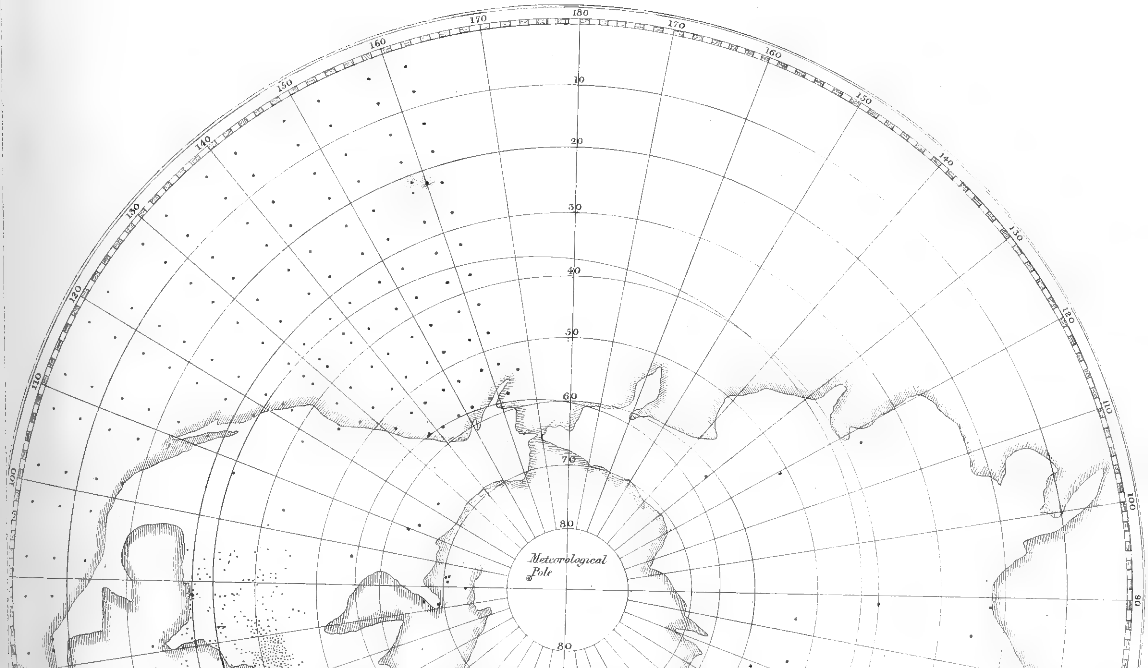
LIST OF PLATES.

PUBLISHED BY THE SMITHSONIAN INSTITUTION,

WASHINGTON, D. C.

NOVEMBER, 1853.

Plate 1.

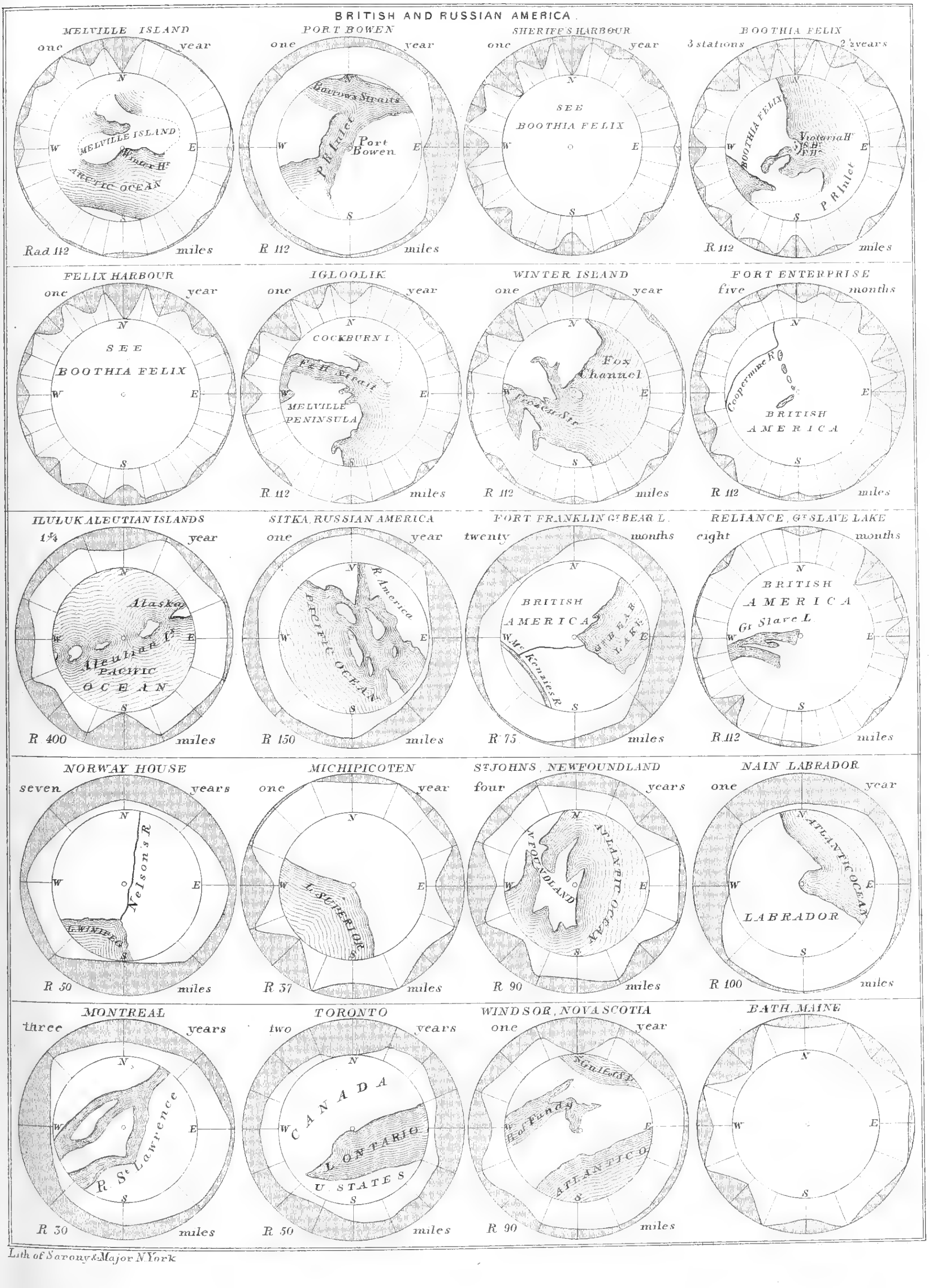


METEOROLOGICAL STATIONS IN THE NORTHERN HEMISPHERE

from which collections of observations have been obtained for this memoir
N B The dots indicate the stations

Lith. of Sarony & Major, New York.

Plate II.



Lith of Sarony & Major N York

Plate III.

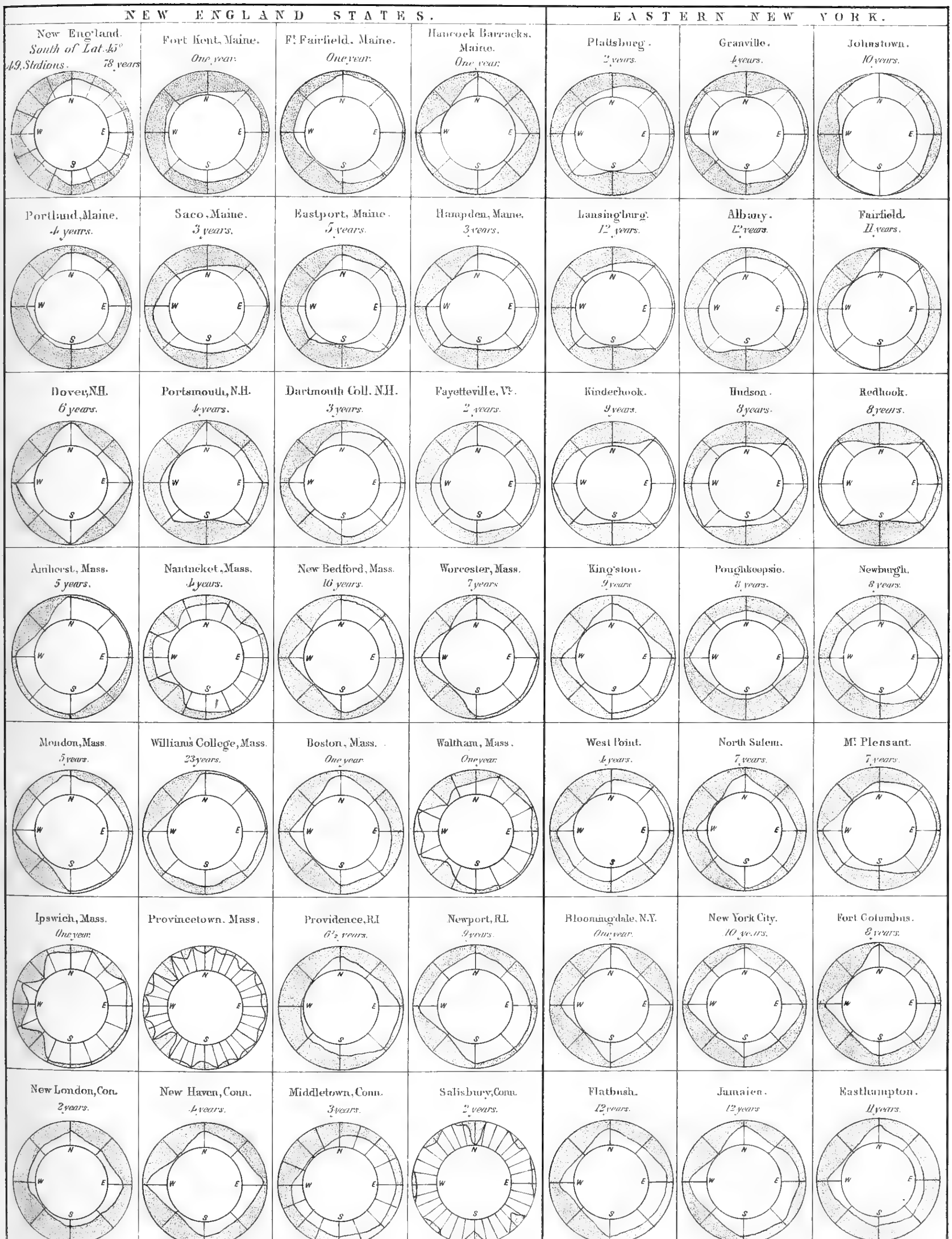
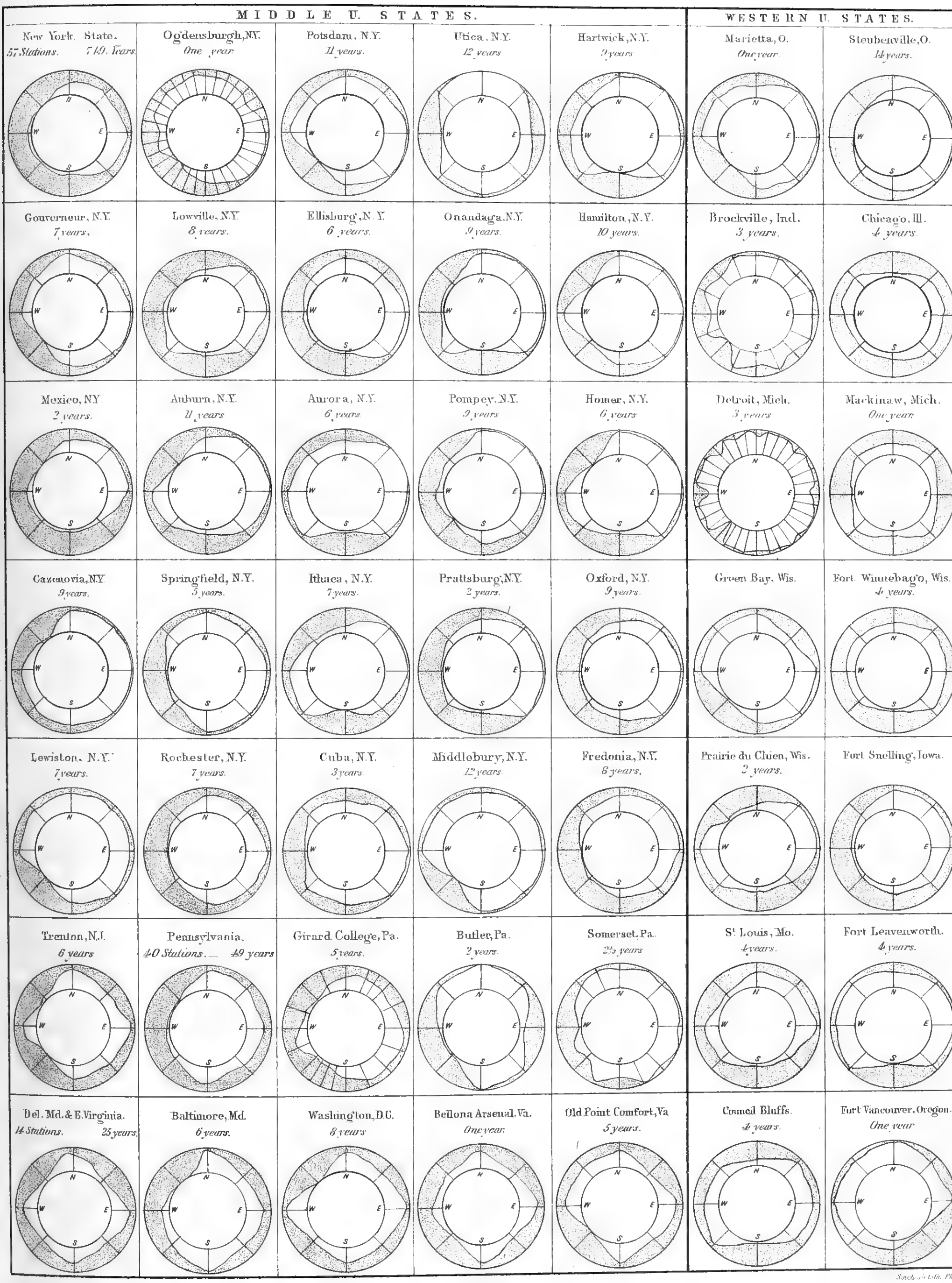
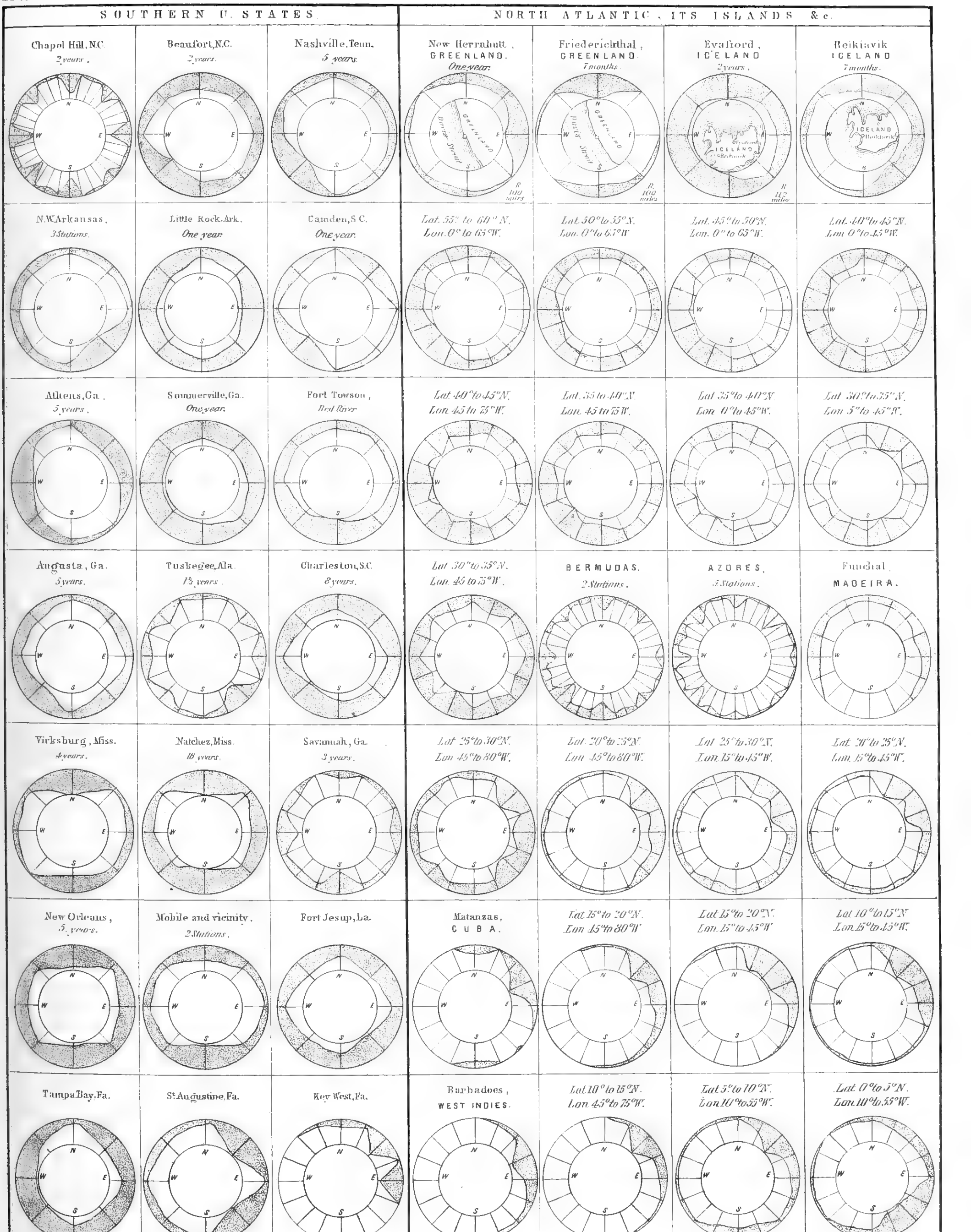

NEW ENGLAND STATES.
EASTERN NEW YORK.
New England. South of Lat. 45° 49 Stations. 78 years
Fort Kent, Maine. One year.
Ft Fairfield, Maine. One year.
Hancock Barracks, Maine. One year.
Plattsburg. 2 years.
Granville. 4 years.
Johnstown. 10 years.
Portland, Maine. 4 years.
Saco, Maine. 3 years.
Eastport, Maine. 5 years.
Hampden, Maine. 3 years.
Lansingburg. 12 years.
Albany. 12 years.
Fairfield. 11 years.
Dover, N.H. 6 years.
Portsmouth, N.H. 4 years.
Dartmouth Coll. N.H. 3 years.
Fayetteville, Vt. 2 years.
Kinderhook. 9 years.
Hudson. 8 years.
Redhook. 8 years.
Amherst, Mass. 5 years.
Nantucket, Mass. 4 years.
New Bedford, Mass. 16 years.
Worcester, Mass. 7 years.
Kingston. 9 years.
Poughkeepsie. 8 years.
Newburgh. 8 years.
Mendon, Mass. 5 years.
Williams College, Mass. 23 years.
Boston, Mass. One year.
Waltham, Mass. One year.
West Point. 4 years.
North Salem. 7 years.
Mt Pleasant. 7 years.
Ipswich, Mass. One year.
Provincetown. Mass.
Providence, R.I. 6½ years.
Newport, R.I. 9 years.
Bloomingdale, N.Y. One year.
New York City. 10 years.
Fort Columbus. 8 years.
New London, Con. 2 years.
New Haven, Conn. 4 years.
Middletown, Conn. 3 years.
Salisbury, Conn. 2 years.
Flatbush. 12 years.
Jamaica. 12 years.
Easthampton. 11 years.

Plate IV.



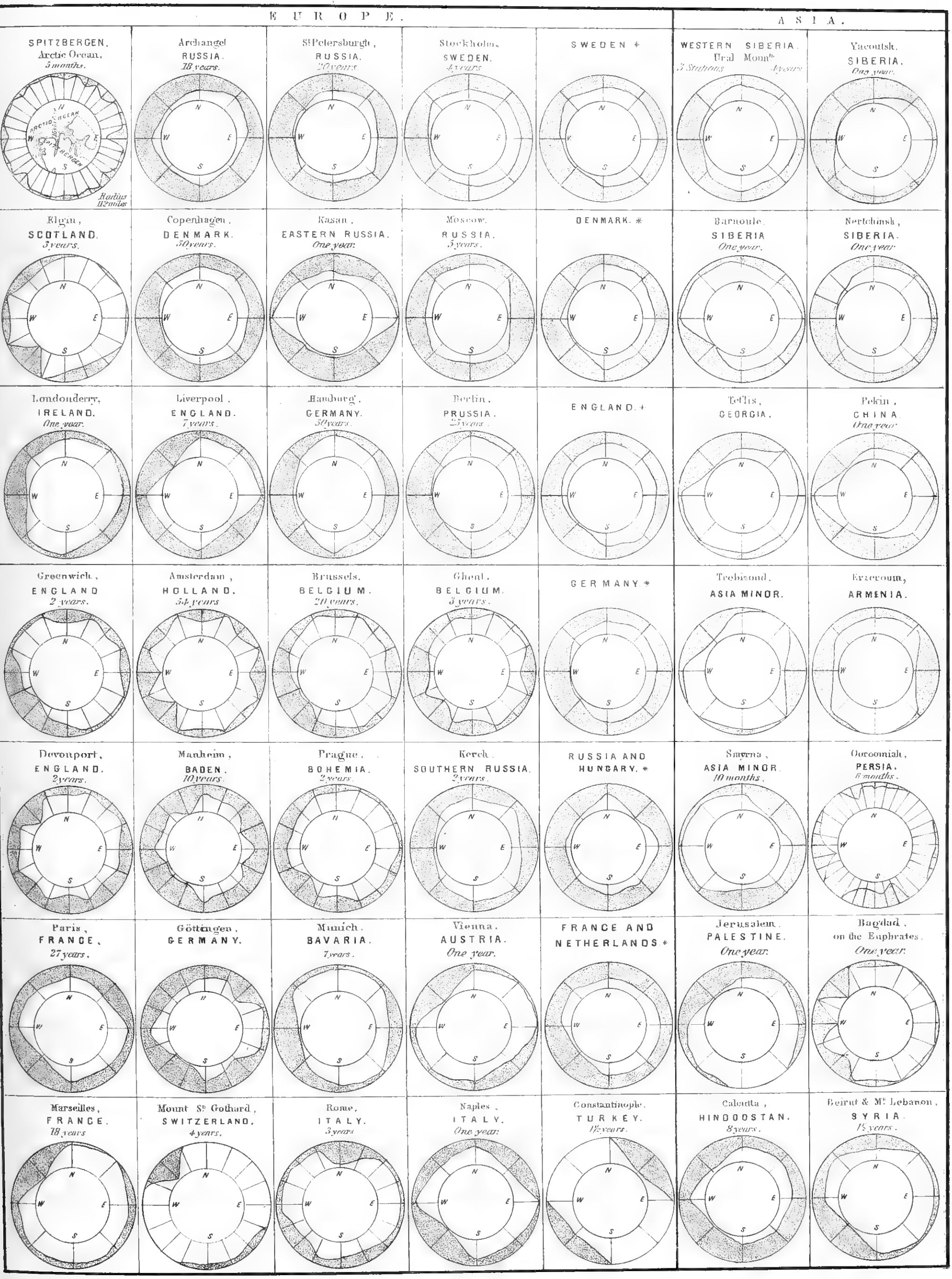
Sinclair's Lith. Phil.

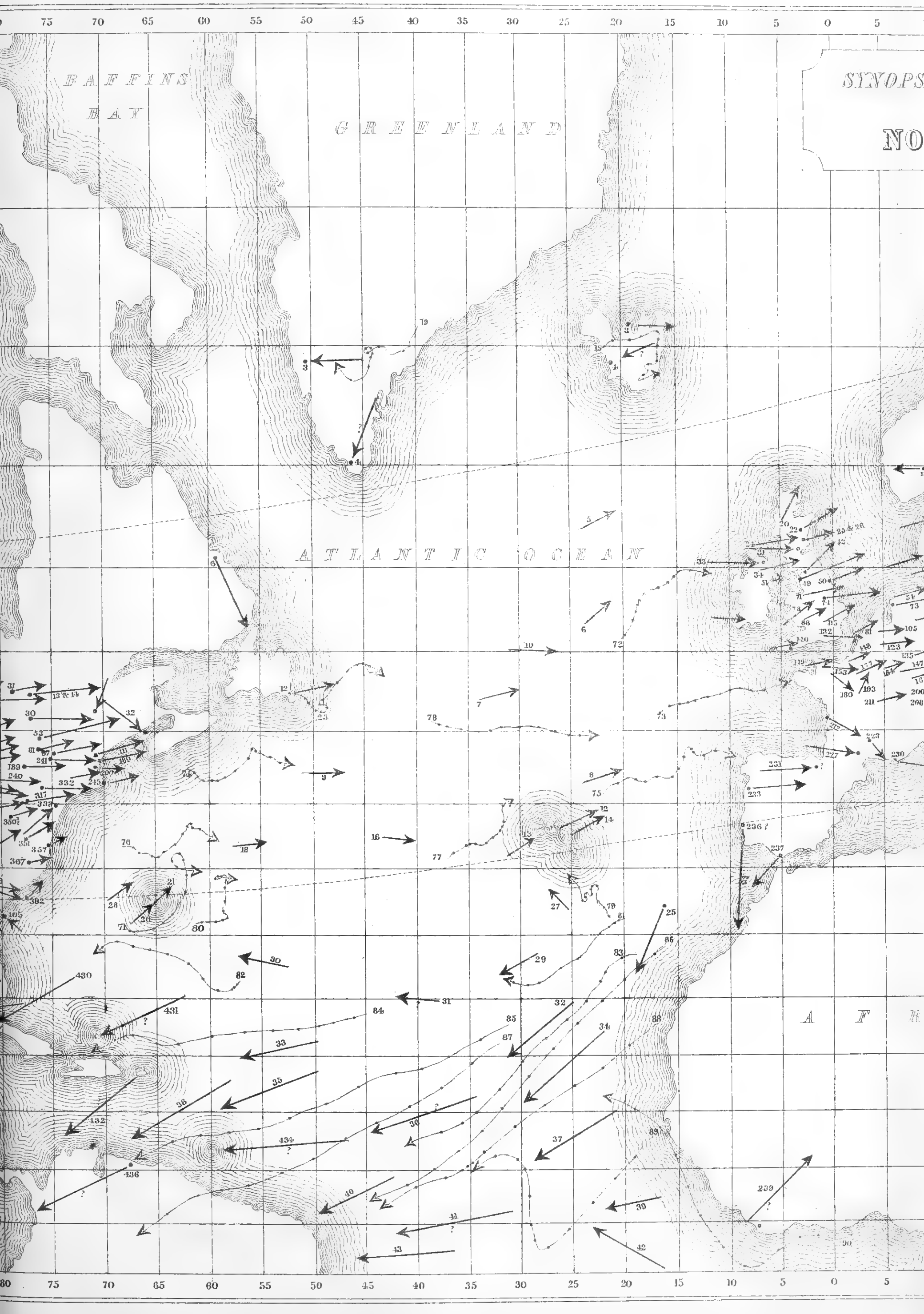
Plate V.



SOUTHERN U. STATES
NORTH ATLANTIC, ITS ISLANDS &c.
Chapel Hill, N.C. 2 years.
Beaufort, N.C. 2 years.
Nashville, Tenn. 5 years
New Herrnhutt, GREENLAND. One year
Friederichthal, GREENLAND. 7 months
Evafiord, ICELAND 2 years.
Reikiavik ICELAND 7 months.
N.W. Arkansas, 3 Stations.
Little Rock, Ark. One year
Camden, S.C. One year.
Lat. 55° to 60° N. Lon. 0° to 65° W.
Lat. 50° to 55° N. Lon. 0° to 65° W.
Lat. 45° to 50° N. Lon. 0° to 65° W.
Lat. 40° to 45° N. Lon. 0° to 45° W.
Athens, Ga. 5 years.
Sommerville, Ga. One year.
Fort Towson, Red River
Lat. 40° to 45° N. Lon. 45 to 75° W.
Lat. 35 to 40° N. Lon. 45 to 75 W.
Lat. 35° to 40° N. Lon. 0° to 45° W.
Lat. 30° to 35° N. Lon. 5° to 45° W.
Augusta, Ga. 5 years.
Tuskegee, Ala. 1½ years.
Charleston, S.C. 8 years.
Lat. 30° to 35° N. Lon. 45 to 75° W.
BERMUDAS. 2 Stations.
AZORES, 3 Stations.
Funchal, MADEIRA.
Vicksburg, Miss. 4 years.
Natchez, Miss. 16 years.
Savannah, Ga. 3 years.
Lat. 25° to 30° N. Lon. 45° to 80° W.
Lat. 20° to 25° N. Lon. 45° to 80° W.
Lat. 25° to 30° N. Lon. 15° to 45° W.
Lat. 20° to 25° N. Lon. 15° to 45° W.
New Orleans, 5 years.
Mobile and vicinity, 2 Stations.
Fort Jesup, La.
Matanzas, CUBA.
Lat. 15° to 20° N. Lon. 45° to 80° W.
Lat. 15° to 20° N. Lon. 15° to 45° W.
Lat. 10° to 15° N. Lon. 15° to 45° W.
Tampa Bay, Fa.
St. Augustine, Fa.
Key West, Fa.
Barbadoes, WEST INDIES.
Lat. 10° to 15° N. Lon. 45° to 75° W.
Lat. 5° to 10° N. Lon. 10° to 55° W.
Lat. 0° to 5° N. Lon. 10° to 55° W.

Plate VI.


E U R O P E.
A S I A.
SPITZBERGEN, Arctic Ocean, 5 months.
ARCTIC OCEAN
SPITZBERGEN
Radius 112 miles
Archangel RUSSIA. 18 years.
St Petersburgh, RUSSIA. 20 years.
Stockholm, SWEDEN. 4 years.
SWEDEN *
WESTERN SIBERIA. Ural Moun^{ts}. 3 Stations 4 years.
Yacoutsk. SIBERIA. One year.
Elgin, SCOTLAND. 3 years.
Copenhagen, DENMARK. 50 years.
Kasan, EASTERN RUSSIA. One year.
Moscow, RUSSIA. 5 years.
DENMARK. *
Barnoule, SIBERIA One year.
Nertchinsk, SIBERIA. One year.
Londonderry, IRELAND. One year.
Liverpool, ENGLAND. 7 years.
Hamburg, GERMANY. 30 years.
Berlin, PRUSSIA. 25 years.
ENGLAND. *
Teflis, GEORGIA.
Pekin, CHINA. One year.
Greenwich, ENGLAND 2 years.
Amsterdam, HOLLAND. 54 years.
Brussels, BELGIUM. 20 years.
Ghent, BELGIUM. 3 years.
GERMANY. *
Trebizond, ASIA MINOR.
Erzeroum, ARMENIA.
Devonport, ENGLAND. 2 years.
Manheim, BADEN. 10 years.
Prague, BOHEMIA. 2 years.
Kerch, SOUTHERN RUSSIA. 2 years.
RUSSIA AND HUNGARY. *
Smyrna, ASIA MINOR. 10 months.
Ooroomiah, PERSIA. 6 months.
Paris, FRANCE. 27 years.
Göttingen, GERMANY.
Munich, BAVARIA. 7 years.
Vienna, AUSTRIA. One year.
FRANCE AND NETHERLANDS *
Jerusalem, PALESTINE. One year.
Bagdad, on the Euphrates. One year.
Marseilles, FRANCE. 18 years.
Mount St Gothard, SWITZERLAND. 4 years.
Rome, ITALY. 5 years.
Naples, ITALY. One year.
Constantinople, TURKEY. 1½ years.
Calcutta, HINDOOSTAN. 8 years.
Beirut & Mt Lebanon, SYRIA. 1½ years.
N
S
E
W


BAFFINS
BAY
GREENLAND
ATLANTIC OCEAN


SYNOPSIS OF THE COURSES OF THE WINDS
IN THE
NORTHERN HEMISPHERE

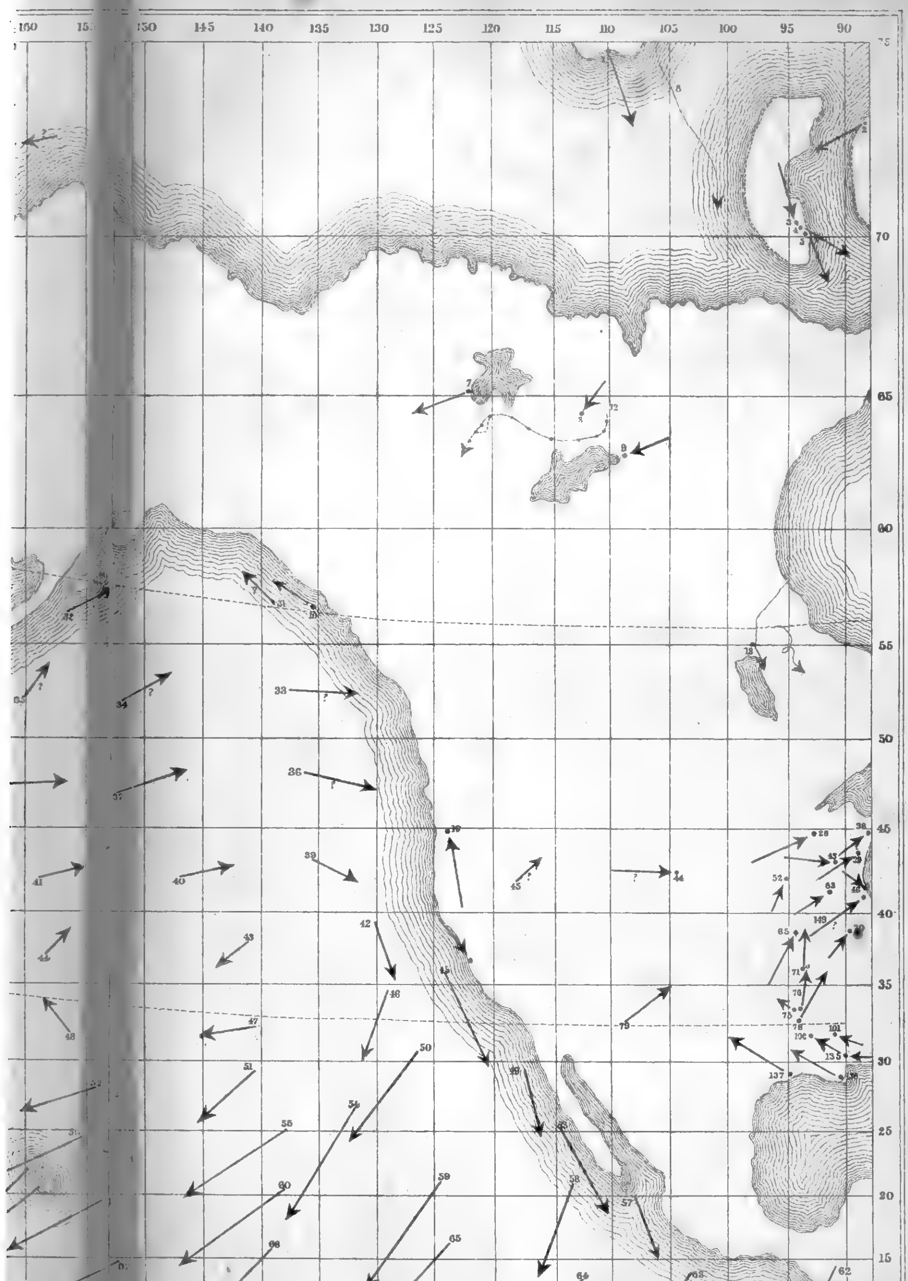

160 155 150 145 140 135 130 125 120 115 110 105 100 95 90
75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
T. Sinclair's lith Phila

Plate VIII.

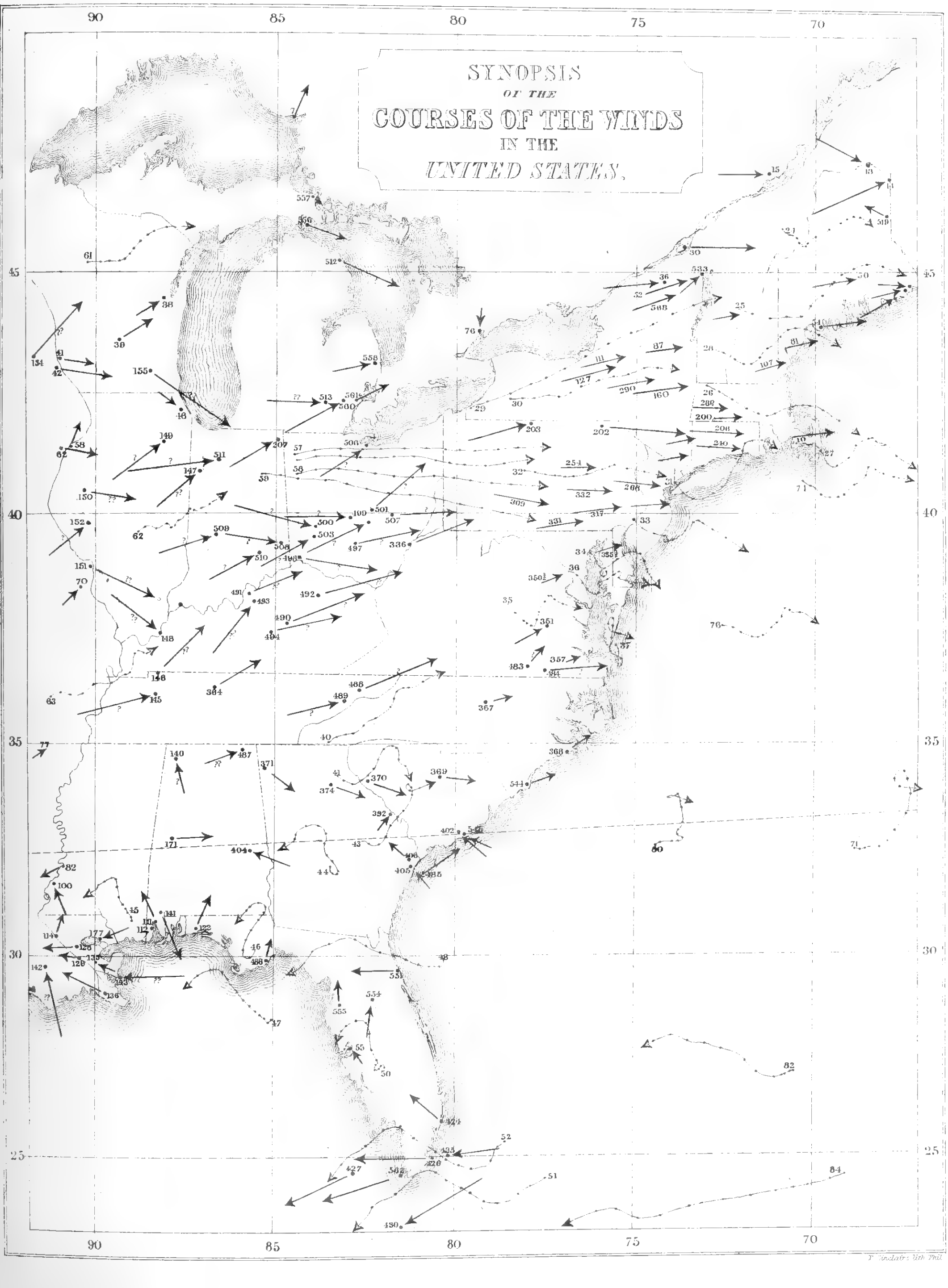

SYNOPSIS
OF THE
COURSES OF THE WINDS
IN THE
UNITED STATES.
T. Sinclair's lith Phil.

Plate IX.

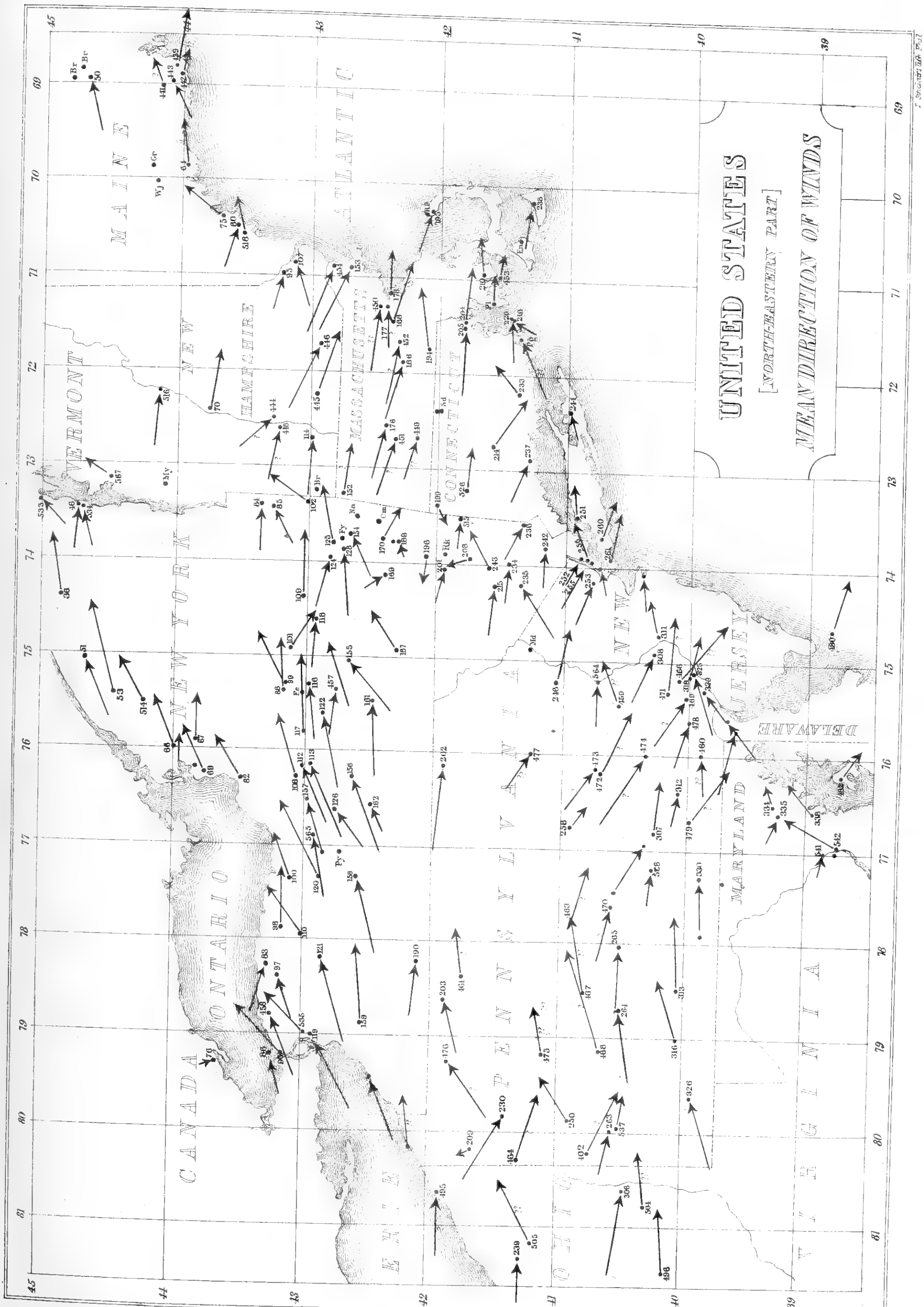
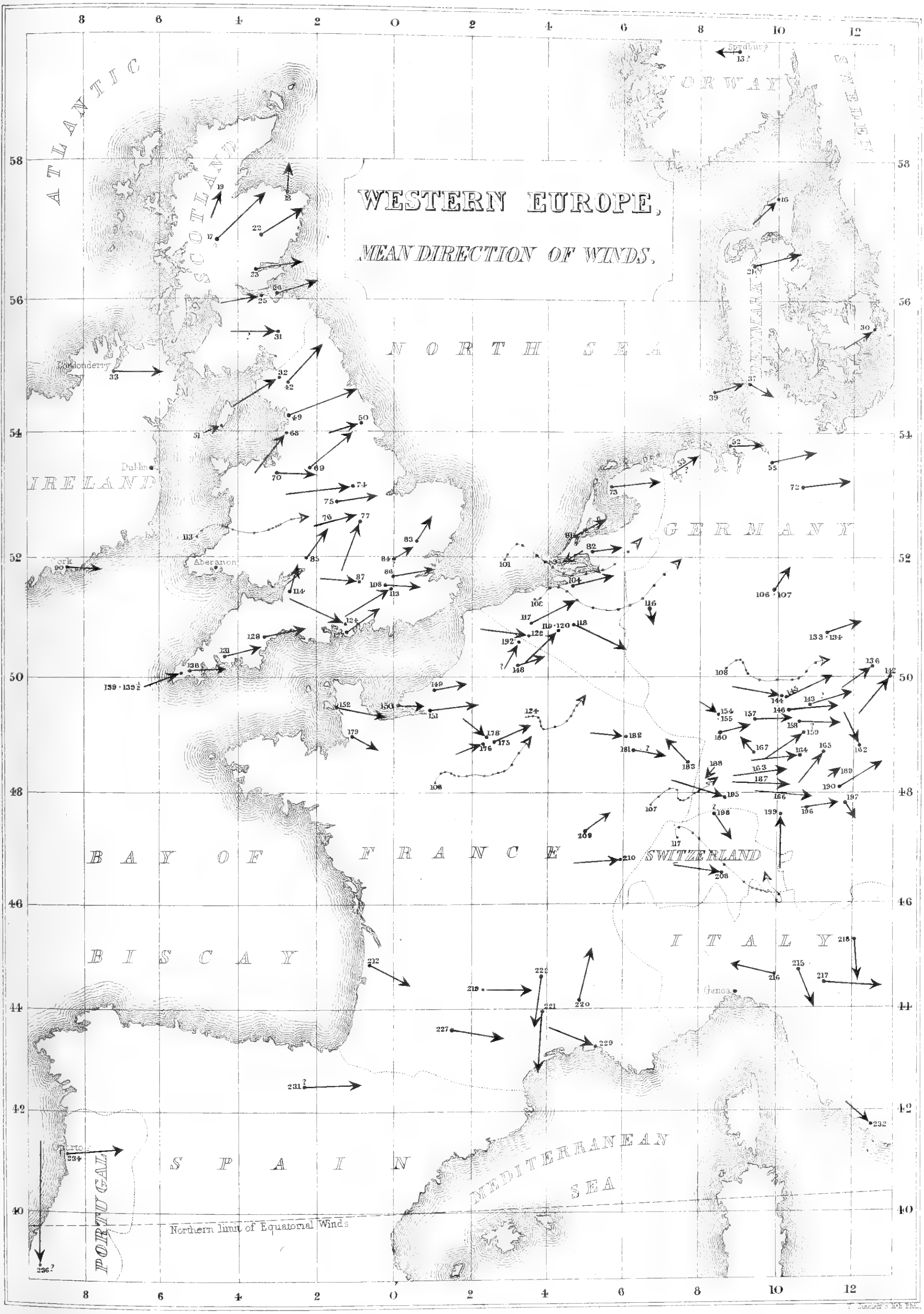
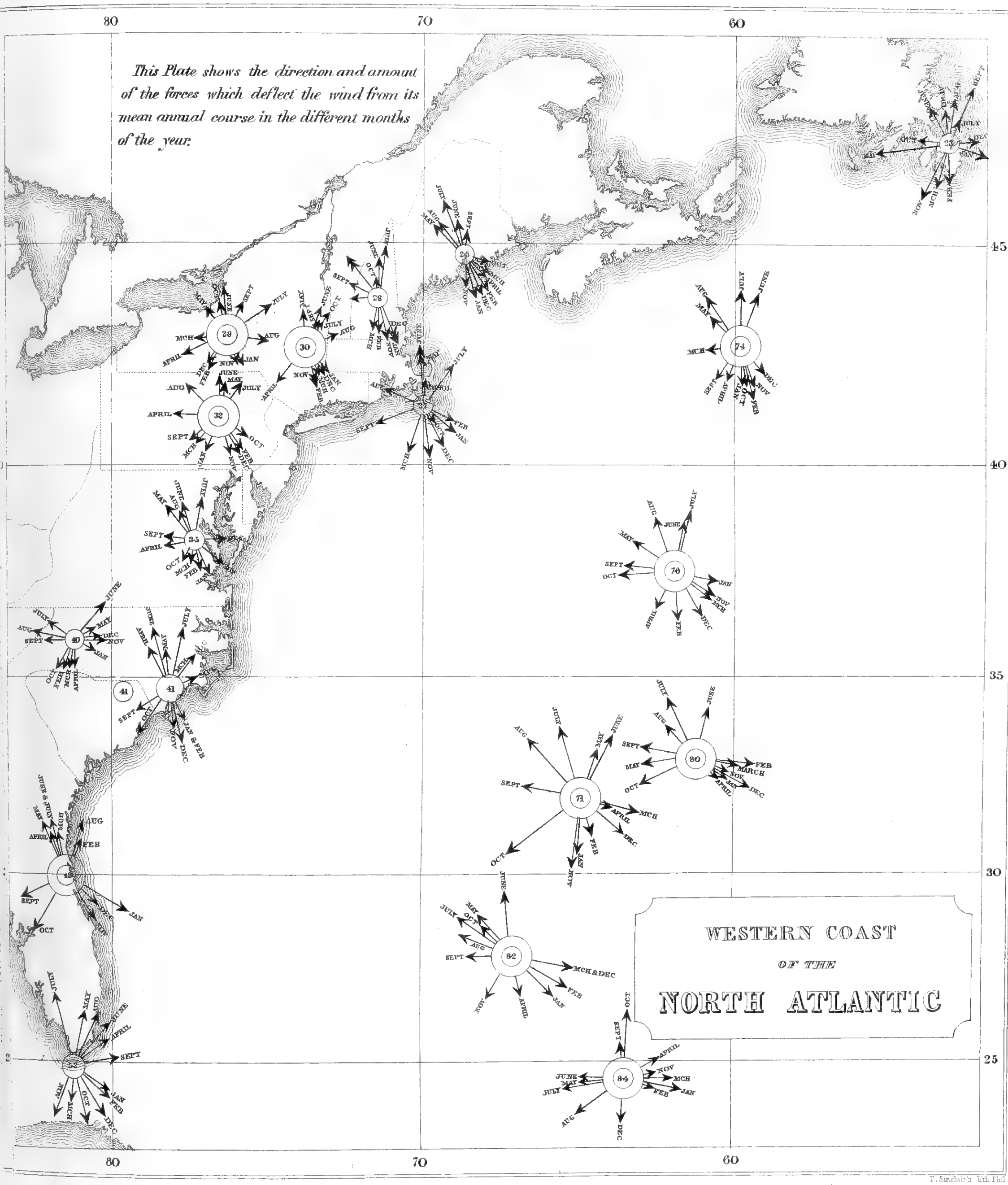

UNITED STATES
[NORTH-EASTERN PART]
MEAN DIRECTION OF WINDS
MAINE
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
CONNECTICUT
NEW YORK
PENNSYLVANIA
NEW JERSEY
DELAWARE
MARYLAND
VIRGINIA
OHIO
CANADA
ONTARIO
ERIE
ATLANTIC

Plate X.


WESTERN EUROPE,
MEAN DIRECTION OF WINDS.
ATLANTIC
SCOTLAND
IRELAND
NORTH SEA
NORWAY
SWEDEN
DENMARK
GERMANY
SWITZERLAND
BAY OF FRANCE
BISCAY
ITALY
SPAIN
PORTUGAL
MEDITERRANEAN SEA
Northern limit of Equatorial Winds
Londonderry
Dublin
Cork
Aberanon
Genoa
Oporto



T. Sinclair's lith. Phil.

Plate

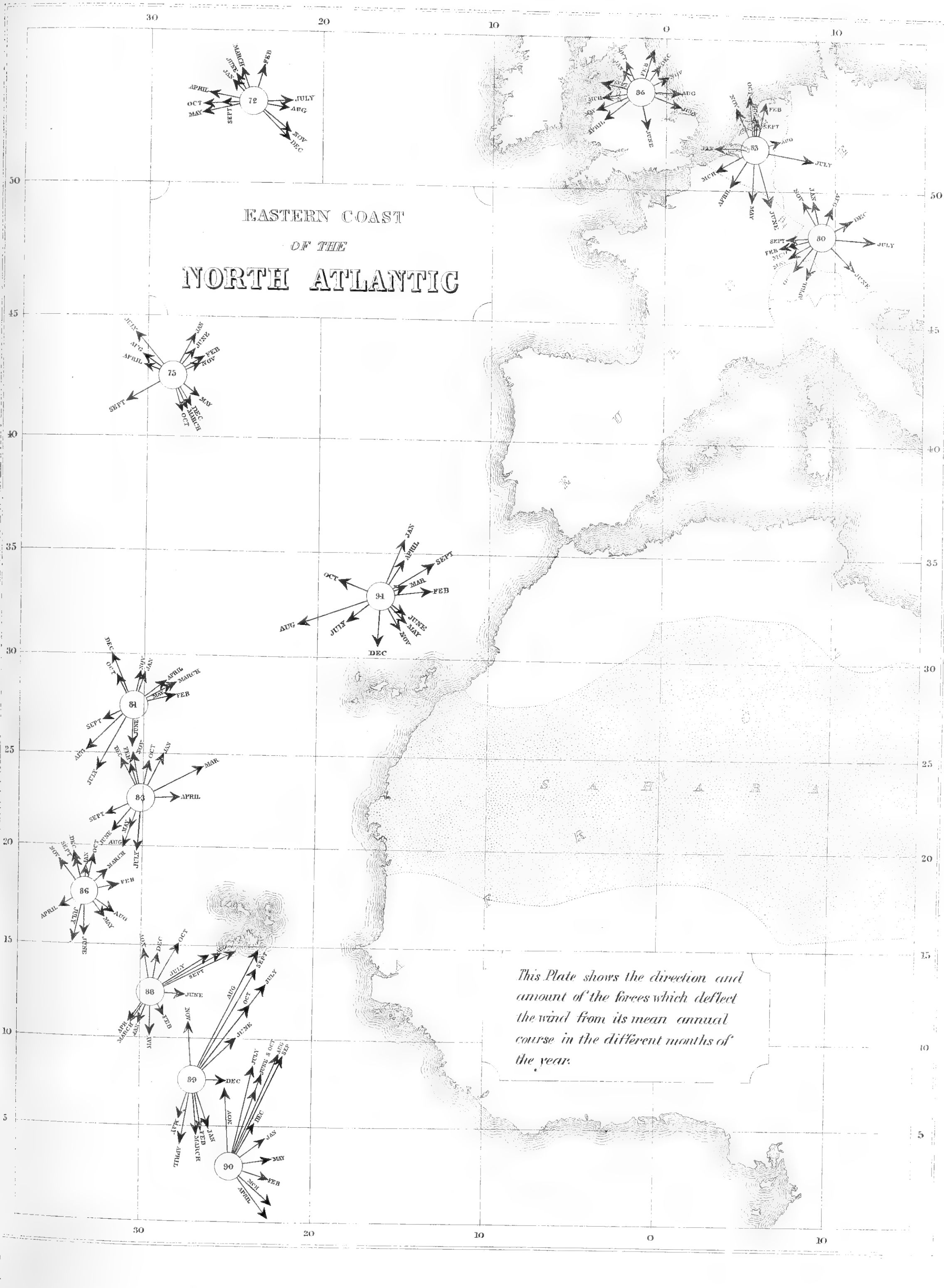
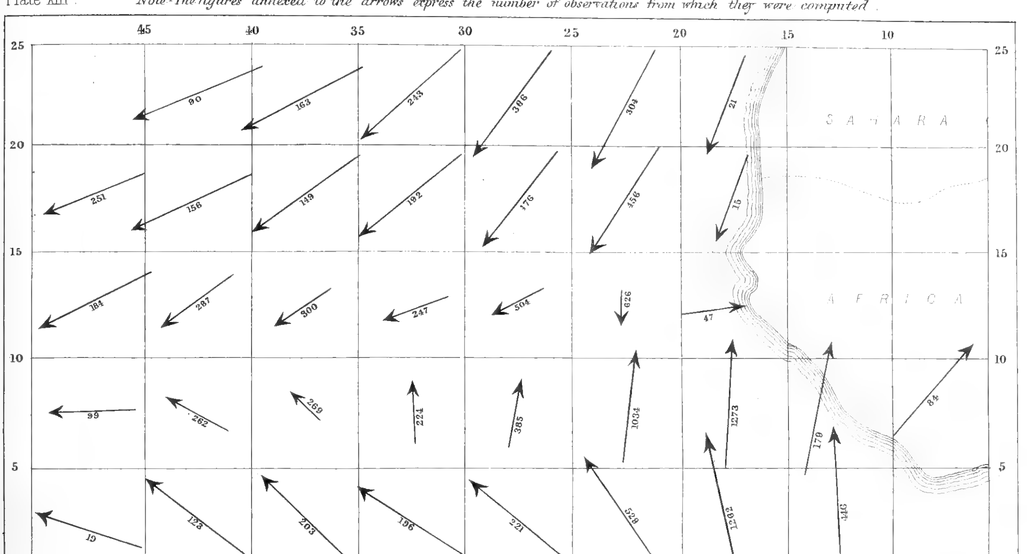

EASTERN COAST
OF THE
NORTH ATLANTIC
This Plate shows the direction and amount of the forces which deflect the wind from its mean annual course in the different months of the year.
S A H A R A
72
85
83
80
75
91
81
83
86
88
89
90
30
20
10
0
10
50
45
40
35
30
25
20
15
10
5

Plate XIII.

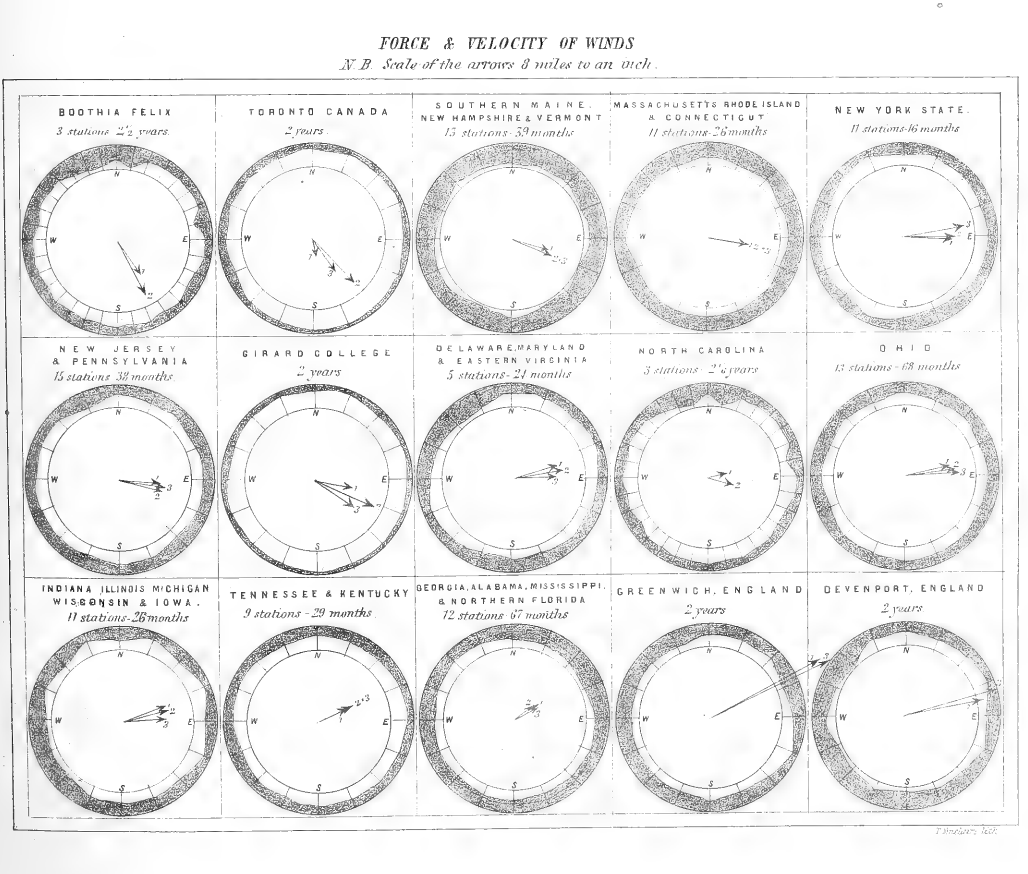
WINDS OFF THE COAST OF AFRICA IN JULY, AUGUST & SEPTEMBER.

Note - The figures annexed to the arrows express the number of observations from which they were computed.

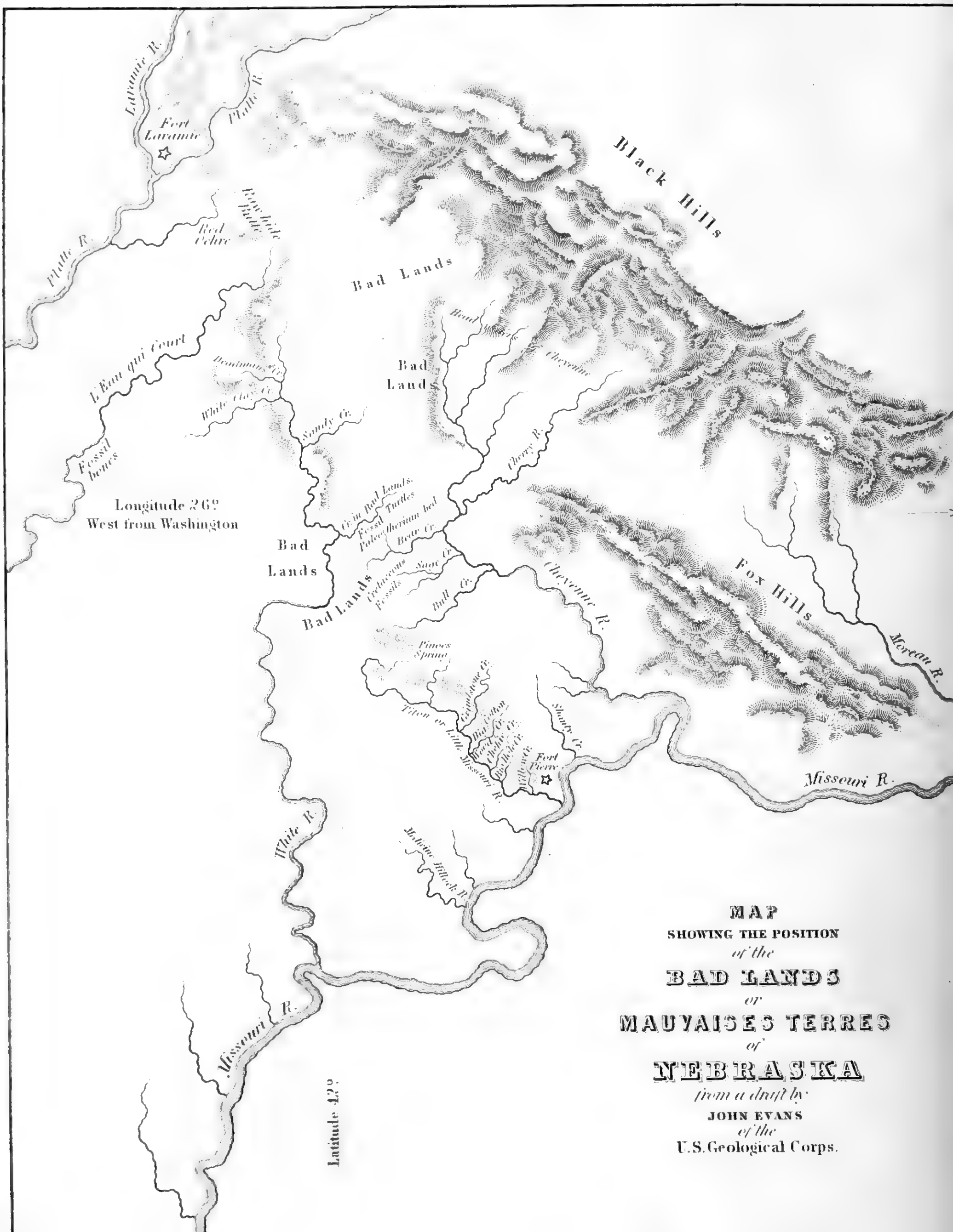


FORCE & VELOCITY OF WINDS

N. B. Scale of the arrows 8 miles to an inch.



T. Sinclair's lith.


Laramie R.
Fort Laramie
Platte R.
Platte R.
Black Hills
Red Ochre
Bad Lands
Bad Lands
Bad Lands
Bad Lands
L'Eau qui Court
White Clay Cr.
Sandy Cr.
Cherry R.
Fossil bones
Longitude 26° West from Washington
Fossil Turtles
Bear Cr.
Sage Cr.
Cretaceous Fossils
Bull Cr.
Cheyenne R.
Fox Hills
Moreau R.
Fort Pierre
Missouri R.
White R.
Missouri R.
Latitude 42°
MAP
SHOWING THE POSITION
of the
BAD LANDS
or
MAUVAISES TERRES
of
NEBRASKA
from a draft by
JOHN EVANS
of the
U.S. Geological Corps.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

THE

ANCIENT FAUNA

OF

NEBRASKA:

OR,

A DESCRIPTION OF REMAINS OF EXTINCT MAMMALIA AND CHELONIA,

FROM THE MAUVAISES TERRES OF NEBRASKA.

BY

JOSEPH LEIDY, M.D.,
PROFESSOR OF ANATOMY IN THE UNIVERSITY OF PENNSYLVANIA.

[ACCEPTED FOR PUBLICATION, DECEMBER, 1852.]

COMMISSION

TO WHICH THIS PAPER HAS BEEN REFERRED.

Prof. JAMES HALL.
JOHN L. LECONTE, M. D.

JOSEPH HENRY,
Secretary S. I.

CONTENTS.

MAMMALIA.

CHAPTER I.

CHAPTER II.

PREFACE.

The present Memoir, entitled "The Ancient Fauna of Nebraska," is founded upon a large and highly important collection of fossil remains of Mammalia and Chelonia, of the Eocene Period, from Nebraska Territory, which have been submitted to me for examination by the Smithsonian Institution, Dr. David Dale Owen, of New Harmony, Indiana, and Dr. Hiram A. Prout and Prof. O'Loghland, of St. Louis, to whom I express my sincere thanks for the interest they have taken in my labors.

To Prof. S. F. Baird, Dr. S. D. Culbertson, Messrs. Alexander, Joseph, and Thaddeus Culbertson, Capt. Stewart Van Vliet, Dr. S. G. Morton, Dr. John H. B. M'Clellan, Dr. A. H. Senseny, and Mr. J. S. Phillips, I am also obliged for the aid which they have contributed to the work.

I embrace the present occasion to acknowledge the talent of the artists who have added so greatly to the value of the Memoir, by the excellent and faithful drawings which accompany it, viz.: Mr. A. Sonrel, of Woburn Centre, near Boston, and Messrs. A. J. Ibbotson, A. Frey, F. Shell, and I. Butler, of Philadelphia.

INTRODUCTION.

It has ceased to be a startling fact that, prior to the advent of man, a long series of ages had rolled by, during which numerous races of plants and animals successively originated and became extinct; and we no longer doubt our power to unveil the past, even to the period when the encrinite, the trilobite, and the brachiopod, were the sole representatives of life upon our planet.

In the earliest known palæozoic rocks, remains of invertebrate animals only have been found, and fossil fishes are first discovered in the upper Silurian formations. Recently, remains of reptiles have been detected in the Old Red Sandstone of Morayshire, Scotland,[1] but it was not until the middle of the Secondary Period that this class of animals appears to have reached the acme of its development.

The era of the origin of birds will probably always be involved in more obscurity than that of the other vertebrata, as, from their physical construction, their remains are the least likely to be preserved. With the exception of footprints, supposed to be those of birds, but which may yet prove to be of reptiles, in the sandstone and conglomerate of the valley of the Connecticut, no truly characteristic remains of the former class have been discovered in any of the primary or secondary fossiliferous strata.

Of mammalia, a few undoubted remains have been found even as low in the geological series as the Trias. Prof. Plieninger recently discovered, in the bone-breccia of Würtemberg, two molar teeth, supposed to have belonged to an insectivorous animal, to which the name *Microlestes antiquus* has been given.[2] In the same deposit, Prof. Plieninger found several incisor teeth, which he considers to have appertained to a species of fish allied to *Sargus*, and, therefore, proposes for the animal the name of *Sargodon*, but Jaeger suspects they also may have belonged to a mammal, which was allied to the *Anoplotherium*, Cuvier.[3]

In the Stonesfield slate of Oxfordshire, England, belonging to the Oolitic Period, seven halves, singularly enough, of lower jaws, have been discovered, which have been referred to three species of two genera of insectivorous marsupialia: the *Amphigonus Prevostii*, Ag.; *Amphigonus Broderipii*; and the *Phascolotherium Bucklandii*, Owen.[4]

---

[1] *Telerpeton elginense*, Mantell: Quart. Journ. Geolog. Soc., 1852, VIII. 100.

[2] Würtemb. naturw. Jahresb., 1847, III. H. 2, 164.

[3] Fos. Säugeth. Würtemb., 1850, 139.

[4] Jahrb. von Leon.u.Bronn, 1835, 186; Owen: Trans. Geol. Soc., 1841, VI. 47, 58; Brit. Fos. Mam., 29, 61.

In Europe, no remains of mammals have been detected in the cretaceous series, but in this country several vertebræ have been found in the Green Sand of New Jersey, associated with bones of the *Mososaurus*, which I have referred to two species of cetacea, under the names of *Priscodelphinus grandævus* and *Priscodelphinus Harlani*.[1]

The tertiary geological period is remarkable for the great number of mammals which have been ushered into existence in successive races, and in the same course have become extinct.

In Europe, the earliest tertiary or eocene formations have yielded an extraordinary abundance of mammalian fossils, in which we have reason to feel a peculiar interest, as, through the brilliant genius of Cuvier, they became the opening chapter to the great volume of palæontological science.

Until recently, in North America, the only mammalian genus which had been detected as a member of the early Tertiary Period was the huge cetacean, the *Basilosaurus*, Harlan, from the eocene deposits of Louisiana, Alabama, and South Carolina. Of this genus several distinct species have been indicated as follow:—

BASILOSAURUS CETOIDES, GIBBES: Journ. Ac. Nat. Sc., 1847, I. 5.
Zeuglodon cetoides, Owen: Trans. Geol. Soc., 1841, VI. 69.
Zeuglodon macrospondylus, Müller: Fos. Res. d. Zeug., 1849.
BASILOSAURUS SERRATUS, Gibbes: Journ. Ac. Nat. Sc., 1847, I. 5.
Zeuglodon brachyspondylus, Müller: Fos. Res. d. Zeug., 1849.
BASILOSAURUS PYGMÆUS?
Zeuglodon pygmæus? Müller: Fos. Res. d. Zeug., 1849.

Quite lately, I referred a cervical vertebra found at Ouachita, Louisiana, to a new genus of cetacean animals under the name:

PONTOGENEUS PRISCUS? Leidy: Proc. Ac. Nat. Sc., 1852, VI. 52. (This may belong to the *Basilosaurus pygmæus*.)

Very numerous remains of extinct mammalia have also been discovered in the miocene and pliocene deposits of Europe, and likewise in those of the latter period in the Sivalik Hills of the Himalayas of India, in South America, and Australia.

The mammalia, which have been indicated as belonging to the Miocene Period of North America, are as follow:—

PHOCA WYMANI, Leidy. Wyman: Am. Journ. Sc., 1850, X. 229.
PHOCODON, Agassiz. Wyman: Ibid., 56.
DELPHINUS CALVERTENSIS, Harlan: Proc. Nat. Inst. Washington, 1842, II. 195.
DELPHINUS CONRADI, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 35; Wyman: Am. Journ. Sc., 1850, X. 231.
BALÆNA PALÆATLANTICA, Leidy: Proc. Ac. Nat. Sc., 1851, V. 308.
BALÆNA PRISCA, Leidy: Ibid.

In the pliocene deposits of this country the remains of extinct mammalia are very numerous, and a large number of species have been determined as follow:—

CERVUS AMERICANUS, Harlan: Fauna Amer., 1825, 245.

---

[1] Proc. Ac. Nat. Sc., 1851, V. 327.

CERVUS ——— ?
Elaphus americanus, De Kay: Nat. Hist. New York, 1842, Pt. I., Zool. Mam., 120.[1]
BISON LATIFRONS, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 117; Smiths. Contrib. to Knowl., 1852, V. 8.
Bos latifrons, Harlan: Fauna Amer., 1825, 273.
BISON ANTIQUUS, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 117; Smiths. Contrib. to Knowl., 1852, V. 11.
BOOTHERIUM CAVIFRONS, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 71; Smiths. Contrib. to Knowl., 1852, V. 12.
Bos Pallasii (in part), Dekay: An. Lyc. Nat. Hist. of N. York, 1828, II. 280.
BOOTHERIUM BOMBIFRONS, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 71; Smiths. Contrib. to Knowl., 1852, V. 17.
Bos bombifrons, Harlan: Faun. Amer. 1825, 271.
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HARLANUS AMERICANUS, Owen: Proc. Ac. Nat. Sc., 1846, III. 94; Journ. Ac. Nat. Sc., 1847, I. 18.
Sus americana, Harlan: Amer. Journ. Sc., 1842, XLIII. 143.
PLATYGONUS COMPRESSUS, Le Conte: Am. Journ. Sc., 1848, V. 103; Trans. Am. Ac. Arts, 1848, III. 257; Leidy: Trans. Am. Phil. Soc., 1852, X. 323.
DICOTYLES DEPRESSIFRONS, Le Conte: Proc. Ac. Nat. Sc., 1852, VI. 3; Leidy: Trans. Am. Phil. Soc., 1852, X. 323.
DICOTYLES TORQUATUS (*fossilis*).
Dicotyles costatus, Le Conte: Proc. Ac. Nat. Sc., 1852, VI. 5.
PROTOCHŒRUS PRISMATICUS, Le Conte: Am. Journ. Sc., 1848, V. 105; Leidy: Trans. Am. Phil. Soc., 1852, X. 323.
EUCHŒRUS MACROPS, Leidy: Trans. Am. Phil. Soc., 1852, X. 323.
EQUUS AMERICANUS, Leidy: Proc. Ac. Nat. Sc., 1847, III. 262.
HIPPARION VENUSTUM, Leidy: Proc. Ac. Nat. Sc., 1853, VI. 241.
TAPIRUS AMERICANUS (*fossilis*). Carpenter: Am. Journ. Sc., 1842, XLII. 390; Ibid., 1846, I. 247; Leidy: Proc. Ac. Nat. Sc., 1849, IV. 180.
Tapirus mastodontoides, Harlan: Fauna Amer., 1825, 224.
TAPIRUS HAYSII, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 148.
ELEPHAS AMERICANUS. (*The fossil elephant of North America.*)
Elephas primigenius, Blumenbach. In part, of numerous authors.
MASTODON GIGANTEUS, Cuvier. See numerous authors.
URSUS AMERICANUS (*fossilis*). Leidy: Proc. Ac. Nat. Sc., 1853, VI.
URSUS AMPLIDENS, Leidy: Proc. Ac. Nat. Sc., 1853, VI.
FELIS ATROX, Leidy: Trans. Am. Phil. Soc., 1852, X. 319.
PROCYON PRISCUS, Le Conte: Am. Journ. Sc., 1848, V. 106.
ANOMODON SNYDERI, Le Conte: Am. Journ. Sc., 1848, V. 106.
CASTOR FIBER (*fossilis*). Wyman: Am. Journ. Sc., 1850, X. 61.
CASTOROIDES OHIOENSIS, Foster: Second Ann. Rep. of the Geolog. Survey of Ohio, 1838, 80, 81; Wyman: Boston Journ. Nat. Hist. Soc., 1846, V. 385.
OROMYS ÆSOPI, Leidy: Proc. Ac. Nat. Sc., 1853, VI. 241.
MEGATHERIUM MIRABILE, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 117.
Megatherium, Cuvier. Cooper: An. Lyc. Nat. Hist. of N. York, 1824, I. 114; Ibid., 1828, II. 267; Hodgson: Mem. on the Megatherium, 1846.
Megatherium Cuvieri, Desmarest. Harlan: Fauna Amer., 1825, 200.
MEGALONYX JEFFERSONII, Harlan: Fauna Amer., 1825, 201.
Megalonyx laqueatus, Harlan: Journ. Ac. Nat. Sc., 1838, VI. 269.
Aulaxodon s. Pleurodon, Harlan: Med. and Phys. Researches, 1835, 330.
MEGALONYX DISSIMILIS, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 117.

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[1] This may prove to be a new species, but it certainly is not the *Cervus americanus* of Harlan, as is supposed by Dr. De Kay, for the remains of the latter indicate an animal even greater in size than the Irish Elk.

MYLODON HARLANI, Owen: Zool. Voy. Beagle, Pt. I., 1840, 68.

Megalonyx laqueatus, Harlan: Med. and Phys. Researches, 1835, 334.

Orycterotherium Missouriense, Harlan: Proc. Am. Phil. Soc., 1841, II. 119; Am. Journ. Sc., 1843, XLIV. 69.

Orycterotherium Oregonensis, Perkins: Am. Journ. Sc., 1843, XLIV. 80.

EREPTODON PRISCUS, Leidy: Proc. Ac. Nat. Sc., 1853, V. 241.

EUBRADYS ANTIQUUS, Leidy: Ibid.

Megalonyx potens, Leidy: Proc. Ac. Nat. Sc., 1852, VI. 117.

DELPHINUS VERMONTANUS? Thompson: Am. Journ. Sc., 1850, XI. 256.

TRICHECUS VIRGINIANUS? Dekay: Nat. Hist. New York, 1842, Pt. I., Zool. Mam., 56.

Trichecus. Mitchell, Smith, and Cooper: An. Lyc. Nat. Hist. N. York, 1828, II. 271.

Trichecus rosmarus (fossilis). Harlan: Med. and Phys. Researches, 1835, 277.

MANATUS, Cuvier. Harlan: Journ. Ac. Nat. Sc., 1825, IV. 236; Med. and Phys. Researches, 1835, 278.

RORQUALIS AUSTRALIS (*fossilis*). Dekay: Nat. Hist. New York, 1842, Pt. I., Zool. Mam. 99.[1]

In addition to the species just enumerated, remains of numerous mammals and other vertebrates have been discovered, by Prof. S. F. Baird, in various caves of Pennsylvania and Virginia, and are now deposited in the Museum of the Smithsonian Institution.[2] The collection contains representatives of nearly all the larger recent mammals and turtles of the United States, together with a few extinct species.

The particular object of the present memoir is the description of a large and highly important collection of remains of mammalia and chelonia from an extensive Eocene deposit, which immediately overlies the Green Sand of the Cretaceous Period, in the Mauvaises Terres of Nebraska Territory.

The Mauvaises Terres, or Bad Lands, as they are named, constitute a district of country extending along the foot of the Black Hills, a spur of the Rocky Mountains, situated between the Platte, or Nebraska, and the Missouri Rivers, at the head of certain branches of the latter called the L'Eau-qui-court, White, Cheyenne, and Moreau Rivers.[3]

Dr. Owen, in describing this region, from notes of a visit made to it by Dr. John Evans, in his magnificent "Report of a Geological Survey of Wisconsin, Iowa, and Minnesota, and incidentally of a portion of Nebraska," observes that it presents one of the most extraordinary and picturesque sights that can be found in the whole Missouri country.[4]

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[1] The following are erroneously reported as fossil remains:—

RHINOCEROIDES ALLEGHANIENSIS, Featherstonhaugh: Journ. of Geol. 1831, I. 10. This is no animal remain whatever, but is merely a fragment of stone. See De Blainville's Osteographie, article *Rhinoceros*, p. 172. Further confirmed by Dr. Isaac Hays and Mr. Isaac Lea, who have had an opportunity of inspecting the specimen.

OSTEOPERA PLATYCEPHALA, Harlan: Fauna Amer., 126. The cranium described under this name is now preserved in the Cabinet of the Academy of Natural Sciences, and without the slightest doubt belongs to the recent *Cœlogenys paca*, Rengger, of South America.

EQUUS CABALLUS?

Equus major, Dekay: Nat. Hist. New York, Pt. I., Zool. Mam., 108.

Equus curvidens, Owen. Leidy: Proc. Ac. Nat. Sc., 1847, III. 262.

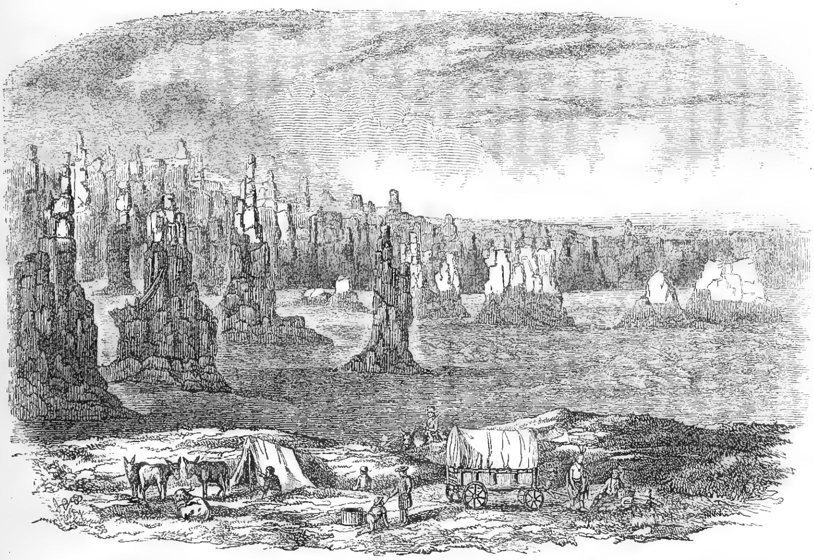
[2] See Proceedings of the American Association, at Cambridge, 1849, II. 352.

[3] See the map accompanying this memoir, for the use of which I am indebted to Dr. D. D. Owen.

[4] P. 196.

"From the high prairies that rise in the back-ground, by a series of terraces towards the spurs of the Rocky Mountains, the traveller looks down into an extensive valley, that may be said to constitute a world of its own, and which appears to have been formed, partly by an extensive vertical fault, partly by the long continued influence of denudation.

"The valley is about ninety miles in length, and thirty in breadth, and stretches away, westwardly, towards the base of the dark gloomy range of mountains, the Black Hills. Its most depressed portion is about three hundred feet below the general level of the surrounding country, and is covered by a soil, similar to that of the higher ground, supporting scanty grasses.



View of the Mauvaises Terres.—From the Geological Report of Dr. Owen.

"To the surrounding country, however, the Mauvaises Terres present the most striking contrast. From the uniform, monotonous, open prairie, the traveller suddenly descends, one or two hundred feet, into a valley that looks as if it had sunk away from the contiguous world; leaving standing, all over the surface, thousands of abrupt, irregular, prismatic, and columnar masses, frequently capped with irregular pyramids, and extending to a height of one or two hundred feet, or more.

"So thickly are these natural towers studded over the surface of this extraordinary region, that the traveller threads his way through deep, confined, labyrinthine passages, not unlike the narrow irregular streets and lanes of some quaint old town of the European continent. Viewed in the distance, indeed, these rocky piles, in their endless succession, assume the appearance of massive artificial structures, decked out with all the accessories of buttress and turret, arched doorway and clustered shaft, pinnacle, finial, and tapering spire.

"One might almost imagine he was approaching some magnificent city of the dead, where the labor and the genius of forgotten nations had left behind them a multitude of monuments of art and skill.

"On descending from the heights, however, and proceeding to thread this vast labyrinth, and inspect in detail its deep intricate recesses, the realities of the scene soon dissipate the delusions of the distance. The castellated forms which fancy had conjured up have vanished; and on every side appears bleak and barren desolation.

"Then, too, if the exploration be made in summer, the scorching rays of the sun, pouring down in the hundred defiles that conduct the wayfarer through this pathless waste, are reflected back from the white or ash-colored walls, that rise around unmitigated by a breath of air or the shelter of a solitary shrub.

"The drooping spirits of the scorched geologist are not permitted, however, to flag. The fossil treasures of the way, well repay its sultriness and fatigue. At every step, objects of the highest interest present themselves. Embedded in the debris, lie strewn, in the greatest profusion, relics of extinct animals. All speak of a fresh-water deposit of the early Tertiary Period, and disclose the former existence of most remarkable races, that roamed about in bygone ages high up in the valley of the Missouri, towards the sources of its western tributaries; where now pasture the Big Horn (*Ovis montana*) and the Buffalo (*Bison americanus*)."

Mr. Thaddeus A. Culbertson, who visited the Mauvaises Terres in 1850, under the auspices of the Smithsonian Institution, and made a good collection of its animal remains, has given a description of this remarkable country closely corresponding with that just detailed. In one part of his journal, he observes: "The road now lay over hills which became more steep and frequent as we approached the Bad Lands. These occasionally appeared in the distance, and never before did I see anything that so resembled a large city; so complete was this deception that I could point out the public buildings; one appeared to have a large dome, which might be the town hall; another, with a large angular top, suggested the idea of a court-house, or some other magnificent edifice for public purposes; and then appeared a row of palaces, great in number and superb in all their arrangements. Indeed, the thought frequently occurred as we rode along, that we were approaching a city of palaces; with everything upon the grandest scale, and adapted for giants, who might have ruled the huge animals, whose remains are there still, and not for pigmies, such as now inhabit the earth. Again and again, as from different positions this region was visible, thoughts of an immense city would arise in my mind, and I could almost fancy its din and bustle were occasionally borne upon the wind to my ear."[1]

The structure of the columnar rocks of the Bad Lands, according to the report of Dr. Evans, quoted in the work of Dr. Owen, before indicated, is as follows:—

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[1] Journal of an Expedition to the Mauvaises Terres and the Upper Missouri in 1850. Fifth An. Rep. of the Smiths. Inst., p. 84.

Section of Beds constituting the early tertiary (*Eocene*) *of the Bad Lands* (*Mauvaises Terres*).—(Numbered in the descending order.)

1. Ash-colored clay, cracking in the sun, containing silicious concretions	30 feet.
2. Compact white limestone	3 "
3. Light-gray marly limestone	8 "
4. Light-gray indurated silicious clay (not effervescent)	30 "
5. Aggregate of small angular grains of quartz, or conglomerate, cemented by calcareous earth (slightly effervescent)	8 "
6. Layer of quartz and chalcedony (probably only partial)	1 inch.
7. Light-gray indurated silicious clay, similar to number 4, but more calcareous, passing downwards into pale, flesh-colored, indurated, silicious, marly, limestone (effervescent), turtle, and bone bed	25 feet.
8. White and light-gray calcareous grit (slightly effervescent)	15 "
9. Similar aggregate to number 5, but coarser	8 "
10. Light-green, indurated, argillaceous stratum (slightly effervescent), *Titanotherium* bed	20 feet.

The extensive cemetery of eocene vertebrata in the Mauvaises Terres, or Bad Lands, of Nebraska, was first brought to our notice in a communication entitled *Description of a Fossil Maxillary Bone of a Palæotherium, from near White River*, published by Hiram A. Prout, M.D., of St. Louis, in the American Journal of Science and Arts, for 1847, page 248.

Nearly at the same time, Mr. J. S. Phillips, when on a visit to Chambersburg, Pennsylvania, observed in the possession of Dr. S. D. Culbertson, several remarkable mammalian fossils, which had been sent as curiosities from the Bad Lands by his nephew, Mr. Alexander Culbertson, of the American Fur Company. These specimens, at the suggestion of the late distinguished Dr. S. G. Morton, were obtained through Dr. John H. B. McClellan, a friend of Dr. Culbertson, and were obligingly placed in my hands for examination. A description of them was published in the Proceedings of the Academy of Natural Sciences, of Philadelphia, for 1847 and 1848; and they were afterwards presented by Alexander Culbertson to the Academy.

The attention of Dr. D. D. Owen having been directed to the interesting region whence the fossils were obtained, he requested Dr. John Evans, an assistant in the geological survey in which he was engaged, to pay it a visit. This gentleman brought home a magnificent collection of fossils, which form the basis of one of the chapters in the Report of Dr. Owen, before quoted.[1]

Through the instrumentality of Prof. S. F. Baird, who from the first fully appreciated the importance of a complete examination of the Mauvaises Terres and their animal remains, Mr. Thaddeus A. Culbertson, under the auspices of the Smith-

[1] Dr. J. Leidy's Memoir, p. 533, of the "Report of a Geolog. Surv. of Wisc., etc."

sonian Institution, visited the locality in 1850, and brought home a valuable additional collection of mammalian and chelonian fossils.

From a variety of favorable circumstances, but especially through important aid from the Smithsonian Institution, and Dr. D. D. Owen, I have been enabled personally to inspect all the animal remains brought from Nebraska, of which I have had any intimation. In commencing, then, with a description of the Eocene Fauna of Nebraska, the following collections were submitted to investigation.

1. The original fragment of a maxillary bone described by Dr. Prout, with the addition of several other important specimens. These were kindly loaned by Dr. Hiram A. Prout, of St. Louis.

2. A collection which accompanied the former, belonging to, and obligingly loaned by Prof. O'Loghland, of St. Louis.

3. Specimens presented by Alexander Culbertson, Esq., through Joseph Culbertson, Esq., to the Academy of Natural Sciences, of Philadelphia.

4. The collection made by Dr. John Evans, at the instigation of Dr. D. D. Owen, for the United States Government, and now belonging to the Smithsonian Institution.

5. A collection procured, as above mentioned, by Mr. Thaddeus A. Culbertson, for the Smithsonian Institution. Very important aid in making this collection was rendered by Mr. Alexander Culbertson.

6. A small but very excellent collection made by Captain Stewart Van Vliet, of the United States Army, and by him presented to the Smithsonian Institution. These specimens, though last received, were actually among the first collected, having been procured by him when on a journey from Fort Pierre to Fort Laramie, in company with Mr. Alexander Culbertson, who, on the same occasion, obtained the specimens first described by me.

Most of the specimens when received, were partially enveloped by, or had attached to them a hard, silicio-calcareous clay, of a dirty cream color; and the same material fills the cavities of the skulls and the interior of the turtle shells.

This matrix, according to Dr. D. D, Owen, has the following composition:—[1]

Water of absorption	HO	2.50
Flesh-colored silicious earth, insoluble in chlorohydric acid		33.00
Lime	CaO	30.90
Carbonic acid	CO_2	19.00
Sesquioxide of iron	Fe_2O_3	2.00
Alumina	Al_2O_3	1.00
Manganese	MnO	1.00
Magnesia	MgO	1.00
Phosphoric acid		1.80
Chlorine	Cl	0.44
Potash	KO	4.08
Soda and loss	NaO	3.28
		100.00

[1] Rep. of a Geolog. Surv. etc., p. 606.

A portion of the matrix attached to the bones of the *Titanotherium*, obtained from the lowest bed of the geological section, No. 10, p. 13, also analyzed by Dr. Owen, was found to be composed as follows:—[2]

Water	HO	4.00
Silica	SiO_3	59.00
Lime	CaO	10.00
Carbonic acid	CO_2	12.20
Sesquioxide of iron	Fe_2O_3	7.20
Alumina	Al_2O_3	4.20
Phosphoric acid		1.90
Chlorine	Cl	0.037
Sulphuric acid	SO_3	0.03
Alkalies and loss		1.433
		100.000

The bones, unlike those of the gypsum quarries of Montmartre, (which are of the same age but not mineralized) are as completely petrified as any found in the most favorable circumstances. Most usually they are exceedingly hard, compact, and heavy, and only rarely have they become friable. The cellular, vascular, and medullary cavities are filled with mineral matter, in most instances, consisting of crystallized or amorphous silex or chalcedony, which is sometimes botryoidal in its arrangement in the larger cavities.

The bones are preserved in very various degrees of integrity, some being beautifully perfect, whilst others are crushed or otherwise fractured, the crevices being filled with the ordinary matrix, or with a harder mineral matter. The latter evidently were subjected to violence while enveloped in a soft mud which now constitutes the matrix; for in most instances in which the fragments have been widely separated, they still retain their proper relative position to one another.

The teeth, where they exist, are usually preserved quite perfect, and in all cases their pulp cavities are filled with dense amorphous, or with crystallized silex.

The dentine is commonly of a cream color, or pure white, but occasionally it is tinged with a roseate hue; and in most cases where exposed from the enamel having been worn off, it is covered by a lamina of compact peroxide of iron. Its texture is firm, though more friable than in the recent condition. The enamel is well preserved in texture, but in every instance is stained. Its color passes from translucent light brown resembling horn, through different shades of brown, to black with a brown or bluish tinge. Its surface is highly lustrous, and in those cases in which it is dark in color, resembles polished steel.

The bones are cream white, yellowish, brownish, brown, and iron gray, and most frequently have a slightly polished surface. Very often a thin layer of brown oxide of iron adheres to the latter, and is difficult to detach, without removing a portion of the osseous structure.

None of the specimens have the appearance of being water worn, or rolled, but all the teeth and processes of bone, when entire, exhibit all their original sharpness

[1] Rep. of a Geolog. Surv. etc., p. 606.

of outline, indicating that the carcasses of the animals to which they belonged decayed upon a soft, muddy bottom of a lake or similar body of water.

An analysis of portions of some of the bones and teeth having been made by Dr. Francis B. Greene, under the immediate inspection of Dr. F. A. Genth, at the request of Dr. D. D. Owen and myself, the following results were obtained :—

Specimen 1. Fragment of an os femoris of *Titanotherium.* This was compact, with a subconchoidal fracture, and tough. Its hardness was = 4.5 ; the sp. gr. = 2.870. Lustre resinous. Color brown; opaque. On heating, it eliminated an ammoniacal water, together with the odor of burnt horn.

Specimen 2. Fragment of a tibia of *Archæotherium.* This was compact, and presented an uneven, somewhat splintery, fracture. Its hardness was = 4.; the sp. gr. = 2.826. Lustre pearly. Color pinkish white; opaque. When heated in contact with the air, it assumed a green tint from the development of manganic acid.

Specimen 3. Fragment of enamel from a molar tooth of *Titanotherium.* Appearance fibrous, with an uneven fracture, and very tough. Its hardness was = 4.7; the sp. gr. = 4.7. Lustre upon the surface subvitreous, that of the fibres pearly. Color bluish gray, opaque.

Specimen 4. Fragment of dentine, from a molar tooth of *Titanotherium.* It was compact, and had an uneven, somewhat subconchoidal fracture. Its hardness was = 2.5; the sp. gr. = 2.935. Lustre dull. Color white, with gray spots and black streaks; opaque. On heating, in contact with the air, it assumed a greenish tint.

COMPOSITION.

		Spec. 1.	Spec. 2.	Spec. 3.	Spec. 4.
Sesquioxide of iron	Fe_2O_3	1.777	trace	trace	trace
Oxide of manganese	MnO	trace	trace	trace	trace
Magnesia	MgO	0.348	1.140	0.219	0.53
Lime	CaO	49.837	47.052	51.872	49.82
Fluoride of calcium	$CaFl$	0.716	5.086	0.099	2.90
Baryta	BaO	0.359	1.131	——	——
Soda	NaO	1.134	1.572	1.288	0.75
Potassa	KO	0.317	0.276	0.239	0.23
Silica	SiO_3	0.135	0.259	0.611	0.79
Sulphuric acid	SO_3	1.067	2.200	1.011	1.51
Phosphoric acid	PO_5	34.148	32.957	39.348	36.10
Carbonic acid	CO_2	4.088	2.270	3.165	2.83
Chlorine	Cl	trace	trace	trace	trace
Water	HO	2.048	1.971	0.626	2.10
Organic matter		5.682	4.086	2.538	2.66
		101.656	100.000	101.016	100.22

Or, the composition may be considered thus :—

		Spec. 1.	Spec. 2.	Spec. 3.	Spec. 4.
Phosphate of iron	$2Fe_2O_3,3PO_5$	2.821	——	——	——
" magnesia	$3MgO,PO_5$	0.770	2.099	0.403	0.98
" lime	$3CaO,PO_5$	69.685	68.582	83.835	77.81
" soda	$2NaO,PO_5$	1.415	1.079	1.413	——
Sulphate of baryta	BaO,SO_3	0.547	1.723	——	——
" soda	NaO,SO_3	1.083	2.443	1.437	1.71
" potassa	KO,SO_3	0.587	0.510	0.442	0.43
" lime	CaO,SO_3	——	——	——	0.60
Silicate of lime	$3CaO,SiO_3$	0.382	0.732	1.727	2.23
Carbonate of lime	CaO,CO_2	9.315	5.172	7.212	6.45
Lime	CaO	6.605	6.517	1.284	2.35
Fluoride of calcium	CaFl	0.716	5.086	0.099	2.90
Water	HO	2.048	1.971	0.626	2.10
Organic matter		5.682	4.086	2.538	2.66
		101.656	100.000	101.016	100.22[1]

Cuvier, in speaking of the remains of mammalia in the gypsum quarries of the Paris basin observes, "on peut s'étonner que dans une contrée aussi étendue que celle qu'occupent nos carriéres, et qui a plus de vingt lieues de l'est à l'ouest on n'ait presque trouvé que des os d'animaux d'une seule famille, et que le petit nombre d'espèces étrangères à cette famille principale, y soient d'une rareté extrême." The distinguished author infers from this a condition analogous to that presented in our day by Australia. More recent researches, however, have shown that in the single family alluded to, the *Pachydermata,* he included members really belonging to one of the other Cuvierian families; for the *Anoplotherium* and *Dichobune* are now generally considered to have been true ruminating animals.

With a single exception, all the species of extinct mammalia, which have yet been obtained from Nebraska, belong to the *Ungulata,* and, as in the case of those of the Paris basin above referred to, consist of *Ruminantia* and *Pachydermata.*

The great order of *Ungulata,* or hoofed mammalia, according to the idea originally expressed by Cuvier, and confirmed by De Blainville, but more especially by Owen, is divisible into two distinct sub-orders, the *Paridigitata* or even-toed ungulates, and the *Imparidigitata,* or uneven-toed ungulates.

The sub-order *Paridigitata* may be divided into the families *Ruminantia* and *Ordinaria.*

The *Ruminantia* are further divisible into sub-families as follows:—

1. Those which are hornless, and have incisors and canines in both jaws; as *Anoplotherium, Macrauchenia, Dichobune, Chalicotherium,* etc.

2. Those which are hornless, and have canines and an incomplete series of incisors or none at all, in the upper jaw; as *Camelus, Auchenia, Moschus, Dorcatherium,* etc.

3. Those which have processes of the os frontis, or have antlers, in one or both sexes, and have or have not upper canines, or have them in a rudimentary condition, and which are without upper incisors; as *Cervus, Cameloepardalis,* etc.

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[1] Proc. Acad. Nat. Sc., VI. 292.

4. Those which possess true horns, and have neither upper canines nor incisors; as *Antilope*, *Bos*, *Ovis*, etc.

The *Paridigitata ordinaria* are represented by *Sus*, *Dicotyles*, *Hippopotamus*, *Chœropotamus*, *Anthracotherium*, *Hyracotherium*, etc.

The second sub-order of *Ungulata* is divisible into the following families:—

Solipedia, represented by *Equus*, *Hipparion*, *Anchitherium*, etc.

Ordinaria, to which belong *Rhinoceros*, *Tapirus*, *Palæotherium*, etc.

Proboscidia, containing *Elephas* and *Mastodon*.

Of the mammalia from Nebraska, which will be described according to the preceding arrangement, there are seven species of four genera which belong to the *Ruminantia*, two species of one genus to the *Paridigitata ordinaria*, one species to the *Solipedia*, and four species of three genera to the *Imparidigitata ordinaria*.

The exceptional case above referred to, belonging to a different order from the *Ungulata*, is a carnivorous animal of the feline genus *Machairodus*.

The chelonian fossils from Nebraska, of which there are five species, belong all to the genus *Testudo*.

MAMMALIA.

CHAPTER I.

DESCRIPTIONS OF UNGULATA PARIDIGITATA.

Fam. 1.—RUMINANTIA.

Gen. **POEBROTHERIUM,** LEIDY.

Poebrotherium Wilsonii, LEIDY.

(PLATE I. Figs. 1–4.)

Poebrotherium Wilsonii, Leidy: Proceedings of the Academy of Natural Sciences of Philadelphia, 1847, III. 322; Owen's Rep. of a Geol. Surv. of Wisc., etc., 1852, 571.

Poebrotherium is a peculiar genus of ruminants, among recent animals most nearly allied to the Musks, and probably belongs to the second sub-family according to the characters before indicated.

The species *Poebrotherium Wilsonii* was established upon the greater portion of a skull, which was the first mammalian fossil, sent to the Academy of Natural Sciences of Philadelphia, from the eocene beds of Nebraska. It was presented by Mr. Alexander Culbertson, of Chambersburg, Pennsylvania, and, when first received, excited great interest among the members of the Academy, as being an indication of the rich palæontological treasures since derived from the same locality.

The specimen has lost the symphysis of the lower jaw, the end of the nose, one zygoma, the upper part of the face, and the upper and posterior part of the cranium. It is also much fractured and fissured; but the portions of it which remain appear to have very well retained their original relative position.

It belonged to an individual just reaching adult age; the permanent true molars having protruded, but none of the deciduous molars having been shed. In the upper jaw the molars are preserved on both sides, but several of those upon the left side are broken. This series consists of the three permanent true molars and three deciduous molars in a continuous row, and the first permanent premolar separated by a hiatus from the others. (Pl. I. Figs. 1, 3.) In the lower jaw, on the left side, are preserved five, and on the right side six teeth, viz., three permanent true molars, and three deciduous molars, forming a continuous row. (Figs. 1, 4.)

When the specimen was received, the right side of the lower jaw contained a fragment of a fang, separated from the remaining molars by a hiatus, and situated just in advance of the position of the first permanent premolar above, with which it most probably corresponded.

The form of the head, if restored, would probably most approach that of the existing Musks, or the extinct *Dorcatherium*, Kaup, from the Middle Tertiary Formations of Europe. The face is relatively longer than in either of these genera, and is also more advanced in position; for in *Poebrotherium* the anterior margin of the orbit is on a line with the middle of the penultimate true molar, whereas in *Dorcatherium* it is in advance of this, and in the Musks it is anterior to the first.

At the side of the nose, the face is depressed into a remarkably deep concavity, at the bottom of which the ossa maxillaria of the two sides are nearly in contact; and the face, in this position, is only about two lines and a half in diameter. (Figs. 1, 2.) The depression may, to some extent, be the result of accident after the death of the animal, for the specimen is fractured; the parts, however, generally appear to have retained their natural position.

Dorcatherium also presents a concavity holding nearly the same relative position; but, in consequence of the distance between the orbit and the bottom of the canine alveolus being comparatively short in this genus, the depression is close to the orbit; whereas, in *Poebrotherium* it is far advanced by reason of the prolongation of the face, which converges from the margin of the orbit to the bottom of the concavity.

Anteriorly, in the specimen, the concavity is abruptly intruded upon by a bulging of the face, apparently produced by a canine alveolus like that of the *Moschus moschiferus* and the *Dorcatherium*.

Below the concavity of the side of the nose, the face becomes rather abruptly, vertically convex; and here, above the anterior fangs of the last temporary molar, less advanced than in the Musks, is situated the exit of the infra-orbital canal.

The anterior and inferior margins of the orbit remain, and show it to have been large and subcircular, as in *Dorcatherium*, and to have had a direction outward and slightly upward, but apparently not at all forward. The margin of the orbit, anteriorly and inferiorly, is everted, and is most prominent at the lachrymal border.

The malar bone below the orbit is about three lines deep, and, except its slightly everted orbital margin, is vertical in its position, so that its lower border is situated considerably exterior to the alveolar processes. That border is nearly on a level with the edge of these processes, and the maxillo-malar suture curves upward and forward from near their edge, about the position of the middle of the last molar tooth. Anteriorly to the orbit, the malar bone rises for nearly half an inch above its inferior margin, and is there from four and a half to five and a half lines wide.

The lachrymal bone externally is six lines broad, and forms part of the slope of the face converging to the bottom of the concavity at the side of the nose, but presents itself no disposition to the formation of a lachrymal sinus. Its orbital face, near the margin, is pierced by an infundibular orifice about one line wide to the ductus ad nasum.

The only parts preserved and visible of the base of the cranium, in the specimen, are the auditory bullæ, separated by the body of the sphenoid bone. These are remarkable for their great size and position. Relatively they are not longer than in the Musks, but their transverse and antero-posterior diameters are rather greater. They are also more vertical in their position than in the Musks, and are so situated that their postero-external portion projects considerably exterior to the ramus of the lower jaw, filling up nearly a concavity formed by its posterior margin. The length of the bullæ from the meatus auditorius is eleven lines, the transverse diameter posteriorly nine lines, and the antero-posterior diameter an inch. Externally they are convex, and converge forwards within the position of the ramus of the lower jaw; internally they are vertical and slightly convex, or nearly plane; posteriorly they inclose the stylal pit; and postero-internally they present a broad irregular surface, which abuts against the paramastoid process. The space separating the bullæ, or the width of the sphenoidal body between them, is about five lines. (Fig. 1.)

The auditory process resembles that of the Musks, and the meatus auditorius externus, which holds the same relative position as in these, is subcircular, and about a line in diameter.

The glenoid articulation, so far as can be ascertained by viewing its position with the condyle of the lower jaw in contact, is much like that of the Musks, but appears rather more concave.

Inferior Maxilla.—The form of the lower jaw in *Dorcatherium* is very similar to that of the recent Musks, but is very peculiar in *Poebrotherium.* In this the base is much more nearly horizontal, and when placed upon a plane surface touches it at the angle and middle, and the anterior portion, which curves downwards from the position of the third premolar to the symphysis, also nearly reaches the same level. (Fig. 1.)

The outer surface of the bone below the true molars is convex, but below the premolars is nearly plane and deeper than in the former position. The alveolar margin rapidly ascends posteriorly from the position of the second true molar, and descends in advance of the second premolar.

The ramus is remarkable for its breadth, and the possession of an angular apophysis, as in the Camel, carnivora, and most rodentia. The process in position and form is intermediate to that of the Camel and Rabbit. From its point a thin convex edge, corresponding to the technical angle, descends to the base of the jaw, and a concavity, which in a great measure is occupied by the auditory bulla, ascends to the condyle.

The relation of the condyle and coronoid process is about the same as in the Musks, but below the notch separating them, the ramus is depressed relatively as much as in the Peccary, a peculiarity in which the genus differs from all existing ruminants.

The condyle externally has nearly the same form as in the Musks, and as far as can be seen in the specimen; its articular surface appears to be a little more convex than in those animals.

The coronoid process is relatively broad, and curves upwards as in the Musks.

Its extremity is broken in the specimen. The symphysis also is broken away, but it appears to have commenced from behind about four lines in advance of the second premolar, and the anterior mental foramen is situated just above this portion of it.

Dentition.—I think it probable that the permanent dentition of *Poebrotherium* was equal to the following formula:—

$$i. \frac{0?\ 0?}{4?\ 4?}\ c. \frac{1?\ 1?}{0?\ 0?}\ p.m. \frac{4\ \ 4}{4\ \ 4}\ m. \frac{3\ \ 3}{3\ \ 3} = 38.$$

In the specimen, the symphysis with its teeth is broken away; and a portion only apparently of the upper canine alveolus remains.

Superior Molars.—The upper teeth, in the specimen, consist of the three permanent true molars, fully protruded, and the three temporary molars, forming together a closed row, and separated from this by a hiatus with an acute concave margin about four lines long, is, what I suspect to be, the first permanent premolar, which had no predecessor. (Figs. 1, 3.)

The permanent true molars resemble those of the Musks, but their constituent lobes possess much less prominent summits. The inner lobes also are less angular, but more convex internally, and the outer lobes are much less prominent in the same direction. The outer lobes of each true molar, in the Musks, are separated by a narrow cleft, but in *Poebrotherium* they are separated only by a longitudinal ridge, which is the most prominent of those existing externally. The median ridge of each lobe externally is the most prominent and convex in the Musks, but is relatively narrow in *Poebrotherium*, and the intervening spaces are more flat in this genus.

In the specimen under consideration, the last molar had been but a short time fully protruded, the enamel being worn only from the summit of its postero-internal lobe, and remaining nearly intact upon the postero-external. The summits of all the other lobes of the true molars present narrow tracts of exposed dentine surrounding the interlobular pits of enamel.

The temporary molars, also, have a very great resemblance to those of the Musks. The last of the series is like the permanent true molars, and in the specimen the enamel has been worn from the masticating surface, except a small crescentic islet between the posterior pair of lobes.

The second temporary premolar in the specimen has its enamelled triturating surface obliterated, and in its present condition is constituted by a wide posterior lobe, the result of the confluence of an original transverse pair, and a narrower anterior lobe with a pyramidal summit, which does not distinctly appear to be formed from the association of an antero-posterior pair, such as exists in the corresponding tooth of the Musks. Externally this tooth presents three convex prominences, separated by concave depressions.

The first temporary premolar has a simple, broad, oblong, trenchant crown, which is most prominent at its anterior part. It is convex externally, and the enamel internally is worn off in a sloping manner.

The first permanent premolar, which, as before observed, is removed from the others by a hiatus, has a simple oblong, trenchant crown like that last described, but is longest or most prominent at the middle, is convex externally, and sloping plane internally, and is inserted in the jaw by two diverging fangs.

Inferior Molars.—(Figs. 1, 4.) The lower teeth, preserved in the specimen, consist of the permanent true molars, and the three temporary molars. The former are remarkable for the simplicity of their lobes, and these, as in the case of those above, have not as prominent summits as are found in the Musks. The internal surface of their inner lobes is vertical and plane in comparison with what it is in the Musks and other ruminants, and its longitudinal ridges are but slightly elevated above the intervening spaces. The external surface of these lobes is quite plane and nearly parallel with the internal.

The outer lobes are vertically prismoid with the anterior surface broader than the posterior, and the internal surface more vertical than in the Musks or Deer. The extremities of the crescentic summits join the corresponding margins of the inner lobes, and there is no disposition to the bifurcation of the posterior horn of the antero-external lobes as in the Musks.

Each transverse pair of lobes, in the specimen, presents a trilateral pit of enamel surrounded by a narrow tract of exposed dentine.

The fifth lobe of the last molar is a simple, thin, enamelled plate, with a trenchant edge.

The last temporary molar, as in all ruminants, is composed of three pairs of lobes; but, in the specimen, from the obliteration of the interlobular enamel pits, it rather consists of three antero-posterior prismoid lobes.

The two temporary premolars, in the broad trenchant character of their crown, resemble those of the Musks. Their trenchant margin rises to the middle of the teeth, the external surface is elevated into three slight convexities, and the inner surface is convex posteriorly, but is depressed anteriorly. The margin of the second premolar is broadest posteriorly, and is worn off in this position in the specimen, and the anterior fifth of the tooth bends within that preceding it. As before observed, when the specimen was first received, a fragment of the first permanent premolar remained in the lower jaw, situated about five lines in advance of the first temporary molar.

This species is named in honor of Dr. Thomas B. Wilson, of Philadelphia, a distinguished patron of the natural sciences.

MEASUREMENTS.

	Inches.	Lines.
Distance from meatus auditorius to anterior part of first permanent premolar	4	9
Distance from meatus auditorius to infra-orbital foramen	3	1
Diameter of orbit from lower part of post-orbital arch to lachrymal margin	1	2
Breadth at meatus auditorius	1	9
Breadth at auditory bulla	2	1
Breadth at malar bone below orbit	2	4
Breadth at infra-orbitar foramen	1	2
Breadth above first permanent premolar		7½
Breadth above middle true molar	1	10
Height of orbit from base of lower jaw	1	8
Height of lower jaw at condyle	1	11
Height of lower jaw at middle true molar		7

	Inches.	Lines.
Height of lower jaw at first temporary premolar		7
Height of angular apophysis		10
Distance from coronoid process to anterior mental foramen	4	4
Length of upper series of six molars	2	6
Length of lower series of six molars	2	8

	GREATEST DIAMETER.	
	Antero-posterior.	Transverse.
Seventh upper molar	7 lines.	6 lines.
Sixth upper molar	6½ "	5¾ "
Fifth upper molar	5½ "	5 "
Third temporary molar	5 "	4 "
Second temporary molar	5 "	3 "
First temporary molar	4½ "	1 "
First permanent premolar	3½ "	1 "
Seventh lower molar	9 "	3¾ "
Sixth lower molar	6½ "	
Fifth lower molar	5½ "	
Third temporary molar	6 "	2½ "
Second temporary molar	5 "	1½ "
First temporary molar	4 "	1 "

AGRIOCHOERUS, Leidy.

Agriochoerus antiquus, Leidy.

(Plate I. Figs. 5–10.)

Agriochoerus antiquus, Leidy: Proc. Acad. Nat. Sci., 1850, V. 121; Owen's Rep. of a Geol. Surv. of Wisc., etc., 571.

Agriochoerus is a remarkable and very peculiar genus of ungulata, representing a type which occupies a position in the wide physiological interval existing between recent ruminants and the anomalous *Anoplotherium.*

It was first established in the Proceedings of the Academy of Natural Sciences of Philadelphia, for 1850, upon a portion of a skull, and several fragments of jaws with teeth, received from my friend, Dr. Hiram A. Prout, of St. Louis.

Of the species characterized under the name of *Agriochoerus antiquus,* I have had the opportunity of studying the following specimens:—

1. A much mutilated face, with the forehead, and portions of both sides of the lower jaw, apparently of an adult individual. The upper jaw contains upon one side the posterior five molars, and upon the other side the posterior six molars. Both fragments of the lower jaw contain the posterior five molars. The first true molar is only slightly worn, while the others have hardly yet been affected by trituration. Received from Dr. Prout. (Pl. I., Figs. 5–8.)

2. Two fragments of the upper maxillæ, containing each the last two true molars, and a fragment of the lower jaw containing the anterior two true molars. These apparently belonged to the same and an older individual than the former. Received from Dr. Prout. (Figs. 9, 10.)

Description of the portion of a Skull.—Viewed from above, the anterior portion of the skull is nearly equilateral triangular, the sides of the face converging in a nearly straight line from the posterior part of the orbit to the most anterior of the molars in the specimen. Viewed laterally (Fig. 5), it is remarkable for the lowness of the forehead and the parallelism of its upper part with the alveolar margin.

The forehead is broad, and between the anterior part of the orbits is convex, but between the posterior part, at its middle half, is flat or slightly depressed, and upon the post-orbitar processes is rather abruptly depressed.

The posterior part of the os frontis, in the specimen, has a small fragment of the ossa parietalia attached on each side, and between these it is convergent backward to where it is broken off, evidently indicating it to have been pointed and received into a notch of the parietalia as in the Camel and *Merycopotamus*. Anteriorly, the os frontis, though broken, is easily perceived to have terminated in angular processes between the ossa lachrymalia and nasi.

The remains of the frontal suture existing in the specimen, are distinct and zigzag posteriorly, but straight and a little out of the normal course anteriorly.

About a line on each side of the frontal suture, in a position corresponding to the anterior third of the orbit and ten lines from its margin, is a small supra-orbitar foramen.

No portions of the nasal bones are preserved, and the notch of the os frontis, for the reception of their posterior extremity, is too much broken to ascertain their limits in this direction, but they appear to have extended a little posterior to the position of the anterior orbital margin.

The orbital entrance is open posteriorly as in *Anoplotherium*, but is relatively larger than in this, and its plane is directed outward and as much upward almost as in feline animals; but not so much forward as in the Deer, though rather more so than in the Musks. In form it is subcircular, and is about one inch in diameter.

The post-orbital processes of the os frontis and os malæ are six lines and three-fourths distant from each other, and are thick, compressed, conoidal, and pointed. That of the former bone is directed outward and downward, that of the latter upward, inward, and slightly anterior, and its point is about four lines external to the one above.

The lachrymal margin is partially broken, but it appears to have been only slightly prominent. The facial surface of the lachrymal bone is seven and a half lines in vertical diameter, and is a feebly depressed inclined plane, on the same level nearly as the orbital entrance.

The malar bone, compared with that of recent ruminants, is robust, and its external face, below the orbit, is vertically slightly convex. Antero-posteriorly it is convex, and its anterior limit is on a line with the first true molar tooth.

The superior maxillary bone, from the position of the malar bone forward and upward, as far as it is preserved in the specimen, is prominent and convex, and below this upon the alveoli is vertically convex. The infra-orbitar foramen is vertically oval and directed forward, and is situated above the hinder fang of the penultimate premolar an inch in advance of the orbit.

The hard palate, for the most part, is obscured by a very hard matrix, to remove which would endanger the specimen; but where exposed, between the anterior of the premolars, it is remarkable on account of the very great degree of inclination of the two sides; its median suture being about five lines above the alveolar margin. (Fig. 6.)

Inferior Maxilla.—The two fragments of lower jaw, preserved in connection with the specimen just described, and comprising as much of the body of each side as contains the hinder five molars, present pretty much the same form as the corresponding portion of the jaw of the Camel, but are relatively deeper and less convex externally. (Fig. 5.)

The alveoli have a remarkable degree of descent forward in relation to the base of the jaw; the depth of the bone below the posterior lobe of the last molar being twenty-one lines, whilst it is only eleven lines below the last premolar.

Internally the lower jaw is much more convex than externally, especially in advance of the first true molar, and also posterior to this upon the alveolar portion of the bone.

Just above the thick, rounded base of the jaw internally, and below the position of the first true molar, a concavity commences, which gradually expands and deepens to a line with the posterior lobe of the last molar, when it abruptly increases and then continues to the broken margin of the specimen, so that it is probable the technical angle of the jaw within is deeply concave, as in the Tapir.

A little more than half way below the position of the last premolar externally is a small foramen directed backward, which is probably an offset from the inferior dental canal.

Dentition.—The molar teeth of *Agriochoerus* are certainly ruminant in their type, and the true molars in both jaws are constructed upon the same pattern as those of all recent ruminants, each being composed of two symmetrical pairs of demiconoidal lobes, with an additional odd lobe to the last lower molar. In the specimen above described, the posterior six molars are preserved in the upper jaw, and the posterior five in the lower jaw.

The molars in both jaws successively decrease in size from behind forward. Those above, on the two sides, are nearly parallel internally, and from thirteen to fourteen lines apart, but externally their line is convergent forward.

Superior Molars.—(Figs. 5, 6–10.) The upper true molars resemble very closely the corresponding teeth of *Hyopotamus* deprived of their anterior median or accessory lobe. As in this genus, their transverse diameter is greater than that antero-posteriorly; the result apparently of the expansion of the teeth from the condition in which they exist in the recent ruminants generally. The lobes are low and spread wide apart, and the interlobular spaces are broad and shallow; thus the perpendicular height of the outer lobes of the last molar is four lines, and the distance between the summits of the anterior pair of lobes is three lines.

The outer lobes conjoin externally to form a prominent median convexity, and another, similar but not quite so large, is formed by the union of the anterior angle of the antero-external lobe with the contiguous prolonged arm of the summit of the antero-internal lobe. The surface of the outer lobes, between the external convexities, is transversely concave with the feeblest degree of median elevation, and inclines very much inward. Internally the outer lobes are convex and nearly vertical.

The inner lobes are smaller than those external, are convex internally, and concave externally with a slight median elevation. The extremities of the summits extend around the base internally of the outer lobes, except that posterior of the antero-internal lobe, which ceases abruptly at its arrival in the transverse valley of the tooth.

Constituent portions of a basal ridge, feebly developed, exist principally between the bases of the inner lobes, and anteriorly and posteriorly.

The fourth premolar is quite peculiar, and rather resembles a last deciduous molar than the permanent premolars of ordinary ruminants. It consists of two pairs of lobes like those of the true molars, but the postero-internal lobe is in a rudimentary condition, consisting of a small pyramidal tubercle occupying the normal position. The prominence externally produced by the confluence of the outer lobes is relatively not so large as in the true molars, but otherwise the principal lobes have the same form.

The third premolar consists of one large trihedral pointed lobe, with a relatively small pyramidal lobe, situated at the base of its postero-internal face. The latter lobe is broken in the specimen. The external face of the former is the broadest, is slightly convex, and is prominent in the median line. The inner faces are sloping, and that posteriorly is concave.

The second premolar has nearly the same form as that last described. Its principal lobe is relatively less broad, and its external face is more convex. A rudimentary lobe, which apparently existed at the base of the postero-internal face of the principal lobe, is broken away in the specimen.

The upper true molars are implanted by four fangs; the last premolar by three; and those in advance by two. The fangs of the anterior premolars, and the outer ones of the last premolar and the true molars, present a remarkable curve outward in their course downward.

Inferior molars.—(Figs. 7–9.) The outer lobes of the lower true molars are larger than those within, but do not rise quite so high. Their internal face is concave and slightly elevated in the median line. Externally they are conoidal, are confluent at the base, are without intervening portions of a basal ridge, and are slightly spread outwardly towards their lateral margins.

The anterior extremity of the summit of the antero-external lobe joins the contiguous margin of the lobe within; its posterior extremity in association with that anterior of the summit of the postero-external lobe turns upward and becomes confluent with the posterior part of the external face of the antero-internal lobe; and the posterior extremity of the postero-external lobe, except that of the last molar, bifurcates, one portion connecting itself with the posterior part of the outer face of the postero-internal lobe, the other with the posterior margin of the same lobe.

The inner lobes externally are convex and nearly vertical, and internally are most prominent in the median line, and have their angles everted into short, prominent, divergent folds.

The fifth lobe of the last molar is about the size of those external, and in section is oval. Its pointed summit descends by a pair of U like arms, one of which joins the margin of the internal of the posterior pair of lobes, the other the contiguous extremity of the summit of the inner of the same pair of lobes.

The fourth premolar, like the true molars and the corresponding tooth of the upper jaw, also has four lobes. Those external have the same form as in the true molars, but that anterior is larger than the one posterior. The inner lobes are reduced representatives of those homologous in the true molars, and still preserve the same form, but as they retain their connection with one another, they are placed at the posterior three-fourths of the position of the tooth.

The third premolar is formed by a single, large, broad, demiconoidal crown, in which, however, may be traced a constitution of two outer lobes corresponding to those of the true molars, the posterior of which has become almost entirely fused with the anterior, but is still distinguishable by a depressed line externally, and a well marked *cul-de-sac* internally.

All the inferior molars have two fangs, and in the last of the series the posterior consists of a confluent pair.

The enamel upon the teeth described is everywhere smooth, or is only very slightly corrugated.

MEASUREMENTS.

	Inches.	Lines.
Breadth of face from one malar bone to the other, posterior to the orbits	4	
Breadth of forehead at post-orbital processes of os frontis	2	4
Distance between the infra-orbital foramina	1	6½
Diameter of the orbits	1	
Height of forehead above the alveolar margin	1	10
Distance between the posterior molars anteriorly	1	2
Distance between the third premolars	1	2
Length of line of the posterior six superior molars	3	
Length of line of the five inferior molars	3	
Length of line of superior true molars	1	10
Length of line of inferior true molars	2	1½
Greatest antero-posterior diameter of the posterior superior molar		9
Greatest transverse diameter of the posterior superior molar		10½
Greatest height of the posterior superior molar		3½
Greatest antero-posterior diameter of first superior true molar		7½
Greatest transverse diameter of first superior molar		8
Greatest antero-posterior diameter of fourth premolar		6
Greatest transverse diameter of fourth premolar		6½
Greatest antero-posterior diameter of second premolar		4½
Greatest transverse diameter of second premolar		3
Height of the second premolar		3½
Antero-posterior diameter of posterior inferior molar	1	
Transverse diameter of posterior inferior molar		6
Antero-posterior diameter of first true molar		6½
Transverse diameter of first true molar		4½
Antero-posterior diameter of fourth premolar		6½
Transverse diameter of fourth premolar		4
Antero-posterior diameter of third premolar		4½
Transverse diameter of third premolar		3

OREODON.

(PLATES II.—VI.)

In the Proceedings of the Academy of Natural Sciences of Philadelphia for 1848, I described two fragments of an upper and a lower jaw of an extinct ungulate animal, from the Bad Lands of Nebraska Territory, presented to the Academy by Mr. Alexander Culbertson. The fragment of an upper jaw contained the last two molars, that of the lower jaw the three true molars, and from the form of the teeth I characterized the animal under the name of *Merycoidodon Culbertsonii.*

In 1851 I received from the Smithsonian Institution, and from Dr. Hiram A. Prout, of St Louis, several fragments of skulls and jaws, obtained from the same locality as the former. These contained the same form of true molars; but, being misled by a fragment of the face of a young animal containing a portion of the first permanent premolar, followed by the entire first, and portions of the second and third deciduous molars, in a verbal communication to the Academy,[1] I referred the specimens to two other distinct genera, to one of which the name *Oreodon* was given, and to the other that of *Cotylops.*

All these have since been satisfactorily determined to belong to a single genus, for which I desire to retain the name *Oreodon,* in preference to *Merycoidodon;* for all the anatomical characters of the animal indicate it to have been a true ruminant, and not merely like one in the form of its molar teeth.

Oreodon is a remarkable and very peculiar genus of ruminant ungulates, constituting one of the links necessary to fill up the very wide gap between existing ruminants and that exceedingly aberrant form of the same family, the extinct *Anoplotherium* of Europe and Asia.

Of this genus I have been enabled to examine crania, more or less perfect, and fragments of others; and teeth of numerous individuals of at least two, and probably three distinct species, and can render our knowledge of the head of the animal almost complete.

Description of the Skull.—The form of the skull of *Oreodon* is so peculiar that I know of none among existing ungulates with which to compare it nearer than that of the Camel; and yet this only approaches it in the form of the cranium proper. Generally it has most resemblance to that of *Anoplotherium,* but from this it strikingly differs, in the existence of post-orbital arches as in all existing ruminants; in the greater size of the orbits; in the presence of deep lachrymal depressions, relatively as large as those of the Deer or of the extinct *Bootherium;* and in other important particulars. The true molar teeth are decidedly of a ruminant character; while canines and incisors exist in both jaws, and form with the molars almost unbroken rows, as in *Anoplotherium.*

Lateral View.—(Pl. II. Figs. 1, 3; III. 2; V. 1; VI. 3, 4, 6.) The side view of

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[1] Proc. Acad. Nat. Sci., V. p. 237.

the skull resembles in its general form very much that of *Anoplotherium*. The upper outline of the skull forms an almost unbroken convexity from the inion to the end of the nose; being depressed very slightly only upon the forehead at the bifurcation of the sagittal crest. The outline of the inion is obliquely downward and forward, and is only intruded upon by the occipital condyles.

Among existing ruminants, the cranium proper of *Oreödon* is very like that of the Camel and Llama. As in these, the temporal fossa is large and extends superiorly to the median line of the skull, where it rises upon a prominent sagittal crest, which posteriorly, in conjunction with the occiput, forms an eminence projecting above the inion and constituting its summit. The fossa at the margin of the inion forms an oblique crest, which relatively is not as deep as that of the Camel, and which is constituted by the junction of the squamous portion of the temporal bone with an elongated process from the pars petrosa intercalated between the former and the occiput; and above by the occiput alone. Anteriorly the fossa is bounded by the divergent portion of the sagittal crest upon the post-orbital process.

The temporal surface generally is smooth and convex, but is concave along the course of the occipital crest and the sagittal crest posteriorly, and as in the Camel, nearly one-half of its extent is constituted by the squamous portion of the temporal bone.

Following the course of the squamous suture at its anterior part, in some of the crania, the parietal bone is depressed into a groove, resembling the impression of a bloodvessel, or the trochlea of a tendon; but in other specimens this groove does not exist, or is very slight. At the back part of the same suture, varying in position in different individuals, are one or two vascular foramina, directed upward and backward. (V. 1.)

In all the specimens under investigation the zygomatic arch is broken; but, judging from a portion remaining in the skull of an immature animal, it is relatively as strong as in the Camel. (VI. 6.)

The malar bone, as in the Deer, has a much more anterior position than in the Camel, but it is more robust than in this, and its outer surface is convex and on the same plane with the entrance of the orbit, being directed forward and upward. Anteriorly, it is continuous with a corresponding swell of the face, converging forward above the alveolar processes.

The post-orbital process of the os frontis combines with that of the malar bone, so as to form a complete post-orbital arch, such as exists in all recent ruminants; which is relatively stronger than that of the Deer, Ox, or Sheep, but is not quite as strong as in the Camel. (IV. 3; VI. 4, 6.) The temporal attachment extends upon the post-orbital arch, as far as the transverse suture.

The entrance of the orbit is sub-rotund, and is directed to about the same extent forward as in the Deer, but in a slight degree more upward. (IV. 3.)

The face, in its general form, strongly resembles that of *Anoplotherium;* and in comparison with that of the Deer, not only appears to be shortened to an extent corresponding with the vast hiatus existing anterior to the molars in the latter, but also to recede; for, the last molar is on a line vertical to the post-orbital arch, as in the Camel and *Anoplotherium;* whereas, in the Deer, and other ruminants, it is beneath the anterior part of the orbit. (II. 1, 2.)

Internal to the position of the malar bone, the face is deeper than in *Anoplotherium,* but relatively is not as deep as in the Camel.

The infra-orbitar foramen is placed above the position of the third premolar, and is more advanced than in the *Anoplotherium* or Camel, but is less so than in the Deer, Ox, Sheep, and other ruminants. The face, from the post-orbital arches to the nose, constitutes very nearly an equilateral triangle, being relatively broader between the post-orbital arches, or at the base of the triangle, than in *Anoplotherium.* The side of the face, in advance of the orbit, is vertically convex, and one of the most remarkable features of the genus exists upon this surface, viz., a large lachrymal depression gradually commencing at the borders of the bones in sutural connection with the lachrymal bone. This depression is rather more elevated in its position than in the Deer, and is hemispherical, as in the extinct genus of pliocene Oxen, the *Bootherium.* Anterior to the infra-orbitar foramen the face is slightly depressed, and just in advance of this position is a gentle rise, corresponding to the course of the fang of the canine tooth.

The lateral view of the extremity of the nose resembles more that of the *Anoplotherium* than of any existing ruminants, presenting the same slope lateral to the convex termination of its floor, which is constituted by the incisive alveoli. The intermaxillary bone, however, is very much smaller than in this genus, projecting as it does at the lateral margin of the nose only very slightly beyond the end of the maxillary, and at the incisive alveoli a very small distance relatively beyond the anterior line of the canine tooth. (II. 1.)

Superior View.—(Pl. IV. Fig. 1; V. 4; VI. 1.) The upper view of the cranium proper, much resembles that of the Camel. The sagittal crest is prominent, and pyramidal, with concave sides; and it bifurcates immediately at the position of the coronal suture. The forehead generally is convex; and it has very nearly the form of that of the Camel, but it is less prolonged outwardly towards the orbits, and is not so prominent above these, and also is relatively not quite so much depressed at the bifurcation of the sagittal crest.

The supra-orbitar foramen varies in its exact position in different individuals, but is usually situated a short distance from the frontal suture, and nearer to the fronto-nasal, than to the coronal suture. It is directed forward, and is continuous with a shallow groove passing to the outer side of the fronto-nasal suture. (IV. 1.)

The muzzle is relatively short, as in *Anoplotherium,* and superiorly is usually transversely convex, with the sides vertical; but in some specimens it is nearly flat at the nasal bones.

As far as can be ascertained in any of the specimens, but principally from an impression upon a portion of matrix, the anterior extremity of the nose, as constituted by the ends of the ossa nasi, appears to have been like that of the Deer; and the lateral margin and incisive alveoli are convex; and the latter project relatively to their position in *Anoplotherium,* or recent carnivora, very little beyond the front of the canines.

Posterior View.—(Pl. IV. Fig. 2.) The occipital surface resembles a good deal that of *Anoplotherium*. Its median portion bulges backward above the foramen magnum, and is concave below the summit of the inion. The lateral portions of the surface are directed outwardly from the median, and are moderately concave, but relatively much less than in the Camel.

The lateral margin of the inion, or the occipital crest, is relatively less prominent than in the Camel; and at its lower part is formed, as in the Deer and other ruminants, by the elevated border of the pars squamosa and a process of the pars petrosa intercalated between the former and the occiput.

The occipital foramen is transversely oval and emarginate above.

The condyles resemble those of the *Anoplotherium*, and do not advance upon the basilar process inferiorly as in the Camel, Deer, and other ruminants. Their position corresponds pretty closely with that which they have in the Camel; and their angle and superior and inferior faces present in the same direction.

Inferior View.—(Pl. III. Fig. 1; V. 2, 3; VI. 3.) The base view of the skull, in its general form, much resembles that of *Anoplotherium;* but it is relatively broader in comparison with its length, and presents numerous peculiarities. The basilar process slopes on each side from a central crest, which expands at the condyles and at its junction with the post-sphenoidal body. The surface of the latter is smooth, slightly convex, and inclines slightly upward in its direction forward. (III. 1; V. 2.)

The pterygoid processes commence a little in advance, and to the outside, of the position of the spheno-basilar junction, and are very oblique in their course downward and forward. To their inner side is a shallow groove, directed to the foramen lacerum, for the reception of the Eustachian tube.

The paramastoid processes form the infero-lateral terminations of the occiput, and are conspicuous objects either in the lateral or posterior view of the skull. They are relatively about as long and strong as those of *Anoplotherium*, but are nearly vertical, or bent slightly forward and outward. Their form is elongated pyramidal, and the outer portion of their base abuts upon the posterior process of the pars petrosa, as in the Deer; while the antero-internal portion rests upon the auditory bulla. Antero-externally the para-mastoid process is longitudinally excavated, and between its base and the pars petrosa it incloses the stylo-mastoid foramen, and in advance of this the pit of reception for the styloid process. (III. 1; V. 2.)

The mastoid process is small, as in all ruminants, and is a compressed eminence or ridge forming the posterior boundary of the meatus auditorius externus. It does not descend as low as the bottom of this, and projects between the auditory process from which it is separated by a notch, and the base of the paramastoid process.

The auditory process constitutes the antero-inferior boundary of the meatus, and inferiorly forms a ridge-like vaginal process curving forward and inward to the auditory bulla with which it is continuous.

The latter is relatively very small to what it usually is in ruminants, and corresponds in this respect with *Anoplotherium*. It is convex, surmounted by the ridge just indicated, rests against the paramastoid process posteriorly, and is continuous with the bony process of the Eustachian tube anteriorly. Internally, as in existing ruminants, the pars petrosa borders a large irregular excavation, constituting the foramen lacerum posterius, and anterius, and a portion of the Eustachian tube.

Immediately posterior to the foramen lacerum, and internal to the base of the paramastoid process, the hypoglossal or anterior condyloid foramen is situated.

The foramen ovale holds the same relative position as in recent ruminants, being a little to the outside of the commencement of the pterygoid processes, and in advance of the bony process of the Eustachian tube.

The glenoid articulation, one of the most important features of the cranium in reference to the habits of the animal, is broad as in existing ruminants, is slightly convex anteriorly and concave posteriorly; and in this position is bounded by a mammillary post-glenoid tubercle, which is compressed antero-posteriorly, and is relatively very large and robust. This tubercle is a very conspicuous object in the lateral view of the head, and projects below the auditory process and bulla. Between it and the auditory process is a narrow fissure, and at the bottom of this internally is the glenoid foramen.

Antero-internally, the glenoid articulation is prolonged upon a broad surface for muscular origin, formed by the conjunction of the post-sphenoid and pars squamosa, and terminating anteriorly in a pyramidal eminence, as in the Deer.

The pterygo-palatine notch is long and narrow, and extends as far forward as the posterior third of the last molar. Its margins are thick, strong, and rounded.

The notch extending between the palate bone and the tuber maxillare is almost as deep as that of the Deer, but is more angular. It terminates on the same line nearly as the pterygo-palatine notch, as in the Sheep.

The hard palate is slightly arched, and deepens in an angular manner towards the centre. In some of the specimens it deepens very much, and in others not more than in the Deer in advance of the molars. Its lateral margins, corresponding with the alveoli, are nearly parallel throughout the course of the molar series.

The posterior palatine foramina are pierced in the palate plates of the superior maxillary bones on a line with the fourth or third premolars.

The position of the incisive foramina, as far as can be ascertained from the imperfect specimens, appears to be on a line with the canine teeth.

Orbits.—(Pl. IV. Fig. 3; VI. 4, 6.) As before observed, the entrance of the orbit is subrotund and directed outward, and a little forward and upward. Its margin is less prominent than in the Deer, and at the inner canthus is elevated into a vertical, slightly sigmoid, compressed mammillary, lachrymal process. The inner wall of the orbit is more oblique in its course backward to the optic foramen than in the Deer, and the alveoli contribute more to its floor, which is deep and concave.

The entrance to the infra-orbital canal is a broad oval orifice at the lower part of the front of the orbit, formed below by the alveolar processes and above by the lachrymal and palate bones.

The lachrymal foramen is vertically oval, and contracted at its lower part, and is situated just within the lower part of the lachrymal process. Near it externally is a small round foramen.

At the inner side of the entrance of the infra-orbital canal, are two foramina, homologous with the posterior palatine and spheno-palatine foramina.

Another foramen, the anterior orbital, is situated in the suture between the lachrymal and palate bone, about half way between the entrance to the infra-orbital canal, and the lachrymal margin of the orbit.

The foramina spheno-orbitale and rotundum, form one large and vertically oval foramen, which is situated just within the pyramidal process forming the terminal conjunction of the temporal and pterygoid surfaces.

The optic foramen is situated some distance in advance of, and slightly above the position of the spheno-orbital, is about one-third the size of the latter, and is also vertically oval.

The bones which contribute to the construction of the orbit are the lachrymal, frontal, superior maxillary, malar, palatal, and anterior sphenoid.

Form, Relations, and Connections of the Bones of the Skull.—The occipital bone posteriorly, is trilateral with a prominent apex, and it terminates by its other angles in the long paramastoid processes.

The lambdoidal suture commences at the outer side of the base of the latter, and ascends posteriorly between the occiput and the process from the pars petrosa, and then advances over the occipital crest to the side of the cranium between the occipital and parietal bones. It is serrated, and at the occipital summit it forms a trifoliate line.

The spheno-basilar connection is not obliterated in the adult specimens under investigation, but is elevated and distinct.

As in the Camel, the squamous portion of the temporal bone, from its great relative size to that of most other animals, is a striking feature in the anatomy of the temporal fossa.

The squamous suture forms about three-fifths of an oval outline, and is pretty strongly serrated as in ruminants generally.

Between the pars squamosa and the occiput posteriorly, is a narrow process from the pars petrosa, ascending from between the mastoid process and the base of the paramastoid, to the conjunction of the occipital with the parietal bones. To the pars squamosa and occiput, it is connected by serrated suture.

As in all ruminants, there is only a single parietal bone; and, as in the Camel, this is remarkable for its length in comparison with that of more ordinary members of the family. It is narrowest posteriorly, and gradually widens to the anterior portion of the squamous suture, where it descends to the wings of the post-sphenoidal bone. Anteriorly it is deeply notched for the reception of the posterior part of the ossa frontis.

The body of the post-sphenoidal unites with that of the ante-sphenoidal on a line with the spheno-orbital foramina.

The wing of the ante-sphenoidal bone articulates with the vertical plate of the palate bone, the frontal, a small portion of the parietal, and the wing of the post-sphenoidal bone.

The external pterygoid process is united with the internal, as in the Sheep and other ruminants; but it is very much more oblique in its course than is usual in these, and even more than in the Sheep.

The internal pterygoid process shows itself as in recent ruminants, at the posterior extremity of the orbit, between the vertical plate of the palate bone, the external pterygoid process, and the wing of the post-sphenoidal bone.

The frontals remain separated in the adult condition, and are relatively shorter than those of ordinary ruminants. They commence in an angular manner posteriorly, and expand rapidly forward and outward to the post-orbital margin, as in the Camel, and then converge forward, the supra-orbital margins being nearly straight, and terminate in angular processes which advance beyond the ossa lacrymalia. Anteriorly they form a deep notch, extending nearly to a line with the anterior orbital margin, for the reception of the posterior extremities of the ossa nasi.

The forehead, as constituted by the ossa frontis, ordinarily is prominent and convex above the orbits, and slightly depressed along the median line or course of the frontal suture. The orbit presents more upward than in recent ruminants, and the post-orbital process in its descent to join the malar bone is directed more outward; and it also is directed backward, as in the Camel, though not to the same relative extent. The nasal bones, anterior to the angular processes of the ossa frontis, are of nearly uniform breadth, are slightly convex, and incline more or less outwardly.

The lachrymal bone forms two sides of an irregular cuboidal figure, with the facial side depressed into a deep hemispherical lachrymal sinus. The two sides are sub-equal, and their angle of union constitutes the anterior orbital margin. Inferiorly the orbital side forms the supero-external boundary of the entrance to the infra-orbital canal; and postero-internally it is deeply notched for the reception of the upper extremity of the palate bone.

As in recent ruminants, the lachrymal bone articulates with the os frontis, os maxillare, os malæ, and os palati; and it is separated some distance from the os nasi by the advance of the angular process of the os frontis.

The palate plates of the ossa palati advance as far as the position of the first true molar, and in some specimens, to the interval between the latter and the fourth premolar. The vertical plates are shallow, but relatively broader than those of recent ruminants.

In the orbit, the palate bone forms the internal boundary of the entrance to the infra-orbital canal, and is pierced internal to this by the posterior palatine canal, and the homologue of the spheno-palatine foramen. It articulates with the maxillary, the frontal wing of the anterior sphenoid, the anterior margin of the internal pterygoid process, and the extremity of the external pterygoid process.

The superior maxillary bone, compared with that of recent ruminants, is not as short as might be supposed; for the space in these which constitutes the hiatus anterior to the molar series, is in *Oreodon* occupied by a molar additional to the ordinary functional number, together with a well-developed canine; leaving a little vacancy for the accommodation of an inferior canine. Its outer side is vertically convex, but is depressed in advance of the infra-orbital foramen.

The suture between the maxillary, and malar and lachrymal bones, ascends in an irregular oblique line from the antero-inferior angle of the malar bone, opposite the position of the second true molar, to the angular process of the os frontis at some distance posterior to its termination.

The malar bone below the orbit externally, presents a single, smooth, convex surface, slightly directed upward. Its inferior margin is thick, strong, and roughened; and its posterior extremity beneath the position of the post-orbital arch, is deeply notched for the reception of the anterior extremity of the zygomatic process of the temporal bone.

The intermaxillary bone, compared with that of recent ruminants, or of the *Anoplotherium*, or even with that of carnivora, is very small but strong. Its upper extremity is received into a notch of the maxillary bone, and does not come into contact with the nasal bone.

Inferior Maxilla.—(Pl. II. Figs. 1, 3; IV. 4; VI. 4, 6.) The lower jaw is intermediate in its form to that of the extinct *Anoplotherium* and the common Hog, except that the alveolar margin, at its anterior extremity, is not everted as in the latter, but retains the upward direction, as along the course of the molar alveoli.

The body of the bone, compared with that of the Deer, is relatively deep, and its base pursues a less sigmoid course, and is very like that of *Anoplotherium* Its outer side is vertical, and very slightly convex, but anterior to the mental foramen is convex forward, or rapidly convergent to the symphysis. Its thickest part is along the line of the latter, and that of the alveoli.

The symphysis is deep, and forms a strong slope; but it approaches the vertical line much more than in the *Anoplotherium*, or than in the Hog. Its lower part, or the posterior mental tubercle, is on a line perpendicular to the second premolar, or in some specimens to the interval between this and the third.

The alveolar margin ascends so rapidly posterior to the last premolar, that the body of the lower jaw behind the last molar, is deeper by more than half than it is below the former tooth.

The ramus is relatively as broad as in the Hog, but is more vertical and convex upon its outer face. It is relatively deeper than in *Anoplotherium*, but is less produced backwards than in this, and more so than in the Hog. The posterior margin is thick and convex, and projects externally into an irregular ridge for the masseteric attachment. The inner side of the ramus inferiorly presents a concavity which converges forward below the molar alveoli. Below the notch separating the condyle and coronoid process the external surface presents a depression in form like that of the Peccary, but deeper, in the possession of which *Oreodon* differs from all recent ruminants.

The coronoid process, in comparison with that of the latter, is remarkable on account of its shortness, being relatively not longer than that of the Hog, which it also resembles in form and relation to the condyle. The latter is a transverse convexity, very slightly inclining downward within, and possesses about the same extent and form as in the Peccary.

The anterior mental foramen is placed below the second premolar, or the interval between it and the first. Not unfrequently there is a second, or even a third, but smaller foramen, situated at variable distances posterior to the principal one.

Dentition.—The dentition of *Oreodon* is remarkably distinct from that of any living or any known extinct genus, and it indicates the combined habits of ruminating and suilline animals, or, in other words, it appears to characterize a ruminating hog.

The formula of the permanent dentition is as follows:—

$$i. \frac{3\ 3}{4\ 4}\ c. \frac{1\ 1}{1\ 1}\ p.m. \frac{4\ 4}{3\ 3}\ m. \frac{3\ 3}{3\ 3} = 44.$$

The true molars are constructed after the type of those of recent ruminants; the premolars approach most, among recent animals, those of the deer tribe; the canines, those of the peccaries; and the incisors occupying both jaws, in this relation among living ruminants, find their nearest representative in the camel tribe.

Relative Position of the Teeth.—(Pl. II.—VI.) The upper molars, internally, are nearly parallel upon the two sides of the jaw, but externally they are convergent forward from the second true molar, by reason of the gradual decrease in size of the teeth in advance of this. Viewed laterally, they present a convexity downward rather greater than that in the Deer.

Each true molar, at its antero-external margin, projects exterior to, and a little in advance of the contiguous margin of the preceding tooth, as among existing ruminants, in *Anoplotherium*, *Rhinoceros*, etc.

The fourth premolar, and in some specimens the third, project at their antero-external margin exterior to the outer face of those preceding, but never in advance of this point.

The second premolar, on the contrary, has its anterior margin a little within the position of the first, as if this had been pushed backward and outward to form the small hiatus existing between it and the canine.

The face increases slightly in breadth in advance of the premolars; apparently for the accommodation of the canines, which, at the base of their crowns, project one-third their transverse diameter exterior to the first premolar.

The hiatus existing between the upper first premolar and the canine, is only sufficiently large to receive the point of the inferior canine. Between the upper canine and the incisors there is usually, but not in all the specimens, a hiatus smaller than the former, adapted to the accommodation of the outer angle of the crown of the large lateral incisor below.

The superior incisors are arranged in the arc of a circle greater than in the Wolf, and they project vertically downward, and very little in advance of the position of the canines.

The inferior molars of the two sides are internally nearly parallel; and are much more nearly so externally than the upper molars, from the breadth of these being less uniform. Viewed laterally, the triturating surface of the former presents a concavity corresponding to the convexity of the series above.

The relation of the true molars and of the third premolar to one another, is the same as in existing ruminants. The anterior margin of the second premolar is placed within the position of the first, and the corresponding portion of the latter holds the same relation to the canine; apparently as if these teeth had been pushed outward and backward in a jaw, in which little space could be spared to form, anterior to the lower canine, a hiatus of sufficient size to accommodate the cusp of the upper one. This hiatus is in a trifling degree less than that posterior to the upper canine.

The inferior incisors are oblique in their position, but relatively, less so even than in the Musks; and they form a longer arc of a lesser circle than those of the upper jaw.

When the jaws are closed, the inferior molars are situated within the line of the outer lobes of the upper true molars, but anteriorly they are placed very little within the outer faces of the upper premolars.

The intervals between the pyramidal crowns of the premolars are triangular, and the three inferior crowns are included by the four superior ones.

The crown of the superior canine is directed downward and outward, and, as in the genus *Palæotherium,* it is placed in advance of the canine below; a position which is exceedingly anomalous. Its point projects considerably exterior to the inferior canine, and only its internal angular margin occupies the hiatus in advance of the latter tooth.

The crown of the lower canine is directed upward, and a little forward and outward; and its point, though projecting slightly exterior to the hiatus provided for it above, is yet within the line of the outer surface of the upper canine.

The inferior incisors, laterally, are included within the circle of the superior; while the cutting edges of those anterior come in contact with the edges of the corresponding teeth above. The outer sides of the upper incisors are vertical, and those of the lower incisors incline to them at an angle of about 50°.

Superior Molars.—(Pl. II. Figs. 1, 3; III. 1, 2; IV. 6; V. 2, 3; VI. 2, 3, 4, 6.) The crowns of the upper true molars are composed of four symmetrical lobes, as in all existing ruminants. Among these, they approach most in their form the crowns of the corresponding teeth of the Deer, but they are more expanded transversely, and more square, the interlobular depressions more shallow, and the inner lobes are uncomplicated with accessory folds or lobes. Among the extinct ruminants of which we have any knowledge, they resemble most those of *Merycopotamus;* but they differ from the teeth of this genus in a number of particulars, more especially in the non-isolation of the outer lobes (which conjoin in a prominent buttress, as in *Anthracotherium*), and in the relatively slight degree of development of the basal ridge, which does not traverse the bottom of the transverse interlobular space, as it does in the *Merycopotamus.* From the corresponding teeth of *Anthracotherium, Hyopotamus,* and *Caenotherium,* they differ most in the absence of the fifth constituent lobe, which in the former two genera is introduced between the anterior pair of normal lobes, and in the last genus between the posterior pair. From those of *Dichodon,* they differ in the absence of the curiously cuspidate basal ridge, and in the less acuteness of the lobes. Finally, from the true molars of the most aberrant forms of extinct ruminants, the *Anoplotherium* and *Chalicotherium,* they differ as characteristically as do those of any of the existing members of the family.

When unworn, the lobes of the true molars have acute crescentic summits elevated to a middle point. The outer lobes anteriorly, and consequently where they conjoin in each tooth, form prominent columns, not robust and convex, as in *Hyopotamus*, but antero-posteriorly compressed and rather abruptly expanded near the base of the crown, where they are more or less connected by intervening portions of a basal ridge. In some specimens, however, this ridge is obsolete, more especially at the postero-external lobe. (II. 1, 3; III. 1, 2.)

In two specimens under investigation, the basal ridge externally is well developed, strong, and rough at the margin; and it exhibits a tendency to extend itself on the outside of the projecting columns, as is indicated by a roughness of the enamel. (III. 1, 2.)

As in all ruminants, there is a disposition in the postero-external lobe of the molars to form a posterior column or fold, which, however, to a great extent, except in the case of the last molar, remains aborted; and which, in the external view of the jaw, is concealed by the anterior column of the antero-external lobe.

The outer faces of the external lobes of the molars between the columns are transversely concave, slightly prominent in the median line; and they incline at an angle of about 40°. The inner faces are nearly vertical, but they incline slightly outward, and are angularly convex.

The internal lobes appear broader transversely than the external, because their outer face becomes confluent at the basal third of the inner face of the latter.

The outer face of the internal lobes is concave, and very slightly prominent in the median line; and it inclines to about the same extent as the corresponding surface of the external lobes. The inner faces are not quite as angular in their convexity as those of the external lobes.

The summits of the latter are confluent at the apex of the median outer column, but those of the internal lobes are not confluent. The anterior extremity of the summit of the postero-internal lobe ceases abruptly, and it is included between the anterior half of the inner face of the postero-external lobe, and the posterior extremity of the summit of the antero-internal lobe, which latter extremity bends forward to the posterior part of the inner face of the antero-external lobe, and then terminates abruptly.

Portions of a basal ridge, which are sometimes more or less excavated, and have an irregular crenulated margin, usually exist at the bases, anteriorly and posteriorly, of the internal lobes. Occasionally they are continuous around the base of the postero-internal lobe of the second and third true molars, but more frequently upon the latter alone than upon both. Between the lobes internally, the ridge sometimes forms a single tubercle, simple and obtuse, or excavated.

In the trituration to which the true molars are subjected in mastication, the summits of the anterior lobes suffer at first more than those of the posterior, and the internal more than the external; but, in course of time, the abrasion is nearly equalized over the grinding surface.

When the dentinal substance is first exposed by the removal of the enamel summits of the external lobes, the surface presents the form of the letter **W**, or of two crescents, confluent where contiguous. At the same period, the inner lobes present distinct broader crescents of exposed dentinal substance. As the attrition proceeds, the latter crescents increase in breadth, and also become continuous.

Subsequently, small portions of the external faces of the inner lobes, in continuity with greater portions of the internal faces of the outer lobes, are left upon each tooth, in the form of two crescentic islets of enamel, occupying the middle of broad spaces of dentine. The portions of the external faces are first obliterated, but they are speedily followed by the remaining portions of the other faces; and the teeth then present only broad, quadrate, dentinal surfaces, bordered by enamel, and bilobed internally and externally. (VI. 2.)

All the premolars have a general resemblance to those of *Anoplotherium*, but they differ in many details of structure. The fourth premolar is composed of a single pair of symmetrical lobes, as are the functional three premolars of all existing ordinary ruminants, and the corresponding tooth of the Camel. The lobes of the fourth premolar are the equivalents of one of the transverse pairs of the true molars, except that they are considerably larger, and that the column at the antero-external margin is not as prominent. (II. 1, 3; III. 1, 2.)

The anterior three premolars decrease a little in succession forward, and the crown of each forms an irregular trilateral pyramid with a pointed apex. The third premolar is broader posteriorly than anteriorly; and, in transverse section, it forms nearly an equilateral triangle. The others are of more uniform breadth transversely, and in section have a more elliptical outline.

In all the premolars, the outer face is cordiform; and in the last of them, it is concave transversely; in the third it is less so; and in the remaining two it is convex, in consequence of the gradually increasing breadth of the median prominence common to these and the true molars.

The inner side of the crown of the third premolar presents a lobe which is like the internal lobes of the true molars; but it is aborted, and it occupies a position exactly corresponding with that of the posterior half of the inner face of the external lobes of the true molars. In advance of this aborted lobe, the anterior half of the inner face of the tooth presents a double enamel fold, inclosing a pair of *culs-de-sac*.

The inner portions of the two anterior premolars present the same elements of structure as the third, but in a more rudimentary condition; in the first premolar, the postero-internal lobe, as it exists in the two premolars behind it, being almost entirely obsolete.

From mastication, the grinding surface of the fourth premolar passes through the same phases as the corresponding portion of a true molar. Among our specimens of the other premolars, there are none which exhibit the course of attrition; but there are several which indicate that, at first, the wearing is greatest at the postero-internal side.

Inferior Molars.—(Pl. II. Figs. 1, 3; III. 3–6; IV. 4; VI. 4–11.) As in all existing ruminants, the lower true molars of *Oreodon* have two pairs of symmetrical lobes; and the last of the series has an additional lobe.

In their form they bear a very great resemblance to those of the Deer, but they are relatively more expanded in breadth, and the transverse pairs of lobes are less oblique relatively to each other. Other and important differences are briefly as follows :—

The inner lobes internally are less prominent in the middle line; their posterior marginal fold is less developed, is shorter, and more divergent; and their external face is more convex. (III. 4.)

The outer lobes are less angular externally, and are more tapering from their base.

Finally, the tubercle between the bottom of the outer lobes is not conoidal, but it appears as a transverse talon with an external angular notch.

The posterior lobe of the last true molar is relatively larger than in the Deer, and is more elliptical in transverse section. (III. 5, 6.)

In the attrition to which the inferior true molars are subjected in mastication, crescentic surfaces of dentinal substance are exposed by the removal of the originally acute enamel summits of the lobes. As the wearing progresses, the dentinal crescents increase in breadth; most rapidly upon the outer lobes until the abrasion reaches the bottom of the inner faces of these; at which period the outer dentinal crescents are considerably below the inner ones, and are twice as broad. At the next stage, a small portion of the internal face of the outer lobes, in union with a larger portion of the external face of the inner lobes, is left between each transverse pair of lobes as a crescentic islet of enamel upon a broad surface of dentine. The external portion of the islet is next obliterated, and is soon followed by the remainder or internal portion. At a late period, the upper surface of the external portions of the basal ridge is worn away by the apices of the outer lobes of the superior molars, so as to leave shallow pits in the dentine. (VI. 5, 8.)

The inferior premolars exhibit more peculiarity in comparison with the true molars, than do the anterior three upper premolars. (II. 1, 3; III. 3, 4; VI. 4, 5, 8, 9.)

In the Deer, it is easy to trace in the lower premolars, the constituent lobes of the true molars. Thus, in the third premolar the anterior pair of lobes are very like the corresponding pair in the true molars, but the posterior pair have undergone modification in size, form, and position. In the second premolar, the antero-internal lobe of the true molars appears to be represented by the anterior double fold, their corresponding outer lobe by the succeeding largest fold, and their posterior pair of lobes by the two hinder folds. In the first premolar, all of the four lobes may be traced as in the second premolar; but all, save the homologue of the antero-external lobe, are reduced to their most rudimentary condition, and in some individuals are entirely obsolete.

The plurality of lobes of the true molars is much less readily distinguishable in the premolars of *Oreodon* than in those of the Deer; nevertheless, their gradual disappearance may be traced.

The premolars decrease in size from the last to the first, and each presents an antero-posteriorly broad pyramidal crown. The transverse section of the crowns of the posterior two at their base is an isosceles triangle with the apex directed forward; while the section of the crown of the anterior at the same position is elliptical.

Externally they are all prominent at the middle and are convex transversely, and the posterior half of the surface is directed outward; while the anterior portion presents forward and outward. The first premolar is simply convex externally; the second presents a slight fold at the posterior part of the external surface; and the third is depressed posterior to the median prominence of the same surface. Postero-internally the last premolar is excavated into a quadrilateral cul-de-sac, of which the inner boundary is a pyramidal tubercle, the homologue of the postero-internal lobe of a true molar. The outer apex of the tooth continues inward upon the summit of a pyramidal sub-lobe, apparently homologous with the antero-internal lobe of a true molar. In advance of this sub-lobe, there is a broad notch sloping to the base of the tooth.

The second premolar exhibits internally a rudimentary form of the corresponding portion of the tooth behind. The tubercle has disappeared; and the sub-lobe in advance of this has degenerated into an oblique ridge descending obliquely backward from the summit of the tooth. The surface postero-internal to this ridge is sloping, and receives from it a slight abrupt offset. Anterior to the ridge, the internal surface presents a simple, broad, sloping depression.

The first premolar exhibits internally a simple ridge descending from the summit obliquely backward, and dividing the surface into two depressions, of which the anterior is the broader.

In tracing upon the premolars, among our specimens, the effects of mastication, it is observed that when the enamel is nearly obliterated from the triturating surfaces of the true molars, the bottom of the posterior cul-de-sac in the third premolar is left as a small oval islet of enamel upon a broad shoe-formed surface of dentine; while the second premolar is worn so as to present a surface of dentine having the form of a Greek ε. (VI. 8.)

As in existing ruminants, the inferior molar teeth of *Oreodon* are inserted by two fangs placed one before the other. The last molar having a fifth lobe, the posterior fang is proportionably broad, and is constituted by a confluent pair.

Canines.—(Pl. II. Figs. 1, 3; III. 1, 2.) The possession of well developed canine teeth in both jaws, is one of the most remarkable characteristics of *Oreodon.* The form of these teeth is peculiar; neither those above nor below grow from persistent pulps; and only the crowns are capped with enamel. Those which I have concluded to belong to the male of *Oreodon*, are more robust than those attributed to the female.

The upper canine, commencing at the extremity of its fang above the interval of the first two premolars, curves forward, downward, and in a less degree outward. In the male, it is directed more externally than in the female. The fang of the upper canine renders the face slightly prominent along its course, and is trihedral, with rounded margins, and approaches more or less a cylindroid form. In some specimens it is flattened, or nearly so, upon the outer side, and exhibits one or two slight flutings at the lower part.

The crown is a trihedral pyramid, with the lateral margins acute, the anterior margin subacute, and the summit pointed. Its sides are nearly equal; one being directed outwardly, another inwardly and forward, and the third posteriorly. The first is nearly plane; and the second is also nearly plane, and presents a median obtuse ridge, which vanishes above in the fang, and below towards the point of the crown. The remaining side is visible in only one specimen; its enamel is worn off, excepting a small portion at each basal angle; and it is quite plane and smooth, and is a little larger than the other sides.

The point and lateral margins of the crown of the upper canine were kept constantly sharp, by being subjected to attrition only at the posterior part, where it came in contact with the corresponding tooth of the lower jaw.

The inferior canine is straight, and is directed from the end of its fang obliquely upward, forward, and outward.

The fang is variable in its form in different specimens; in one its section is transversely compressed and elliptical, in another cylindroidal, and in a third quadrilateral with rounded margins.

The crown is a broad, transversely-compressed pyramid, with trenchant margins converging to a slightly rounded but sharp summit. It is of about the same length as that of the upper canine, but is a little broader.

The inner face is convex; and the outer face is angularly convex, with one portion directed outwardly, and the other antero-externally.

The anterior margin is directed inward and forward, and at its outer part, when the jaws are closed, comes into contact with the posterior face of the upper canine, so as to suffer from attrition most in this position. The margins at the bottom of the crown project slightly beyond the outline of the fang.

The enamel of the canines is a little thicker externally than internally, and is slightly corrugated; and that upon the trenchant margins of the lower ones has a slightly crenulated appearance.

Incisors.—(Pl. II. Figs. 1, 2.) In only one specimen among the many under investigation are the incisors preserved, and in this, their outer face alone is visible, the other being enveloped in a matrix, the removal of which would endanger their integrity. There are three incisors above, and four below, upon each side of the median line.

Of the superior incisors, the internal is smaller than the outer two, which are nearly equal in size. Their outer face is convex, and they are trapezoidal or nearly ovoid in outline, with the long diameter about one-fourth greater than the transverse. The cutting edge and inner margin are convex, and the outer margin has a slightly prominent talon.

Of the inferior incisors, the internal is the smallest; the succeeding two are nearly equal in size, and the external is a fifth larger than the others. The outer face of the anterior three incisors is convex, and oblong quadrilateral. The cutting edge of the first incisor is convex, that of the second slightly so, and that of the third straight. The lateral margins have a more prominent talon than those of the incisors above, and this is larger externally, and is situated about half-way down the crown. The outer face of the external or fourth incisor is also convex, but is more trapezoidal than the others. Its cutting edge is convex, and is above the level of those of the incisors in advance of it. The lateral margins are oblique and nearly straight.

The presence of eight incisors, in addition to well-developed and undoubted canines, in the lower jaw of *Oreodon*, appears to indicate, in accordance with the view of M. Cuvier, that the lateral or fourth incisors of existing ruminants, are true physiological incisors; and not transformed canines, as inferred by Mr. Owen, unless we adopt a hypothesis which supposes the lateral incisors of *Oreodon* to be transformed canines, and the functional canines to be the transformed first of the normal series of seven molars. The latter view is favored by the absence in *Oreodon* of the first of the normal number of molars, and also by the unusual position of the inferior canine tooth. Further, the latter has almost the exact form which would be produced by merely prolonging the crown of the first functional premolar. On the other hand, in *Palæotherium*, the lower and upper canines have the same relative position as in *Oreodon*, and yet the lower jaw has the normal number of premolars.

Temporary Dentition and Order of Succession.—The deciduous dentition of *Oreodon*, so far as can be ascertained from the specimens under investigation, is expressed by the following formula:—

$$i.\ \frac{?}{?}\ c.\ \frac{1\ \ 1}{1\ \ 1}\ p.m.\ \frac{2\ \ 2}{2\ \ 2}\ m.\ \frac{1\ \ 1}{1\ \ 1}.$$

In the order of protrusion of the temporary molars, judging from the relative extent of abrasion which these teeth have undergone in the specimens under observation, the true molar is first, and then follow the premolars in succession from behind forward.

Form of the Temporary Molars.—(Pl. IV. Figs. 4, 5; V. 2, 3; VI. 6, 7, 10, 11.) The superior temporary true molar has exactly the same form as the permanent true molars, but is about one-sixth less in size than the first of these. (V. 2, 3.)

The crown of the second upper premolar is composed of three lobes like those of the true molars: two posterior and transverse, the other anterior and opposite to them. It resembles very much the crown of the fourth permanent premolar in conjunction with that of a small third premolar. The anterior lobe at its inner side is connected with the adjacent side of the postero-internal lobe by means of a shallow fold, which forms a *cul-de-sac* between the two.

The anterior premolar has nearly the same form as the corresponding permanent tooth, but is smaller in size. Its antero-internal *culs-de-sac* are not as deep as in the latter, and the external of these is twice as broad as the other, but is shallower.

The inferior deciduous true molar, as in all existing ruminants, possesses three pairs of symmetrical lobes, which have the same form, and the same relative position with one another as those of the permanent true molars, but which decrease in size from behind forward. (IV. 4, 5; VI. 6, 7, 10, 11.)

The two deciduous premolars of the lower jaw closely resemble in form the corresponding permanent teeth.

The normal first superior molar appears to belong to the permanent series, succeeds all the temporary molars in the order of protrusion, and has no deciduous predecessor.

The permanent true molars successively protrude and occupy their functional position before any of the deciduous molars are shed. The displacement of the latter by their permanent successors, appears to begin with the eruption of the last of these, which is followed by those in advance. The first permanent premolar of the upper jaw appears to have protruded after the deciduous teeth, and occupied a position with them in the functional series, but remains after these are shed.

In comparing Prof. Owen's figure of the series of upper molar teeth of *Hyopotamus vectianus* (in Plate VII. Vol. IV., of the London Quarterly Journal of the Geological Society), with that stage of the dentition of *Oreodon* in which the permanent true molars occupy their functional position in company with the deciduous teeth, I cannot avoid a suspicion that what are represented as the third and fourth permanent premolars (the latter of which has the exact form of the succeeding permanent true molars), are really deciduous teeth, which were to give place to more simple, bilobed, anthracotheroid, permanent premolars. The teeth, however, represented as of the latter character, to belong to the deciduous series, appear too slightly worn in relation to the condition presented by the first permanent true molar, although it is not improbable that the permanent true molars might follow the eruption of the deciduous teeth so rapidly as to exhibit little difference in the relative extent of their abrasion. In the lower jaw of an undoubtedly adult individual of another species, *Hyopotamus bovinus* (represented in Fig. 3 of Plate VIII. of the same work), it is observable that the anterior two permanent true molars are deeply worn, while the two permanent premolars in advance are but slightly abraded, which could not be the case under such circumstances as those presented by the upper teeth in the figure first referred to.

Oreodon Culbertsonii.

(Pl. II.; III.; IV. Figs. 1–5; V. Figs. 1, 2; VI. Figs. 8–11.)

Merycoidodon Culbertsonii, Leidy: Proc. Acad. Nat. Sci., 1848, iv., 47, pl. figs. 1–5.
Oreodon priscus, Leidy: Proc. Acad. Nat. Sci., 1851, v., 238.
Cotylops speciosa, Leidy: Proc. Acad. Nat. Sci., 1851, v. 239.
Oreodon Culbertsonii, Leidy: Owen's Report of a Geol. Survey of Wisc., etc., 548.

Of this species of *Oreodon*, I have had the opportunity of examining the following specimens:—

1. A very much fractured skull, with the posterior extremity, zygomata, postorbital arches, upper margins of the orbits, upper part and left side of the end of the nose, and most of the teeth of the left side broken away.

On the right side, the entire series of teeth exist in both jaws in a state almost as perfect as when the animal was living. (Plate II. Fig. 1.)

From the collection of Mr. T. A. Culbertson.

MEASUREMENTS.[1]

	Inches.	Lines.
Height of face from infra-orbitar foramen to the end of the angular process of the os frontis	1	4
Distance of supra-orbitar foramina from the ossa nasi		7
Height of symphysis of lower jaw	1	8

[1] As far as the specimens permit, measurements are given to show the variations which may in this way exist in different individuals.

	Inches.	Lines.
Depth below the hinder portion of the lower middle premolar		11
Length of entire series of upper teeth	4	3
Length of entire series of lower teeth	4	4
Length of series of upper molar teeth	3	4
Length of series of lower molar teeth	3	3
Length of series of upper true molar teeth	1	10
Length of series of lower true molar teeth	2	
Antero-posterior diameter of last upper molar		9
Antero-posterior diameter of last lower molar		11
Length of crown of the canine teeth		7
Extent of hiatus behind the upper canine		3
Extent of hiatus between canines and incisors		1½

2. A very much mutilated skull, with the zygomata, upper superficial portion of the face, orbital margins, and rami and greater portion of the base of the lower jaw broken away. The specimen is very much fissured, apparently from exposure to the weather since its exhumation. All the teeth, except the crowns of the canines and incisors, remain on both sides.

The form, proportions, and size of the specimen correspond pretty closely with that first indicated.

From Messrs. Culbertson's collection.

MEASUREMENTS.

	Inches.	Lines.
Length of head from occipital condyles to the anterior incisive alveoli	7	5
Breadth of face at infra-orbitar foramina	1	8½
Breadth of face above first premolar	1	7½
Breadth of face at roots of incisors just in advance of the upper canines	1	2½
Height of symphysis of lower jaw	1	7
Depth of lower jaw below second premolar	1	½
Length of series of upper molars	3	5
Length of series of lower molars	3	3
Length of series of upper true molars	1	9½
Length of series of lower true molars	1	11

3. A much broken anterior portion of a skull, agreeing very closely in its form and proportions with the corresponding part of the preceding specimens.

From Capt. Van. Vliet's collection.

MEASUREMENTS.

	Inches.	Lines.
Breadth of face at infra-orbitar foramina	1	9
Distance from the latter to the frontal angular processes	1	4½
Length of series of upper molars	3	5
Length of series of lower molars	3	4
Length of series of upper true molars	1	9
Length of series of lower true molars	2	

4. An anterior portion of a skull containing all the true molars and one last premolar, with fragments of the others. It is accompanied by a portion of lower jaw containing the last premolar and the succeeding two true molars.

The specimen agrees with the preceding, except that the face is more flat above so as to appear of less depth, and in transverse section more square.

From Messrs. Culbertson's collection.

MEASUREMENTS.

	Inches.	Lines.
Breadth of face at infra-orbitar foramina	1	6
Breadth of face above the first premolar	1	6
Height from infra-orbitar foramina to angular processes of os frontis	1	2½
Breadth of ossa nasi between the points of the latter processes		11½

5. A portion of a very much mutilated skull, with attached fragments of both sides of the lower jaw widely extended from the upper teeth. Upon one side the specimen contains all the upper true, and the lower posterior two true molars, and on the other side the upper posterior two and the last lower molar teeth.

From Messrs. Culbertson's collection.

MEASUREMENTS.

	Inches.	Lines.
Length of series of upper true molars	1	11
Antero-posterior diameter of the upper last molar		10
Antero-posterior diameter of the lower last molar	1	

6. A fragment of the right side of the face of a young animal, containing a portion of the first, the entire second, and the inner portion of the third temporary molars, and the succeeding two permanent molars.

It was this specimen to which I applied the name *Cotylops speciosa*, erroneously supposing it to be distinct from *Oreodon*.

From Capt. Van Vliet's collection.

7. Thirteen fragments of upper and lower jaws, all containing from one to three true molars, except one, in which are preserved the anterior two lower premolars. They apparently belonged to seven different individuals.

From the collections of Dr. Owen, Capt. Van Vliet, Dr. Prout, Prof. O'Loghland, and Messrs. Culbertson.

8. A portion of the right side of the lower jaw of a young animal, with the remains of the anterior two temporary premolars; the entire temporary true molar, considerably worn; and the succeeding two permanent molars. (Pl. VI. 10, 11.)

From the collection of Capt. Van Vliet.

9. A nearly entire skull, comparatively slightly fractured, and wanting only the end of the nose anterior to the canines, the upper of the latter, the incisors, zygomata and post-orbital arches, a portion of the parietal crest, and the right angle of the lower jaw.

Its details of form vary in a very slight degree from those of specimen 1. In the latter, it was observed in the table of measurements, a hiatus of one and a half lines in extent existed between the canines and incisors, but in the specimen under inspection no hiatus existed in a corresponding position of the lower jaw, the lateral incisor having been in contact with the canine. (Plate II. Fig. 2.)

From the collection of Dr. David Dale Owen.

MEASUREMENTS.

	Inches.	Lines.
Breadth of face at infra-orbitar foramina	1	6¼
Breadth of face above first premolar	1	3
Distance from infra-orbitar foramina to frontal angular processes	1	4
Breadth of ossa nasi at the points of the latter processes		8¾
Length of series of upper molars	3	4¼
Length of series of lower molars	3	4
Length of series of upper true molars	1	10
Length of series of lower true molars	2	½

10. A skull with the anterior extremity of the nose, the zygomata, and summit of inion broken away. The forehead is slightly crushed, but otherwise the specimen is comparatively well preserved. It contains all the molar teeth of both sides, the left canine, and the fang of the right canine. A small fragment of the right side of the lower jaw, containing the true molars, accompanies the former specimen.

The skull I suspect to have belonged to a male individual of *Oreodon Culbertsonii*, on account of its generally more robust character than most of the others which have been indicated; and specimen 9, particularly, I suppose to have belonged to a female.

Besides the relatively greater degree of robustness of the male skull of *Oreodon Culbertsonii*, the face is depressed or flattened above, or is not so much arched as in the female, and in transverse section it has a more square than conoidal appearance, as in the latter. The molar teeth, also, are more robust, and the true molars possess a well-developed ridge between the bases of the external columns or buttresses, and a feebler ridge exists externally at the base of the premolars. The canines are a little more robust, a little longer, and project a trifling degree more outwardly.

In the specimen under immediate inspection, the supra-orbitar foramina are nearer the centre of the forehead on each side than in any of the preceding.

The parietal region on one side of the sagittal suture presents an irregularly eroded and areolated vascular appearance, with several slight thin exostoses, indicating inflammation to have existed during the life of the animal. (Plate III. Figs. 1, 2.)

From the collection of Dr. Owen.

MEASUREMENTS.

	Inches.	Lines.
Breadth of face at infra-orbitar foramina	1	7½
Breadth of face above first premolar	1	7½
Distance from infra-orbitar foramina to frontal angular processes	1	4
Breadth of ossa nasi at the ends of the latter processes		9½
Length of series of upper molars	3	7½

	Inches.	Lines.
Length of series of upper true molars	1	11½
Antero-posterior diameter of last upper molar		9½

11. The facial portion of a skull, apparently of a male, containing all the molars except the crown of the first premolar. In section, it presents the same squareness of character as in specimen 10, and also has the same flatness above and uniformity of breadth anteriorly. The ossa nasi have been slightly shorter than those in specimen 10, and less rounded posteriorly.

The specimen is remarkable in comparison with that last indicated, because the true molars are a little smaller and the premolars a little larger; but this increase of the latter is in breadth, and not antero-posteriorly, so that it produces no effect upon the length of the series.

The basal ridge of the molars is more feebly developed internally than in specimen 10, and externally it is obsolete.

The hard palate is slightly more arched, and has a little greater breadth than in specimen 10.

From Capt. Van Vliet's collection.

MEASUREMENTS.

	Inches.	Lines.
Breadth of face at infra-orbitar foramina	1	7½
Breadth of face above first premolar	1	7½
Distance from infra-orbitar foramina to frontal angular processes	1	2
Breadth of hard palate posteriorly	1	5
Breadth of hard palate anteriorly	1	4
Extent of hiatus posterior to the upper canine		2½
Length of series of upper molars	3	5
Length of series of upper true molars	1	9
Antero-posterior diameter of last upper molar		9

12. A fragment of the face and forehead. The former in transverse section is nearly square, but is rather more arched above than in specimen 10, and is narrower and less deep than usual.

From Dr. Owen's collection.

MEASUREMENTS.

	Inches.	Lines.
Breadth of face at infra-orbitar foramina	1	5½
Breadth of face above first premolar	1	4¾
Distance from infra-orbitar foramina to frontal angular processes	1	½
Breadth of ossa nasi at the ends of the latter processes		11

13. A portion of the face and forehead of an individual just arriving at adult age. Though very imperfect, the specimen is an instructive one, as it exhibits the order of succession of the permanent to the temporary molar teeth.

Upon the right side, the last molar is preserved and fully protruded, and has the enamel summits of its anterior lobes slightly worn. The second true molar has the dentine exposed upon the summits of the lobes; most so upon that antero-internal, and least so upon that postero-internal. Of the first true molar the inner half alone is preserved, and presents the corresponding lobes with broad crescentic surfaces of dentine.

The socket of the fourth premolar had lost its tooth, and is now filled with matrix.

Portions of the crowns of the third and second premolars, yet remaining, indicate that these teeth had not been protruded from the gums.

From this account, it appears that all the permanent true molars are fully protruded before the temporary molars are shed.

The two entire teeth above indicated, are in this specimen a trifling degree smaller than in specimens 1 and 10, and yet the fragment of skull, though not of a fully adult animal, is larger than the corresponding portion of any of the preceding specimens described. In the upper view, it appears as if it had belonged to a distinct species from *Oreodon Culbertsonii*, and had it been the only specimen in the collection besides the first indicated in the list, I would have so considered it without hesitation, but, from the many variations presented in numerous individual cases, I am inclined to think it is only a variety.

The forehead is unusually long and broad; being about three-fourths of an inch greater in the former direction than in the largest specimen previously indicated. The supra-orbitar foramina are removed to double their usual distance from the fronto-nasal suture, or rather they appear to occupy the ordinary position, while the portion of the os frontis in advance of them is unusually prolonged. The lachrymal depression, also, is more shallow than usual, apparently by the spreading or expansion of the lachrymal bone; for the outer face of this is several lines higher and broader than in the preceding specimens.

From the collection of Dr. Owen.

MEASUREMENTS.

	Inches.	Lines.
Distance of infra-orbitar foramina from frontal angular processes . . .	1	6
Distance of supra-orbitar foramina from fronto-nasal suture	1	2
Length of series of upper true molars	1	9
Antero-posterior diameter of last molar		8

14. A fragment of a face of a young animal, containing on both sides portions of the temporary molars; the succeeding two permanent true molars; and, concealed within the jaw, the last molar.

From the collection of Dr. Owen.

15. The greater portion of a face and lower jaw, containing all the molars except one of both sides. It presents nothing peculiar, except a slight variation in details of size.

From the collection of Dr. Owen.

MEASUREMENTS.

	Inches.	Lines.
Breadth of face at infra-orbitar foramina	1	8
Distance from infra-orbitar foramina to frontal angular processes	1	4
Length of series of upper molars	3	1
Length of series of lower molars	3	
Length of series of upper true molars	1	8
Length of series of lower true molars	1	10

16. The skull of a young animal, accompanied by the greater portion of the left side of the lower jaw. The end of the nose and superficial portion of the right side of the face are broken away. The upper jaw, on the right side, contains all the molars perfect; consisting of the first permanent premolar and the succeeding three temporary and two true molars protruded, and the last true molar just on the point of protrusion. The portion of lower jaw also contains all the molars nearly perfect; consisting of three temporary molars and three permanent true molars, the last of which is only partially protruded.

Independently of the specimen not being adult, it evidently indicates a smaller individual of *Oreodon Culbertsonii* than any of the others previously designated. (Plate V. Figs. 1, 2.)

From the collection of Dr. Owen.

MEASUREMENTS.

	Inches.	Lines.
Length from occipital condyle to canine alveolus	6	
Length of series of upper molars	3	1
Length of series of lower molars	3	
Length of series of upper permanent true molars	1	8
Length of series of lower permanent true molars	1	10
Antero-posterior diameter of last upper molar		$7\frac{3}{4}$
Antero-posterior diameter of last lower molar		9

17. Fragment of the left side of the lower jaw of an old individual, containing the true molars and the two premolars in advance, with the characteristic enamelled triturating surfaces nearly obliterated. (Plate VI. Figs. 8, 9.)

From the collection of Dr. Owen.

MEASUREMENTS.

	Inches.	Lines.
Length of series of true molars	1	9
Antero-posterior diameter of last molar		10

18. Seven fragments of upper and lower jaws, containing true molars, apparently from six different individuals.

From the collection of Dr. Owen.

19. A skull, without the lower jaw, and with the end of the nose and posterior part of the cranium broken away. It is particularly valuable from its preserving the post-orbital arch entire on both sides. The teeth are all broken. (Plate IV. Fig. 3.)

From the collection of Dr. Hiram A. Prout, of St. Louis.

20. Fragments of the upper and lower jaw, the former containing the last two molars, the latter the last three molars. Upon these was originally established the *Merycoidodon Culbertsonii,* in the Proceedings of the Academy of Natural Sciences (vol. iv. p. 47. Plate: Figs. 1–5).

The specimens were collected by Mr. Alexander Culbertson, and presented to the Academy of Natural Sciences by his father Mr. Joseph Culbertson.

Average Measurements of Specimens of OREODON CULBERTSONII; *but principally taken from the female head represented in Plates II. and IV. Figs.* 1, 2.

	Inches.	Lines.
Length of skull from occipital condyles to incisive alveoli in the female	7	4
Length of skull from occipital condyles to incisive alveoli in the male	7	9
Length of face from antero-orbital margin to incisive alveoli	3	6
Length from post-glenoid tubercle to incisive alveoli	6	6
Length from hinder part of last molar to incisive alveoli	4	3
Length from inion to coronal suture	2	10
Length from coronal suture to end of nose	4	8
Length of os frontis at middle	1	10
Greatest breadth of skull at zygomata	4	2
Greatest breadth at inter-temporal region, near middle	1	7
Least breadth at coronal suture	1	3
Breadth at middle of post-orbital arches	3	3
Breadth of face above last molar	2	9
Breadth of face above first premolar	1	4
Breadth of face at infra-orbitar foramina	1	7
Breadth between ends of frontal angular processes		9
Breadth of each nasal bone		5
Vertical diameter of the orbit	1	3
Transverse diameter of the orbit	1	1
Greatest length of lower jaw	6	2
Height of lower jaw at coronoid process	3	3
Height of lower jaw at condyle	2	9
Height of lower jaw at last molar	1	7
Height of lower jaw at second premolar	1	1
Length of series of upper molars	3	4
Length of series of lower molars	3	3
Length of series of upper true molars	1	10
Length of series of lower true molars	2	
Antero-posterior diameter of last upper molar		9
Antero-posterior diameter of last lower molar		11
Antero-posterior diameter of penultimate lower molar		7
Antero-posterior diameter of upper premolars		5
Antero-posterior diameter of lower premolars		5½
Length of crown of upper canine	male 9 lines; female	7
Length of crown of lower canine		6¾
Breadth of lateral series of upper incisors		7½
Breadth of lateral series of lower incisors		9
Length of crown of upper internal incisor		3½
Length of crown of upper lateral incisor		4½
Length of crown of lower internal incisor		3¾
Length of crown of lower lateral incisor		5

The species is respectfully dedicated to the Messrs. Culbertson, through whose aid the first specimens were obtained upon which the genus was established.

Oreodon gracilis, Leidy.

(Pl. V. Figs. 3, 4; VI. Figs. 1–7.)

Oreodon gracilis, Leidy: Proc. Acad. Nat. Sci., 1850, v., 239; Owen's Rep. of a Geol. Surv. of Wisc., etc., 550.
Merycoidodon gracilis, Leidy: Owen's Rep., 550.

This species was first characterized in a verbal communication to the Academy of Natural Sciences in August, 1851, from several fragments of an upper and a lower jaw containing the true molars and one premolar.

The head is about two-thirds the size of that of *Oreodon Culbertsonii.*

The specimens, which I have had the opportunity of examining, are as follows:—

1. Lower and upper jaws, occiput, and os frontis of an old individual. The rami of the lower jaw are broken away, but on the left side it contains all the true molars, the third premolar, and the fangs of those in advance. The right side of the upper jaw contains the true molars, the fourth premolar, and the roots of those anterior. (Plate VI. Fig. 4, the lower jaw; Fig. 5.)

From the collection of Captain Van Vliet.

MEASUREMENTS.

	Inches.	Lines.
Length of series of upper molars	2	2
Length of series of lower molars	2	2
Length of series of upper true molars	1	2½
Length of series of lower true molars	1	4
Distance between ends of frontal angular processes		4¾
Distance between supra-orbitar foramina		5½

2. The skull of an adult, with the end of the nose, base of the cranium, and zygomata broken away. It contains upon the right side the true molars and the fourth premolar, and on the left, fragments of all the molars. Accompanying it is a portion of the lower jaw, containing the true molars. (Plate VI. Figs. 1–3.)

From the collection of Drs. Owen and Evans.

MEASUREMENTS.

	Inches.	Lines.
Breadth of cranium above roots of zygomata	1	6
Breadth of cranium at most prominent part of the temporal fossæ	1	4
Distance from bifurcation of sagittal crest to ossa nasi	1	6½
Distance between supra-orbitar foramina		3½
Length of series of upper true molars	1	3
Length of series of lower true molars	1	4

3. A facial fragment containing on the left side the last two molars, the fangs of all those in advance, and that of the canine. It is particularly valuable from the left orbit being preserved entire.

The specimen corresponds in its proportions and details with specimen 2. (Plate VI. upper part of Fig. 4.)

From the collection of Dr. Owen.

MEASUREMENTS.

	Inches.	Lines.
Length of series of upper molars	2	1
Breadth of face at infra-orbitar foramina		11½
Distance between supra-orbitar foramina		4
Distance between frontal angular processes		8½

4. The skull accompanied by the right side of the lower jaw of a young animal. The former has the posterior and superior portions of the cranium and the nose broken away; the latter the ramus and symphysis.

The upper jaw contains on the left side the molar series nearly complete, consisting of the first permanent premolar, the temporary molars, and the succeeding two permanent true molars which are fully protruded.

The portion of lower jaw contains two temporary molars, and the succeeding two permanent molars.

The forehead of this specimen is remarkable for its flatness; being much more arched in the adult. (Plate V. Figs. 3, 4; VI. Figs. 6, 7.)

From the collection of Dr. Owen.

Average Measurements of Specimens of OREODON GRACILIS.

	Inches.	Lines.
Estimated length from summit of inion to incisive alveoli	4	8
Breadth below the orbit at the maxillo-malar suture	2	5
Breadth of cranium at most prominent portion of temporal fossæ	1	4½
Breadth of cranium at narrowest portion		10½
Estimated length of sagittal crest	1	10
Length of forehead in median line	1	7
Breadth of forehead at middle of post-orbital arches	2	2
Breadth of face from above the lachrymal tubercle	1	7
Breadth of face at infra-orbitar foramina	1	
Breadth of face between ends of frontal angular processes		8½
Height from middle palate suture to fronto-nasal	1	3½
Height from middle palate suture on a line with the first premolar	1	½
Diameter of the orbit		9
Breadth of palate between fourth premolars		8½
Depth of lower jaw at last molar	1	
Depth of lower jaw at third premolar		8
Length of series of upper molars	2	1
Length of series of lower molars	2	1½
Length of series of upper true molars	1	2½
Length of series of lower true molars	1	4
Antero-posterior diameter of upper middle true molar		5
Antero-posterior diameter of upper fourth premolar		3
Antero-posterior diameter of last lower molar		7½
Antero-posterior diameter of second lower true molar		5½
Antero-posterior diameter of third lower premolar		4

Comparison between OREODON CULBERTSONII *and* OREODON GRACILIS.

Besides the great disproportion in size between *Oreodon Culbertsonii* and *Oreodon gracilis,* (the latter being nearly one-third less than the former,) there are other differences which, though slight, are important.

In *Oreodon Culbertsonii,* the sagittal crest rises from the sides of the temporal fossæ in a gradual pyramidal manner; but in *Oreodon gracilis,* the intertemporal region at its upper part is more arched, and the sagittal crest rises from it in the form of a thick, abrupt, rugged, linear ridge.

In the latter species the lachrymal depressions are relatively less deep, and the entrance of the orbits more nearly circular.

The posterior convergent extremities of the ossa nasi terminate more abruptly in *Oreodon gracilis;* or in this they are convex and in *Oreodon Culbertsonii* are angular.

The ossa tympanica are relatively much more inflated in *Oreodon gracilis;* and the prominent ridge continuous from them to the auditory process in *Oreodon Culbertsonii,* is but feebly developed in the former species.

Oreodon major, LEIDY.

(PL. IV., Fig. 6.)

Syn. *Merycoidodon major.*

A third species of *Oreodon* with some hesitation is proposed upon a fragment of the right side of the upper jaw, containing the true molars, from the collection of Dr. Owen.

The specimen belonged to a middle-aged individual, as indicated by the trituration to which the teeth have been subjected in mastication; the characteristic enamelled grinding surface of the first true molar being quite obliterated.

The teeth correspond closely in form with those of *Oreodon Culbertsonii,* but they are much larger than any of the specimens which have been attributed to the latter.

It is not improbable, that upon further investigation, the specimen may prove to belong merely to a large variety of *Oreodon Culbertsonii,* for the difference in size of the teeth from those indicated in the specimen 10, of the latter species, is not as great as that existing between the teeth of this and those of specimen 16.

MEASUREMENTS.

	Inches.	Lines.
Length of series of upper true molars	2	3¾
Antero-posterior diameter of the last molar	1	
Breadth anteriorly		11

EUCROTAPHUS, Leidy.

Eucrotaphus Jacksoni, Leidy.

(Plate VII. Figs. 4–6.)

Eucrotaphus Jacksoni, Leidy: Proc. Acad. Nat. Sci., 1850, v. 92.

Eucrotaphus auritus, Leidy.

(Plate VII. Figs. 1–3.)

Eucrotaphus auritus, Leidy: Owen's Rep. of a Geol. Surv. of Wisc., etc., 563.

The genus *Eucrotaphus* was originally proposed in the Proceedings of the Academy of Natural Sciences of Philadelphia, upon a cranial fragment presented to the Society by Mr. Alexander Culbertson through his father, Mr. Joseph Culbertson.

The specimen is remarkable for the great relative size of the pars squamosa of the temporal bone; being hardly equalled in this respect by that of the Camel or of *Oreodon*.

The family to which *Eucrotaphus* belongs has not yet been ascertained with certainty, though from the form and proportions of the cranium being so very much like those of *Oreodon*, I suspect it to have appertained to the ruminantia.

Coincidentally, Dr. Owen's collection contains the portion of a cranium corresponding to that just indicated; but it belongs to a different and rather larger species.

Besides the foregoing, no specimens have been discovered, which can be ascertained to belong to *Eucrotaphus*. From the similarity in construction of the cranium proper of the latter and of *Oreodon*, and from the decided ruminant characters of the specimens upon which *Agriochoerus* has been proposed, with the relations of size which these bear to those of *Eucrotaphus*, I suspect the latter two are in reality the same genus.

To the smaller species of *Eucrotaphus*, the head of which was about the size of that of *Oreodon Culbertsonii*, the name *Eucrotaphus Jacksoni* was given in honor of my much esteemed and distinguished friend Dr. Samuel Jackson, Professor of the Institutes of Medicine in the University of Pennsylvania.

For the second species the name *Eucrotaphus auritus* is proposed, from the relatively larger size of the auditory bullæ.

It is unnecessary to describe in detail the specimens upon which the two species are founded, for they agree so closely with the corresponding portion of the skull of *Oreodon*, that it is sufficient to point out the peculiarities of structure which distinguish them from the latter and from each other.

The lateral and upper views of the cranium proper of *Eucrotaphus* (Pl. VII. Figs. 1, 2, 4, 5,) are identical with those of *Oreodon*, except, perhaps, the pars squamosa is a trifling degree larger in the former, and the parietalia are rather more depressed in advance and upon the course of the squamous suture.

The outline of the base view (Figs. 3, 6), and the position of the foramina are also the same as in *Oreodon;* but in *Eucrotaphus*, the glenoid articulation is rather deeper; the post-glenoid tubercle is shorter and relatively very much more robust; and the os tympanica, instead of being slightly swollen at the inner termination of the vaginal crest of the auditory process, as in the former, is developed into a bulla relatively as large as in the Californian Deer.

In *Eucrotaphus Jacksoni* (Fig. 6), the auditory bulla forms a large, simple mammillary eminence, which abuts against the sphenoid bone anteriorly and the paramastoid process posteriorly, and rests with its base internally upon the margin of the basilar process and the conjunction of this with the sphenoidal body, and is outwardly continuous with a ridge the homologue of the vaginal process.

In *Eucrotaphus auritus* (Fig. 3), the auditory bulla has the same connections as in the former, but in addition rests against the post-glenoid tubercle; and it is relatively slightly larger, and laterally compressed.

Fam. 2.—Paridigitata Ordinaria.

Gen. **ARCHAEOTHERIUM,** Leidy: (*Entelodon?* Aymard.)

Archaeotherium is a remarkable genus of suilline ungulata combining apparent ruminant and carnivorous characteristics. In the form of its superior molar teeth it exhibits an affinity to the extinct *Choeropotamus*, Cuvier, and in a less degree to the *Hyracotherium*, Owen; but, judging from a sketch in Gervais's Zoologie et Paleontologie Françaises,[1] of the upper molars of *Entelodon*, Aymard, it approaches this much more nearly than either the former. Indeed, the posterior five superior molars of *Entelodon* and *Archaeotherium* are so alike in relative position, proportion, and form, that I consider it doubtful whether the latter is distinct from the former; but not having an opportunity of examining the original descriptions and figures of Aymard,[2] nor of extending the necessary comparisons, I have provisionally retained the generic name originally proposed.

Archaeotherium Mortoni, Leidy.

(Plate VIII; IX; X. Figs. 1–7.)

Archaeotherium Mortoni, Leidy: Proc. Acad. Nat. Sci., 1850, v. 92; Owen's Rep. of a Geol. Surv. of Wisc., 558.
Archaeotherium (*Entelodon?*) *Mortoni*, Leidy: Owen's Rep. etc., refer. to Table X.

The species *Archaeotherium Mortoni* was established in the Proceedings of the Academy of Natural Sciences (Vol. V. p. 92, for 1850), upon a fragment of a face containing the third and fourth premolars of the left side, presented to the Academy by Mr. Alexander Culbertson.

Later, I have been enabled very greatly to extend our knowledge of this animal by the investigation of several interesting specimens in the collection of Dr. Owen.

One of these is a portion of the face very much mutilated, of an adult individual,

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[1] P. 102, p. 2, 26, fig. 12.

[2] Mem. Soc. Agric. Sci., etc., du Puy, t. xii. p. 240; 1848. *Gervais.*

containing, on both sides the anterior two true molars, and the fangs of the last molar and of the last premolar. The other specimen, much the most important, consists of the greater portion of the skull of a young animal, in which the anterior two permanent true molars had protruded, but all the other permanent molars were yet concealed within the jaw. It is broken into two pieces, and is accompanied by fragments of both sides of the lower jaw. The upper part of the face, left orbit, and left zygoma are broken away, but upon the right side the latter two are almost perfect. The upper jaw, in its present condition, contains upon the left side the posterior five permanent molars (those concealed within the jaw having been artificially exposed), and upon the right side, the permanent true molars and the posterior two temporary molars. The fragments of the lower jaw consist of one of the left side containing the posterior five molars, of which the first and last had not yet protruded; and two of the right side, of which one is the angular portion, and the other contains the last temporary molar, the permanent last premolar and the first and last permanent true molars.

Description of the Skull.—The form of the head of *Archaeotherium Mortoni* is so peculiar that I know of none among existing ungulata with which to compare it. In viewing it from above, it resembles more in general configuration that of the Lion or other species of *Felis,* than it does that of any of its own tribe now in existence. From the head of the Lion, however, it differs in numerous important points, among the most striking of which, are, the uniform height forward of the sagittal crest, the recession of the temporal fossæ, the verticality of the zygomatic root, the existence of a post-orbital arch as strong as that of the Camel, the verticality of the orbital entrance, the relatively great size and depressed character of the forehead, the extent of the lachrymal bone, the more prolonged and demicylindroidal form of the face, the advanced position of the infra-orbital foramen, etc.

Lateral View.—(Pl. IX., Fig. 1.) In the side view of the head, the upper outline descends slightly from the inion, then rises towards the forehead, and again descends along the face as in the Lion, but relatively not to the same extent. The outline of the inion appears more oblique than in the Peccary, and is intruded upon by the occipital condyles and a vertical convex prominence above them.

The temporal fossa is quite transverse in its direction in comparison with that of the Hog and Peccary, and, as in these, its position is more posterior than in the Lion; but it is relatively longer and less deep than in the former animals, and is as much more capacious than these, as is that of the latter animal. Its increased capacity is not only produced by extension upward upon a strongly developed parietal crest, but also, as in the *Choeropotamus* and Lion, by the greater extension outwardly of the zygoma than in the Hog or Peccary.

The root of the zygomatic process in association with the mastoid and paramastoid processes forms a remarkably strong scroll-like apophysis, which protrudes directly outward from the lateral margin of the inion, and expands like the mouth of a trumpet, is open below; and it leads to the meatus auditorius. Its anterior surface is an almost vertical convexity, nearly two inches in depth, and contributes very greatly to the extent of attachment of the powerful temporal muscle. Externally, the zygomatic process becomes abruptly narrowed to less than half the depth of its root, and from this position it turns directly forward and terminates by resting upon a long rectangular notch of the malar bone.

The posterior half of the outer surface of the zygoma forms a nearly vertical plane; but anteriorly, where formed by the malar bone, it is remarkable for its extraordinary depth; being over two inches, and is vertically plane above, but slightly bent outwardly below.

In the specimen, the sagittal crest is broken at the inion and along its free margin, but it is yet sufficiently entire to exhibit the remarkable uniformity of its height in comparison with that of the Camel and Lion. Posteriorly, as in the two latter, it has the appearance of having contributed to the formation of a strong process overhanging the inion, but it is not as concave laterally as in either of these animals.

The margin of the temporal fossa bordering upon the inion is acute, but forms no trace of a projecting crest.

The post-orbital process of the os frontis is as thick and strong as in the Camel; and, as in this, has nearly the same direction outward and backward, and it joins an equally short and strong process of the os malæ.

The temporal surface along the sagittal crest is concave, but below the base of this is uniformly convex in the vertical direction.

The orbit is relatively larger than in the Hog or Peccary, and is broader below; is vertical and ovoidal at its entrance, and is directed outward and forward at an angle of about 45°. Its superior margin is prominent and obtuse, and the lachrymal border forms a simple, compressed mammillary eminence, bounded above and below by a rounded notch. Just internal to the lower notch is a single lachrymal foramen. Below the orbit the malar bone is remarkably shallow, and its surface, from the infra-orbital margin, slopes outward, downward, and backward.

The post-orbital arch is even relatively stronger than in the Camel, and has about the same form. The possession of this arch by *Archaeotherium* is a remarkable peculiarity, as it does not exist in the closely allied *Choeropotamus*, nor in any of the recent suilline genera, except as an inconstant characteristic in the *Hippopotamus*.

The side of the face is vertically convex, and is directed forward in a straight line from the position of the termination of the malar bone.

The outer face of the lachrymal bone is slightly bent and nearly plane and vertical. The infra-orbitar foramen is vertically oval, and is situated above the position of the penultimate premolar, and nearly three inches in advance of the orbit.

Superior View.—(Pl. IX. Fig. 2.) In the upper view of the head of *Archaeotherium*, the cylindrical form of the interparietal region, bounded above by the high sagittal crest, is a striking peculiarity of the genus.

Between the zygomata the breadth of the head is relatively greater than in feline animals.

The space inclosed by the zygomatic arches is as capacious as in the Lion, but is relatively a little longer and not quite so broad, and is oval in form.

The forehead and prognathous face much resemble those of the *Hyracotherium*.

The former is relatively broad compared with that of the Hog and Peccary, and in this character and in its form is more like that of the Camel.

The sagittal crest at its bifurcation is, to an extraordinary degree, strong and prominent, and the fronto-temporal ridges leading from them are at first elevated and acute, but afterwards decline and become irregular in their course outwardly.

The forehead presents a rugged appearance; is prominently convex on each side above the orbits, and is deeply depressed in the middle. In the greater part of one side remaining in the specimen, over the orbit, are two small vasculo-neural foramina; and near the middle line and the fronto-nasal suture, is a fronto-orbital foramen, which is relatively very small to that of the Hog or Peccary. The face has the form of a demi-cylinder very slightly convergent forward. Its upper part in the latter direction forms a very slightly concave slope similar to that existing in the same position in the *Dicotyles labiatus.*

Posterior View.—(Pl. X., Fig. 6.) The inion forms a broad triangle, from the middle of the base of which the occipital condyles project downward and backward, and these have very nearly the same form and relation to each other as in the Hog.

Above the condyles the occiput forms two vertical convex prominences separated by a concavity which extends to the summit of the inion, as in the Hog and Peccary, but is deeper than in these. Laterally, the inion is depressed into a deep pit, at the bottom of which is a large foramen communicating with the interior of the cranium, as in the Camel.

Inferior View.—(Pl. VIII., Fig. 1.) The base view of the skull bears considerable resemblance in its form to that of *Choeropotamus;* but posteriorly it is relatively broader, from the greater degree of extension outwardly of the zygomata.

The basilar process is demi-cylindroidal, convergent anteriorly, and terminates in two lateral abutments, which rest against a corresponding pair extending as lateral ridges from the post-sphenoidal body.

The post-sphenoidal body at its middle forms a concave gutter, and anteriorly terminates at the orifice of a very large azygous canal, which also exists in the Hog, but in a relatively feebly developed condition.

The anterior condyloid foramen occupies a position at the bottom of the concave lateral portion of the basilar process, a few lines in advance of the condyle.

In front of the latter foramen is a large, irregularly crescentic foramen lacerum, which surrounds the inner side of the auditory bulla.

The foramen ovale is situated in front and at the extreme bottom of the zygomatic root. The foramen spheno-orbitale is placed about three-fourths of an inch in advance of the ovale, is circular, and is bounded externally by a prominent acute ridge, which curves upward and forward, and constitutes the antero-inferior limit of the temporal fossa.

The optic foramen is relatively about as large as that in the Hog, and is situated about three lines anterior to the one last described.

The homologues of the paramastoid processes or the inferior angles of the occiput are thick and strong, and are prolonged in a curvilinear manner outward and downward. In the specimen they are broken at their extremity, and they are associated with the mastoid processes, considerably external to the position of the occipital condyles, and constitute the posterior part of the infundibular expansion of the root of the zygomatic process.

The auditory bullæ, broken in the specimen, appear to have been broad and convex, but compared to those in recent suilline animals were feebly developed. A strong conoidal process projected from them anteriorly downward and forward, bounding the passage of the Eustachian tube externally, and the foramen caroticum internally. Externally, the auditory bullæ are prolonged into a broad and strong auditory process.

The external auditory meatus is circular, is relatively considerably larger than in the Hog, and is remarkable for the large infundibular expansion which leads to its entrance.

The inferior border of the root of the zygomatic process is thick and convex, and is prolonged outward and downward to the glenoid articulation.

The latter in position and form resembles that of the Peccary; but it is relatively broader and more shallow, or its anterior and posterior tubercles are shorter.

From the glenoid articulation, the zygoma converges to the face and expands outward and downward; and where constituted by the antero-inferior margin of the malar bone, it forms a prominent acute edge.

The posterior palatine notch, as in the Tapir, *Rhinoceros*, and extinct *Choeropotamus*, extends to some part of the space intervening to the penultimate molar teeth. It is about three-fourths of an inch wide at its commencement, and has nearly parallel sides and a concave bottom.

The hard palate is concave, and parallel at its sides, and is not roughened as far as preserved in the specimen.

The palate plates of the palate bones are short, as in the Hog; and the posterior palatine foramina are situated in the transverse palatal suture.

Form, Relations, and Connections of the Bones of the Skull.—The parietalia are fused at the sagittal crest into a single symmetrical bone, which descends on each side in advance of the pars squamosa, to the bottom of the temporal fossa to join the sphenoid bone, and anteriorly is notched for the adaptation of the os frontis.

The pars squamosa of the temporal bone appears to be almost entirely extended outwardly to form the deep anterior face of the root of the zygomatic process; and its suture descends so rapidly that its most anterior part is only a little over an inch from the position of the meatus auditorius.

The os frontis, even in the young animal, is single, and it contributes to nearly one-third of the extent of the temporal surface. Anteriorly, it terminates in angular processes, which extend in advance of the ossa lachrymalia, and for more than two inches along the sides of the ossa nasi.

The bottom of the fronto-nasal suture is nearly on a line with the anterior margin of the orbits, from which position the ossa nasi gradually widen to the points of the angular processes of the os frontis, and then, in the specimen, in a more gradual manner decrease in width to their broken extremities.

The facial surface of the lachrymal bone forms an oblong square measuring nearly two inches antero-posteriorly.

The maxillo-malar suture descends in the same oblique line, as that anterior to the lachrymal bone, to about the middle of the position of the penultimate molar tooth.

Inferior Maxilla.—Of the lower jaw we have the opportunity of examining only several small fragments, but fortunately these are important ones, as from the form of the superior molar teeth resembling very closely those of *Choeropotamus*, we might expect to find a lower jaw constructed like that of this animal, which is far from being the case. One of the fragments consists of the posterior extremity of the right side, externally attached to a mass of matrix. (X. 7.) The coronoid process and condyle are broken, but they appear to have preserved their relative proportion and position to one another, which are as in modern suilline animals. The technical angle, which is preserved entire, is not prolonged into a hook as in *Choeropotamus*, nor is it rounded as in the Hog and Peccary, but is almost rectangular, and lengthened slightly backward and downward, as in the Deer; and it is thick and convex at the apex. The ascending ramus is broad, and, as in the Hog, is apparently not depressed to any extent in advance of the position of the condyle. The posterior border of the jaw is vertically concave; and, indeed, excepting the condyle and coronoid process, the posterior part of the bone partakes of the form of that of the Hog and Deer.

The other fragments are portions of the lower jaw of both sides containing molar teeth; and are two inches in depth below the position of the first true molar. That of the right side is an exceedingly interesting and important piece (VIII. 2), for, as in *Anthracotherium*, it has a short obtuse process projecting from the base of the bone. The direction of the process is outward and downward, and it is situated below the position anteriorly of the last permanent premolar. From the outward curve of the process the jaw above and on a line with it is concave.

Dentition.—Of the permanent dentition of *Archaeotherium* we are acquainted only with the posterior five upper molars, and the posterior four below. These are constructed upon an undoubted suilline type, but approach none of the recent forms so much as they do those of *Hyracotherium*, or more those of *Choeropotamus*, and most, if they are not identical with, those of *Entelodon*.

In the specimens, the molar teeth above mentioned form a close row in both jaws, and their relation to one another is the same as in the Hog, Peccary, or *Hippopotamus*.

Superior Molars.—(VIII. 2; IX. 1, 3–5; X. 1.) The upper true molars are constructed after the same type as those of *Choeropotamus* and *Hyracotherium*, but differ principally in the less extent of development of the basal ridge.

The crowns of the anterior pair of true molars are quadrate with convex sides, and internally as in *Entelodon magnum* have no basal ridge like that existing in the other two genera mentioned. The grinding surface of these teeth presents two transverse rows, each of three conical lobes, of which those external and that antero-internal are the larger, and are nearly equal in size; and the remainder are subequal.

The enamelled sides of the lobes are corrugated and their apices are excavated, though feebly, compared with what they are in *Hyracotherium* and *Choeropotamus*.

Anteriorly, the crowns are embraced by a strong and deep basal cingulum or ridge, relatively more robust than in any of the allied genera.

In the first true molar a strong basal ridge passes in a festooned manner from the apex of the postero-internal lobe posteriorly to the base of the corresponding external lobe, and from this externally to the base of that in advance, but does not embrace it as in *Entelodon magnum.*

In the second true molar, as in the corresponding tooth of *Entelodon magnum,* the apex of the postero-internal lobe is continuous with a thick basal ridge ascending posteriorly from the base of the postero-external lobe; but no ridge exists externally upon the tooth as in the latter animal.

The last of the true molar series has a quadrilateral oval crown, presenting as in the teeth described, an anterior row of lobes, bounded at base anteriorly by a similar but shorter and more tuberculated basal ridge. The posterior third of the triturating surface is composed of an assemblage of four low tubercles, which correspond to the posterior lobes and basal ridge of the two molars in advance.

The posterior two premolars are not at all like those of *Hyracotherium,* but are constructed upon the same pattern as those of *Choeropotamus,* and are very much like those of *Entelodon magnum.*

As in the latter, the last premolar has a quadrilateral crown with the inner side shortest and that anterior oblique. It is composed of a transverse pair of conical lobes, of which the internal is the smaller, and both are very much larger than the homologous constituents of the true molars. Posteriorly they are associated by a strong basal ridge, a portion of which exists also at the anterior part of the outer lobe, but no portion exists internally and externally as in *Entelodon magnum.*

The crown of the penultimate premolar forms a single, large, laterally compressed conoidal lobe, resembling very much that of a corresponding carnivorous tooth. It is relatively greater antero-posteriorly, and is narrower than that of *Choeropotamus,* and is very much like that of *Entelodon magnum;* but, judging from Gervais's sketch of this tooth of the latter, is more uniform in its transverse diameter. Externally it is convex, and in its direction downward curves slightly backward. Its anterior margin is convex, but posteriorly it presents a salient margin separating the external and internal faces. Posteriorly, the internal face towards the base of the crown is rugged, and anteriorly it presents a portion of a basal ridge, which forms a double festoon downward.

The enamel of the molar teeth of *Archaeotherium* is everywhere corrugated, but this appearance wears off as age advances.

In the trituration to which the true molars are subjected, the enamel at the apices of the lobes is first worn through, and the exposed dentine afterwards extends across the latter in transverse tracts.

The posterior two premolars, in the specimen upon which the species was originally established, exhibit the result of considerable mastication. In the last premolar the posterior basal ridge is partially worn away, and the anterior portion of the same ridge and the division between the lobes are completely obliterated. The triturating surface in its present condition, presents a broad, transversely ellipsoidal disk of dentine, communicating by means of a narrow isthmus with a smaller disk, of the same form as the former, at the base of the anterior margin of the outer lobe. In the penultimate premolar the apex of the crown is worn off, leaving a subcircular dentinal surface continuous with a narrow tract, extending the length of the posterior margin. (IX. 3, 4.)

The upper true molars of *Archaeotherium*, and the last premolar are inserted by three fangs; two external and nearly vertical, and a third internal, which is broad, and is apparently composed of two portions confluent. The penultimate premolar is implanted by two fangs, which are nearly vertical, and are placed one before the other.

Inferior Molars.—(VIII. 2; X. 2, 3.) Of the lower molar teeth of *Archaeotherium* we have the true molars and the last premolar; but we have no opportunity of comparing them with figures of the corresponding teeth of *Entelodon.*

The crowns of all the true molars possess the same form, and differ only by successively decreasing from behind. They are oblong oval, and constricted at the middle, and are composed of two transverse pairs of conical lobes, with wrinkled sides. Posteriorly they are bounded by a conical tubercular heel, which relatively is not better developed in the last of the series than in those in advance; and anteriorly below the confluence of the lobes they are embraced by a thin basal cingulum.

A remarkable peculiarity of a generic character in these teeth is a transverse division of the apex of the antero-internal conical lobe, apparently as if this was composed of a confluent pair.

The last permanent premolar is constructed upon the same plan as the penultimate premolar of the upper jaw. The crown is large, transversely compressed conoidal, and slightly curved backward, and is bounded anteriorly and posteriorly by a salient margin. At the base posteriorly a ridge exists with a festooned prolongation on each side, and antero-internally a smaller and excavated talon exists with an outer simple and inner double festoon.

The inferior true molars are inserted by two broad fangs placed one before the other, and consisting each of a connate pair; and the last premolar also has two fangs, but these are simple in their form.

Temporary Dentition.—(VIII. 1, 2; IX. 1.) As in the Hog, the anterior two permanent true molars are fully protruded before the deciduous molars are shed, from which fact, together with the evident suilline character of *Archaeotherium,* it is reasonable to suppose the order in succession of the permanent to the caducous dentition is the same as in the former animal.

The upper temporary true molar resembles the upper permanent true molars, but it is very oblique antero-internally, and all the lobes of the masticating surface except the two external are quite rudimentary. At the base of each outer lobe externally there exists a festooned ridge.

The penultimate deciduous tooth has an antero-posteriorly elongated, trihedral crown; the posterior half of which is the broader, and is composed of a transverse row of three lobes, as in the true molar behind it, except that the internal one is as well developed as that external; and the anterior half forms a quadrilateral pyramid, more elevated than the lobes behind.

The deciduous true molar with its anterior portion broken away is contained in one of the fragments of a lower jaw, and is sufficiently perfect to show it keeps up the suilline character of the animal, in having an additional pair of conical lobes to the normal number of the permanent true molars.

The enamel of the deciduous teeth is thinner and less corrugated than that of the permanent teeth.

The species is named in honor of the late distinguished Dr. Samuel George Morton, of Philadelphia.

MEASUREMENTS.

(*Taken from the young specimen.*)

	Lines.	Inches.
Distance from meatus auditorius to the infra-orbital foramen	8	6
Distance from meatus auditorius to the lachrymal tubercle	5	9
Breadth of head at the transverse fronto-malar suture	7	0
Greatest breadth at lowest part of ossa malarum	8	9
Length from occipital condyles to anterior part of penultimate premolar	10	0
Distance inferiorly between the glenoid articulations	4	6
Greatest breadth inferiorly of the temporal fossæ	3	3
Greatest length inferiorly of the temporal fossæ	3	6
Narrowest part of inter-temporal region	2	3
Greatest breadth at squamous suture	2	9
Breadth at lachrymal tubercles	4	1
Breadth at posterior margin of infra-orbital foramina	2	8
Breadth of hard palate between the middle true molars	1	5

SUPERIOR MOLARS.

	Antero-posterior.	Transverse.
Diameter of seventh molar	9¾ lines.	9 lines.
Diameter of sixth molar	11¾ "	11½ "
Diameter of fifth molar	10 "	10 "
Diameter of fourth molar	9¾ "	9 "
Diameter of third molar	12½ "	7 "
Diameter of last temporary molar	10 "	8 "
Diameter of penultimate molar	11½ "	7½ post. 4 ant.

INFERIOR MOLARS.

Diameter of seventh molar	12 lines.	8 lines.
Diameter of sixth molar	12 "	8½ "
Diameter of fifth molar	10½ "	7½ "
Diameter of fourth molar	12¾ "	6 "

Archaeotherium (*Entelodon?*) **robustum**, Leidy.

(Plate X., Figs. 8–13.)

Arctodon, Leidy: Proc. Acad. Nat. Sci., 1851, v. 278.

Archaeotherium robustum, Leidy: Owen's Rep. of a Geol. Surv. of Wisc., etc., 572.

This species is proposed upon fragments of the crowns of the posterior two molars of the left side, and a portion of the crown of a canine tooth probably of the left side inferiorly.

These specimens, which belong to the collection obtained by Mr. T. A. Culbertson, I at first supposed indicated the existence of a genus allied to the Bear; but by comparison, they have since been determined to belong to a species of *Archaeotherium* larger than that described in the preceding pages.

The fragments of molars (X. 10–13) are almost identical in their form with the corresponding portion of the same teeth of *Archaeotherium Mortoni*, except that in the last molar the posterior basal ridge rises into a conical eminence or fifth lobe, which is more regular, but less prominent, and more expanded at the base than those in advance. The teeth have been almost a fourth larger than those corresponding of *Archaeotherium Mortoni.*

The fragment of the crown of a canine (8, 9) resembles more that of the Bear than that of any existing ungulates. It is curved conical in form, and presents a slight longitudinal ridge defining its outer and inner faces. It is completely covered with enamel, which is thinnest at the inner face, and is unworn in the specimen.

CHAPTER II.

DESCRIPTION OF UNGULATA IMPARIDIGATATA.

Fam. 1.—SOLIPEDIA.

Gen. **ANCHITHERIUM**, MEYER.

UNDER the name of *Palaeotherium aurelianense,* M. De Blainville has included also the *Palaeotherium monspessulanum,* and the *Palaeotherium equinum,* Lartet, seu *hippoides,* De Blainville.[1] These, according to the view of M. De Christol, (Comptes Rendus, vol. xxiv., p. 374,) do not belong to the genus *Palaeotherium,* but to a soliped, to which the name of *Hipparitherium* is given. In regard to this animal, he observes, "Ses os des membres ressemblent à un tel degré à ceux de l'Ane et du Cheval, qu'on en trouve une description très étendue et trés-rigoureuse dans les traités d'anatomie vétérinaire, et qu'on peut suivre sur ces os de pretendus Palaeotheriums les descriptions myologiques des vétérinaires aussi complétement et aussi sûrement que sur une squelette d'âne ou de cheval."

H. von Meyer had already placed this species in a new genus under the name of *Anchitherium Ezquerrae,*[2] which generic name is adopted by M. Pomel, in his classification of the *Palaeotheria,* as a subgenus.[3]

As a result of these investigations the specific name of the animal is *Anchitherium aurelianense,* Gervais.

A second species, the *Anchitherium Dumasii,*[4] has been indicated by Gervais from the eocene formations of France.

Anchitherium Bairdii, LEIDY.

(PLATE X., Figs. 14–21; XI.)

Palaeotherium Bairdii, Leidy: Proc. Acad. Nat. Sci., 1850, v. 121.
Anchitherium Bairdii, Leidy: Owen's Rep. of a Geol. Surv. of Wisc., etc., 572.

Among the fossil remains collected by Mr. Alexander Culbertson were the greater portion of a skull and fragments of jaws with teeth, of a species of *Anchitherium.* The teeth of this so closely resemble those represented in De Blainville's Osteographie, under the name of *Palaeotherium hippoides,* that they might readily

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[1] Osteographie: Palaeotherium, 75.
[2] Jahrbuch für Mineralogie, 1844, 298.
[3] Bul. Soc. Geol. de France, vii. 219.
[4] Comptes Rendus, xix., 381, 572.

be considered to belong to the same species, were it not that those of the Nebraska animal, which I have called *Anchitherium Bairdii*, are only about three-fifths the size of those of the former.

The specimens which we have an opportunity to study are as follows:—

1. The cranium proper, with a portion of the face containing on one side the last two and on the other the last three molars. The zygomata and post-orbital arches are broken away. The specimen was accompanied by several fragments of a lower jaw, of which two contain the last two molars, and one has the coronoid process nearly entire.

2. Both sides of the upper and lower jaws containing nearly all the molar teeth.

3. Three small fragments of lower jaws of different individuals, containing teeth.

The *Anchitherium Bairdii*, as indicated by the specimens, was rather more than half the size of the *Anchitherium aurelianense*.

Description of the Head.—The cranial specimen is particularly important from its being the first yet discovered of the genus *Anchitherium*. In its form it is remarkably like that of the corresponding portion of the skull of the Horse, and presents but few points of resemblance to the *Palaeotherium*, to which genus it has been supposed to belong.

Lateral View.—(XI. 1.) The skull of *Anchitherium* appears relatively shorter than that of the Horse; as, in the specimen under examination, the molar teeth are much less advanced in their position than in the latter; the last of the series being placed below the middle of the orbit.

The upper outline of the cranium proper, as in the Horse, is convex, and the temporal fossa has the same form and relative convexity; and posteriorly it mounts in the same manner upon a low sagittal crest. The summit of the inion and the posterior boundary of the temporal fossa are relatively not quite so prominent as in the Horse, but as in this, the root of the zygomatic process is implanted about the middle of the lower border of the fossa.

The mastoid portion of the temporal bone is relatively higher than in the Horse; and, as in this, impressed upon the parietal bone, there ascends from the squamous suture a large, deep, irregular, branched, vascular channel.

The meatus auditorius is bounded below by a thick auditory process.

The face is relatively of less depth than in the Horse, arising from the shortness of the teeth, compared with those of the latter. Below the position of the orbit the alveolar margin is convex antero-posteriorly, as in the Horse.

The malar bone does not advance as much upon the face as in the latter; its anterior suture ascending obliquely from the position of the last molar to the anterior lachrymal suture.

In the specimen, the orbits, at their inferior margin are broken away. When perfect, their entrance appears to have had almost the same form as in the Horse, but was relatively very much larger. They are also more deeply excavated, and approached each other much more. Their floor is very extensive, and at its posterior part forms a thick, obtuse margin, which is situated considerably below the level of the sphenoidal bodies.

Whether a post-orbital arch existed cannot be ascertained from the specimen, for in this the process of the os frontis, which, in the Horse, contributes to its formation, is broken away to its base, leaving a triangular surface, two sides of which measure only three lines, the other four lines.

The lachrymal bone externally is almost as concave as in the Sheep, leading us to suspect the existence of shallow larmiers. Its orbital margin is acute, and within this, at its lower part, there is a single, vertically oval, lachrymal foramen.

Superior View.—(XI. 2.) The upper view of the cranium of *Anchitherium* also resembles very much that of the Horse. The forehead is a little more flat, and extends into a relatively larger triangle posterior to the coronal suture, which holds a corresponding position. The anterior margin of the frontals are not extended into long angular processes between the bases of the ossa nasi, as in the Horse, but form together a very obtuse angle.

The sides of the face, as formed by the lachrymal bones and the upper maxillaries below them, descend much more abruptly from the anterior orbital processes of the ossa frontis, or they approach the vertical line much more nearly than in the Horse.

In the specimen, the sagittal suture of the frontals and parietals is still open.

Posterior View.—(X. 20.) The inion, from its summit being relatively less broad, is more triangular in outline than in the Horse. Its middle part bulges over the foramen magnum, and above this point is depressed upon each side of a slight vertical ridge.

The relative position and form of the condyles and the form of the foramen magnum are very much the same as in the Horse, except that the inferior surfaces of the former are more nearly horizontal, and diverge more posteriorly and approach nearer anteriorly.

Above each condyle, as in the Horse, there exists a crescentic depression of the occipital surface.

Inferior View.—(X. 21.) The basilar process is relatively broader, less deep, and more angular than in the Horse, and upon each side it presents a long impression, and at the middle is elevated into a superficial tuberosity for muscular attachment.

The junction of the basilar process with the sphenoidal body occupies the same position as in the Horse, being on a line with the anterior margin of the foramina lacera, but in the specimen it is obliterated.

The sphenoidal bodies are slightly convex compared with those of the Horse, and the posterior does not present the deep muscular impressions existing in that animal.

The paramastoids hold the same relative position to the condyles as in the Horse, and as in this between them a deep fossa exists, at the inner side of which the anterior condyloid foramen is situated.

The os tympanica is relatively slightly more dilated than in the Horse; and the os petrosa abuts closely against the basilar process.

The base of the styloid process, alone remaining in the specimen, is embraced antero-internally by the os tympanica.

The foramen lacerum is large anteriorly, but becomes a very fine crevice posteriorly.

The inner portion of the glenoid articulation, which alone is preserved in the specimen, resembles very much that corresponding to it in the Horse. The post-glenoid tubercle is relatively much more robust; and is mammillary in its form.

The surface, for attachment of the external pterygoid muscle in advance internally of the glenoid articulation, is much less inclined than in the Horse; and at the antero-internal part, as in this, it presents a foramen conducting to the foramina rotundum and spheno-orbitale.

The latter, and the optic foramina, are of large size, and hold very nearly the same relative position as in the Horse.

The interpalatine notch, as in the latter, expands as it approaches its bottom, which is on a line with the interval of the fifth and sixth molar teeth.

The hard palate is broken in the specimen, but it appears to have been about as much arched as in the Horse, and the exit of the posterior palatine canals is just in advance of the sides of the interpalatine notch.

Inferior Maxilla.—(Pl. X., Figs. 18, 19; XI. 5, 6.) As in the case of the alveoli of upper jaw, corresponding with the shortness of the teeth relatively and comparatively with those of the Horse, the body of the lower jaw of *Anchitherium* is proportionately less deep than in the latter. Its outer side is vertical and slightly convex; its base is thick and slightly convex forward; and its upper margin rapidly ascends posteriorly, and curves in a sigmoid manner more backward to the summit of the coronoid process than in the Horse.

The coronoid process is curved like in ordinary ruminants, but is relatively shorter and broader.

The condyle is very like that of the Horse, but the notch in advance of it is relatively broader.

The ramus, which in the Horse is very slightly depressed externally below the position of the coronoid process, in the fossil is almost as much depressed as in the Peccary.

Dentition.—(Pl. X. 14–17, 21; XI. 1, 3–8.) Gervais[1] states the formula of the dentition of *Anchitherium* to be:—

$$in. \frac{3 \quad 3}{3 \quad 3} \; can. \frac{1 \quad 1}{1 \quad 1} \; mol. \frac{7 \quad 7}{7 \quad 7}.$$

It is extraordinary that *Anchitherium* should be so much like *Palaeotherium* in the anatomical and physiological construction of its teeth, and yet be so much like the Horse in its skeleton.

The crowns of the molar teeth of *Anchitherium* are entirely devoid of cementum, and in the adult are completely exserted.

The specimens of *Anchitherium Bairdii*, which we have an opportunity of examining, contain in the upper and lower jaws all the molar teeth except the first of the series.

The posterior six upper molars (XI. 3, 4,) are nearly alike in form and size; the crowns, as in those of *Palaeotherium*, consisting of two transverse pairs of lobes.

The outer lobes, as in the genus just mentioned, are demiconoidal with triangular summits, the basal angles of which are continuous with the extremities of inverted U shaped ridges bounding the sides and bases of the external transversely concave surfaces.

The inner lobes are conoidal, and are prolonged outwardly to the antero-internal

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[1] Zoolog. et Palæont. Franç., p. 63.

side of the outer lobes; in this course becoming dilated into a small conoidal process about the middle.

These teeth are not bounded by a basal ridge internally, but portions exist anteriorly and posteriorly; and in the latter position inclose a small conoidal process.

The first upper molar of the normal series is much smaller than the others, as is indicated in the specimens by two small fangs, one before the other.

The inferior molars (X. 14–17; XI. 5–8,) also are exceedingly like those of *Palaeotherium*. Their crowns are composed of two lobes placed one before the other, except the last of the series, which has an additional, or third lobe. The lobes are demiconoidal, with their outer side angularly convex and their inner side concave and sloping. Their summit is V shaped; and the posterior extremity of this rises to the apex of a pyramidal process of the inner side of the crown. The anterior extremity of the summit of the anterior lobes curves to the base of the anterior pyramidal process, while that of the summit of the posterior lobe ceases upon the outer side of the same process. In the unworn teeth the apex of the anterior pyramidal process is indented. The third lobe of the last molar is smaller than those in advance, is ovoidal in form, and has a crescentic summit inclosing a concave fossa.

The inferior molars have no continuous basal ridge, but a portion exists between the bases of the lobes externally, in the form of a small pyramidal tubercle; at the anterior part of the crown; and at the posterior part of the latter, in which position it forms an angular process.

The first inferior molar, as indicated in the specimen by a single fang which it possesses, is a much smaller tooth than any of those in the series posterior to it.

The species is named in honor of Prof. S. F. Baird, of the Smithsonian Institution.

MEASUREMENTS.

	Inches.	Lines.
Length of cranium from summit of inion to anterior extremity of ossa frontis	4	8
Length from occipital condyle to anterior orbital margin	4	0
Length of temporal fossa	3	0
Length of sagittal crest	1	7
Length of ossa frontis	2	5
Height of inion	1	8
Height of face at last molar alveolus	2	2
Height of orbit from floor to supra-orbital margin	1	6
Breadth of cranium at para squamosæ	2	0
Breadth of forehead at anterior orbitar processes	1	10
Breadth at paramastoids	1	9
Breadth at post-glenoid tuberosities	2	4
Breadth of hard palate at sixth molares	1	0
Height of body of lower jaw at last molar	1	2
Height of body of lower jaw at second molar	0	7½
Length of upper normal series of molars	2	11
Length of lower normal series of molars	3	0
Antero-posterior diameter fourth upper molar	0	6
Transverse diameter fourth upper molar	0	7¼
Antero-posterior diameter fourth lower molar	0	6
Transverse diameter fourth lower molar	0	4¾
Antero-posterior diameter last lower molar	0	7

Fam. 2.—IMPARIDIGITATA ORDINARIA.

TITANOTHERIUM, LEIDY.

Titanotherium Proutii, LEIDY.

(PLATE XVI. XVII., Figs. 1–10.)

Palaeotherium, Prout: Am. Journ. Sci. Arts, 1847, iii., 248, figs. 1, 2.
Palaeotherium? Proutii, Owen, Norwood, and Evans: Proc. Acad. Nat. Sci., 1850, v., 66; Leidy: Ib., 122; Owen's Rep. of a Geol. Surv. of Wisc., etc., 551.
Rhinoceros Americanus? Leidy: Ib., 1852, vi., 2.

IN the American Journal of Science and Arts for 1847, page 248, Dr. Hiram A. Prout, of St. Louis, described and figured the fragment of a lower jaw containing the true molars of a huge animal, supposed to be a species of *Palæotherium*.

The specimen, which was the first fossil from the eocene cemetery of Nebraska, presented to the notice of the world, with another corresponding of the opposite side, apparently from the same individual, were kindly loaned to me by Dr. Prout for examination. (Pl. XVI. Fig. 1.)

These strongly resemble the corresponding portion of the lower jaw of *Palæotherium*, and if they do not belong to this genus they do to one closely allied to it; and if the animal preserved the same relations of size as *Palaeotherium magnum* it was more than twice the size of this, which Cuvier has estimated to have been over four and a half feet in height at the withers, or equal to the *Rhinoceros* of Java; less lofty than a large Horse, but stouter, with a more massive head, and with extremities thicker and shorter.

The two fragments of the lower jaw, before assuming their present mineralized condition, were very much fractured, and the fissures are now filled up by a hard matrix, which also adheres to their exterior surface in a concretionary form.

Along the true molar series the jaw measures eleven inches; below the middle lobe of the last molar it is six inches in depth; and midway below the position of the first true molar is nearly two and a half inches in thickness. The sides are slightly convex vertically, and the bone is thick and rounded, and descends from the position of the last molar towards the posterior broken margin of the specimen. Two inches back of the last molar the depth of the fragment is nine and a half inches, but its thickness is not so great as it is anteriorly.

The inferior true molars are constructed upon the pattern of those of *Palaeotherium;* the anterior pair being composed of two, the last of three demiconoidal lobes. These have crescentic summits, the extremities of which rise to the inner side of the teeth, and there become confluent, and form prominent points. In the specimens under examination, the outer side of the lobes of the molars is embraced by a strong basal cingulum about two lines in depth. The inner surface of the teeth forms a vertical plane, which is slightly convex antero-posteriorly, and does not possess the slightest trace of a basal ridge such as exists in the true *Palaeotherium*.

The triturating summits of the lobes present more or less broad crescentic surfaces of exposed dentine, bordered by enamel, with the horns rising to the inner side of the teeth, and there becoming confluent and forming simple conoidal prominences. The enamel spaces embraced by the horns of the crescentic summits of the lobes do not slope towards the base of the teeth internally, as is represented to be the case in the figures of the corresponding teeth of *Palaeotherium*, but they form deltoidal concavities, which are nearly on the same level with the dentinal crescents, and are bounded internally by a thick obtuse border; open, however, at the middle to the bottom of the concavities.

The third lobe of the last molar is smaller than those in advance, and resembles one of them atrophied at its posterior half. The external basal ridge of this tooth ceases upon the third lobe just before reaching its posterior surface; but upon this internally a small portion is developed.

The enamel of the teeth is rugose, and is most so externally, in which position it also presents a very uniform series of transverse striae. At the triturating surface of the teeth externally, where the enamel is thickest, it measures one line and two thirds.

The measurements of the teeth in the fragments of jaw just described, are as follows:—

	ANTERO-POSTERIOR.		TRANSVERSE.	
	Inches.	Lines.	Inches.	Lines.
Last molar	4	6	1	10
Second true molar	3	3	2	
First true molar	2	8	1	10

In the collection of Dr. Owen, there is preserved a portion of the left side of a lower jaw (Pl. XVI., Figs. 2, 3) containing true molars exactly like those just described, and the fangs of the preceding two premolars. Accompanying this specimen, and probably derived from the same individual skeleton, there are also the crown of the second or third left lower premolar, the crown of a lower canine, and fragments of two upper molars. The fragment of lower jaw, before it became infiltrated with mineral matter, was very much crushed, and at present it is more light and friable than any other of the specimens of fossils which have been brought from Nebraska. It is considerably smaller than the corresponding part of the bone in Dr. Prout's specimens, measuring nine and a half inches along the series of true molars, five and a quarter inches in depth below the last molar, and an inch and a quarter in thickness below the first true molar. Two inches posterior to the last molar it is seven and a quarter inches in depth. Its form closely corresponds with that of Dr. Prout's specimens, as does also the form of the teeth contained in it, except that their basal ridge is not of uniform depth, but gradually rises in a pyramidal manner, and becomes thinner from between the lobes to their most prominent external part.

The teeth are more worn than in the specimens of Dr. Prout, and their enamel presents the same appearance, but in the same position is a third of a line less in thickness.

The measurements of the true molars are as follows:—

	ANTERO-POSTERIOR. Inches.	Lines.	TRANSVERSE. Inches.	Lines.
Last true molar	4	2	1	11
Second true molar	2	9	1	9
First true molar			1	7

The isolated crown above mentioned of an inferior left premolar (Pl. XVI. Figs. 8–10), probably the second, measures only sixteen lines antero-posteriorly, and almost an inch transversely, indicating a rapid reduction in size of the teeth from behind forward; nevertheless, this is gradual, for the fangs of the last premolar, still retained in the portion of lower jaw, on a line with the connection to their crown, measure twenty-one lines antero-posteriorly. The inner side (Fig. 10) of the specimen of the premolar is a smooth vertical plane; and externally (Fig. 9) the basal ridge is deep, but thin, and rises to the most prominent part of the lobes, as upon the true molars. The masticating surface (Fig. 8) presents a broad tract of dentine bordered by enamel, bilobed externally, and straight internally.

The crown of the inferior canine (Pl. XVI., Figs. 11, 12) is curved conical in form, and, in section at its base, is very nearly circular. Internally, its base is embraced by a thick, deep cingulum, with a prominent margin, which exhibits also a tendency to pass around the outer side of the tooth. The outer (Fig. 11) and inner (Fig. 12) sides of the tooth are defined by a saliance of the surface, and the former is uniformly convex and smooth, the latter angularly convex, less broad, and less smooth. The enamel is worn off from the point of the tooth, and also below this antero-externally over an oval space almost half an inch in length, indicating that the inferior canine, as in the undoubted *Palaeotherium*,[1] occupies a position, when the mouth is closed, posterior to the superior canine.

Measurements of the crown of the inferior canine are as follows:—

	Inches.	Lines.
Circumference at base	3	
Length of external convex surface	1	7
Height from the base internally	1	2

Of the two fragments of upper molars above mentioned, one is the internal half of the crown of a premolar (Pl. XVII., Figs. 5, 6), probably the second; the other is an internal portion of a true molar (Pl. XVI., Figs. 6, 7).

The former specimen measures one inch five lines antero-posteriorly, and its masticating surface (Pl. XVII., Fig. 5), which is very much worn down, presents a form intermediate to that in the corresponding tooth of *Palaeotherum magnum*, and *Aceratherium incisivum*. Internally (Fig. 6), the crown is transversely convex, and is very sloping inwardly from the fangs, so that the tooth has projected very considerably internal to the alveolar margin of the palate. This side of the tooth is formed by a thick and deep cingulum, which envelops the bases of the inner lobes, and exhibits an obtusely rounded margin, thickest anteriorly.

The inner lobes, of which the anterior is very much larger than the posterior, are confluent, and, in the specimen, are nearly worn to their base, and present a

[1] Cuvier, Rech. sur les Ossem. Foss., éd. 3, III. 8, 9, Pl. V., Fig. 1.

tract of dentine (Fig. 5) extending to the broken margin of the tooth. The external portion of the dentinal surface about its centre, and near the posterior margin, is occupied by a pair of trilateral enamel islets, which are the remains of the terminations of transverse valleys, such as exist in the molars of *Rhinoceros* and *Palaeotherium.*

The fragment of a superior true molar (Pl. XVI., Figs. 6, 7) presents a large conical protuberance, corresponding to that antero-internal in the *Palaeotherium magnum.* It has the enamel of its apex just worn through, leaving a discoidal surface of dentine about one line in diameter. External to the conical lobe are remains of the abraded masticating surface of the outer lobes of the tooth, and at the base of the former, there exists one side (Fig. 7) of a deep pit homologous with that at the base of the posterior half of the inner face of the antero-external lobe of the corresponding tooth in *Palaeotherium magnum.* Antero-internally to the base of the conical lobe, a thick, obtuse prominence (Figs. 6, 7) exists, which is a portion of a basal ridge; but of this no trace exists on the inner side of the tooth, like that in *Palaeotherium magnum.*

In Dr. Owen's collection, there are also the isolated crowns of an inferior first and last true molar (Pl. XVII., Figs. 8–10), apparently from two other distinct individuals of the same species as that indicated by the specimens just described. The measurements of these are as follows:—

	Inches.	Lines.
Antero-posterior diameter of the last inferior molar	4	3
Transverse diameter of the last inferior molar	1	7
Antero-posterior diameter of the first true molar	2	10
Transverse diameter of the first true molar	1	10

In the collection of Dr. Prout, and accompanying the two portions of a lower jaw, which have been the subject of investigation, is a portion of the left superior posterior molar, probably belonging to the same species, though not to the same individual (Pl. XVI., Figs. 4, 5). What is preserved of this specimen exhibits a strong resemblance to the corresponding part of the homologous tooth in *Palaeotherium magnum;* but it presents several important differences.

Upon the masticating surface of the crown, the valleys everywhere, antero-posteriorly as well as transversely, are nearly uniform in depth (Fig. 5).

The summits of the outer lobes have been denuded of their enamel, and present the remains of a broad **W** shaped tract of dentine, while the apex of the antero-internal mammillary lobe has not yet had its enamel worn through.

As in *Palaeotherium magnum,* at the base of the posterior half of the inner face of the antero-external lobe, there is a deep elliptical pit of enamel, and a little posterior to this is a second smaller and shallower pit.

The external face of the crown of the superior molars of *Palaeotherium,* as described by Cuvier, inclines inward as it descends, and is divided by three longitudinal salient ridges (*arretes*) into two concavities, rounded towards the fang, and terminating in a triangular cusp at the triturating surface, the basal angles of which rest upon the salient ridges.

In the special subject under investigation, about three-fourths only of the outer surface of the antero-external lobe (Fig. 4) is preserved, and this does not conform to the characteristic appearance of the corresponding portion of the tooth of *Palaeotherium*. It inclines and terminates below as in the latter, but relatively is only slightly concave, and it possesses no bounding salient ridge at its anterior part, such as is represented in the figures of the teeth of *Palaeotherium* in the works of Cuvier, Jaeger, De Blainville, Gervais, and others. In the place of such a ridge, the tooth forms a prominent convex margin, projecting, as in ruminants, in *Rhinoceros* and *Palaeotherium* itself, exterior to the position occupied by anterior molars, and the basal ridge winds around the prominent margin to the anterior part of the tooth, descending to its masticating surface, which it reaches, in the specimen, a half inch internal to the outer edge of the latter.

The dimensions of the tooth, so far as they can be ascertained in its present condition, are as follows:—

	Inches.	Lines.
Distance from the apex of the antero-internal lobe to that externally of the antero-external lobe	1	6
Height of latter from base to point	2	2

The enamel of the specimen just described is smooth upon the masticating surface, and at the base of the antero-internal conical lobe is about one line in thickness. On the outer side of the antero-external lobe it is rugose, and at the external masticating margin of this is also about one line in thickness. In other positions it is thinner, especially where it invests the inner sides of the outer lobes, the bottom of the antero-posterior valley, and the deep pits.

The various fragments of lower jaw and teeth above described, though exhibiting a very great resemblance to the corresponding parts of the *Palaeotherium magnum*, are yet sufficiently different to indicate they probably belong to a distinct but closely allied genus, for which the provisional name of *Titanotherium* is proposed. The most important differences, which have been presented, are the absence of a basal ride at the inner side of the inferior molars, and at the same side of the fragment of a superior true molar; the nearly uniform depth of the antero-posterior and transverse valleys in the upper true molars; and the absence of the salient ridge, characteristic of *Palaeotherium*, at the anterior margin of the antero-external lobe of the last superior molar.

In the collection of Mr. Thaddeus A. Culbertson, there are the crowns, nearly whole, of two superior premolars (Pl. XVII., Figs. 1–4), and fragments of two others, which also probably belong to *Titanotherium Proutii*. These, I stated in a verbal communication to the Academy of Natural Sciences, probably belonged to a species of *Rhinoceros*, for which the name *R. Americanus* was proposed,[1] but they certainly do not belong to this genus, though closely partaking in its characters those of *Palaeotherium*.

The nearly perfect crowns of the superior premolars are quadrate, and are greater in their transverse diameter than antero-posteriorly. Their outer side

[1] Proc. Acad. Nat. Sci., VI., 2.

(XVII. 2) presents a basal ridge, descending at its anterior and posterior margin to the masticating surface; but it does not possess a median salient ridge like that of *Palaeotherium*, nor does it present the anterior characteristic fold of the *Rhinoceros*. The portion of this surface corresponding to the posterior lobe inclines inward, in its course downward, and the anterior portion of the same surface rises into a median longitudinal prominence, descending to the apex of the anterior lobe.

The inner side (1) of the teeth is transversely convex, and forms a thick and deep cingulum, with a wide, obtusely rounded border, enveloping the bases of the inner lobes.

The latter, of which that anterior is very much the larger, are confluent their entire height, and are isolated from the outer lobes nearly to their base; thus destroying the principal transverse valley as it usually exists in the molars of *Rhinoceros* and *Palaeotherium*, and creating one antero-posteriorly (3, 4).

The antero-posterior valley, at the position corresponding to the depressed interval of the outer lobes, communicates with a large and deep trilateral pit, homologous with the termination of the principal transverse valley in the molar teeth of *Rhinoceros*, and with a similar pit in the teeth of *Palaeotherium*. Posteriorly this valley is connected with another, but smaller and shallower pit, which also finds its homologue in the *Rhinoceros* and *Palaeotherium*. In one of the specimens (4), probably the third premolar, the antero-internal lobe is more confluent with the corresponding outer lobe than in the other; and its internal cingulum is more irregular.

In the trituration to which these teeth have been subjected, the enamel has been worn off from the masticating surface of the outer lobes, very nearly to the base of those within, leaving a broad tract of exposed dentine, which is bilobed internally by the deep central enamel pit. In the supposed third premolar (4), this tract is continuous, anteriorly upon the summit of the antero-internal lobe, but in the fourth premolar, the summits of the inner lobes present a separate antero-posterior tract.

The enamel of these teeth, except where worn, is slightly rugose, and, upon the outer lobes, externally exhibits numerous transverse undulating lines. It is thickest upon the inner lobes, where it is one line and a half; and upon the external part of the outer lobes it is about one line in thickness.

The measurements of the two specimens, in their present condition, are as follows:—

	Inches.	Lines.
Antero-posterior diameter of third premolar	2	5
Transverse diameter of third premolar	1	10
Antero-posterior diameter of fourth premolar	2	7
Transverse diameter of fourth premolar	1	9

One of the fragments of the premolars above mentioned, exhibits the inner lobes entirely associated as one, and disconnected to their base from the outer lobes. This connate lobe has the form resulting from the confluence of an anterior larger cone, with another posterior and smaller (7). The sides of the connate lobe, where not affected by attrition, are rugose, and the summit presents a clavate tract of dentine with a border of enamel nearly one line and a half in thickness.

The antero-posterior diameter of the tooth to which this fragment belonged, is one inch ten and a half lines. The specimen still retains a portion of the internal basal cingulum, extending anteriorly and posteriorly, and also portions of the two enamel pits with the intervening antero-posterior valley of the tooth.

The other fragment of a premolar, alluded to, consists of the fangs and a portion of the outer lobes, which exhibits the same peculiarities as those already described.

Dr. Evans states, in the report of Dr. Owen, previously quoted, that the remains of the *Palaeotherium* (*Titanotherium*) *Proutii* were found in a green, argillo-calcareous, indurated stratum, situated within ten feet of the base of the geological section. (See page 13 of this memoir.) He observes: "A jaw of this species was found, measuring, as it lay in its matrix, five feet along the range of the teeth, but in such a friable condition that only a portion of it could be dislodged; and this, notwithstanding all the precautions used in packing and transportation, fell to pieces."

"A nearly entire skeleton of the same animal was discovered in a similar position, which measured, as it lay imbedded, eighteen feet in length, and nine feet in height."

The specific name applied to the animal whose remains have just been described, was proposed in a letter to the Academy of Natural Sciences, of Philadelphia, by Drs. Owen, Norwood, and Evans, in honor of Dr. Hiram A. Prout, of St. Louis, who first indicated its existence.

PALAEOTHERIUM, Cuvier.

Palaeotherium giganteum, Leidy.

(Plate XVII., Figs. 11–13.)

In the collections of Messrs. Culbertson and Dr. Owen, there are several fragments of molar teeth of an animal equally huge with the *Titanotherium*, and most probably belonging to a species of *Palaeotherium*, which was twice the size of the *Palaeotherium magnum*.

The fragments, of which there are five, are only single external lobes of the upper molars. These, externally, correspond to the description of Cuvier of the teeth of *Palaeotherium*. A conjoined pair of the lobes forming the outer part of a tooth, "present the external face strongly inclined inwards in descending, and divided by three salient ridges into two concavities, which are rounded towards the fangs, and terminate in a triangular cusp at the masticating surface, the basal angles of which rest upon the termination of the salient ridges." The median ridge is a thick obtuse fold outwards of the tooth, and the anterior and posterior ridges are acute, roughened offsets from the basal ridge, descending to the masticating surface.

The measurements of the more perfect specimens are as follows:—

	Inches.	Lines.
Length of the longest lobe	2	4
Length of a second specimen	2	0
Breadth of the second specimen at the basal angles of the cusp	1	8
Length of the shortest lobe	1	7
Breadth of the shortest lobe at the basal angles of the cusp	1	3

RHINOCEROS, Linnaeus.

The existing species of *Rhinoceros* are confined to Africa and Asia, and the Islands of Java and Sumatra. A vast quantity of remains of extinct species have been discovered in Great Britain, the continent of Europe, Siberia, and the Himalayas, but, until the region of Nebraska had been visited, no traces of the genus had been found in America.[1]

The number of extinct species which have been proposed, frequently upon the slightest characters, is so great, that the criticism of De Blainville upon their authors appears to be quite just: "Qui semblent considérer les os comme des individus, comme des masses minérales, sans considérations biologiques ou physiologiques; en sorte que les espèces se créent chez eux, pour ainsi dire, au compas."[2]

Among the fossil remains discovered at Nebraska, are those of two species of *Rhinoceros*, certainly different from any of those found in other parts of the globe. The larger of the two species, as indicated by an almost entire skull, was nearly three-fourths the size of the *Rhinoceros indicus*, or it was about the size of the *Rhinoceros minutus*, Cuvier, which is regarded by De Blainville as a small variety of the *Rhinoceros incisivus*. The other was less than two-thirds the size of the former species, and is therefore the smallest *Rhinoceros* which has ever yet been indicated.

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[1] In the Monthly American Journal of Geology, etc., 1831, p. 10, the editor, G. W. Featherstonhaugh, has given a description of what he considered to be the fragment of a jaw, containing two incisor teeth of an animal closely allied to the *Rhinoceros*, found in Pennsylvania. Mr. Featherstonhaugh observes: "The mineral composition of this fragment gives it a very anomalous character, and is a circumstance entitled to the particular consideration of geologists. There is nothing of the nature of bone about it, except its form; the whole substance, the teeth included, being constituted of an aggregate of quartzose particles, and presenting the appearance, not of a gradual substitution by mineral infiltration to osseous matter, but of a cast of part of a jaw and teeth formed of small quartzose grit, and giving a semi-translucency to the teeth, which is wanting to the more opaque jaw."

Dr. Harlan, in his Medical and Physical Researches, refers to this specimen, page 268, and says: "For ourselves, we are disposed to wait for further discoveries of this nature, previous to admitting the present specimen as part of our fossil fauna. The specimen is no less singular or interesting to geologists, as demonstrating the very close analogy of a mere *lusus naturæ* of the mineral kingdom, if it be nothing else, to a portion of the animal skeleton." Dr. Harlan further remarks, in a note: "The original specimen was sent to London, and the geologists who there examined it, considered it of too doubtful a character to be admitted as a fossil remnant."

De Blainville, in his Osteographie, page 172, in reference to this specimen, says: "Ce n'est pas le lieu de discuter ce point au moins fort contestable; mais comme la pièce en nature fait aujourd'hui partie des collections du Muséum, nous pouvons assurer qu'elle ne resemble pas le moins du monde à un fragment de mâchoire de Rhinocéros, ni pour le corps de l'os, ni pour les dents prétendues. C'est sans doute une pièce artificielle, une grossière supercherie. Il est donc véritablement à regretter qu' on en ait hasardé et exprimé la pensée; et que tous les catalogues de paléontologie aient inscrit une espèce de Rhinocéros fossile en Amérique, sans même une expression de doute."

In addition, my friends Dr. I. Hays, and Mr. I. Lea, have informed me they had seen the specimen, and had always regarded it as a mere mineral fragment.

[2] Osteog. Gen., Rhinoceros, 212.

I was at one time disposed to consider the two species of Nebraska *Rhinoceros* as having belonged to the subgenus *Aceratherium*, Kaup, from the fact that in one of the specimens, upon which the larger species was established, the upper part of the face, as far forward as the position of the second molar tooth, presents no indication of an advancing rise to produce a prominence or boss at the end of the nose for the support of a horn. In the specimens of the smaller species, the face is too much mutilated to obtain any idea of its form, but from the resemblance of the back part of the cranium and the lower part of the face to those of the larger species, I supposed the similarity probably continued in the remainder of the face, and thus indicated the species to be of the same subgenus as the other. Upon more mature reflection, I am inclined to think both species of *Rhinoceros* of Nebraska possessed a horn upon the end of the nose, for although this portion of the face is not preserved in any specimens to determine the fact, yet the construction of the remaining portion of the face is more after the type of that of the true *Rhinoceros* than that of the *Aceratherium*. In this, according to the representation by Kaup (Fig. 2, Tab. X. of the Ossem. Foss.), the lateral notch of the anterior nares extends as far back as the commencement of the fifth molar tooth; or, as represented by De Blainville (Ost. Gen., Rhin., Pl. IX.), (who regards the *Aceratherium incisivum* as the female of the *Rhinoceros incisivus*, Cuvier, with which the name is synonymous), as far as the fourth molar tooth, thus leaving little width to the face from this point to the orbit, and a feeble support to the nasal bones from the ossa maxillaria, necessary to afford a firm basis to a nasal horn. On the contrary, in both species of Nebraska *Rhinoceros*, the lateral notch of the nares does not extend beyond the position of the first molar tooth, thus producing a great degree of relative breadth to the face, and an ample support laterally to the nasal bones, so as to enable them to sustain the horn, which probably tipped the nose. Both species of Nebraska *Rhinoceros*, at most, were unicorn, for the forehead is slightly depressed and smooth, and presents neither boss, elevated roughness, nor other indication of the existence of a frontal horn.

In the form of the upper molar teeth, the species of Nebraska *Rhinoceros* resemble the *Aceratherium incisivum* more than they do recent species of *Rhinoceros*, especially in the existence of a well-developed basal ridge on the inner side of the premolars.

In the smaller species of Nebraska *Rhinoceros*, incisor teeth existed in both jaws in the adult, as indicated in two specimens by small remaining fragments of the fangs, and it is probable that they also existed, under the same circumstances, in the larger species, although this is proved only for the upper jaw, one of the specimens of which yet preserves a portion of an incisive alveolus in the intermaxillary bone.

Rhinoceros Occidentalis, Leidy.

(Plates XII., XIII.)

Rhinoceros occidentalis, Leidy: Proc. Acad. Nat. Sci., 1850, v., 119; Ib. 1851, 276; Owen's Rep. of a Geol. Surv. of Wisc., etc., 552.
Aceratherium, Leidy: Proc. Acad. Nat. Sci., 1851, v., 331.

The materials which we have in possession to describe the larger species of *Rhinoceros* from Nebraska, are as follows:—

1. A skull, with the right superficial portion and end of the nose broken away, and otherwise much fractured and mutilated. It contains upon the left side all the molar teeth except the first, which fortunately exists upon the other side; but all the remainder are broken. From the collection of Dr. D. D. Owen.

2. Two fragments of lower jaws, from two other individuals; one containing the last two molars, the other the posterior three molars, except the last. From Dr. Owen's collection.

3. Nine fragments of as many upper molars, and eight small fragments of lower jaws, only two of which contain perfect teeth; apparently from three or four different individuals. From the collections of Messrs. Culbertson and Capt. Van Vliet.

The species was originally established upon several small fragments of molar teeth, procured by Mr. A. Culbertson, and its existence was afterwards confirmed by several entire molars brought home by Mr. T. A. Culbertson.

Description of the Skull.—The skull in the collection of Dr. Owen, is about three-fourths the size of that of the *Rhinoceros indicus*. Its upper part and left side, with the corresponding molar teeth, are comparatively well preserved. The specimen is an adult one, though it did not belong to an old individual, for all the molars are protruded, but in none is the enamelled triturating surface obliterated.

Lateral View.—(Pl. XII. Fig. 2.) One of the most remarkable features of the species is presented in the side view of the skull, viz.: the verticality of the inion, with the slight degree of inclination forward of the upper part of the head. Indeed, the latter is so nearly horizontal, that, in comparison with the skull of *Rhinoceros indicus*, it appears as if the two extremities of the head had been depressed, or, in other words, as if the head had been forcibly made straight. In connection with the peculiarity just described, a relatively large proportion of the temporal fossa is situated posteriorly to the root of the zygomatic process, which holds a position about the middle of the fossa, whereas in *Rhinoceros indicus* it is placed at the posterior third of the latter.

The zygomatic process extends from its root less outwardly, but rises more than in *Rhinoceros indicus*. Its upper margin slopes forward more than in the latter, and the upper surface of its root is nearly horizontal. The outer surface is vertical and convex; but anteriorly, or where the malar bone contributes to the formation of the zygoma, it is flat. The deepest part of the zygoma is just in advance of the glenoid articulation, and measures about two inches.

The meatus auditorius is vertically ovate, with the narrow part downward.

The temporal fossa has almost the same relative extent as in *Rhinoceros indicus*, but it is longer, and less deep vertically. Superiorly, it is bounded by an acute ridge, diverging from the median line to the post-orbitar process. The parietal crest formed by the contiguity of this ridge of each side is broad and strong, and includes a median angular groove.

From the temporal surface, inclining to the middle line of the cranium, it appears more oblique than that of *Rhinoceros indicus*, but for two inches and a half above the zygomatic root it is nearly vertically convex. In advance of the root of the zygomatic process, the temporal fossa appears more deeply excavated than in the last mentioned species; and anteriorly it is better defined from the orbital cavity by a prominent pyramidal ridge, which proceeds in a curved line inward and backward from the post-orbital process to the position of the spheno-orbital foramen.

The side of the face from the post-orbital process forward is vertical. The orbit is excavated more transversely and deeply than in *Rhinoceros indicus*, and its orifice is better defined. The entrance constitutes three-fourths of a circle, and is bounded above by a very prominent supra-orbitar process, which is formed by the confluence of the antero- and post-orbitar processes. The surface of the supra-orbitar process is convex and rough, and its lower margin slightly overhangs the inferior edge of the orbit. The vertical diameter of the entrance of the orbit is two inches and a quarter; and it is defined below by a small pyramidal process at the junction of the malar bone with the zygomatic process of the temporal. The floor of the orbit is deeply concave, and terminates posteriorly by an abrupt convex margin. The lachrymal bone and foramen are too much broken to judge accurately of their form, but there appears to have been a single one of the latter, relatively of large size. The lachrymal process was small and rough. The face in advance of the orbit is much fractured in the specimen. It is relatively longer than in *Rhinoceros indicus*, and is quite vertical the entire extent. The greater portion of the infra-orbitar foramen is broken away, but sufficient remains to show its position to be about one inch and a half above the interval of the second and third molar. From a fragment of the left intermaxillary bone being preserved, it may be determined that the notch of the anterior nares was relatively short, compared with that of *Rhinoceros indicus;* and this bone is stronger, and is articulated by a finer serrated suture. It rises much more than in *Rhinoceros indicus*, its postero-superior extremity being even above the middle line of the face, or it is on a line with the inferior suture of the lachrymal bone, which is above the inferior margin of the orbit. The maxillo-intermaxillary suture is only a half an inch below the anterior portion of the naso-maxillary suture.

The intermaxillary fragment retains the bottom of the corresponding incisive alveolus, and this is just twenty-two lines from the posterior extremity of the bone in which it is situated, or is one inch and a quarter from the upper portion of the maxillo-intermaxillary suture, and presents some idea of the relative position of the incisive teeth compared with those of *Rhinoceros indicus*. So far as can be ascertained, the hiatus in advance of the molars to the intermaxillary bone has been about one inch and a half.

Superior View.—(Pl. XIII. 1.) The upper view of the head presents an extensive, depressed, trapezoidal surface. Commencing posteriorly as an angular groove, included by the two ridges forming the parietal crest, it gradually expands forward, and, between the supra-orbitar processes, measures in its perfect state seven inches in breadth. On each side of the forehead above the anterior part of the orbits, and extending a short distance upon the nose, it is prominent and convex; but in the middle of the forehead, and upon the nasal bones, which incline slightly at their upper surface towards each other, it is transversely concave. Upon the forehead, in the specimen, are three slight exostoses.

The fronto-nasal suture is doubly crescentic with the conjoined horns directed forward. The lateral margins of the ossa nasi converge anteriorly, and are a little concave, but vertically are convex, and the naso-maxillary suture has been about three inches and a half in length.

Posterior View.—In examining the head from behind, the remarkable degree of lateral compression of the cranium in comparison with that of the *Rhinoceros indicus* is a striking feature of the species. The inion is exceedingly narrow in comparison with that of other species of *Rhinoceros*, and the occiput, in a corresponding degree, bulges out posteriorly, so that, in the median line, it projects at least an inch back of the position of the condyles.

In a corresponding degree with the narrowness of the cranium this is elongated, so that neither its capacity nor its surfaces for muscular attachment are less than in existing species of *Rhinoceros*.

In the specimen, the occipital foramen and condyles are too much broken to judge accurately of their form. The former appears to have been vertically oval, and not so much notched above as in *Rhinoceros indicus;* and it measured about one inch and a half in its long diameter, and one and a fifth in breadth. The condyles appear not to have differed in form from those of recent species of the same genus.

Inferior View.—(Pl. XII. 1.) The base of the skull is more nearly horizontal than in recent species of *Rhinoceros*.

A portion of one condyle, preserved in the specimen, indicates the position of the condyles to be more vertical than in *Rhinoceros indicus*. The angle of their articular surface is also more abrupt, is lateral, and nearly vertical. The posterior portion of the articular surface is directed backward and relatively slightly upward; the inferior portion forward and outward, or much less downward than in *Rhinoceros indicus*.

The basilar process in advance of the condyles is narrow, measuring a little over an inch only between the anterior condyloid foramina. It is elevated in the median line into a prominent acute crest, which is pyramidal posteriorly, and serves as a sort of abutment to the inferior termination of the condyles, and anteriorly it gradually decreases and vanishes at the prominent junction of the process with the post-sphenoidal body. The sides of the basilar process are concave antero-posteriorly, and form, between the condyle and the para-mastoid process, a deep concavity, at the anterior part of the bottom of which the condyloid foramen is situated.

The para-mastoid processes are broken in the specimen, and they appear to have been relatively small in comparison with those of *Rhinoceros indicus;* projecting, as they do, very little below the mastoid processes, which are much more robust in their proportions.

The foramen lacerum is relatively small compared with that of *Rhinoceros indicus*, and the foramen ovale, which is distinct from it, is situated on a line internally with the glenoid articulation.

The latter antero-posteriorly in comparison with its breadth, is relatively greater than in *Rhinoceros indicus*, and is directed more outwardly, and at its postero-external portion is more depressed.

The post-glenoidal tubercle is relatively short, thin, and broad compared with that of *Rhinoceros indicus*. It is obliquely compressed, and has one broad surface directed backward and inward; the other, forming part of the articulation, presenting outward and forward.

As in *Rhinoceros indicus*, the root externally of the pterygoid processes, is traversed by a short but large canal, into which opens a foramen representing the associated foramina rotundum and spheno-orbitale.

The passage to the posterior nares, between the pterygoid processes and vertical plates of the palate bones, has about the same relative extent as in *Rhinoceros indicus*.

The hard palate in the specimen is very much fractured, but the parts appear to have retained their natural relative position; and it is remarkable for its deep and narrow arched form. The molar teeth, in a nearly straight line upon each side, converge anteriorly, and are distant between the first premolars only nine lines, and between the anterior lobes of the seventh molars twenty-two lines. The inner sides of the molars, in advance of the posterior two, project internally beyond the alveolar margin, and gradually increase in this disposition to the first premolars, so that the passage between these latter and the hard palate forms nearly four-fifths of a cylinder.

Inferior Maxilla.—(Pl. XIII. 2–4.) Of the two fragments of the lower jaw preserved in Dr. Owen's collection, which are both of the left side of two different adult individuals, the one contains the last two molars and half of that in advance, and the other contains the third to the fifth inclusive. The depth of the lower jaw below the posterior molar is twenty-eight lines, and its thickness fourteen lines.

Superior Molars.—(Pl. XII.) The superior molars are about three-fourths the size of those of *Rhinoceros indicus*, and present a very great degree of resemblance to those of *Aceratherium incisivum*. All possess a basal cingulum, which, however, is feebly developed at the outer side of the antero-external lobe, and is entirely obsolete at the base postero-internally of the fifth and sixth molars, and for a narrow space internally upon the antero-internal lobes of the same pair of teeth. Upon the inner side of the base of the molars, from the second to the fourth inclusive, it is better developed than in the same position in *Aceratherium incisivum*.

In the seventh molar, the lobes are quite simple, neither of those within sending any sublobes into the single valley of the tooth, although they are very feebly bulging about the middle of their course.

In the corresponding lobes of the two molars in advance, the bulging of that anterior successively increases, while that posterior in the same position is constricted. This bulging of the lobes diminishes the depth of the principal valleys to a degree corresponding to its successive increase forward.

The bottom of the single, simple valley of the last molar is nearly level its whole length, and is bounded at its entrance by a prominent portion of the basal cingulum.

The principal valleys of the sixth and fifth molars are successively shallower externally, and deepen in a sloping manner toward their entrance, where they are partially closed by a prominent portion of the basal ridge, and hence, in the trituration to which the teeth are subjected, these valleys are obliterated from without inward, and leave no isolated enamel islands, or pits, as in the molars in advance, or in the corresponding teeth of *Rhinoceros indicus.*

In the sixth molar, the posterior valley is as deep externally as the principal valley, and in the fifth molar it is deeper.

In the specimen under consideration, trituration has left the principal valley of the fifth molar as a tract of enamel, which is narrow and slightly depressed externally and curves backward and inward, and expands and deepens as it approaches its termination.

In the second to the fourth molar inclusive, the inner lobes at their bases internally are confluent, and from the degree of trituration which the third and fourth molars have undergone in the specimen, the principal valleys are left as simple, oblique, trilateral pits or islets of enamel, occupying the centre of the exposed dentinal surface. In the second molar, from the less degree of confluence of the inner lobes internally, in addition to its being less worn, the principal valley still remains open.

In the fourth molar, the postero-internal lobe is not much more than half the thickness of that in advance; but in the second and third molars, the inner lobes are nearly equal in size.

The basal cingulum of the molars, from the second to the fourth inclusive, envelops the base of the postero-internal lobes to a much greater extent than upon the antero-internal lobes, or rather these are shorter than the former, and the basal ridge descends in its course postero-internally, where it is very thick and strong, and is so prominent, that when the teeth are worn down so that the principal valleys remain only at their outer extremity as very small pits, the posterior valleys, which are very nearly as deep, would be left in the same condition.

The first molar in the specimen presents an almost equi-trilateral surface of exposed dentine, with the internal lobes of the crown curving inward and backward and dilating at their termination, and with the antero-external lobe forming its anterior rounded and prominent apex. Portions of a basal ridge connect the bases of the inner and the antero-external lobes together. The short principal valley remains as a narrow tract of enamel constricted at the middle and deepened at both extremities. The posterior valley remains as a small trilateral islet of enamel. Between the antero-external and internal lobes the basal ridge forms a broad cul-de-sac.

Inferior Molars.—(Pl. XIII. 2–6.) The teeth, preserved in the fragments of lower jaws referred to, belong all to the posterior four molars, and these do not differ in their form from those corresponding to them in recent species of *Rhinoceros.* A basal ridge with a rough margin exists in all, but is obsolete on the inner side of the posterior three molars, and on the outer side of the posterior lobe of the same teeth, except the last. Between the bases of the lobes externally it forms a small tubercle.

Other Teeth.—No incisors are preserved in any of the specimens, but from a portion of alveolus preserved in one of the latter, already referred to, it is of course conclusive that incisors existed in the adult, at least in the upper jaw.

MEASUREMENTS OF THE HEAD AND TEETH.

	Lines.	Inches.
Length of skull from the upper margin of the occipital foramen to the inter-maxillary bone	16	9
Length of skull from same position to the first molar	15	4
Breadth of inion at the mastoid processes; estimated	5	0
Greatest breadth at the zygomata	8	0
From the tip of one post-glenoid tubercle to the other; estimated	3	6
Distance from the meatus auditorius externus to the lachrymal tubercle	8	0
Height of face from alveolar margin on a line with the anterior orbital margin	5	6
Height of face from alveolar margin on a line with the infra-orbitar foramen	4	6
Greatest breadth of forehead at the supra-orbitar processes	7	0
Length of upper molar series	7	3
Greatest breadth of seventh molar	1	7
Greatest breadth of sixth molar	1	8
Greatest breadth of fifth molar	1	7
Greatest breadth of fourth molar	1	6
Greatest breadth of third molar	1	4
Greatest breadth of second molar	1	0
Greatest breadth of first molar	0	9
Antero-posterior diameter of last lower molar	1	6
Antero-posterior diameter of the third lower molar	1	1

Rhinoceros Nebrascensis, Leidy.

(Plate XIV., XV.)

Rhinoceros Nebrascensis, Leidy: Proc. Acad. Nat. Sci., 1850, v., 121; Owen's Rep. of a Geol. Surv. of Wisc., etc., 556.

Aceratherium Nebrascensis, Leidy: Proc. Acad. Nat. Sci., 1851, v., 331.

Of the smaller *Rhinoceros* of Nebraska we possess portions of at least twelve different individuals, as follows:—

1. The anterior portion of a skull, accompanied by the lower jaw, of an adult individual. The former has the forehead, orbital entrance, and molar teeth well preserved, but the face is very much broken, and its nasal part is displaced. The lower jaw contains all the molars in perfect condition, but it has lost its rami and the symphysis. (XIV. 1–3.) From Captain Stewart Van Vliet's collection.

2. A much mutilated face, containing on both sides the molar teeth nearly perfect. It belonged to a nearly adult individual, as the teeth, which belong to the permanent series, are all in place except the last, which has about two-thirds protruded. (XIV. 13.) From the collection of Dr. Owen.

3. The skull, accompanied by a small fragment of the lower jaw, of a very old individual. The former has its upper part broken away, but the base is nearly

entire; and it contains all the molar teeth, which have their crowns worn nearly to a level with the alveolar margin. (XV. 1, 2.) From Dr. Owen's collection.

4. The crowns of four permanent premolars of the left side of the upper jaw and one of the right side. These are perfect and are not at all worn, having been concealed within the maxillary bones, from which they were removed with much labor. (XIV. 4–8.) Presented to the Academy of Natural Sciences, by Mr. Alexander Culbertson.

5. A small fragment of an upper jaw containing the first permanent true molar, slightly worn, and a portion of the fourth permanent premolar, which was still concealed within the bone. From Dr. Owen's collection.

6. A small fragment of an upper jaw, with an unworn sixth molar, and the seventh unprotruded. From Mr. Culbertson's collection.

7. A second inferior permanent molar, and two fragments of lower jaws. One of the latter contains the fifth molar unworn, and the other contains a sixth molar partially protruded. All three specimens are apparently from different individuals. From Mr. Culbertson's collection.

8. A fragment of the right side of a lower jaw, containing the last three molars. From Dr. Owen's collection.

9. A fragment of the left side of a lower jaw of a very young animal, containing the last temporary molar unworn, and the first permanent true molar protruded. (XIV. 9, 10.) From Dr. Owen's collection.

10. A fragment of the right side of the upper jaw, containing the posterior three temporary molars, which are considerably worn. (XIV. 14.) From Mr. Culbertson's collection.

Description of the Head.—The skull of *Rhinoceros Nebrascensis* is about three-fourths the size of that of *Rhinoceros occidentalis.*

Lateral View.—(Pl. XIV. 1; XV. 1.) So far as can be ascertained from the imperfect specimens, the side of the head presents most of the characters of that of *Rhinoceros occidentalis.*

The root of the zygomatic process is implanted about the middle of the bottom of the temporal fossa, and its upper surface is antero-posteriorly convex.

The temporal surface is convex and smooth, and, as in *Rhinoceros occidentalis,* apparently rose upon a prominent sagittal crest. Its occipital border curves from the base of the mastoid process upward and backward to the summit of the inion.

The squamous portion of the temporal bone is nearly vertically convex, and is an inch in height above the root of the zygomatic process.

The squamous suture at its upper part pursues a course almost horizontal for nearly three inches. At its posterior part, in the particular specimen under investigation, there are two deep, ascending, vascular grooves.

The orbit has about the same form as in *Rhinoceros occidentalis,* but in the specimens its floor is more superficial.

The optic foramen is large and vertically oval, and is placed an inch in advance of the spheno-orbital foramen.

The margin of the orbital entrance is as well defined as in *Rhinoceros occidentalis;* but the supra-orbitar process is neither quite so prominent nor so rough.

The post-orbital process, though merely the termination of the supra-orbital margin, is nevertheless well marked compared with its condition in *Rhinoceros indicus.*

As in the latter, there exists a prominent lachrymal process; but there are two lachrymal foramina, placed one above the other internal to the process.

The malar bone is robust, and in its course is directed a trifling degree more outward than in *Rhinoceros occidentalis*, and its external face presents more upward.

The alveolar portion of the face is vertical, but antero-posteriorly is convex. The position of the lachrymal bone presents an oblique slightly depressed surface.

The infra-orbital foramen is placed about an inch above the interval of the second and third molar teeth.

In all the specimens, the remainder of the face is too much broken to form any correct idea of its form.

Superior View.—(Pl. XIV. 11.) The forehead, preserved nearly entire in one specimen, is broad, and above the orbits is elevated and convex, but is depressed towards the median line. The temporal ridges converging from the post-orbitar processes are relatively not so prominent as in *Rhinoceros occidentalis;* but, as in this, they evidently conjoin to form a sagittal crest.

Posterior View.—(Pl. XIV. 12.) The inion has a more trilateral outline than in *Rhinoceros indicus,* and in the middle it is much more bulging or prominent, so that the superior angular margin of the foramen magnum projects considerably posterior to the basilar margin. Towards the summit the median portion of the surface of the inion becomes depressed, and each side is directed quite laterally in its course to the temporal margin.

The occipital condyles are more vertical in their relation to one another than in *Rhinoceros indicus;* and above each there is a well-marked depression of the surface.

The occipital foramen is subrotund, and about ten lines in diameter, and it has an angular margin above and a concave one below. It is directed backward and a little downward.

Inferior View.—(Pl. XV. 2.) In the specimen in which the base of the skull is preserved, the junction of the basilar process and sphenoidal body is completely obliterated. Near its position on each side is a superficial rough elevation for muscular attachment.

The median line of the basilar process is prominent, and each side is slightly depressed.

The sphenoidal bodies are prominently convex, and within the roots of the pterygoid processes slope on each side to form a broad shallow groove for the Eustachian tube.

Separated by the anterior scroll-like terminations of the occipital condyles, a distance of ten lines, are the anterior condyloid foramina, which are oval and three lines in diameter antero-posteriorly.

To the outside of the latter, and a little in advance, is the para-mastoid process, existing in the specimen as a broad stump, compressed antero-posteriorly.

The mastoid process forms the posterior abutment of a high arch conducting to the entrance of the tympanic cavity, or in other words the meatus auditorius, as it exists in *Rhinoceros indicus*, is open at the bottom. The process is strong and is bent forward at its apex, which is tuberous and extends nearly as far downward as the post-glenoid tubercle, from which it is about five lines distant.

The pars petrosa is quite small. It appears at the bottom of the arch between the post-glenoid and para-mastoid processes, as a V-shaped body, bent forward at its lower part by the base of the styloid process.

The remaining portion of the latter, in the specimen, is a stout cylinder clasped antero-internally by the os petrosa.

Between the bottom of the styloid and para-mastoid processes is the stylo-mastoid foramen.

The foramen lacerum is a very large reniform vacuity, being about an inch in diameter antero-posteriorly, and about four lines transversely.

In advance of the latter a few lines is a distinct foramen ovale, and a short distance antero-internal to this is a round foramen, conducting into the homologue of the foramina rotundum and spheno-orbitale.

The latter opens at the bottom of the orbit just internal to a pointed process arising from the conjunction of three ridges; one of which comes from the margin of the foramen, the other from above the position of the optic foramen, and the third constitutes the boundary of origin between the temporal and external pterygoid surfaces.

The optic foramen is placed about an inch in advance of the spheno-orbitale.

The glenoid articulation is more concave than in *Rhinoceros indicus*, and that portion of its surface situated on the anterior part of the root of the zygomatic process presents more backward and outward.

The post-glenoid tubercle, compared with that of *Rhinoceros indicus*, is relatively short; at its outer margin being ten lines in length, and it projects only two lines below the mastoid process. What it loses in length it gains in robustness and breadth; and its outer side is rough, and the apex truncated. Posteriorly it is perforated by a vertical foramen.

The interpalatine notch extends forward as far as the posterior third of the penultimate molar tooth.

The hard palate is strongly arched, though not so much as in *Rhinoceros occidentalis*, and it also differs from that of the latter in being relatively broader, and less convergent at the alveolar margin anteriorly.

Inferior Maxilla.—(Pl. XIV. 2.) The body of the lower jaw externally is vertically convex, and anteriorly is more convergent than in *Rhinoceros indicus*. Its depth below the posterior molar tooth is about twenty lines; below the first molar, fifteen lines. The base is rounded, and is about as convex antero-posteriorly as in the last mentioned species.

In the specimen under investigation, the symphysis is broken off a few lines in advance of the molars, and it there presents a crescentic surface only ten lines broad and six deep, indicating the inferior incisor teeth to be of small size in this species. Upon each side of the broken surface, about three-fourths of an inch from the position of the first molar teeth, there remains the end of the fang of the external incisors.

The anterior mental foramen occupies a position near the base of the bone below the hinder fang of the second molar of the remaining series. In advance of it, on nearly the same line, are two other and smaller foramina of the same kind.

A portion of the ramus shows this to have been thin and deeply excavated internally, as in the Tapir. The posterior mental foramen is large, and placed about one inch behind the last molar tooth.

Dentition.—Except the first inferior molar tooth, which is shed at an early period, the entire series of permanent molar teeth in *Rhinoceros Nebrascensis* is retained to a late period of life, as is indicated by the specimen of a skull of a very old individual in the collection of Dr. Owen, in which, although the crowns are almost completely worn away, yet the whole number remains.

From minute fragments of fangs of an upper and lower incisor existing in two of the adult specimens under investigation, we are satisfied of the existence of these teeth permanently, but the number we have no means of ascertaining.

Superior Molars.—(Pl. XIV. 1, 13; XV. 3.) The upper molars bear a very great resemblance in form to those of *Aceratherium incisivum*; and they possess a basal ridge all round except at the inner side of the bases of the internal lobes of the true molars, and where it has been obliterated by pressure from the teeth in contact.

The outer surface of the true molars is broad and slightly depressed at the middle, and at the anterior fifth forms an abrupt fold, as in all other species of *Rhinoceros*.

The last molar exhibits a disposition to the development of a posterior valley, or rather a separation, as in the other molars, of the postero-internal and external lobes. The anterior valley of this tooth is almost as deep as the crown, is nearly level at bottom, and is bounded at its entrance by a mammillary eminence, which is a portion of the basal ridge. The hinder lobe is quite simple, and exhibits no tendency to encroach upon the anterior valley; but the antero-internal lobe at its middle posteriorly protrudes considerably into the latter.

The inner lobes of the true molars in advance expand gradually to their base, are impressed anteriorly, and protrude into the valleys about their middle posteriorly. The valleys are of equal depth at their outer extremities or termination, and the principal ones, except in the penultimate tooth in one specimen in which the bottom throughout is nearly uniform, deepen towards their entrance, so that in the trituration to which the teeth are subjected in mastication, as in *Rhinoceros occidentalis* and *Aceratherium incisivum*, they become obliterated from without inwardly. The entrance of the anterior or principal valleys in the fifth and sixth molars is not obstructed by the existence of a constituent portion of the basal ridge, as in *Rhinoceros occidentalis*.

A small fragment of an upper jaw, presented to the Academy of Natural Sciences by Mr. Alexander Culbertson, contained the crowns of the four premolars entirely concealed within the bone. These, having been divested of their hard envelop, are remarkable for their state of preservation and beauty, and lead me to describe them more minutely than may be considered essential. (XIV. 4–8.)

The first premolar is only three-fourths the size of the others, and it is trilateral with the inner and posterior sides, forming a continuous convexity. The posterior three premolars increase slightly to the last one, and they are quadrate and have the inner side convex and narrowest.

The outer side (4) of these teeth forms a large quadrilateral surface with rounded angles. It is slightly convex, and is feebly waved longitudinally. At the fore part a narrow fold descends from the base and expands towards the triturating margin; but it is successively less developed forward, and in the first of the series is rudimentary. This fold increases in depth in the true molars, and is quite characteristic of the outer part of these teeth in *Rhinoceros*, as it does not exist in *Palaeotherium*, *Titanotherium*, nor *Anchitherium*.

In advance of the fold just described, the antero-external margin of the molars projects forward and slightly outward, and looks like an independent column or buttress, and is the shortest portion of the outer lobes.

The triturating margin of the latter, in the specimens of premolars under especial examination, is bilobed and acute.

The inner surface of the postero-external lobe is a little convex, and from the same surface of the antero-external lobe in the third and fourth premolars an abrupt fold projects into the principal valley of the teeth (5). This fold, when the teeth are partially worn away, gives the termination of the principal valley a bifurcated appearance; and in *Rhinoceros indicus* and *Rhinoceros tichorinus* it is the extension and confluence of the fold with the anterior part of the postero-internal lobe of the teeth which produces a division of the principal valley, represented when the teeth are considerably worn away by two enamel pits.

The internal lobes have acute summits and more or less expanding bases, and, except in the first tooth, their inner extremities for more than half their depth are confluent, so that the principal valley is a deep pit, with shelving sides and an internal notch (5, 6).

In the fourth premolar, the postero-internal lobe is a sigmoid fold projecting from the confluence of the outer lobes.

In the three premolars in advance, the postero-internal lobe consists of two portions; an inner pyramid with two broad sides directed obliquely antero-posteriorly, and a bent fold extended between the confluence of the outer lobes and the outer side of the pyramid, and separating the two characteristic valleys of the teeth. This fold does not reach the summit of the inner pyramid, nor of the outer lobes, and it looks more like a narrow partition separating the valleys than a constituent portion of the postero-internal lobes.

The antero-internal lobe of the premolars, except in the first, is directed transversely inward on a line with the characteristic fold of the outer surface of the teeth, and it expands as it approaches its termination, and antero-internally swells into a sort of conoidal buttress, gradually increasing in distinctness from the second to the last premolar. In the first premolar it appears only as a small, compressed mammillary eminence of the basal cingulum.

The latter, as in *Rhinoceros occidentalis*, is well developed upon all the premolars. In the specimens under special examination, ossification had not yet advanced to its production, externally (4), but in older specimens in this position it measures over a line in depth (1). At the postero-external margin of the teeth it very abruptly descends half the length of the crown (6), then, proceeding inward, it envelops the base of the postero-internal lobe, and internally it ascends to the base of the antero-internal lobe, and winds anteriorly to the antero-external margin of the crown, and then makes an abrupt ascent to the base externally (7, 8).

The anterior and posterior valleys in all the premolars are deep culs-de-sac with shelving sides (5).

When the molar teeth have had one-half their crown worn away in mastication they are hardly recognizable in those which have not been subjected to trituration. Comparatively with one another, they of course suffer attrition most in the order of their succession, and this, judging from the specimen in Dr. Owen's collection, in which the seventh molar is only partially protruded, may be determined to occur in the following manner. After the temporary teeth, the fifth molar is protruded, and in the permanent series appears most worn; then succeed the first to the fourth permanent molars, then the sixth, and finally the seventh (13).

In the specimen of the skull containing all the molars, presented by Capt. S. Van Vliet to the Smithsonian Institution, these teeth are worn about one-half away, and exhibit very strikingly the transformation of form produced by attrition. (XV. 3.)

The enamelled grinding surface of the fifth molar, except a short inlet constituting the entrance of what was the principal valley, has been completely obliterated. The exposed dentinal surface is concave, and bordered by enamel, except anteriorly and posteriorly, where it also appears to have been removed, probably from the combined influence of long-continued pressure and friction from the contiguous teeth.

In the sixth molar, the exposed dentinal surface is more deeply bilobed internally than in the former; or, in other words, a longer tract of enamel remains from the anterior valley; and farther, almost the whole of the bottom of the posterior valley yet remains.

The seventh molar, from its being the last to take its position in the functional series, is worn less than any of the others. Its valley remains entire, except that it is rendered a little more shallow, from the summits of the lobes which embrace it being worn off. The exposed dentinal surface presents an irregular V-shaped figure, with the apex and extremities of its arms bifurcated.

The second to the fourth molars inclusive present nearly square dentinal surfaces bordered with enamel, bilobed internally, and possessing, each, two trilateral pits of enamel, the remains of the valleys. The central pit is the larger, and has convex sides and rounded angles; and the smaller pit is in contact with the posterior border of the teeth.

The exposed dentinal surface of the first premolar, in the specimen, upon one side of the jaw, has two small circular pits of enamel, and on the other, a single trilateral pit, which remains from the posterior valley; and in both teeth a cul-de-sac in connection with the internal border exists before and behind the rudimentary antero-internal lobe.

When the enamelled triturating surfaces of the molars are completely obliterated by mastication (1, 2), as is the case in the specimen of a skull of a very old animal in the collection of Dr. Owen, the exposed dentinal surfaces are quadrate and bilobed internally, a little broader transversely than antero-posteriorly, smooth and more or less depressed. Most of the crowns are bordered with enamel only at their internal portion; it having entirely disappeared upon the true molars externally, and probably also upon the premolars, but these, in the specimen, are too much broken at their outer part to judge. Between the teeth also the enamel has partially and in many positions entirely disappeared, so that the dentinal masticating surfaces are separated only by the interstices of the crowns.

Inferior Molars.—(Pl. XIV. 2, 3.) The normal number of lower molar teeth of *Rhinoceros* is seven, as in the upper jaw; but in the only specimen of the lower jaw of *Rhinoceros Nebrascensis* which we possess, the number of molars on each side is six; the first having been long shed and its alveolus entirely obliterated.

In form, the inferior molars resemble closely those of all other species of *Rhinoceros*. All have a basal ridge surrounding them, except where it has been obliterated, in the course of time, by pressure and friction between the teeth.

The second molar of the normal series, in outline transversely, presents an isosceles triangle, but, like the others, it is constituted of two distinct lobes, of which the anterior is so much compressed laterally as to lose the crescentoid form.

In the specimen of the lower jaw accompanying the skull obtained by Captain Van Vliet, the crowns of the molars are considerably worn away. The fifth molar has its two crescents nearly obliterated; the sixth is less worn; and then follows in succession the fourth to the second, and then the seventh. In the latter, the exposed dentinal surfaces of the crescentic lobes are distinct, but in all the others they have become confluent. From the long continuance of pressure and friction the enamel has disappeared where the teeth are in contact, except between the anterior and the posterior two.

In a small fragment of lower jaw accompanying the skull of a very old animal in Dr. Owen's collection, containing the fifth molar, the enamel of this has been worn away, except a very small portion at each posterior angle, and the masticating surface of dentine in outline has the form of the figure 8, and is transversely convex and antero-posteriorly concave. Small fragments of the teeth in advance and behind, in the same specimen, indicate them not to have been as much worn, so that the nearly entire tooth is probably the first of the true molar series.

Temporary Molars.—The posterior three temporary molars, as I suppose them to be, contained in a fragment of the upper jaw, are of about the same size as their permanent successors (XIV. 14). They are more square, or are less contracted and convex internally, and the inner lobes are more equal in size, and do not become confluent internally. In consequence of the latter arrangement, the principal valleys are open at their entrance to the bases of the lobes, and in the third and fourth molars they deepen from without inward, as in the case of the two anterior permanent true molars. In these two temporary teeth, also, the posterior valleys are deeper at their outer end than those anterior. In the second molar, the bottoms of both valleys are nearly uniform in their depth throughout and with each other. The basal ridge is horizontal upon the inner side of the temporary molars, and in front and behind very gradually descends to the external margins of the crown.

The inferior last temporary molar preserved unworn, in company with the first permanent true molar protruded, in a fragment of lower jaw, exhibits a disposition to the formation of three lobes, by the ordinary anterior-normal lobe being deeply notched at its anterior horn, while in advance of this a smaller transverse lobe, slightly bent forward and inward, is developed at its outer side. A continuous basal ridge surrounds the tooth, which otherwise than in the characters given corresponds with the permanent molars. (XIV. 9, 10.)

MEASUREMENTS OF THE HEAD AND TEETH.

	Inches.	Lines.
Length of skull from the upper margin of the occipital foramen to the anterior part of the first molar tooth	9	0
Breadth of inion at ends of mastoid processes	3	0
Greatest breadth at the zygomata (estimated)	5	2
Breadth at the post-glenoid tubercles	3	4
Distance from meatus auditorius to the lachrymal tubercle	4	6
Height of face from the alveolar margin on a line with the middle of the orbit	3	4
Greatest breadth of forehead at the supra-orbitar processes	3	5
Breadth of hard palate about its middle	1	7
Length of upper molar series	4	10
Length of lower molar series	4	4
Breadth of last superior molar	0	11
Breadth of fourth molar	0	11
Breadth of first molar	0	6
Antero-posterior diameter of fifth upper molar	0	11
Antero-posterior diameter of second upper molar	0	8½
Antero-posterior diameter of first upper molar	0	6½
Antero-posterior diameter of last lower molar	0	11
Antero-posterior diameter of first (of six)	0	7½
Breadth of fourth lower molar	0	6½

CHAPTER III.

CARNIVORA.

Fam.—Digitigrada.

Gen. **MACHAIRODUS**, Kaup.

The genus *Machairodus* was proposed by Kaup upon specimens of upper canine teeth, found in the later tertiary deposits of Europe, remarkable for their length, falciform shape, and serrulated margins. They had been previously referred to the genus *Ursus*, but the discovery in France, by M. Bravard, of an almost entire skull containing a tooth like those in question, decided the animal to belong to the feline family.

Several species occurring in Europe and India have since been indicated, and the skull of a very large one was discovered by M. Lund in the caverns of Brazil.

Machairodus primaevus, Leidy and Owen.

(Plate XVIII.)

Machairodus primaevus, Leidy and Owen: Proc. Acad. Nat. Sci., 1851, v. 329; Owen's Rep. of a Geol. Surv. of Wisc., etc., 564.

Among the mammalian remains brought by Dr. Evans, while engaged in the geological survey of Dr. Owen, from the Mauvaises Terres of Nebraska, is the head of a small species of *Machairodus*, which is probably the most ancient known.

The species was characterized in the Proceedings of the Academy of Natural Sciences under the name of *Machairodus primaevus*.

The specimen upon which the latter is established is very much fractured and fissured, and it has the summit of the inion, the zygomata, anterior extremities of the ossa nasi, superior incisors, and the greater portion of the corresponding canines, and the symphysis of the lower jaw with the incisors and canines, broken away. When first received, it was partially enveloped in a matrix, which, though having the same general appearance as that inclosing all the other mammalian fossils from Nebraska, was unusually hard. Attached to the mass, but separated from the skull, was the greater portion of a tooth, which I have considered to be of an inferior canine of the same animal; but it may be one of the upper incisors, which, as indicated by the alveoli, are relatively very large compared with the corresponding teeth of *Felis*.

The head of this species is about half the size of that of *Machairodus neogaus*, and indicates an animal about one-fifth smaller than the American Panther, *Felis concolor*.

Lateral View.—(Pl. XVIII. 1.) In the side view, the upper outline of the skull is more convex antero-posteriorly than in the species of *Machairodus* just mentioned or the Panther, from the greater elevation of the forehead above the orbits posteriorly.

The ossa nasi are not prominent above the border of the upper extremity of the os maxillare superius, as in *Felis*, but are concealed from view laterally, and the anterior slope of the head is more uniform in its descent, or is less arched than in this genus.

The temporal fossa relatively to that of *Felis* is shorter, of greater breadth, and much greater depth. The anterior surface of the zygomatic root inclines at an angle of about 50°, instead of being nearly horizontal, as in *Felis*. The temporal surface generally disposes to be much more rapidly convergent towards its exit inferiorly than in the latter, and indeed the whole arrangement of the temporal fossa is such as to have given a much less oblique course to the fibres of the temporal muscle.

The entrance to the meatus auditorius is not a broad archway, as in *Felis*, but is a relatively deep narrow arch, apparently resulting from a modification of that in the latter genus, produced by the root of the zygomatic process being depressed downward and backward. The meatus is bounded posteriorly by a relatively very robust and distinct mastoid process, which is directed downward and forward, and has a broad rough apex for muscular attachment. The posterior surface of the process curves upward and backward, and its base abuts against the paramastoid process, which is a short, thick, roughened tuberosity.

The form, relative size, and direction of the orbit are the same as in *Felis;* being ovoid, with the narrower part above. It is an inch and four lines in vertical diameter, and has the plane of its entrance inclined at an angle of about 50°; presenting outward, forward, and upward.

The infra-orbitar foramen is vertically oval, and not only relatively but absolutely very much larger than that of the Panther. It is about half an inch in vertical diameter and five lines transversely, and is situated internal to the position of the orbit, with more than half its extent placed above the line of the lower margin of the latter.

Above the foramen, just in advance of the orbital margin, the surface is more definitely concave than in *Felis*, and anterior again to this the convexity of the canine alveolus commences.

In the specimen, the upper carnassial tooth is placed far external to the tooth in advance, but this relation of position appears to be the result of a dislocation inward of the latter, and it is most probable that in the natural condition the upper molars were arranged in an oblique line convergent forward and upward, as in *Felis*.

The anterior portion of the external alveolar surface is transversely concave, but vertically is very strongly convex in comparison with what it is in the latter genus.

Superior View.—(XVIII. 2.) In the upper view of the skull, the temporal surfaces above the position of the roots of the zygomatic processes are much less convex than in *Felis,* and just behind the post-orbital processes are more deeply excavated and of much greater vertical extent.

The sagittal crest, though broken in the specimen, can yet be seen to have been prominently elevated and strong to the point of its bifurcation.

The forehead is much more strongly arched than in *Felis,* and also is more depressed along its median line.

The coronal and squamous sutures are entirely co-ossified in the specimen, and the frontal suture is also obliterated, but its original position is indicated by a rugged line.

The face is relatively much broader superiorly than in *Felis,* and along the sides of the ossa nasi it is rendered prominently convex by the greater degree of extension, upward and backward, of the canine alveoli than in the latter genus.

The posterior portions of the ossa nasi, remaining in the specimen, are relatively narrow compared to those of the Panther, are placed slightly below the general level of the corresponding part of the forehead and face, and are quite flat and slightly inclined towards each other.

The intermaxillaries are not quite so prominent forward as in *Felis,* but they are rather stronger, in accordance with the greater size of the incisive teeth.

The inion, which at its upper part is broken, appears to have had nearly the same form as in *Felis;* but the short thick paramastoids are situated higher, and the fossæ between them and the occipital condyles are less deep.

The latter and the occipital foramen have the same form and relative size and position to each other as in *Felis.* The foramen is transversely oval, nine lines in its greater, and six and a half lines in its shorter diameter.

The base of the skull, for the most part, is enveloped in a hard matrix, which to remove would endanger the integrity of the much fissured specimen; nevertheless it presents a few points visible and worthy of notice.

The mastoid processes are a little more advanced in their position, and more internally situated than in *Felis.*

The anterior condyloid foramina are more exposed in their position than in *Felis,* or rather they are not directed to the same extent into the exit of the jugular canal.

The auditory bullæ, though broken away in the specimen from their remaining connections, may be inferred to have been as well developed as in *Felis.*

Inferior Maxilla.—(Pl. XVIII. 1, 3.) The lower jaw corresponds in its general form with that of the latter, but it presents the same remarkable characters as in the other known species of *Machairodus.*

The coronoid process is relatively very short compared with that of *Felis,* and, instead of curving backward, its posterior border is quite vertical to the base of the bone.

The extent of the fossa below the coronoid process, and the form of the condyle, are about the same as in *Felis.*

The post-coronoid process is short and thick, and is bent outward instead of inward, as in *Felis.*

The external surface of the lower jaw, near the base and below the position of the first premolar, presents the commencement of a ridge, which no doubt passed to an alary process of the symphysis, such as exists in *Machairodus neogaus* and other species.

Nine lines of the hiatus in advance of the molars exists in the specimen, without any disposition anteriorly to expand for the accommodation of the canine alveolus. Its margin is acute, and, viewed from the broken part, appears a little everted. Below it externally the surface slopes in a slightly convex manner outwardly to the base of the bone, and it presents two small mental foramina.

Dentition.—(Pl. XVIII. 1, 3, 4, 5.) The upper jaw in the specimen contains the incisive alveoli filled with matrix, portions of the canines, the alveolus for the first molar, and all the other molars except the posterior two of the left side. The lower jaw contains only the molars.

Characteristic of *Machairodus,* the superior incisive alveoli indicate the possession of larger incisors than exist in *Felis.* Laterally they border so closely on the canine alveolus that a smaller hiatus is left than in other species of the genus, and they increase in size from the first to the last.

The upper canine (1) is laterally compressed, and is relatively much less broad than in *Machairodus neogaus,* and was about half as long and broad as that of *Machairodus cultridens.* In the fragment, preserved in the specimen, the posterior sub-trenchant edge, about ten lines below the enamel border of the crown, commences to be crenulate, as in other species of *Machairodus.* Antero-internally there exist the remaining three lines of a ridge, which commences near the enamel border and proceeds downward and forward, and at its lower third is also crenulated. In section the upper canine is elliptical, and is acute posteriorly, and at the enamel border of its crown measures seven lines and a half in breadth, and about four lines and a half transversely.

The first superior molar, as indicated by the remaining alveolus, had a simple mammilloid crown, as in *Felis.* The alveolus is subrotund, about one and a half lines in diameter, and borders closely upon that for the canine.

Posterior to the first molar, a relatively very large hiatus exists compared with that of *Felis* and other species of *Machairodus,* being four lines in length, or equal to the whole interval between the canine and second molar of *Machairodus neogaus.*

The crown of the last mentioned tooth (3), compared with that of the Panther, is shorter relatively to its breadth, and in comparison of size with that of the carnassial tooth is relatively very much smaller than in any species of *Felis.* Its outer surface has the same inclination and prominent base as in the latter, but is less convex. It is composed of a median compressed mammillary cusp, with a trenchant margin, a small anterior lobe, as in *Machairodus neogaus,* and a posterior, simple, compressed mammillary lobe with a trenchant border, relatively equal to the corresponding pair in the latter species and in *Felis.*

The crown of the upper carnassial tooth (1) has about the same relative size as in the latter genus, and also the same degree of inclination of its outer surface, but it does not possess the lenticular fossa at the conjunction of the median cusp with the posterior lobe. The anterior lobe descends much lower than in *Felis,* so as to shorten very considerably the corresponding margin of the median cusp, which in this position is more vertical and posteriorly is more oblique. The posterior lobe is broad as in *Felis*, but is less oblique at the trenchant margin, which also is indented as in the latter genus.

The crown of the tubercular molar (1) is transversely oblong, as in the Domestic Cat, is three lines broad by two antero-posteriorly, and externally forms a mammillary tubercle, and posteriorly a smaller one.

As previously mentioned, the symphysis of the lower jaw, with the incisors and canines, is broken away from the specimen.

The portion of tooth supposed to be part of an inferior canine (4, 5) is of the right side. It corresponds in its form and relative size with that of *Machairodus neogaus;* having a curved demi-conoidal crown, with the postero-internal side defined by longitudinal ridges, of which that external is most salient. At the enamel border this tooth measures three lines antero-posteriorly and two transversely.

The first inferior molar (3) is relatively very much smaller than in *Felis*, and in form it is like that of *Machairodus cultridens;* the crown being compressed conoidal, with a small simple basal lobe anteriorly and posteriorly.

The second molar (3) is less robust in its proportions than in *Felis*, and has the same form nearly, very much increased in size, of the first tooth; for the posterior lobe, though broken in the specimen, appears to be quite simple, or it is without the prominent heel existing in the latter genus, and the division possessed by *Machairodus neogaus.*

The inferior carnassial tooth (3) is quite peculiarly modified from the feline type, and if it had been found as an isolated and unique specimen, it would certainly have led to the separation of the species from the genus *Machairodus.* It possesses the two characteristic lobes, separated by a large angular notch with trenchant margins, as in *Felis*, but the slight posterior heel of this genus is developed into a broader lobe than that occupying a similar position in the tooth in advance. This third lobe is more than half the length of the crown, is depressed externally and notched at its upper posterior angle. It exists only in a rudimentary condition in *Machairodus neogaus.*

MEASUREMENTS.

	Inches.	Lines.
Length from occipital condyles to upper incisive alveoli	6	5
Length from occipital condyles to lachrymal tubercle	4	4½
Height from base of lower jaw to forehead	3	10
Breadth of cranium at most prominent part of temporal fossæ	1	10
Breadth of forehead at post-orbitar processes	2	8
Breadth at ossa malæ below their orbitar processes	4	4
Breadth of face from inner side of infra-orbitar foramina	1	9
Breadth at most prominent part of the canine alveoli	2	1
Height of coronoid process from base of lower jaw	1	7
Height of latter below first molar	0	11
Antero-posterior diameter of second upper molar	0	5½
Antero-posterior diameter of upper carnassial tooth	0	10
Antero-posterior diameter of first lower molar	0	3
Antero-posterior diameter of second lower molar	0	6
Antero-posterior diameter of lower carnassial tooth	0	8½

CHELONIA.

CHAPTER I.

TESTUDO, Linnaeus.

All the fossil turtles from Nebraska, which have come under my inspection, belong to the genus *Testudo*.

In the ordinary constitution of *Testudo*, the osseous carapace is composed of ten vertebral plates, eight pairs of costal plates, and eleven marginal plates upon each side of a symmetrical nuchal and pygal plate.

Fig. 1.

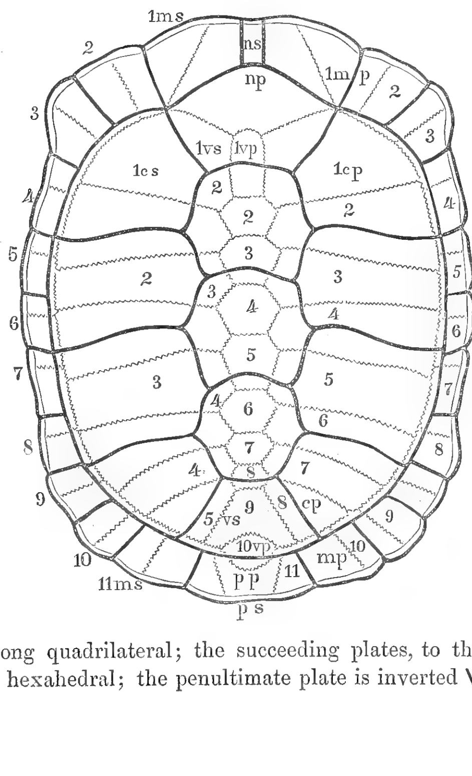


Fig. 1. Ideal view of the structure of the carapace of Testudo. The dark outlines indicate the boundaries of the scutes; the serrated lines, the limits of the plates. 1vp—10vp (*median line*), vertebral plates; 1cp—8cp (*right hand*), costal plates; 1mp—11mp, marginal plates; np, nuchal plate; pp, pygal plate; 1vs—5vs, vertebral scutes; 1cs—5 (*left*), costal scutes; 1ms—11ms, marginal scutes; ns, nuchal scute; ps, pygal scute.

The first vertebral plate is oblong quadrilateral; the succeeding plates, to the eighth inclusive, are most usually hexahedral; the penultimate plate is inverted V shaped; and the last of the series is rhomboidal, and is included in the notch of the latter and one similar of the pygal plate.

The costal plates are alternately broader and narrower.

In the recent condition, the carapace is invested by corneous scutes, which impress it with their form.

There are five vertebral scutes, four pairs of costal scutes, and eleven marginal scutes upon each side of a narrow symmetrical nuchal scute and a broad undivided pygal scute.

The plastron or sternum of *Testudo* is composed of a single, more or less pyriform, entosternal plate, inclosed by a pair of episternal and hyosternal plates, and posterior to the latter of a pair of hyposternal and xiphisternal plates.

Fig. 2.

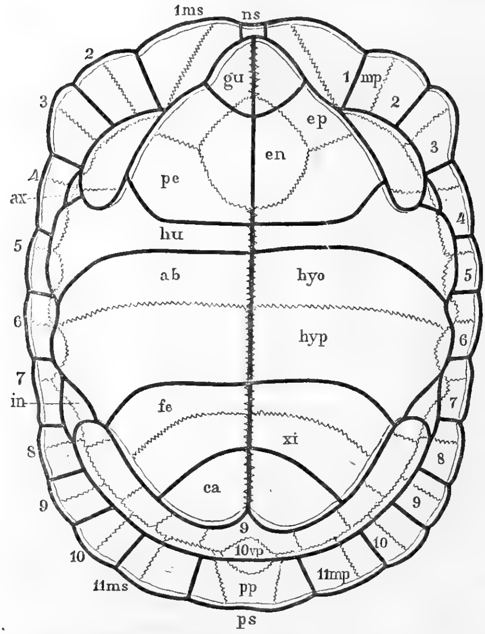


Fig. 2. Ideal view of the structure of the sternum of Testudo. en, entosternal plate; ep, episternal plate; hyo, hyosternal plate; hyp, hyposternal plate; xi, xiphisternal plate; gu, gular scute; pe, pectoral scute; hu, humeral scute; ab, abdominal scute; fe, femoral scute; ca, caudal scute; 1mp—11mp (*right*), marginal plates of the carapace; 1ms—11ms (*left*), marginal scutes of the carapace; ns, nuchal scute; ps, pygal scute; 9, 10vp, vertebral plates; pp, pygal plate.

The corneous scutes of the sternum, which impress their osseous basis, consist of eight pairs, as follows: the gular, pectoral, humeral, axillary, abdominal, femoral, inguinal, and caudal scutes.

Dr. Evans, in the Geological Report of Dr. Owen, before quoted, states that fossil turtles were found in a portion of the Bad Lands, some five or six miles in extent, having much the appearance of an ancient lake, where it is entered from Bear Creek, a tributary of the Cheyenne. At one of these lake-like expansions hundreds of fossil turtles were discovered. They do not rest immediately on the grassy plain that forms the present floor or bottom, but on the talus and debris, collected into mounds, which have been derived from the disintegration of the marly earths that have slid from above. The particular stratum in which they seem to have been originally imbedded, is a pale flesh-colored, indurated, siliceous, marly limestone, situated from thirty to forty feet above, as shown in Number 7 of the geological section, page 13 of this memoir. In the succeeding pages I shall describe five species of *Testudo*, but at the same time I suspect that they may not all be truly distinct.

Testudo Nebrascensis, Leidy.

(Plate XIX.)

Stylemys Nebrascensis, Leidy: Proc. Acad. Nat. Sci., 1851, v., 172.
Testudo Nebrascensis, Leidy: Proc. Acad. Nat. Sci., 1852, vi., 59; Owen's Rep. of a Geol. Surv. of Wisc., etc., 567.

Of this species I have the opportunity of examining four specimens from the collections of Messrs. Culbertson, Captain Van Vliet, and Dr. Owen. All are more or less broken, and two are crushed; all have lost the anterior and posterior marginal plates, and in one the carapace is almost entirely gone. They vary a little in size, and apparently belonged to immature individuals, as the costal plates had not yet been connected to the marginal plates by cartilage.

The form of the species approaches very much that of the genus *Emys*, and is more depressed than the Gopher, *Testudo polyphemus*.

The marginal plates are oblique at the sides of the carapace, and turn abruptly beneath at their lower third.

The processes of the sternum, which act as columns of support to the carapace, at the bottom of the lateral notches are remarkable for their prominence and thickness. Those anterior are twenty-one lines long, four lines broad, and two and a half lines thick, and ascend inwardly at an angle of about 45°, and are received at their free extremity into a pit about the middle of the outer margin of the first costal plate. Those posterior are equally strong with the former, and join the carapace at the junction of the fifth and sixth costal plates.

The sternum is flat, turned a little upward anteriorly, and is slightly convex at its junction with the carapace.

The axillary and inguinal notches are directed downward; and the line of union of the sternal with the marginal scutes is nearly parallel on the two sides.

The species is the smallest and most depressed of those brought from Nebraska, and in all the specimens the arrangement of the plates is the same, except in the smallest, which has an additional vertebral plate introduced between the ordinary eighth and the inverted V-shaped penultimate plate.

Plates of the Carapace.—(Pl. XIX. Fig. 1.) The first vertebral plate has convex sides, and in the smallest specimen, being the only one in which it is preserved, is ten lines long and six broad. The vertebral plates, from the second to the eighth inclusive, are hexahedral; and to the fifth are nearly equal in size, but afterwards undergo a rather sudden reduction, and then also continue to be nearly equal.

The second vertebral plate articulates with the first and second pairs of costal plates; the third with the second and third; and in the same manner the remaining vertebral plates, to the eighth inclusive, articulate each with two pairs of costal plates.

The first costal plate joins the first to the third marginal plate inclusive.

Plates of the Plastron.—(Pl. XIX. Fig. 3.) In the largest specimen of *Testudo Nebrascensis*, in which the sternum is best preserved, the entosternal plate is pyriform, and measures one and a half inches long by sixteen lines broad. It encroaches for a third of an inch upon the position of the gular scutes, and extends within a line of the humeral scutes. In the other specimens, the entosternal plate reaches the boundary of the latter.

In the largest specimen, the episternal plates are one and a half inch long.

The hyosternal plates are two and a quarter inches long, and in all the specimens articulate with the third to the fifth marginal plates inclusive.

The hyposternal plates, in the smallest specimen, are one and a half inch long, in the largest two inches; and they articulate with the postero-inferior angle of the fifth marginal plates, and the sixth and seventh of the latter.

Scutes of the Carapace.—(Pl. XIX. 1.) The vertebral scutes, from the second to the fourth inclusive, are hexahedral, and are broader than they are long. The second and third are nearly equal in size, and in the smallest specimen measure about nineteen lines broad by fifteen long. The fourth vertebral scute is sixteen lines broad by fifteen long, and in another specimen, twenty broad by sixteen long, and it has the postero-lateral sides more convergent backward than in the preceding scutes.

Scutes of the Plastron.—(Pl. XIX. 3.) Upon the sternum, in all the specimens, the scutes agree in the details of their arrangement, except that in the smallest the anterior margin of the humeral scutes courses along the bottom of the axillary notches, but in the others turns forward and outward to the latter.

The gular scutes, the position of which is preserved in the largest specimen, are one inch in length and are angular posteriorly.

The pectoral scutes are two inches and one line long.

The humeral scutes internally measure a half an inch in length, but externally expand before and behind, and join the axillary and the fourth and fifth marginal scutes. In the smallest specimen they reach to the sixth marginal scutes, but in the largest one not within several lines.

The abdominal scutes of the largest specimen are two inches two lines long, but are a fourth of an inch less in the smallest one, and in this they join the sixth and seventh marginal and the inguinal scutes, and in that several lines of the fifth marginal scutes in addition.

The lines of junction of the scutes of the sternum with those of the carapace are nearly parallel on the two sides, and are undulant and intersect the sutural connection of the contiguous plates.

The axillary scute rests upon the hyosternal and third marginal plates between the humeral and fourth marginal scutes.

The inguinal scute is supported upon the hyposternal plate, and in the largest specimen upon the sixth and seventh marginal plates, but in the smallest upon the seventh only, between the abdominal and seventh marginal scutes.

MEASUREMENTS.

	THREE SPECIMENS.		
	Smallest.	Medium.	Largest.
Estimated length of sternum			7 in.
Breadth of sternum at inferior border of marginal scutes	$4\frac{3}{4}$ in.	$4\frac{3}{4}$ in.	$5\frac{1}{2}$ in.
Length of transverse curve of the carapace from the level of the sternum	$8\frac{3}{4}$ in.		
Height from the level of the sternum	3 in.		
Length of the lateral marginal plates	$1\frac{1}{2}$ in.	$1\frac{3}{4}$ in.	
Height of latter from the level of the sternum	$1\frac{1}{2}$ in.		

Testudo hemispherica, Leidy.

(Plates XX., XXIV. Fig. 3.)

Emys hemispherica, Leidy: Proc. Acad. Nat. Sci., 1851, v., 173.
Testudo hemispherica, Leidy: Proc. Acad. Nat. Sci., 1852, vi., 59; Owen's Rep. of a Geol. Surv. of Wisc., etc., 570.

This species originally was established upon a specimen consisting of the sternum with a small portion of the carapace attached, from the collection of Capt. Van Vliet.

In Dr. Owen's collection, a nearly entire carapace and sternum of the same species are preserved.

The carapace is relatively more convex and hemispheroid, or rather hemi-ovoid, than that of any of the other fossil turtles brought from Nebraska.

The lateral marginal plates are vertical; the axillary notches are directed outward and downward; the inguinal notches present downward; and the sternum is quite flat, except that its anterior extremity inclines upward.

In both specimens, the costal plates of the carapace had yet been unconnected by suture with the adjoining marginal plates.

The species presents the ordinary or normal number and arrangement of vertebral plates.

Plates of the Carapace.—(Pl. XX. 1.) The first vertebral plate is one and a quarter inch long by three-fourths of an inch broad; the succeeding plates, to the eighth inclusive, are hexahedral; those to the sixth being nearly equal in size; and the tenth transversely rhomboidal plate is three-fourths of an inch long by one and a quarter broad.

The first costal plate is three inches long by one and three-quarters broad, and articulates with the first and second and four-fifths of the third marginal plates.

The nuchal plate comes in contact with the position of the first costal scute at the anterior angle of this, and here measures two and a half inches in breadth.

The pygal plate is vertical, and measures one and a half inch broad.

Plates of the Plastron.—(Pl. XX. 2.) The sternum is truncated anteriorly, and at its posterior extremity is rounded and emarginate.

The entosternal plate is broad, pyriform, and extends for half an inch upon the position of the gular scutes, reaches posteriorly the boundary of the humeral scutes, and is about two inches long and broad.

The episternal plates in the median line are two inches in length.

The hyosternal plates are two inches and eight lines long in the middle, and articulate with the third to the fifth marginal plates inclusive.

The hyposternal plates are two inches two lines long, and articulate with the sixth and seventh marginal plates.

The xiphisternal plates are convex at their margin, and are notched intermediately.

Scutes of the Carapace.—(Pl. XX. 1.) The vertebral scutes, from the second to the fourth inclusive, are hexahedral or quadrate, with bow-shaped sides, and are nearly equal in size. The fifth vertebral scute is prolonged anteriorly, and measures two inches in length.

The nuchal scute is three lines wide, and the pygal scute two and a quarter inches.

The gular scutes together measure two inches in width, and encroach for half an inch upon the ento-sternal plate.

Scutes of the Plastron.—(Pl. XX. 2.) The pectoral scutes are two and three-quarter inches long.

The humeral scutes internally are two-thirds of an inch long, and externally at their anterior border curve forward and outward to the axillæ, and at their posterior border diverge backward and outward in a straight line, so as to join the axillary scute, half of the fourth and the whole of the fifth marginal scutes.

The abdominal scutes are two inches and ten lines long, and join the sixth and seventh marginal scutes and the inguinal scute.

The femoral and caudal scutes, in the median line, measure about one inch and two-thirds long.

MEASUREMENTS.

	Inches.
Length of the sternum	8½
Breadth of the sternum	6⅓
Length of the antero-posterior curve of the carapace	12½
Height of the carapace from the level of the sternum	5
Length of the lateral marginal plates	2¼
Height of latter above the level of the sternum	3

Testudo Oweni, Leidy.

(Pl. XXI., XXIV. Fig. 4.)

Emys Oweni, Leidy: Proc. Acad. Nat. Sci., 1851, v., 327.
Testudo Oweni, Leidy: Proc. Acad. Nat. Sci., 1852, vi., 59; Owen's Rep. of a Geol. Surv. of Wisc., etc., 568.

This species is established upon a nearly entire carapace and plastron. The former has nearly the same degree of convexity and form of that of the Box Tortoise (*Cistudo Carolina*).

The costal plates had not yet united by suture with the marginal plates.

The latter, at the sides of the carapace, are vertically convex, with their upper border elevated two and a half inches above the level of the sternum. Anteriorly and posteriorly they are less inclined than the contiguous dorsal plates.

The sternum is flat, except at its union with the carapace, in which position it is convex, and anteriorly is turned upward, and has its margin angularly convex; and posteriorly it is emarginate.

Plates of the Carapace.—(Pl. XXI. 1.) In the specimen there are ten vertebral plates. The first is one and a half inch long, by ten lines broad. Those succeeding to the eighth inclusive are hexahedral; the second to the fifth are nearly equal in size; those to the eighth successively decrease.

The second vertebral plate articulates with the first and second pairs of costal plates; the third with the second and third; and so on successively to the eighth plate inclusive.

The tenth vertebral plate is fourteen lines long by seventeen broad, and is divided into two nearly equal triangles by the posterior border of the last vertebral scute.

The first costal plate is three inches long by two broad, and articulates with the first to the commencement of the fourth marginal plate.

The nuchal plate is three and a quarter inches broad, and is equal to the first vertebral scute. The pygal plate is twenty-two lines broad.

Plates of the Plastron.—(Pl. XXI. 2.) The entosternal plate is pyriform, and is two inches four lines long and broad. Its anterior extremity borders on the position of the gular scutes, and posteriorly it extends to the humeral scutes.

The anterior margin of the episternal plates is convex. Their length obliquely at the middle is equal to that of the preceding plate.

The hyosternal plates are three and a half inches long from their anterior angle, and they articulate with the third to the angle of the sixth marginal plates inclusive.

The hyposternal plates are two and a half inches long at their middle, are slightly oblique at the posterior margin, and articulate with the sixth and seventh marginal plates.

The xiphisternal plates include an acute notch posteriorly, and are two and a quarter inches long.

The suture between the marginal plates of the carapace and those of the plastron, and the junction of the contiguous scutes from two irregular undulant intersecting lines.

Scutes of the Carapace.—(Pl. XXI. 1.) The second and third vertebral scutes are nearly equal in size, each being two inches seven lines broad, the former two inches long, and the latter one line longer. Their lateral margins are bow-formed, and the anterior margin of the second is nearly straight, while that of the third is convex forward.

The fourth vertebral scute is slightly broader than long, being two inches two lines in the former direction, and two inches one line in the latter. Its lateral margins, also, are bow-formed, and converge behind, and the anterior margin is angular forwards. The nuchal scute is four lines broad.

The gular scutes together are two and a quarter wide, are convex posteriorly, and do not encroach upon the position of the entosternal plate.

Scutes of the Plastron.—(Pl. XXI. 2.) The pectoral scutes are three and a quarter inches long, and have their posterior border a little behind the axillary notches.

The humeral scutes are about seven and a half lines long where they come in contact, but outwardly expand to two and a half inches. They join the axillary scute, the posterior angle of the fourth, the whole of the fifth, and the lower half inch of the anterior margin of the sixth marginal scutes.

The abdominal scutes are three inches in length, and join the sixth and seventh marginal, and the inguinal scutes.

The length of the femoral scutes is two and a quarter inches, and that of the caudal scutes where they are conjoined, is one inch five lines.

The axillary scute is placed upon the anterior angle of the hyosternal and the postero-inferior margin of the third marginal plates, between the fourth marginal and the humeral scutes.

The inguinal scute rests upon the hyposternal and seventh marginal plates, between the abdominal and seventh and eighth marginal scutes.

MEASUREMENTS.

	Inches.	Lines.
Length of sternum in the median line	10	0
Breadth of sternum at the suture of the hyo- and hyposternal plates	7	0
Estimated length of antero-posterior curve of the carapace	13	6
Length of transverse curve from the level of the sternum	15	6
Height	5	6
Length of the sixth marginal plate	2	6
Height of the upper edge of the lateral marginal plates from the level of the sternum	3	0

This species is respectfully dedicated to Dr. David Dale Owen, of New Harmony, Indiana, whose many contributions to Palaeontology and Geology have rendered him distinguished in science.

Testudo Culbertsonii, Leidy.

(Plates XXII., XXIV. Fig. 2.)

Emys Culbertsonii, Leidy: Proc. Acad. Nat. Sci., 1852, vi., 34.
Testudo Culbertsonii, Leidy: Proc. Acad. Nat. Sci., 1852, vi., 59; Owen's Rep. of a Geol. Surv. of Wisc., etc. 569.

This species is established upon a nearly entire carapace and plastron in the collection of Dr. Owen. The specimen upon one side is a little crushed out of its original form; and it is much larger than that upon which is founded the *Testudo Oweni*, and is relatively less convex and high in comparison with its length and breadth, and also is less abruptly retuse posteriorly.

The sternum in the specimen is concave, indicating a male individual, and anteriorly it does not turn upward.

The costal plates, though in conjunction with the marginal plates, had not yet united by suture.

The lateral marginal plates are vertically convex, and three and a half inches long in the curve, and became inferior at their lower fourth, but have no salient angle. Anteriorly and posteriorly to the union of the carapace and plastron, the marginal plates are oblique. The line of suture of the two former is undulant, as is also the corresponding line of conjunction of the scutes; the two intersecting each other several times. These lines are less irregular in their course than in *Testudo Oweni*, and on the two sides are nearly parallel. The axillary and inguinal notches present directly downward.

Plates of the Carapace.—(Pl. XXII. 1.) The carapace has eleven vertebral plates. The first of the series is quadrilateral, with convex sides, and is two and a quarter inches long and one and a half broad. The second is octohedral, with alternating long and concave and short and straight sides; or it is quadrilateral, with concave sides and the angles truncated. It is one and a half inch long and one inch and seven lines broad, and articulates with the anterior three pairs of costal plates. The third vertebral plate is quadrilateral, with convex sides, and it is one and a half inch long and one inch ten lines broad, and articulates with the third pair of costal plates.

A similar arrangement to that described of the second and third vertebral plates exists also in the Gopher (*Testudo polyphemus*).

The fourth to the eighth vertebral plate inclusive are hexahedral, of which the fifth is the largest, while the others decrease in succession from the fourth to the last of the number.

The ninth vertebral plate is an accessory to the usual number, is quadrate, with convex sides, and articulates with the eighth pair of costal plates.

The penultimate V-shaped plate incloses one-half of that succeeding, which is one and a half inch long and two and a quarter inches broad.

The first costal plate is five and a quarter inches long by three inches broad, and articulates with three-fourths of the first marginal plate, all of the second, and three-fourths of the third.

The nuchal plate comes in contact with the position of the first costal scute at the anterior angle, in which position it is five and a quarter inches broad, and equal to the first vertebral scute.

Plates of the Plastron.—(Pl. XXII. 2.) The entosternal plate is pyriform, and is three inches five lines long and two lines broader. Its neck extends three-fourths of an inch upon the position of the gular scutes, and its base is about a third of an inch removed from the humeral scutes.

The hyosternal plates are over five inches in length, and articulate with the third to the angle inclusive of the sixth marginal plates.

The hyposternal plates are four inches long at their middle, and articulate with the sixth and seventh marginal plates.

The xiphisternal plates include a notch behind, and in the median line of the sternum are three inches long.

Scutes of the Carapace.—(Pl. XXII. 1.) The second and third vertebral scutes are three inches long; the former three and a half, the latter four inches broad. The sides are bow-shaped, and nearly parallel. The anterior margin of the second is deeply concave; that of the third bow-shaped. The fourth vertebral scute is three inches three lines broad, and is seven lines longer. It has bow-shaped sides, converging posteriorly, and its anterior margin is angular. The last vertebral scute is prolonged anteriorly as a cup-shaped process.

The nuchal scute is five lines broad, and the pygal scute four and a half inches.

Scutes of the Plastron.—(Pl. XXII. 2.) The gular scutes are acute behind, and encroach upon the position of the entosternal plate.

The pectoral scutes are five and a quarter inches long, and extend posteriorly to the axillary notches.

The humeral scutes are about an inch long, but expand outwardly, and join the axillary and the fourth and fifth marginal scutes.

The abdominal scutes are four and a half inches long at their middle, and join the sixth and seventh marginal and the inguinal scutes.

The femoral scutes are three and a half inches long, and the caudal scutes, where they come into contact, are one and three-quarter inches.

The axillary scute is situated at the outer side of the notch, and rests upon the inferior angle of the hyosternal plate between the humeral and fourth marginal scutes. The inguinal scute rests upon the hyposternal and seventh marginal plates, between the abdominal and seventh and eighth marginal scutes.

MEASUREMENTS.

	Inches.
Estimated length of sternum in the median line	15
Breadth of sternum	11
Estimated length of the antero-posterior curve of the carapace	22
Estimated length of transverse curve	22
Height	6½
Length of sixth marginal plate	3¾
Height of lateral marginal plates above level of the sternum	4

This species is respectfully dedicated to Mr. Thaddeus A. Culbertson, through whose interested zeal so many of the animal remains of Nebraska have been discovered.

Testudo lata, Leidy.

(Plates XXIII., XXIV. Fig. 1.)

Testudo lata, Leidy: Proc. Acad. Nat. Sci., 1851, v., 173; Owen's Rep. of a Geol. Surv. of Wisc., etc., 572.

This species is the largest of any of the turtles brought from Nebraska, and was obtained by Mr. Thaddeus A. Culbertson. The specimen upon which it was established consists of a carapace and plastron broken into two pieces and otherwise much mutilated. A considerable portion of the carapace is lost, and the sternum is crushed inward from its articulation with the former.

The form of the species is very much like *Testudo Culbertsonii,* and it may possibly be the same, though it differs in several of its anatomical details.

In the specimen, the costal plates are united to the marginal plates by close suture.

The lateral marginal plates are vertical at their upper four-fifths, and those anteriorly and posteriorly are oblique.

The sternum appears to have been quite flat, and the axillary and inguinal notches are directed downward.

Plates of the Carapace.—(Pl. XXIII. 1.) The first vertebral plate has convex sides, and has the form of a sugar-loaf; it is two and three-quarter inches long and one inch seven lines broad at its middle.

The second and third, and portions of the fourth and seventh, and the eighth vertebral plates, preserved in the specimen, are hexahedral, and the first two are subequal.

The ninth, or inverted V-shaped vertebral plate, is a little depressed anteriorly to receive the border of the plate in advance.

The tenth, or rhomboidal vertebral plate, is two and three-quarter inches long, and three and a half broad.

The first costal plate is six and three-quarter inches wide and four and a half inches antero-posteriorly, and articulates with the first to the third marginal plates inclusive.

The nuchal plate, as in all the species described, reaches only the anterior angle of the position of the first costal scute, and there measures seven inches in breadth.

Plates of the Plastron.—(Pl. XXIII. 2.) The entosternal plate is pyriform, and is four inches long and three-fourths of an inch broader.

The hyosternal plates are seven and a quarter inches long, and articulate with the marginal plates from the third to the middle of the sixth inclusive.

The hyposternal plates are five and a half inches long, and articulate with the sixth and seventh marginal plates.

The xiphisternal plates, where in contact, measure four inches in length.

Scutes of the Carapace.—(Pl. XXIII. 1.) The second vertebral scute is quadrilateral, and is four inches long and three-fourths of an inch greater in its breadth. The lateral margins are slightly bow-formed and parallel, and the anterior and posterior borders are concave.

The last vertebral scute is prolonged anteriorly into a cup-shaped process, receiving the scute in advance.

Scutes of the Plastron.—(Pl. XXIII. 2.) The gular scutes are angular posteriorly, and encroach for one inch upon the position of the entosternal plate.

The humeral scutes are one and a quarter inch long internally, and outwardly join the axillary and the fourth to the middle of the sixth marginal scute.

The abdominal scutes are five and a half inches long, and join the sixth and seventh marginal and the inguinal scutes.

MEASUREMENTS.

	Inches.
Estimated length of the sternum	21
Breadth of the sternum	15
Estimated length of antero-posterior curve of the carapace	27
Estimated length of transverse curve	27
Height above level of the sternum	8
Length of lateral marginal plates	5

SYNOPSIS

OF THE

GENERA AND SPECIES OF EXTINCT MAMMALIA AND CHELONIA DESCRIBED IN THIS WORK.

MAMMALIA.

UNGULATA PARIDIGITATA.

RUMINANTIA.

POEBROTHERIUM. Hornless; without lachrymal fossæ; auditory bullæ very large and inflated; orbits closed by a post-orbital arch. Lower jaw with an angular apophysis. Dental formula: $in.\ \frac{0?-0?}{4?-4?}$ $c.\ \frac{1?-1?}{0?-0?}$ $p.m.\ \frac{4-4}{4-4}$ $m.\ \frac{3-3}{3-3} = 38?$ True molars composed as in existing ruminants; premolars most like those of the recent Musks; first premolar removed from the others by a hiatus.

POEBROTHERIUM WILSONII. Unique species.

AGRIOCHOERUS. Hornless; without lachrymal fossæ; orbits open behind. Dental formula: $in.\ \frac{3?-3?}{4?-4?}$ $c.\ \frac{1?-1?}{1?-1?}$ $p.m.\ \frac{4?-4?}{3?-3?}$ $m.\ \frac{3-3}{3-3} = 44?$ True molars constructed after the type of those of existing ruminants; premolars with from one to four lobes, modified in form from those of the true molars.

AGRIOCHOERUS ANTIQUUS. Unique species.

OREODON. Hornless; with a sagittal crest; with the pars-squamosa of the temporal bone relatively as well developed as in the Camel; auditory bullæ none; orbits closed behind; very large lachrymal fossæ. Dental formula: $in.\ \frac{3-3}{4-4}$ $c.\ \frac{1-1}{1-1}$ $p.m.\ \frac{4-4}{3-3}$ $m.\ \frac{3-3}{3-3} = 44.$ Teeth of both jaws forming nearly closed rows. True molars constructed after the type of those of existing ruminants; premolars with one or two lobes. Upper canine with a curved, trihedral, pyramidal crown; lower canine with a compressed conoidal crown. Incisors with flattened crowns.

1. OREODON CULBERTSONII. About the size of the Wolf of Pennsylvania.
2. OREODON GRACILIS. About two-thirds the size of the former.
3. OREODON MAJOR? A little larger than *Oreodon Culbertsonii.*

EUCROTAPHUS. Cranium constructed like that of *Oreodon*, except that it possesses large, inflated auditory bullæ. Dental formula: as in *Oreodon?*

1. EUCROTAPHUS AURITUS. Auditory bullæ laterally compressed spheroidal.
2. EUCROTAPHUS JACKSONI. Smaller than the preceding; auditory bullæ mammillary.

ORDINARIA.

ARCHAEOTHERIUM. With a sagittal crest; orbits closed by a post-orbital arch; glenoid articulation transverse. Lower jaw with a basal apophysis as in *Anthracotherium.* Dental formula: *in.* $\frac{?-?}{?-?}$ *c.* $\frac{1?-1?}{1?-1?}$ *p.m.* $\frac{4?-4?}{4?-4?}$ *m.* $\frac{3-3}{3-3}$. Crowns of upper true molars quadrate, with two transverse rows of three conical tubercles or lobes; the lower ones with two transverse pairs of tubercles, of which that antero-internally is subdivided. Last upper premolar bilobed; penultimate upper molar compressed conoidal. Last lower premolar compressed conoidal.

1. Archaeotherium Mortoni. Head about the size of that of the Lion.
2. Archaeotherium robustum. Rather larger than the preceding.

UNGULATA IMPARIDIGITATA.

SOLIPEDIA.

ANCHITHERIUM. With a short sagittal crest; forehead broad and large; orbits large. Dental formula: *in.* $\frac{3-3}{3-3}$ *c.* $\frac{1-1}{1-1}$ *m.* $\frac{7-7}{7-7}$. Molars constructed after the type of those of *Palaeotherium.*

Anchitherium Bairdii. About the size of *Anchitherium aurelianense.*

ORDINARIA.

TITANOTHERIUM. Dental formula as in *Palaeotherium?* Upper molars quadrate, complex, intermediate in form to those of *Palaeotherium* and *Rhinoceros;* their outer side without the double arched ridge characteristic of the former, and without the anterior marginal fold characteristic of the latter. Lower molars like those of *Palaeotherium,* but possessing no inner basal ridge.

Titanotherium Proutii. Unique species.

PALAEOTHERIUM. Dental formula: *in.* $\frac{3-3}{3-3}$ *c.* $\frac{1-1}{1-1}$ *p.m.* $\frac{4-4}{4-4}$ *m.* $\frac{3-3}{3-3} = 44$. Upper molars quadrate, complex; with an external double-arched ridge. Lower molars bilunate; the last trilunate.

Palaeotherium giganteum. Twice the size of the *Palaeotherium magnum;* being the largest species of the genus.

RHINOCEROS. With a nasal or frontal horn, or both, or none. Dental formula: *in.* $\frac{0-0}{0-0}$, or $\frac{1-1}{1-1}$, or $\frac{2-2}{2-2}$ *c.* $\frac{0-0}{0-0}$ *m.* $\frac{7-7}{7-7}$. Upper molars quadrate, complex; with a characteristic antero-external fold. Inferior molars composed of a pair of right angled crescentoid lobes.

1. Rhinoceros occidentalis. With a sagittal crest; frontal horn none; nasal horn? forehead broad and flat. Three-fourths the size of *Rhinoceros indicus.*
2. Rhinoceros Nebrascensis. With a sagittal crest; frontal horn none; nasal horn? Three-fourths the size of *Rhinoceros occidentalis.*

CARNIVORA.

DIGITIGRADA.

MACHAIRODUS. Dental formula: $in.\ \frac{3-3}{3-3}\ c.\ \frac{1-1}{1-1}\ m.\ \frac{4-4}{3-3}$. Superior canine long, curved, compressed laterally. Inferior carnassial tooth with a third lobe.

MACHAIRODUS PRIMAEVUS. A little smaller than the American Panther.

CHELONIA.

TESTUDO. Carapace with 10 vertebral plates, 8 pairs of costal plates, and 11 marginal plates each side of a symmetrical nuchal and pygal plate; and 5 vertebral scutes, 4 pairs of costal scutes and 11 marginal scutes each side of a narrow nuchal and a broad undivided pygal scute. First vertebral plate oblong quadrilateral; the succeeding plates to the eighth inclusive hexahedral; penultimate plate inverted V-shaped; the last rhomboidal. Plastron composed of an entosternal and 4 pairs of lateral plates, and furnished with 8 pairs of scutes.

1. TESTUDO NEBRASCENSIS. Small, emydiform. Entosternal plate encroaching upon the position of the gular scutes, but usually not reaching that of the pectoral scutes.

2. TESTUDO HEMISPHERICA. Hemiovoid. Entosternal plate encroaching upon the position of the gular scutes, and reaching that of the pectoral scutes.

3. TESTUDO OWENI. Robust. Entosternal plate not encroaching upon the position of the gular scutes, but reaching that of the pectoral scutes.

4. TESTUDO CULBERTSONII. Large, depressed. Entosternal plate encroaching upon the position of the gular scutes, but not reaching that of the pectoral scutes.

5. TESTUDO LATA. It is possible that this species and the last indicated may be the same. In the specimens upon which these two were proposed, the latter is very much the larger, but the former is immature. In the former, also, the second vertebral plate is octohedral, while in the latter it has the normal hexahedral form, but this variation may be an individual peculiarity only.

INDEX.

[Synonymes and names incidentally used are in Roman.]

EXPLANATION OF THE PLATES.[1]

PLATE I.

All the figures are of the natural size.

Figs. 1–4. *Poebrotherium Wilsoni.*

Fig. 1. View of the right side of the face. The top of the head and the cranium proper are broken away. To the left is represented the angular apophysis, and in the concavity above this is the very large os tympanica. The upper jaw contains the first premolar, separated from the others by a hiatus, the temporary molars, and the permanent true molars. The lower jaw contains the temporary molars and the permanent true molars.

Fig. 2. Upper view of the nasal extremity of the face, exhibiting its great narrowness.

Fig. 3. View of the masticating surfaces of the upper molars of the specimen 1.

Fig. 4. View of the masticating surfaces of the lower molars of the specimen 1.

Figs. 5–10. *Agriochoerus antiquus.*

Fig. 5. View of the right side of the face. The specimen is much mutilated, but the orbit is observed not to be closed by an arch posteriorly. In the upper jaw the inner part of the second premolar of the left side is visible, and succeeding it upon the right side the posterior two premolars and the true molars. In the portion of lower jaw are visible the posterior two premolars and the true molars.

Fig. 6. Inferior view of the upper jaw, exhibiting the triturating surfaces of the molars, five of which are preserved on the right side and six upon the left. The hard-palate is obscured by a mass of very dense matrix, which would endanger the integrity of the specimen to remove.

Figs. 7, 8. Triturating surfaces of the posterior five inferior molars of the right and left sides.

Fig. 9. Triturating surfaces of the first and second true inferior molars of the left side, somewhat worn.

Fig. 10. Triturating surfaces of the posterior two true superior molars of the left side, a little worn, and probably belonging to the same individual as the last specimen.

PLATE II.

Figures of the natural size.

Oreodon Culbertsonii.

Fig. 1. The right side of a much fractured skull with the lower jaw, of an adult, containing the full complement of teeth quite perfect. In the upper jaw are three incisors, the canine, four premolars, and three true molars; in the lower jaw, four incisors, the canine, three premolars, and three true molars.

Fig. 2. Front view of the three upper and four lower incisors of the right side, from the same specimen as the preceding figure.

Fig. 3. The left side of another adult specimen, which is in a comparatively fine state of preservation. It has lost the nasal extremity, post-orbital arch, and zygoma; the latter, however, was entire when the specimen was received, but was afterwards accidentally broken off and lost. The upper jaw contains the seven molars, and the lower jaw the canine and six molars.

[1] All the Plates are drawn directly from Nature, on stone. Plates 1, 2, 3, 8, 9, 10, 11, 13, are by Mr. A. Sonrel, of Woburn, Mass.: Plates 4, 7, 13, 14, 16, 20, 21, 22, 23, 24, by Mr. A. Frey, of Philadelphia: Plates 5, 6, 12, by Mr. A. J. Ibbotson, of Philadelphia: Plates 18, 19, by Mr. F. Schell, of Philadelphia: and Plate 17 by Mr. J. Butler, of Philadelphia.

PLATE III.

Figures of the natural size.

Oreodon Culbertsonii.

Fig. 1. View of the base of a skull containing on both sides all the molars perfect, and on the left side the canine in the same condition. From an adult male individual. The molar teeth are four premolars and three true molars.

Fig. 2. View of the left side of the same specimen as the last, exhibiting the canine and the succeeding series of molars.

Fig. 3. Inner view of a series of inferior molars of the right side, restored from several different individuals. The teeth consist of three premolars and three true molars.

Fig. 4. View of the masticating surface of the same series as the last.

Fig. 5. External view of a right posterior inferior molar, removed from its socket.

Fig. 6. View of the masticating surface of the same tooth as the last.

PLATE IV.

Figures of the natural size.

Figs. 1–5. *Oreodon Culbertsonii.*

Fig. 1. Upper view of the skull, from the same specimen as figure 3, Plate II.

Fig. 2. View of the inion or occipital region, from the same specimen as the preceding.

Fig. 3. View of a specimen upon the left side of the face, exhibiting the orbit and lachrymal depression entire.

Fig. 4. Greater portion of the left side of the lower jaw of a young individual, containing the first premolar, the succeeding two temporary molars, and the permanent true molars, of which the last is only partially protruded.

Fig. 5. View of the triturating surfaces of the premolars and last temporary true molar, from the same specimen as the last.

Fig. 6. *Oreodon major.* View of the triturating surfaces of the superior true molars, of the right side, considerably worn.

PLATE V.

All the figures are of the natural size.

Figs. 1, 2. *Oreodon Culbertsonii.*

Fig. 1. View of the left side of the skull of a young individual. The zygoma, end of the nose, and nearly all the teeth are broken away. In advance of the orbit is observable the large lachrymal depression.

Fig. 2. View of the base of the same specimen as the last. Upon the right side of the jaw all the molars are preserved, consisting of the temporary series and the permanent true molars. The foramina visible at the base of the cranium, proceeding backward on each side, are the rotundum, ovale, lacerum, and condyloideum.

Figs. 3, 4. *Oreodon gracilis.*

Fig. 3. View of the base of the skull of a young animal. The teeth visible on the left side, proceeding backward, are, a fragment of the canine, the two fangs of the first premolar, three succeeding temporary molars, and two permanent true molars. On the right side are preserved the last temporary true molar and the succeeding two permanent true molars. The oblique lines indicate a portion of the matrix, in which the specimen was originally imbedded.

Fig. 4. Superior view of the same specimen as the last. It presents a remarkable degree of flatness of the forehead.

PLATE VI.

All the figures are of the natural size.

Figs. 1–7. *Oreodon gracilis.*

Fig. 1. Upper view of a broken skull.

Fig. 2. Base view of the same specimen. On the right side the jaw contains entire the last premolar and all the true molars of the permanent series.

Fig. 3. View of the right side of the same specimen as the last.

Fig. 4. View of the left side of a face and lower jaw of another adult specimen. The upper jaw exhibits the last two molars, and the lower jaw the last premolar and all the true molars. The orbit is entire.

Fig. 5. View of the masticating surfaces of the lower molars of the specimen last indicated.

Fig. 6. View of the left side of the skull and lower jaw of a young individual, being the same specimen represented in Figs. 3, 4, Plate V. The orbit is nearly entire. The upper jaw exhibits a series of the first premolar restored, the three temporary molars, and the anterior two permanent true molars. The lower jaw contains two temporary molars and the succeeding two permanent true molars.

Fig. 7 represents the masticating surfaces of the inferior teeth last mentioned.

Figs. 8–11. *Oreodon Culbertsonii.*

Fig. 8. Masticating surfaces of the inferior posterior five molars of the left side, very much worn.

Fig. 9. Inner view of the same teeth as those last indicated.

Fig. 10. Fragment of the lower jaw of the right side of a young animal. It contains the broken canine, and the entire last temporary molar and the succeeding two permanent true molars.

Fig. 11. Outer view of the same specimen as the last.

PLATE VII.

Figures all the size of nature.

Figs. 1–3. *Eucrotaphus auritus.*

Fig. 1. View of the left side of a portion of the cranium, exhibiting the pars squamosa and the parietal bone.

Fig. 2. Upper view of the same specimen.

Fig. 3. View of the base of the same specimen, exhibiting the large ossa tympanica, portions of the glenoid articulations, and the occipital and sphenoidal bodies.

Figs. 4–6. *Eucrotaphus Jacksoni.*

Fig. 4. View of the right side of a portion of the cranium, exhibiting the pars squamosa, the post glenoid tubercle, the meatus auditorius externus, and part of the parietal bone.

Fig. 5. Upper view of the same specimen as the last. The parietal crest is broken away.

Fig. 6. View of the base of the same specimen. It exhibits one os tympanica with its superficies broken off, one glenoid articulation, and the occipital and sphenoidal bodies.

PLATE VIII.

Figures of the natural size.

Archaeotherium Mortoni.

Fig. 1. View of the base of the skull of a young animal. The deciduous teeth had not yet been shed, and only the first two permanent true molars had protruded. Upon the left side are exhibited the last two permanent premolars, exposed by breaking away deciduous teeth occupying a corresponding position; the first two permanent true molars, which are in place; and the last molar, which was exposed by breaking away the bone. Upon the right side are exhibited the last two deciduous molars, succeeded by the three permanent true molars.

In the specimen, a large mass of matrix occupies the inner surface of the right zygoma, which is allowed to remain so as to give strength to the latter.

Fig. 2. Fragment of the lower jaw of the right side, exhibiting the basal apophysis, and also presenting to view the greater portion of the last temporary molar, beneath which is exposed the last permanent premolar, and posterior to it the protruded first permanent true molar.

PLATE IX.

Archaeotherium Mortoni. Figures 1 to 3 are half the diameter of nature, and the remaining figures are of the natural size.

Fig. 1. View of the right side of the skull. The orbital entrance is entire; and in the upper jaw the posterior two temporary molars and the anterior two permanent molars are seen. The dotted line represents the upper part of the face restored from another specimen.

Fig. 2. Upper view of the same specimen represented in figure 1. The ossa nasi are represented, in dotted lines, from another specimen.

Fig. 3. View of the left side of a facial fragment, from an old individual, containing the posterior two permanent premolars.

Fig. 4. View of the triturating surfaces of the teeth represented in figure 3.

Fig. 5. View of the triturating surfaces of the anterior two permanent true molars of the left side of the upper jaw; from an adult individual.

PLATE X.

Figs. 1–7. *Archaeotherium Mortoni.* All the figures of the natural size except 6 and 7.

Fig. 1. Outer view of the last two premolars and the true molars of the left side of the upper jaw, from the same specimen as Plate VIII., figure 1.

Fig. 2. Outer view of the last premolar and the true molars of the left side of the lower jaw.

Fig. 3. View of the masticating surfaces of the same teeth represented in figure 2.

Fig. 4. Inner view of the last premolar of the left side of the lower jaw; from the same specimen represented in figure 2.

Fig. 5. Inner view of the penultimate premolar of the left side of the upper jaw; from the same specimen represented in figure 1.

Fig. 6. Half the diameter of nature. View of the inion or occipital region. Upon the right of the figure, when placed in proper position, the large infundibular expansion of the root of the zygomatic process is observed.

Fig. 7. Half the diameter of nature. Inner view of the angular portion of the right side of the lower jaw. Near its middle the entrance to the dental canal is observable.

Figs. 8–13. *Archaeotherium robustum.* All the figures of the natural size.

Fig. 8. Outer view of the crown of a canine.

Fig. 9. Anterior view of the same specimen as the preceding.

Fig. 10. View of the triturating surface of a fragment of an inferior second true molar of the left side.

Fig. 11. View of the outer surface of the same specimen represented in figure 10.

Fig. 12. View of the triturating surface of a fragment of an inferior last true molar of the left side.

Fig. 13. View of the inner surface of the same specimen represented in figure 12.

Figs. 14–21. *Anchitherium Bairdii.* All the figures are of the natural size.

Fig. 14. Outer view of the posterior five inferior molar teeth of the left side. The last of the series has lost its hinder lobe.

Fig. 15. View of the masticating surface of the posterior three inferior molars of the left side. From an older individual than the preceding specimen.

Fig. 16. Outer view of an unworn inferior molar of the right side.

Fig. 17. Inner view of the same specimen as figure 16.

Fig. 18. Outer view of the condyle of the left side of the lower jaw.

Fig. 19. Posterior view of the same specimen as the preceding.

Fig. 20. View of the occipital region.

Fig. 21. View of the base of a skull. The jaw yet contains on both sides the last two molars nearly perfect.

PLATE XI.

All the figures are of the natural size.

Anchitherium Bairdii.

Fig. 1. View of the left side of a skull, with the zygoma and fore-part of the face broken away. In the jaw may be observed the posterior two molars entire.

Fig. 2. Upper view of the same specimen as the last.

Fig. 3. Masticating surfaces of all the right superior molar teeth except the first, which is small, and in the specimen is broken away.

Fig. 4. Outer view of the same specimen as the last. The surface of the teeth is much injured from the influence of the weather.

Fig. 5. Portion of the right side of the lower jaw attached to a mass of matrix. It contains the posterior two molar teeth.

Fig. 6. Inner view of a portion of the right side of the lower jaw containing the posterior five molar teeth. From the same specimen as figure 14, Plate X.

Fig. 7. View of the masticating surfaces of the latter-mentioned teeth.

Fig. 8. View of the masticating surfaces of six inferior molars of the left side.

PLATE XII.

Figures half the diameter of Nature.

Rhinoceros occidentalis.

Fig. 1. View of the base of the skull. The left zygoma is preserved nearly entire, and upon the same side of the jaw all the molars except the first, which is, however, whole upon the right side. A portion of the left occipital condyle remains; and in advance of it may be observed the anterior condyloid foramen, the mastoid process, the post-glenoid process, and the glenoid articulation.

Fig. 2. View of the left side of the skull. The face is much mutilated, but the form of the orbit is comparatively well preserved. The zygoma is almost entire, and posterior to its root is observed the meatus auditorius, formed between the post-glenoid and mastoid processes. By the restoration of the first tooth of the series, all the molars are exhibited quite perfect.

PLATE XIII.

Figs. 1–4. Half the diameter of nature; the remaining two of the natural size.

Rhinoceros occidentalis.

Fig. 1. View of the top of the skull, from the same specimen as Plate XII.

Fig. 2. Fragment of the left side of the lower jaw containing the last two molars, viewed from without.

Fig. 3. Fragment of the left side of the lower jaw, containing the three molars anterior to the last.

Fig. 4. View of the triturating surfaces of the teeth, from the same specimen as the last.

Figs. 5, 6. Outer view of two inferior, slightly worn, molars of the right side.

PLATE XIV.

Rhinoceros Nebrascensis.

Figs. 1, 2. Two-thirds the diameter of nature. View of the left side of a much mutilated face and lower jaw. In the upper jaw are seven molar teeth, the triturating surfaces of which, from the same specimen, are represented of the natural size in Fig. 3, Plate XV. The lower jaw contains six molars entire.

Fig. 3. The size of nature, represents the triturating surfaces of the teeth last mentioned, from the same specimen.

Figs. 4–8. Different views of superior molars, which had not yet protruded from the jaws, and therefore were entirely unworn. Of the natural size.

Fig. 4. External view of the anterior four molars of the left side.

Fig. 5. View of the triturating surfaces of the same teeth.

Fig. 6. Internal view of the same teeth.

Fig. 7. View of the anterior side of the third right superior molar.

Fig. 8. View of the posterior side of the same specimen as the last.

Fig. 9. Triturating surfaces of the teeth from the same specimen represented in the succeeding figure. Natural size.

Fig. 10. Fragment of the left side of the lower jaw of a very young animal, viewed upon its outer side and exhibiting the last temporary molar and the first succeeding permanent molar.

Fig. 11. One-half the diameter of nature. View of the forehead taken from the same specimen as figure 1.

Fig. 12. Two-thirds the diameter of nature. View of the inion or occipital region, represented from the same specimen as Figs. 1, 2, Plate XV.

Fig. 13. View of the triturating surfaces of the entire series of the superior molars of the right side, from a different individual from any other indicated. Natural size.

Fig. 14. Fragment of an upper jaw of the right side of a young animal, exhibiting the triturating surfaces of the posterior three temporary molars. Natural size.

PLATE XV.

Rhinoceros Nebrascensis.

Figs. 1, 2. Two-thirds the diameter of nature.

Fig. 1. View of the right side of a skull, with the top broken away its whole length. The specimen belonged to a very old individual, as the molar teeth are nearly worn away to the fangs.

Fig. 2. View of the base of the skull from the same specimen as the last. The characteristic enamelled triturating surfaces of the molars are entirely obliterated.

Fig. 3. The size of nature. It represents the triturating surfaces of the superior molars of the left side.

PLATE XVI.

Titanotherium Proutii.

Figs. 1, 2. One-third the diameter of nature.

Fig. 1. A portion of the right side of the lower jaw, containing the last two and part of the first molar.

Fig. 2. A portion of the left side of the lower jaw of a second and smaller individual, containing the three true molars and the fangs of that in advance.

Fig. 3. One-half the diameter of nature. View of the triturating surface of the true molars, from the same specimen as figure 2.

Figs. 4–7. Two-thirds the diameter of nature.

Figs. 4, 5. Fragment of a left posterior superior molar. Fig. 4. Outer view of the entire portion of the fragment. Fig. 5. View of the masticating surface of the same fragment. This last presents the external anterior cusp with two pits at its base, and the large internal conical lobe.

Figs. 6, 7. Fragment of a superior true molar. Fig. 6. Inner view. Fig. 7. Triturating surface of the same specimen, presenting a large conical lobe, with portion of an enamelled pit at the outer side of its base.

Figs. 8–12. The size of nature.

Figs. 8–10. A second? inferior molar of the left side. Fig. 8. The triturating surface. Fig. 9. The outer view. Fig. 10. The inner view, which is a vertical plane.

Figs. 11, 12. An inferior canine tooth, the size of nature. Fig. 11. Outer view. Fig. 12. Inner view.

PLATE XVII.

All the figures of the natural size, except 8–10, which are two-thirds the diameter.

Figs. 1–10. *Titanotherium Proutii.*

Figs. 1–3. A superior premolar. Fig. 1. Inner view. Fig. 2. Outer view. Fig. 3. View of the triturating surface.

Fig. 4. View of the triturating surface of another superior premolar.

Figs. 5, 6. Fragment of a superior premolar. Fig. 5. View of the triturating surface. Fig. 6. Inner view.

Fig. 7. View of the triturating surface of a fragment of a superior premolar.

Figs. 8–10. A last posterior inferior molar of the left side. Fig. 8. Outer view. Fig. 9. View of the triturating surface. Fig. 10. Inner view.

Figs. 11–13. *Palaeotherium giganteum.* Views of three fragments of as many superior molar teeth; being single external lobes seen upon their outer face.

PLATE XVIII.

Figures of the natural size.

Machairodus primaevus.

Fig. 1. View of the right side of a skull, with the lower jaw. The symphysis of the latter, upper incisors, and zygoma are broken away. The upper jaw presents a portion of the canine, and the second to the last molar inclusive; and in the lower jaw the first and a portion of the second molars are visible.

Fig. 2. Superior view of the right half of the same specimen as the preceding.

Fig. 3. View of the left side of the lower jaw, containing the three molars and a portion of the upper jaw, exhibiting the second molar, from the same specimen as the preceding.

Fig. 4. Outer view of the right inferior canine, which was attached to the mass of matrix adhering to the preceding specimen.

Fig. 5. Front or anterior view of the same tooth.

PLATE XIX.

Figures two-thirds the diameter of nature.

Testudo Nebrascensis.

Fig. 1. Dorsal view of the carapace.

Fig. 2. Lateral view of the carapace.

Fig. 3. Inferior view of the sternum.

PLATE XX.

Figures half the diameter of nature.
Testudo hemispherica.
Fig. 1. Dorsal view of the carapace.
Fig. 2. View of the sternum.

PLATE XXI.

Figures half the diameter of nature.
Testudo Oweni.
Fig. 1. Dorsal view of the carapace.
Fig. 2. View of the sternum.

PLATE XXII.

Figures one-third the diameter of nature.
Testudo Culbertsonii.
Fig. 1. Dorsal view of the carapace.
Fig. 2. View of the sternum.

PLATE XXIII.

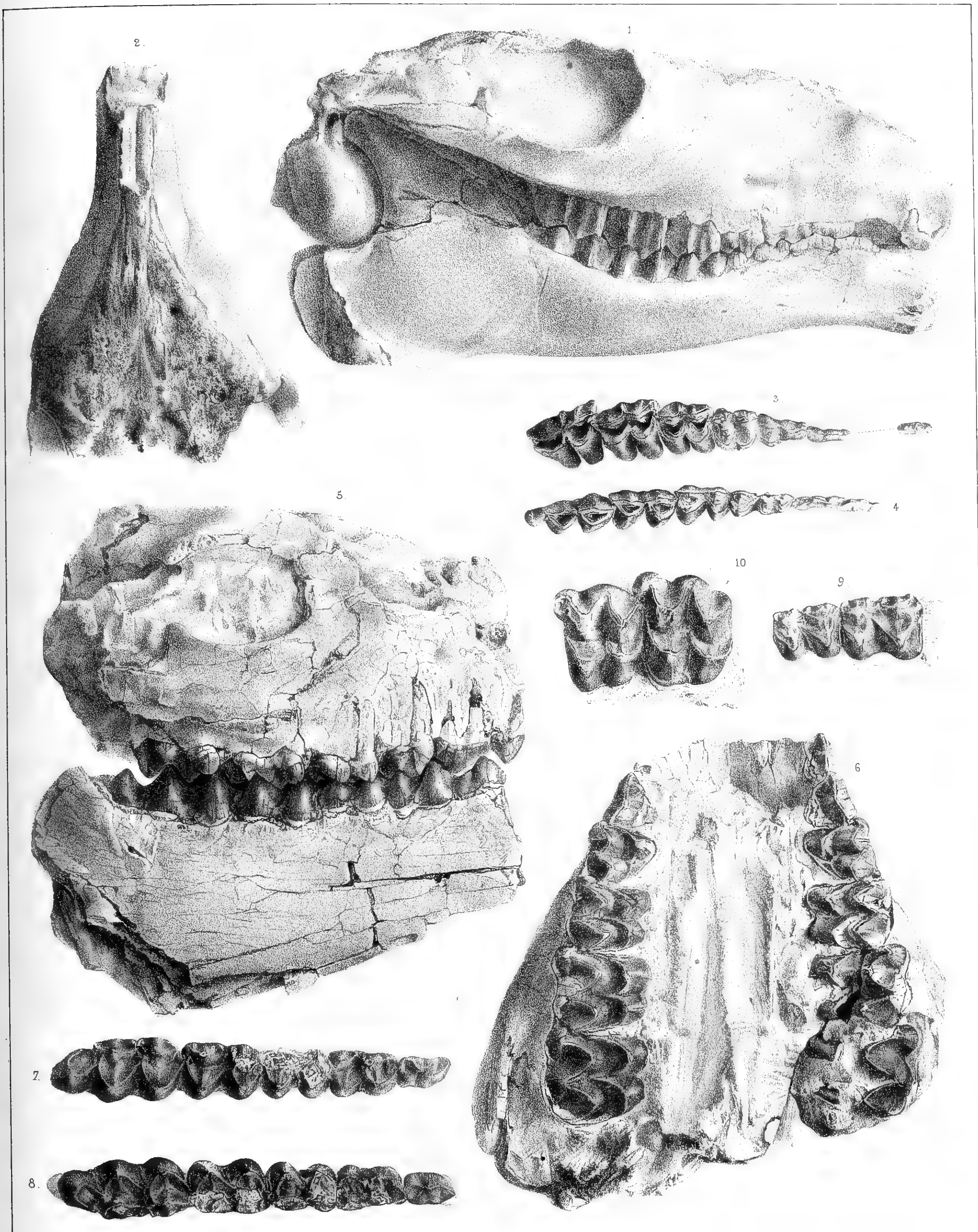
Figures one-fourth the diameter of nature.
Testudo lata.
Fig. 1. Dorsal view of the carapace.
Fig. 2. View of the sternum.

PLATE XXIV.

Fig. 1. One-fourth the diameter of nature; the remaining figures one-third.
Fig. 1. View of the left side of the carapace of *Testudo lata.*
Fig. 2. View of the left side of the carapace of *Testudo Culbertsonii.*
Fig. 3. View of the left side of the carapace of *Testudo hemispherica.*
Fig. 4. View of the left side of the carapace of *Testudo Oweni.*

PUBLISHED BY THE SMITHSONIAN INSTITUTION,
WASHINGTON, D. C.
JUNE, 1853.

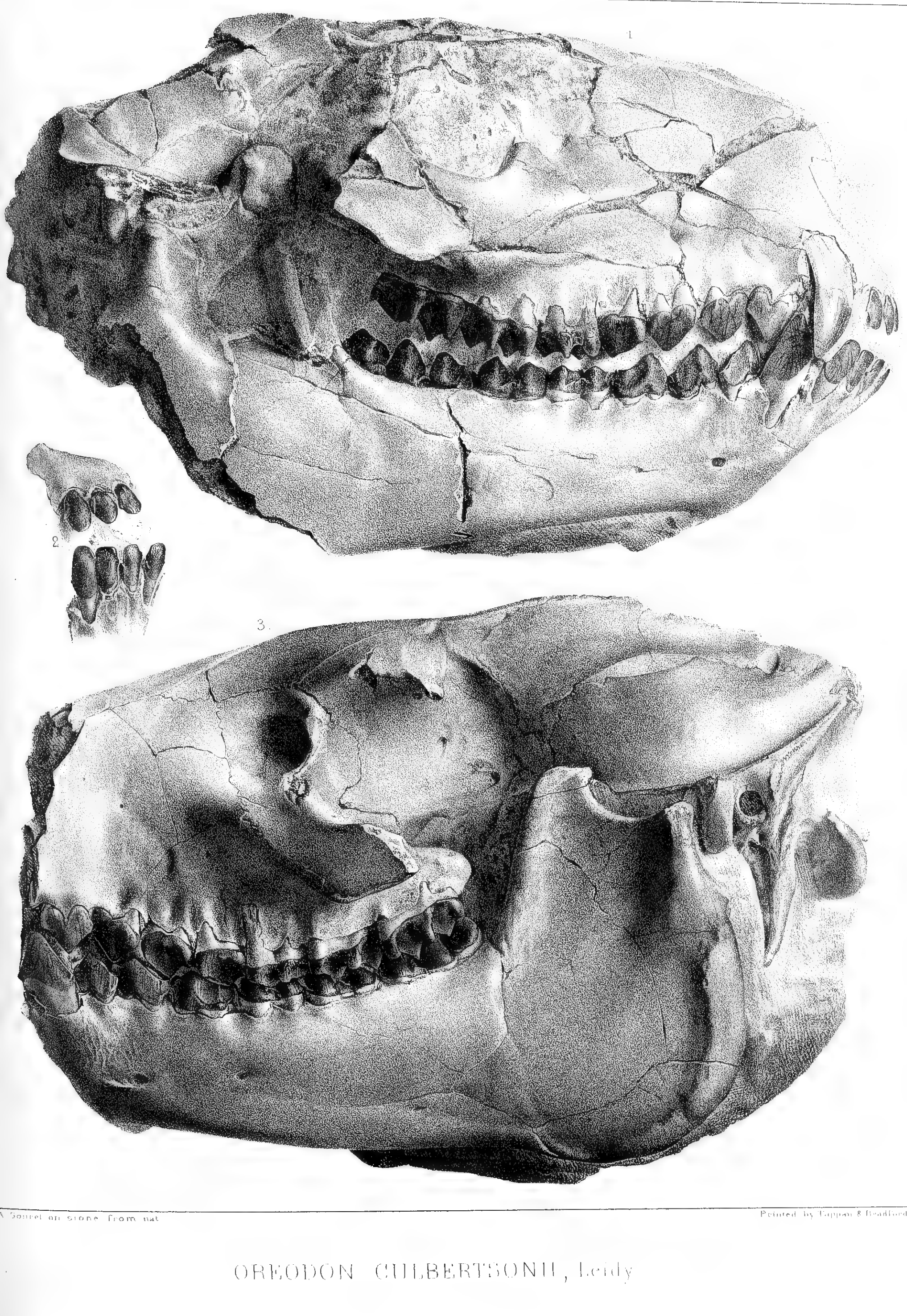
Plate I.



A. Sonrel on stone from nat.

Printed by Tappan & Bradford

1-4. POEBROTHERIUM WILSONII, Leidy. 5-10. AGRIOCHOERUS ANTIQUUS, Leidy.

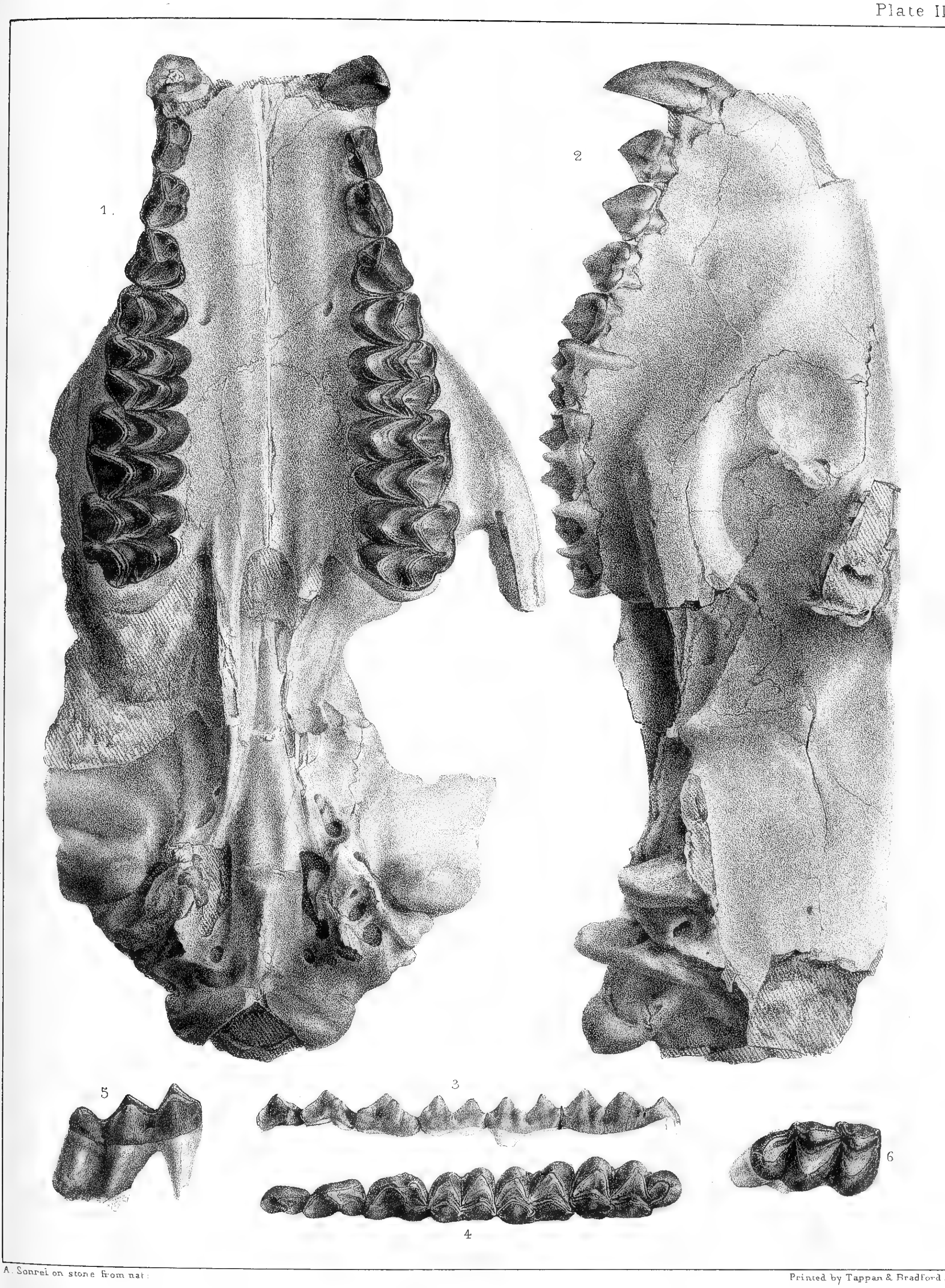


A. Sonrel on stone from nat.

Printed by Tappan & Bradford

OREODON CULBERTSONII, Leidy

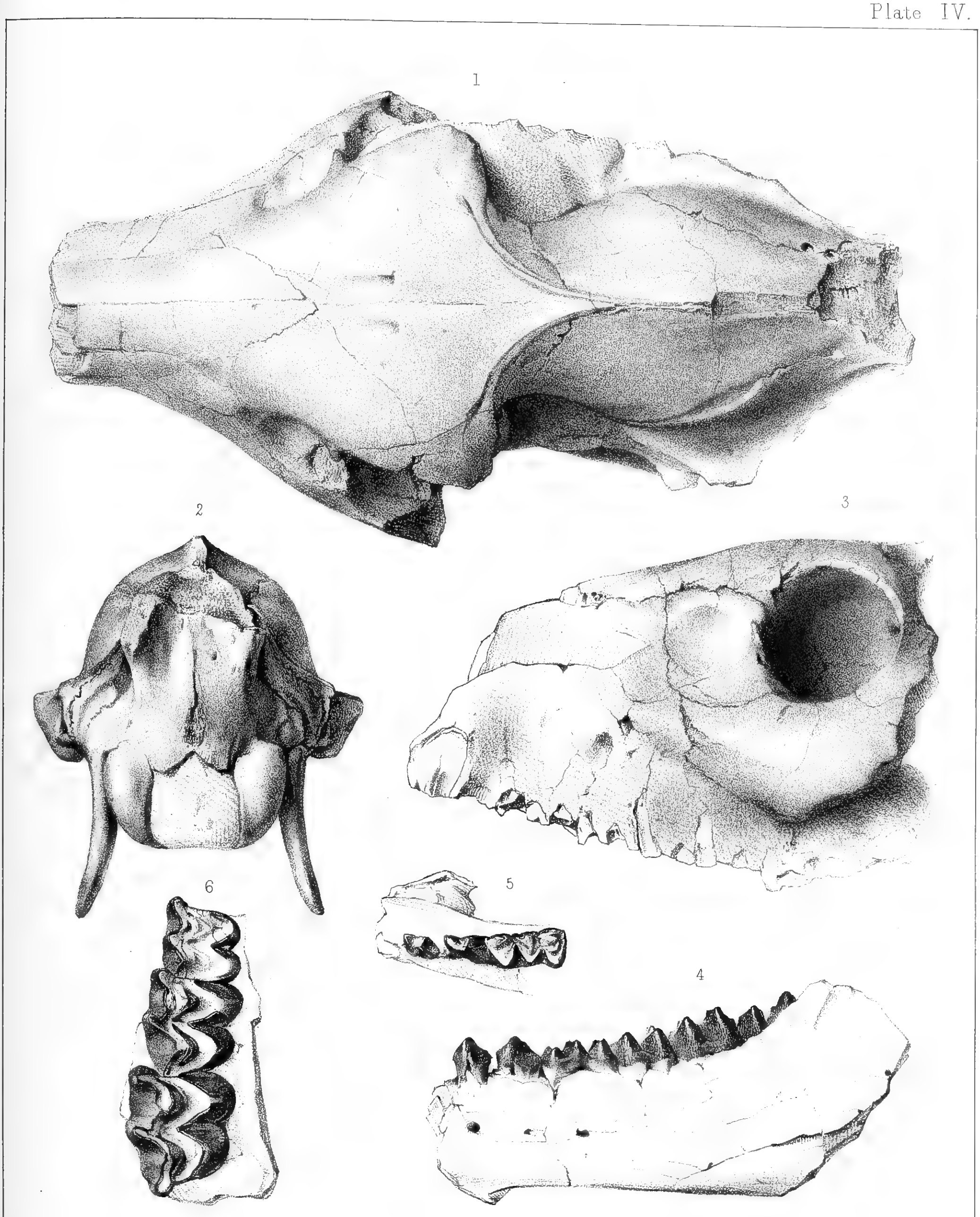
Plate III.



A. Sonrel on stone from nat:

Printed by Tappan & Bradford.

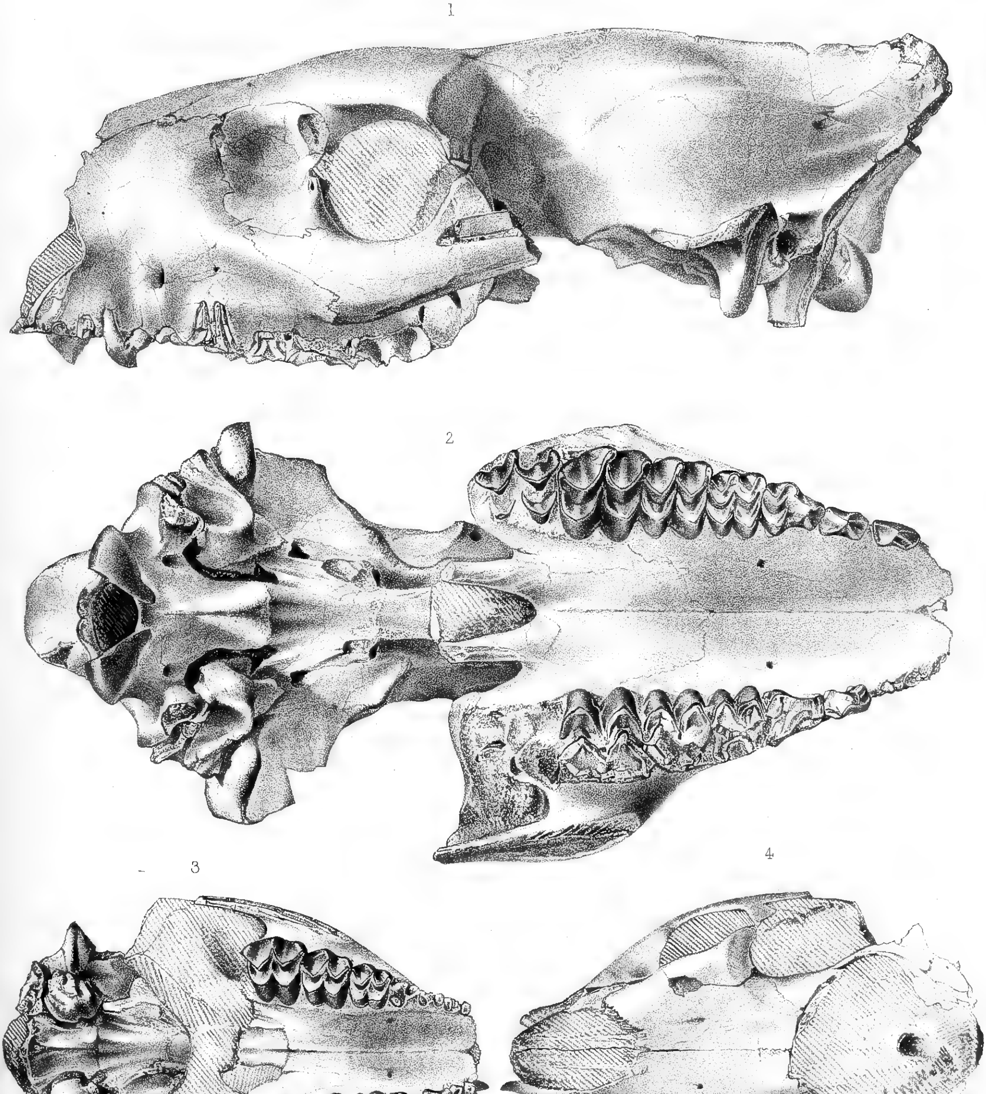
OREODON CULBERTSONII, Leidy.



A. Frey Del.

T. Sinclair's Lith. Phila.

1-5, OREODON CULBERTSONII, Leidy.
6, OREODON MAJOR, Leidy.

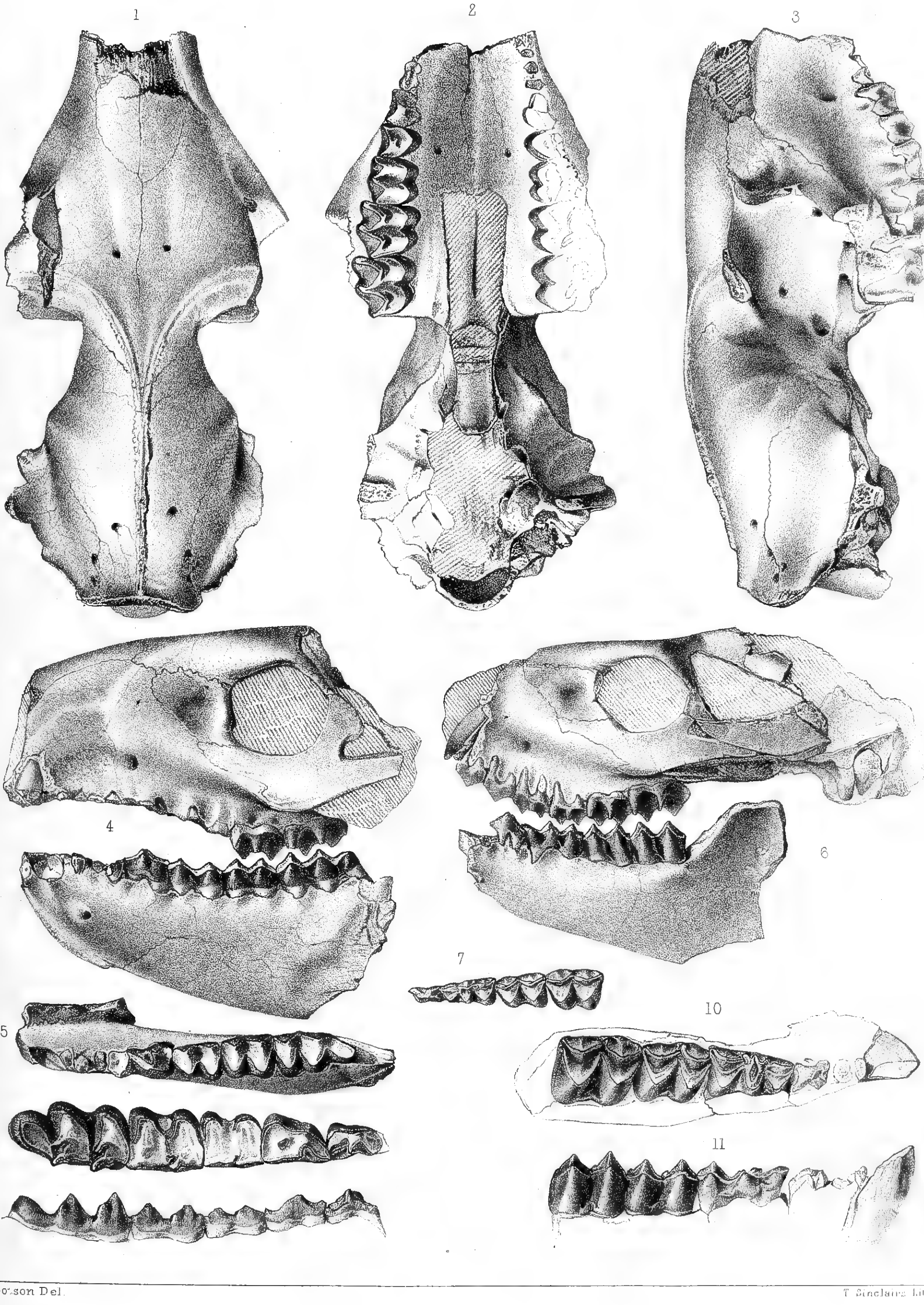


A. J. Ibbotson Del.

T. Sinclairs Lith. Phila.

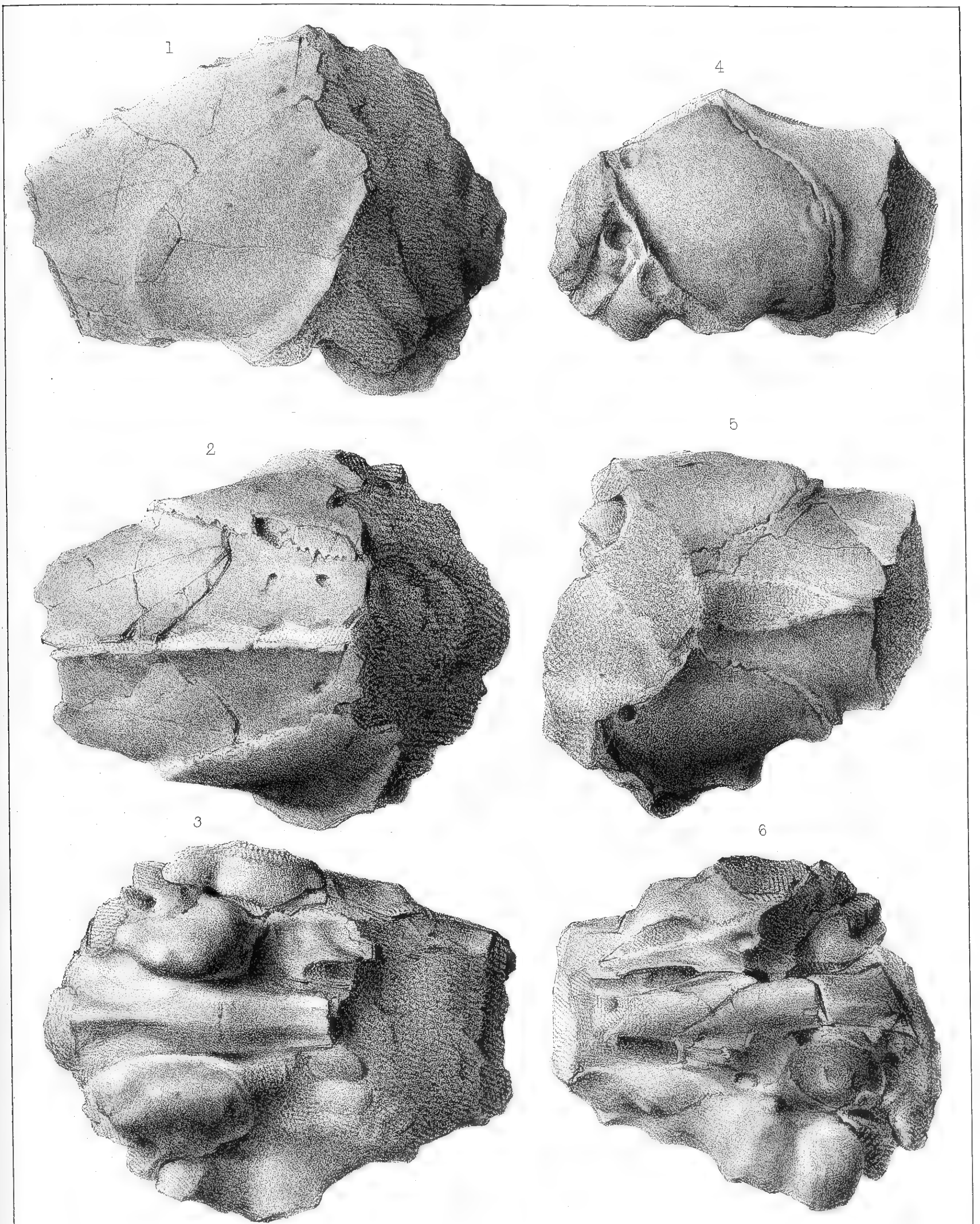
1, 2, OREODON CULBERTSONII, Leidy.
3, 4 OREODON GRACILIS, Leidy.

Plate VI.



A J Ibbotson Del. T. Sinclair's lith Phila

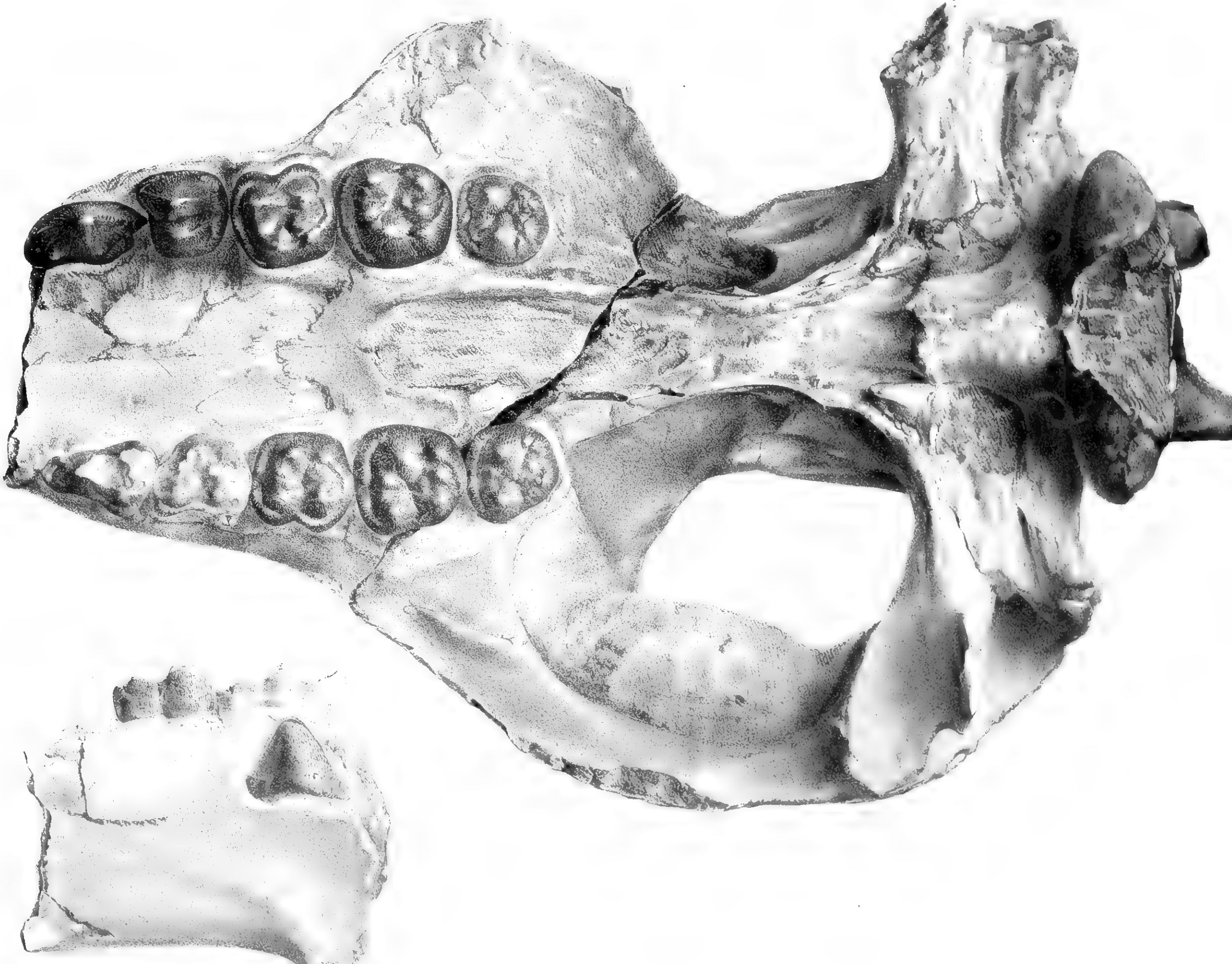
1–7 OREODON GRACILIS, Leidy.
8–11 OREODON CULBERTSONII, Leidy.



A Frey Del

T. Sinclair's Lith. Phila.

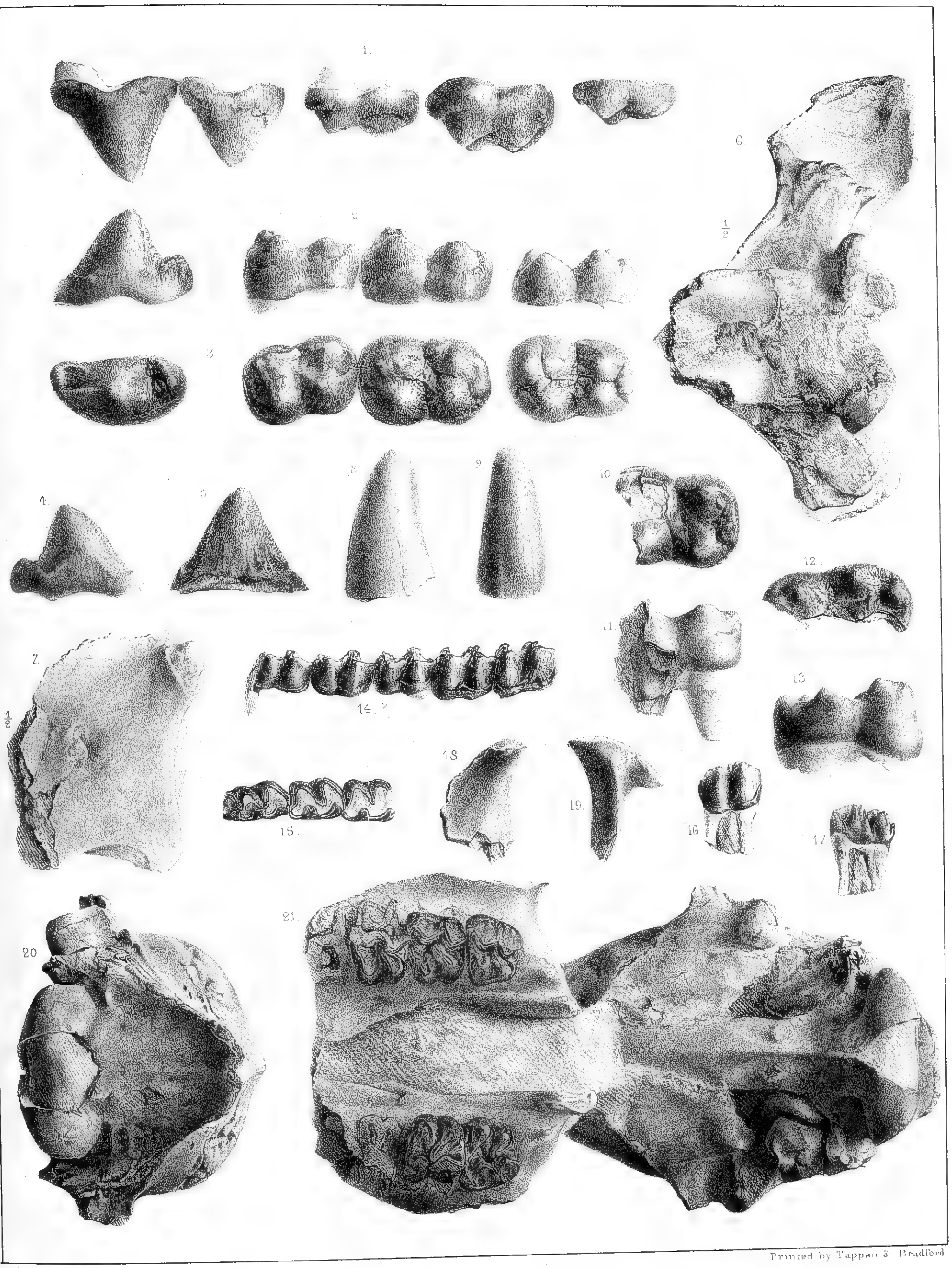
1–3, EUCROTAPHUS AURITUS, Leidy.
4–6, EUCROTAPHUS JACKSONI, Leidy.



...THERIUM MORTONI, Leidy

A. Sonrel, fr. nat.　　Printed by Tappan & Bradford

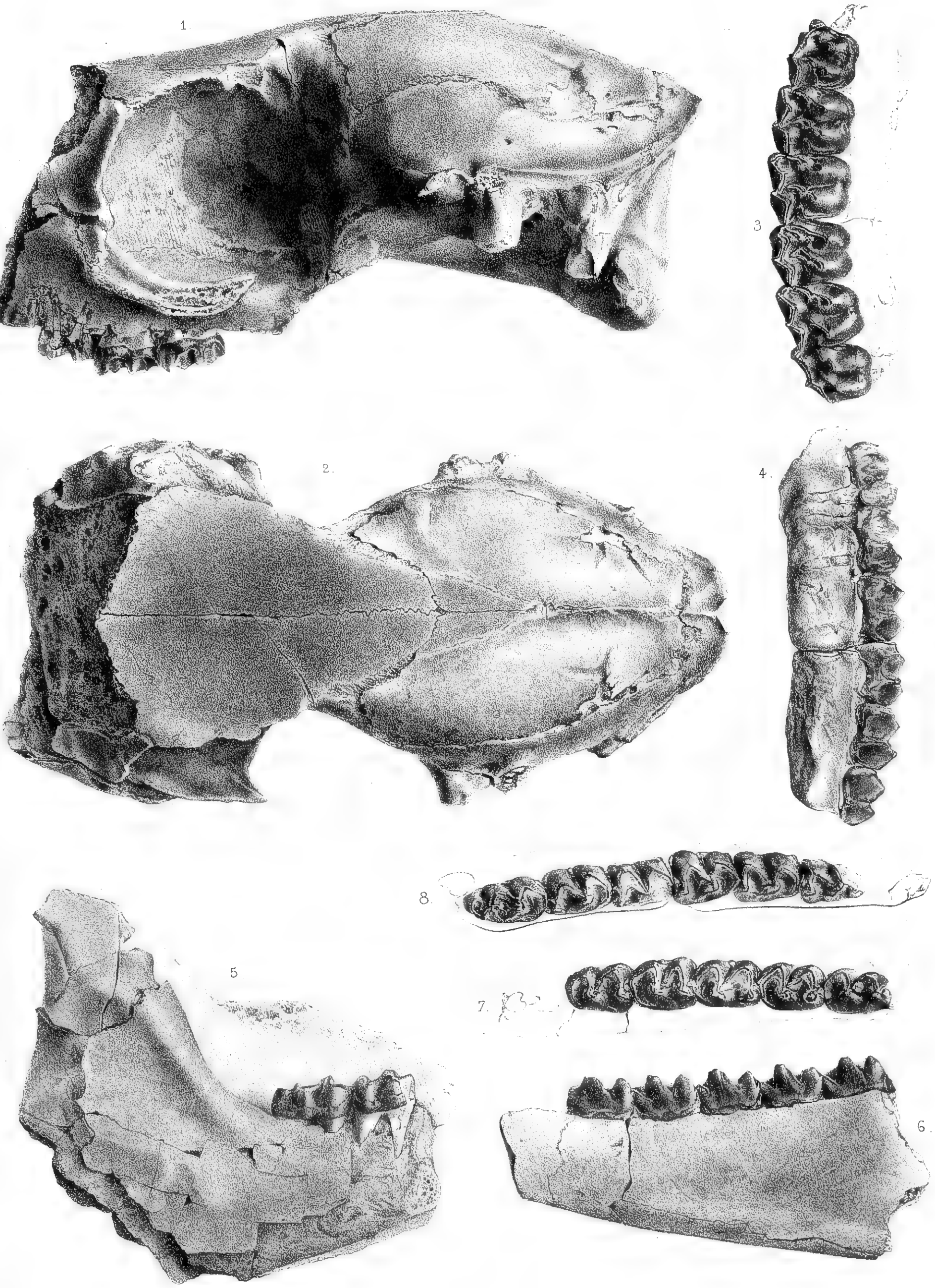
ARCHAEOTHERIUM MORTONI, Leidy.



A. Sonrel, from nat. on stone.

Printed by Tappan & Bradford.

1-7, ARCHAEOTHERIUM MORTONI, Leidy. 8-13, A. ROBUSTUM, Leidy.
14-21, ANCHITHERIUM BAIRDII, Leidy.

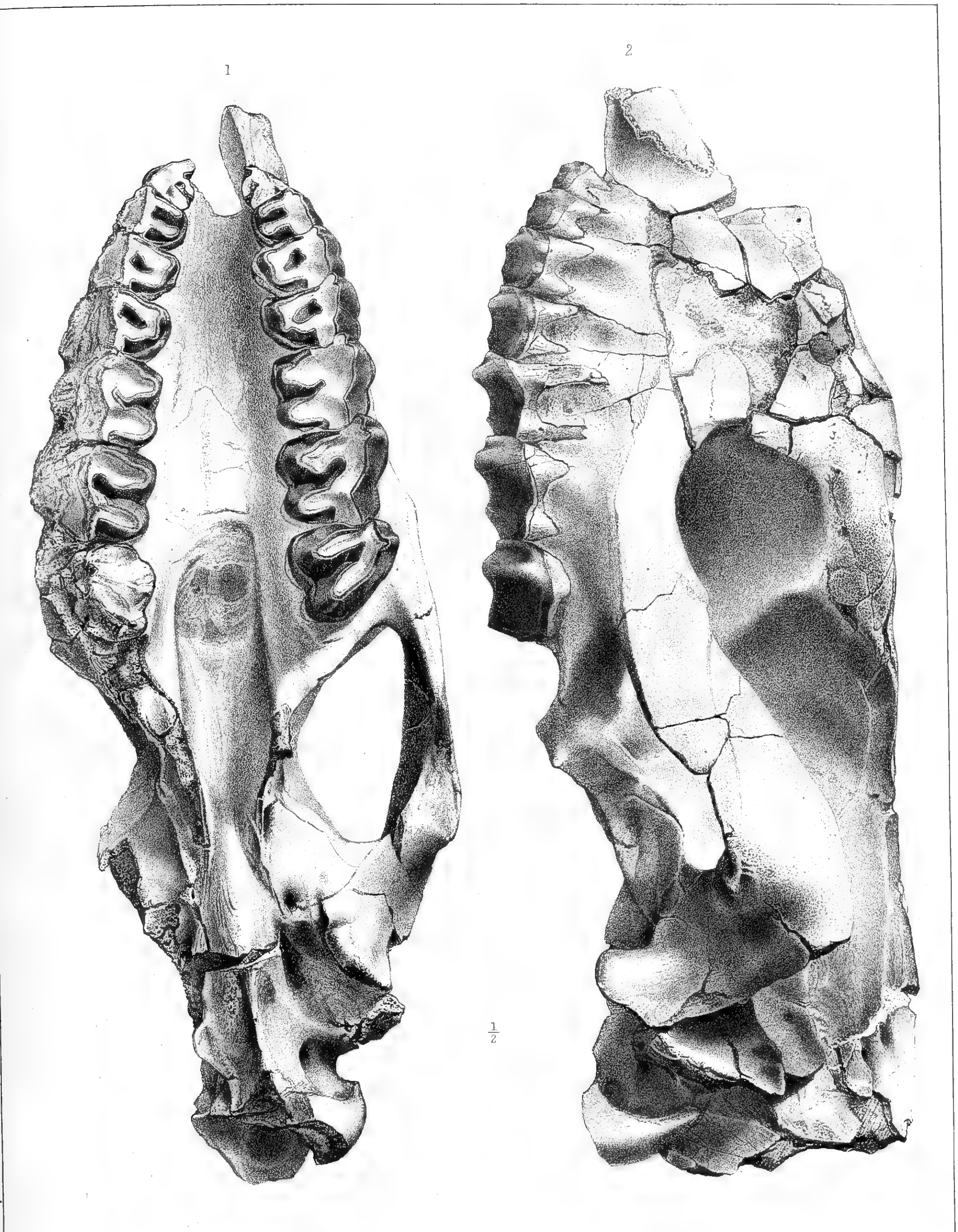


A. Sonrel on stone from nat.

Printed by Tappan & Bradford

ANCHITHERIUM BAIRDII, Leidy.

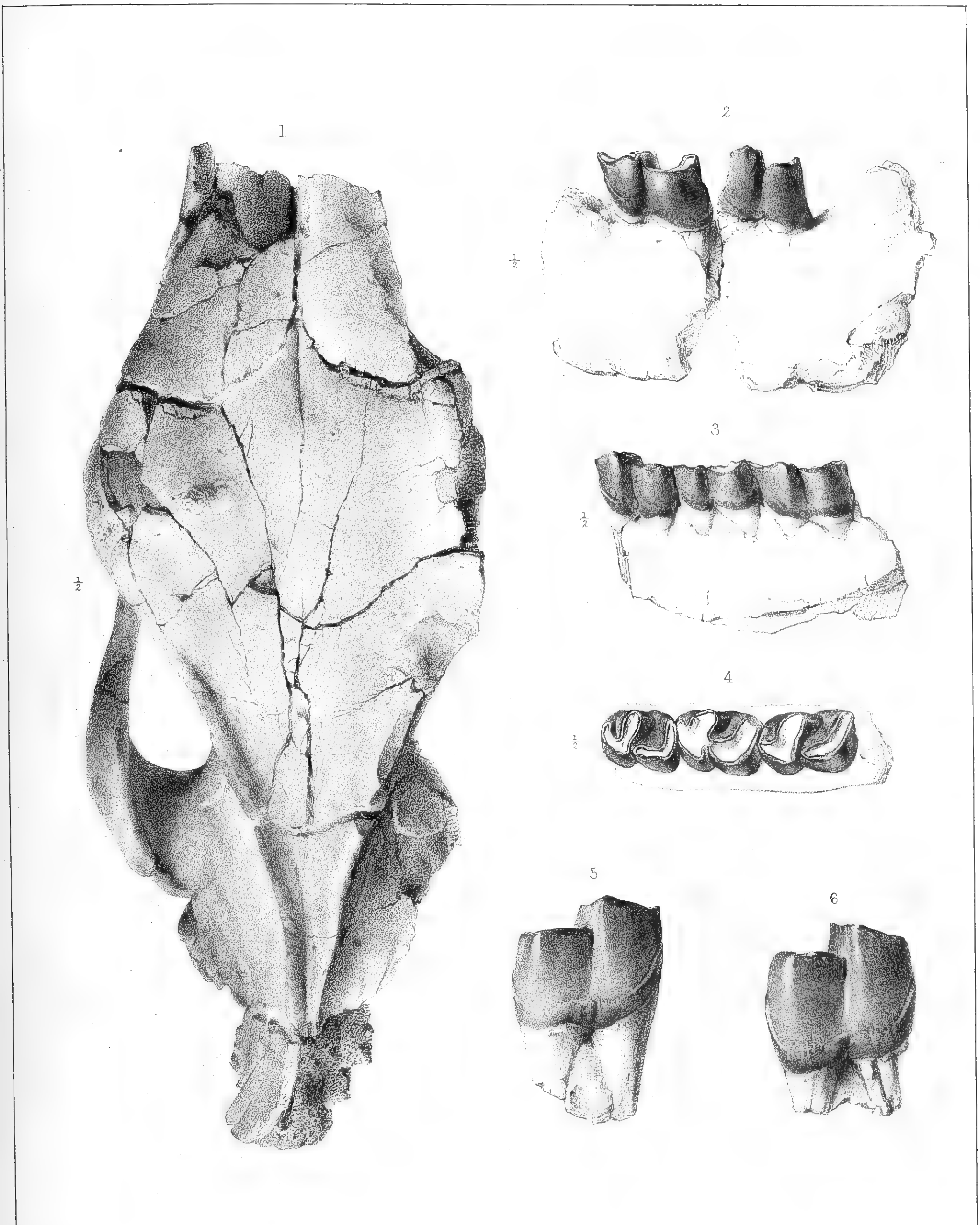
Plate XII.



A. J. Ibbotson Del.

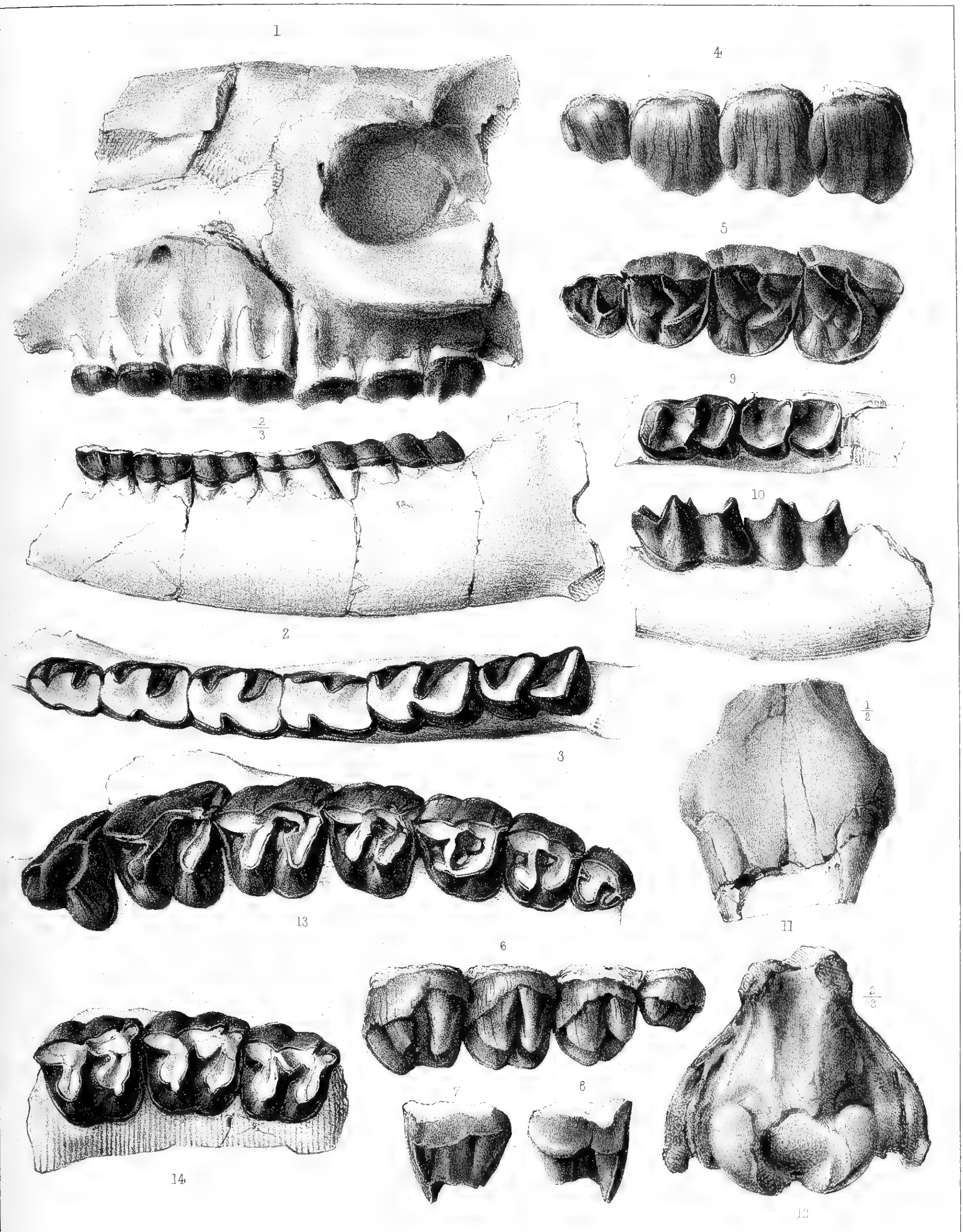
T. Sinclair's lith. Phila.

RHINOCEROS OCCIDENTALIS, Leidy.



A. Frey, Del. T. Sinclair's Lith. Phila.

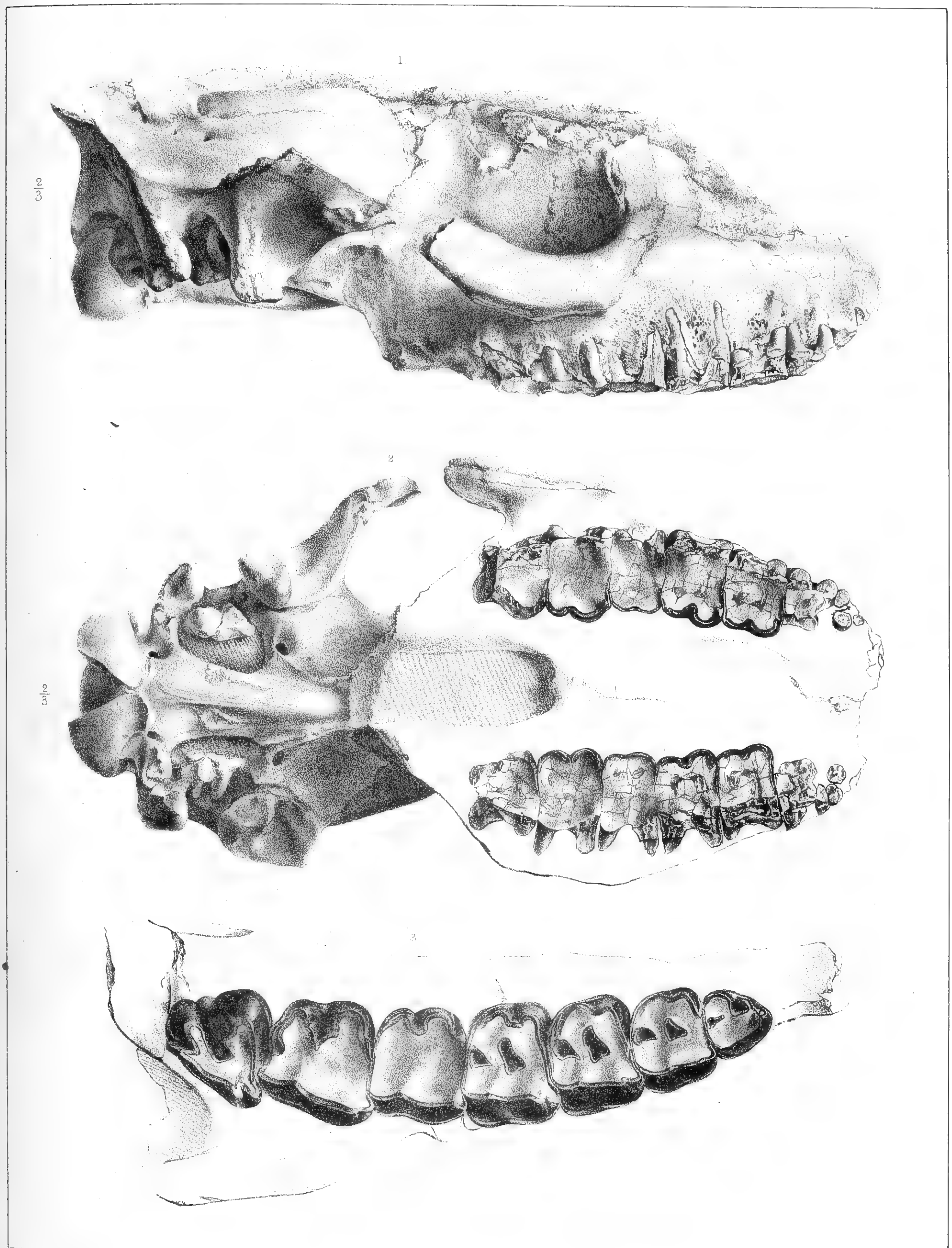
RHINOCEROS OCCIDENTALIS, Leidy.



A. Frey Del.

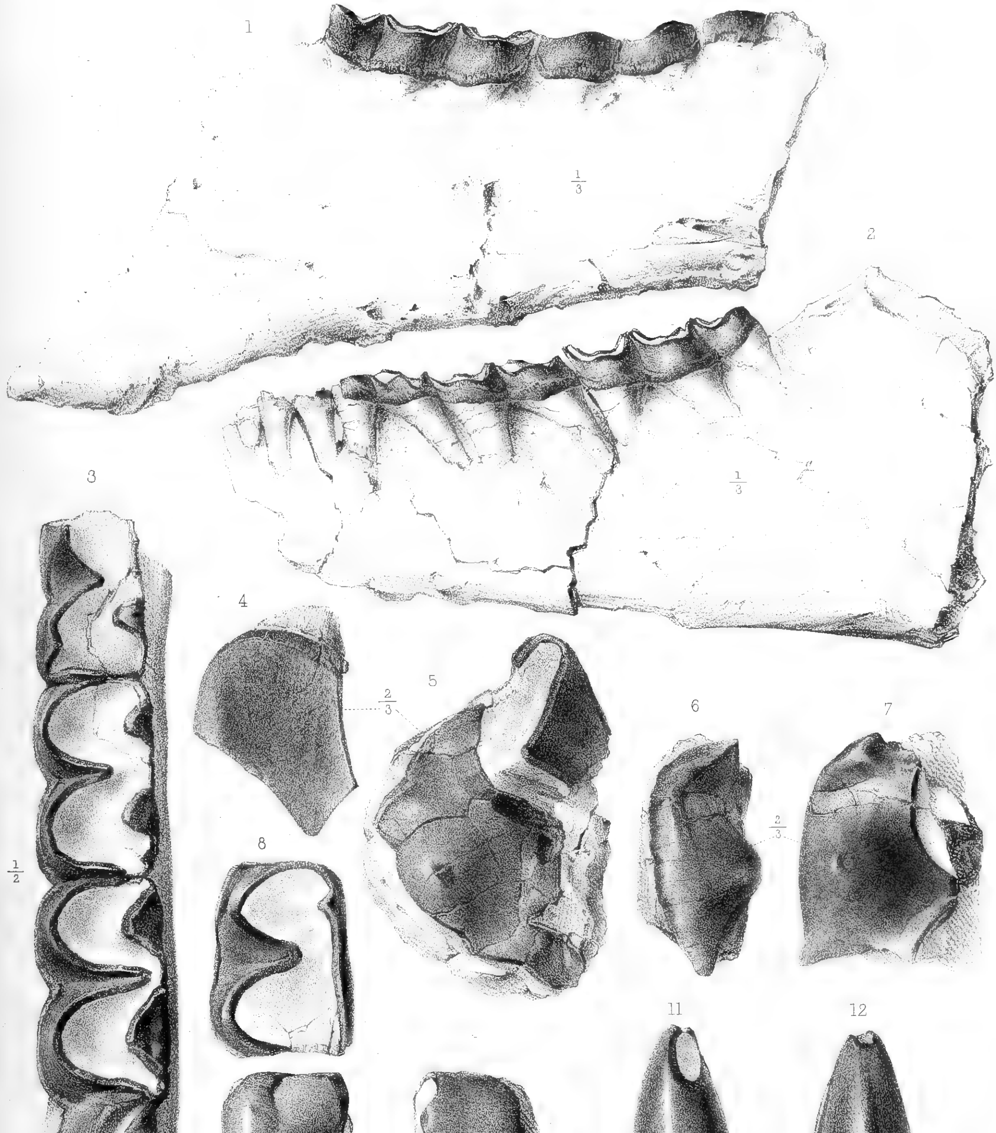
T. Sinclair's lith. Phila.

RHINOCEROS NEBRASCENSIS Leidy



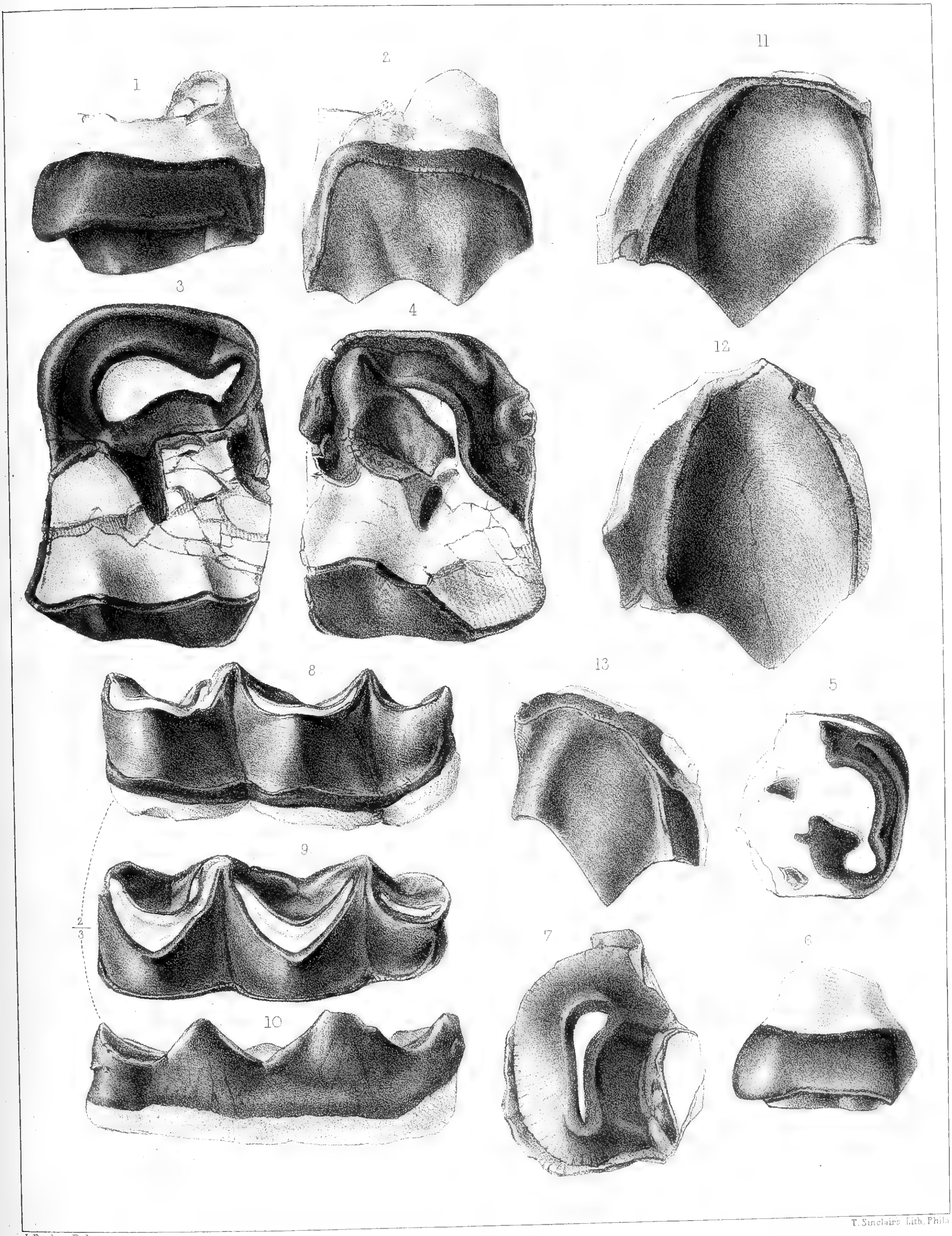
Printed by Tappan & Bradford.

RHINOCEROS NEBRASCENSIS, Leidy.



A. Frey, Del. T. Sinclair's Lith. Phila.

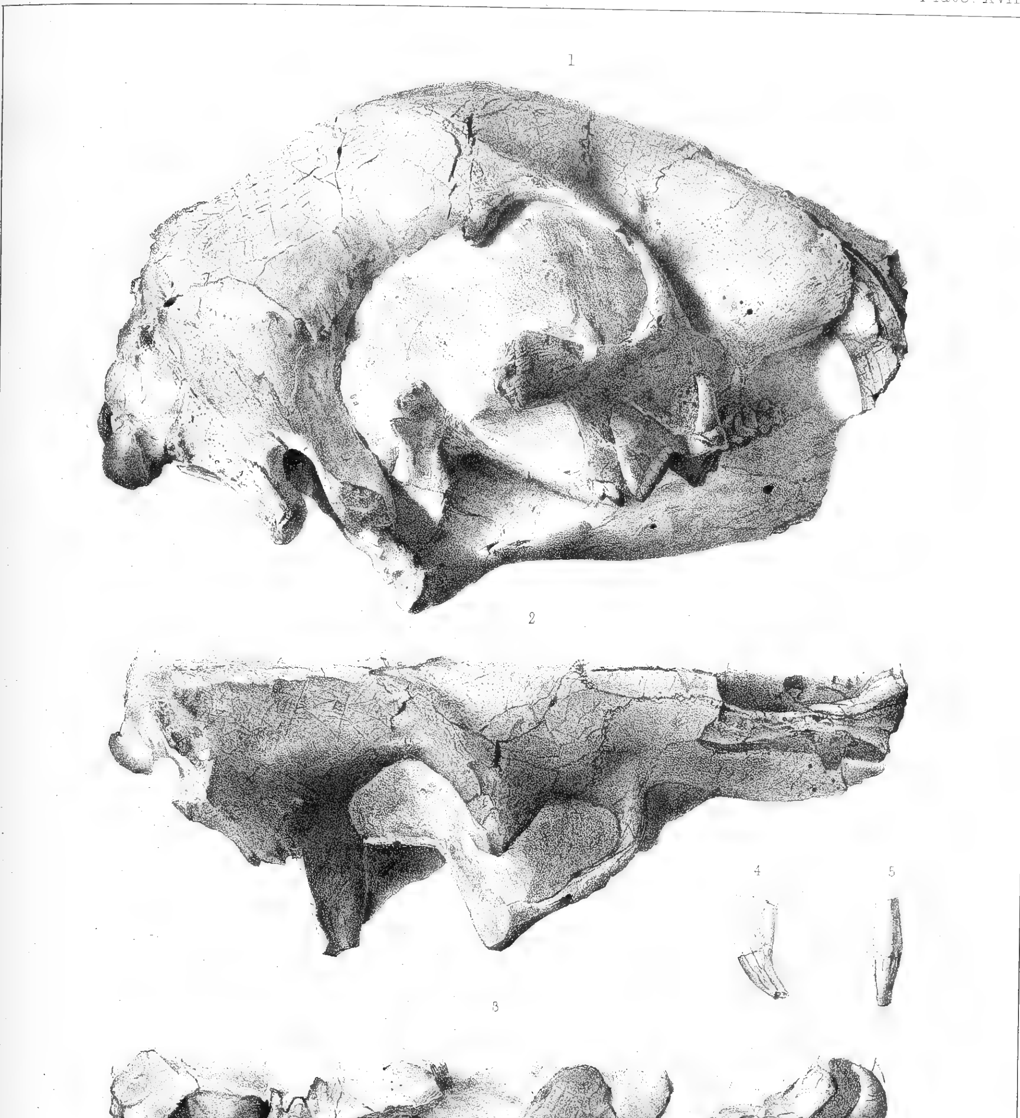
TITANOTHERIUM PROUTII, Leidy.



I Butler Del.

T. Sinclair's Lith. Phila.

1-10 TITANOTHERIUM PROUTII, Leidy.
11-13 PALAEOTHERIUM GIGANTEUM, Leidy.

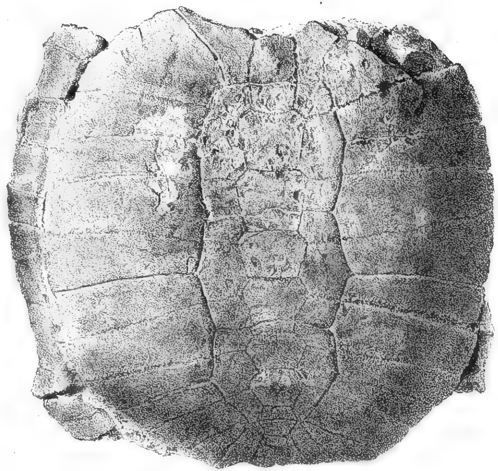


F. Schell, Del.

T. Sinclair's lith Phila.

MACHAIRODUS PRIMAEVUS, Leidy and Owen.

1



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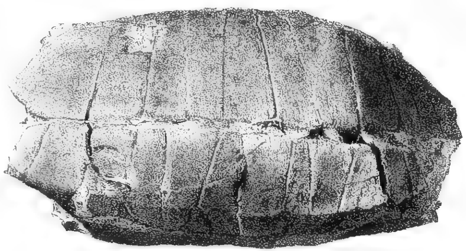

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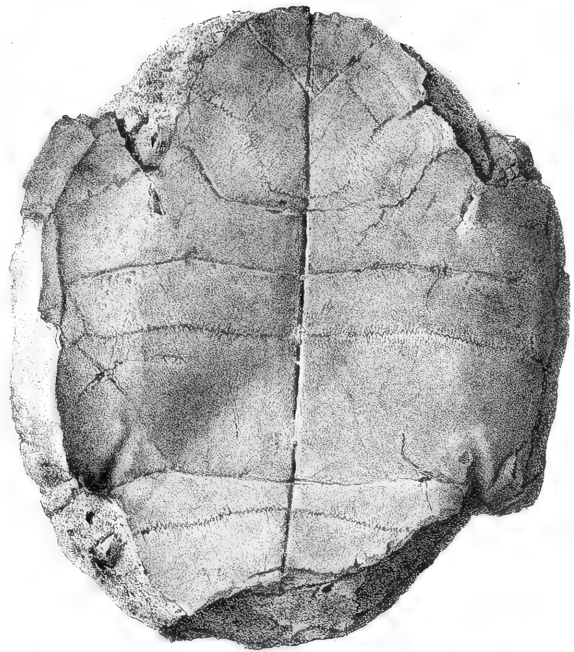


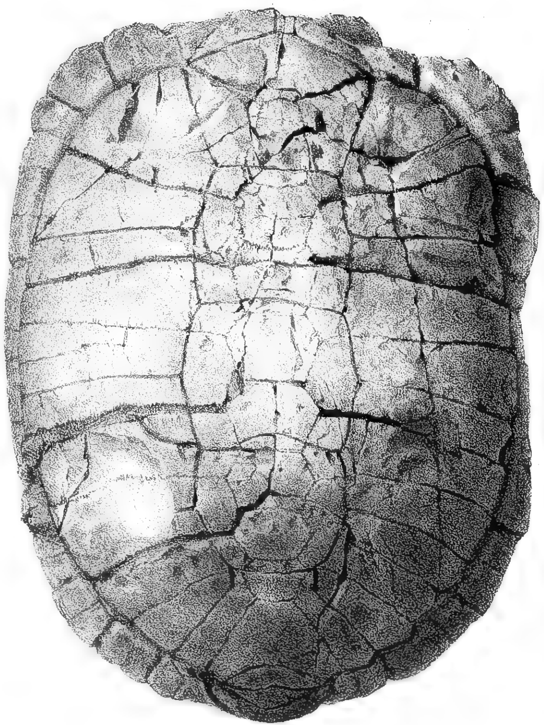
2/3

F. Shell Del

TESTUDO NEBRASCENSIS, Leidy.

T. Sinclair's Lith, Phila.

1



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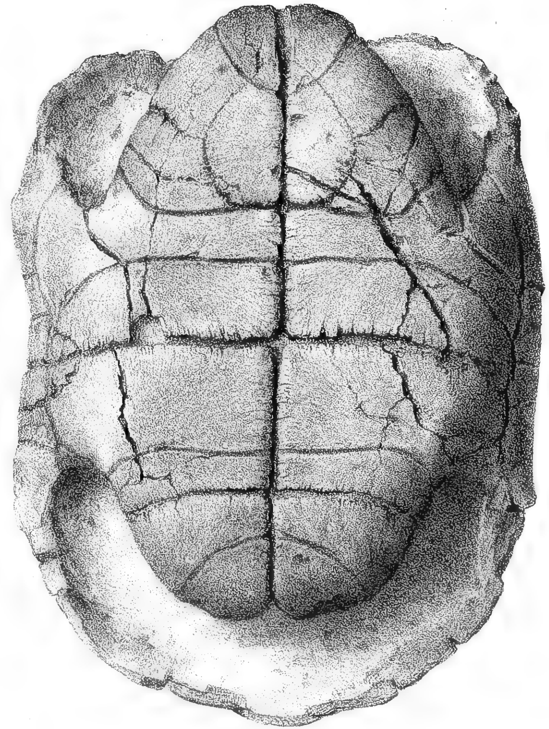


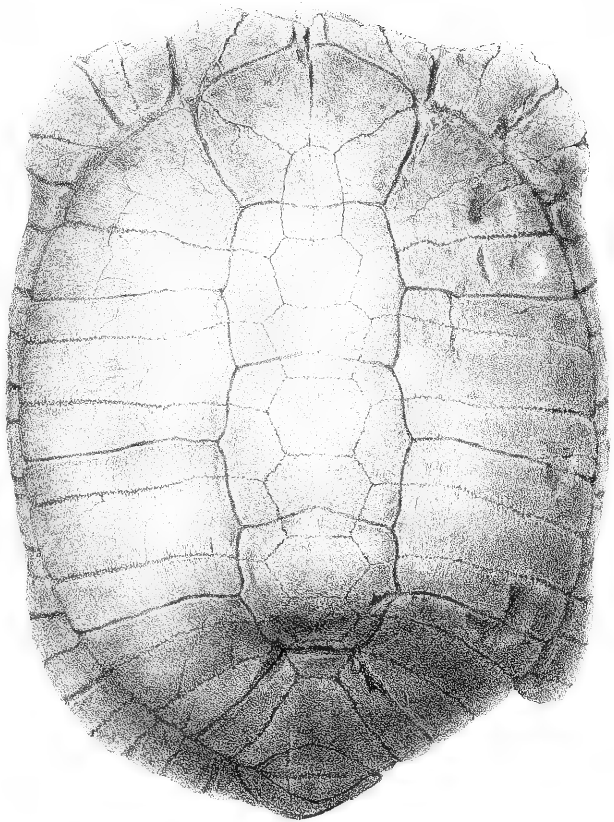
½

A Frey Del.

TESTUDO HEMISPHERICA, Leidy.

T Sinclairs Lith Phila

1



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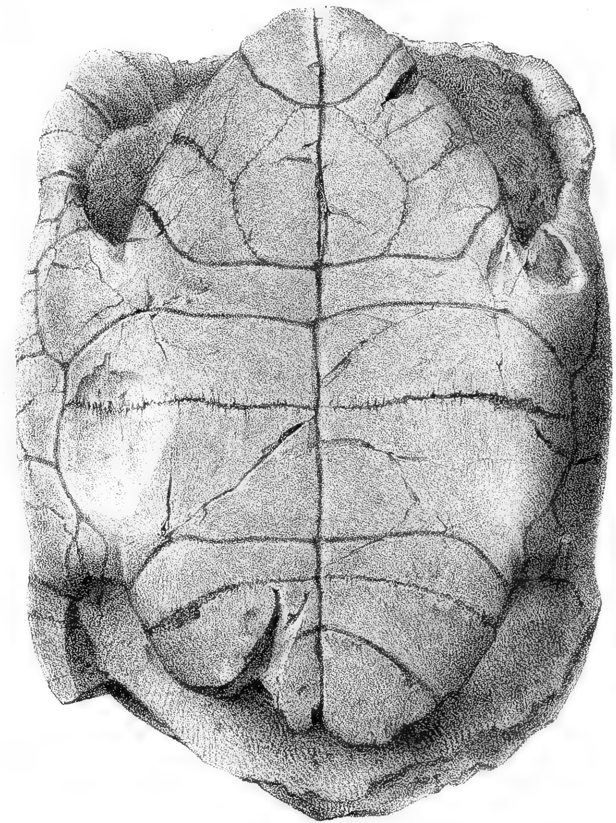


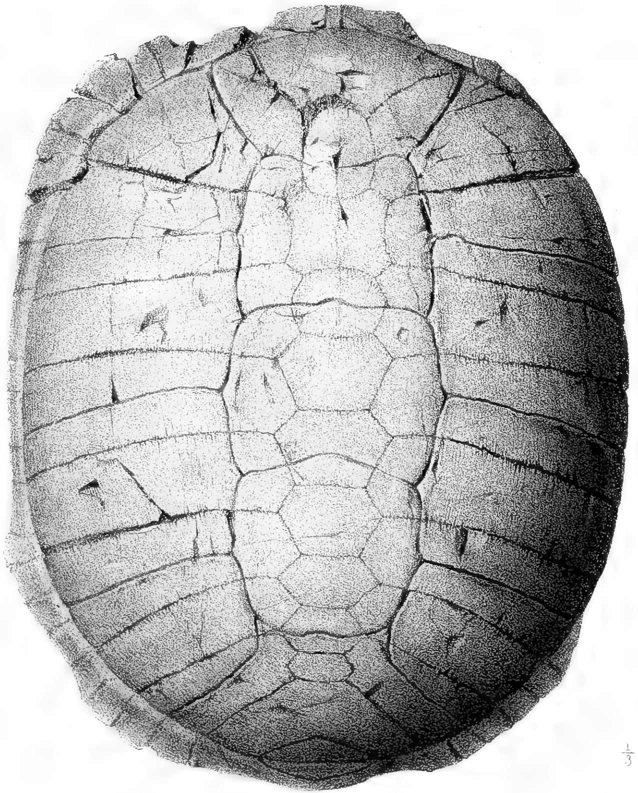
$\frac{1}{2}$

A. Frey Del.

TESTUDO OWENI, Leidy.

T. Sinclairs Lith Phila.

1



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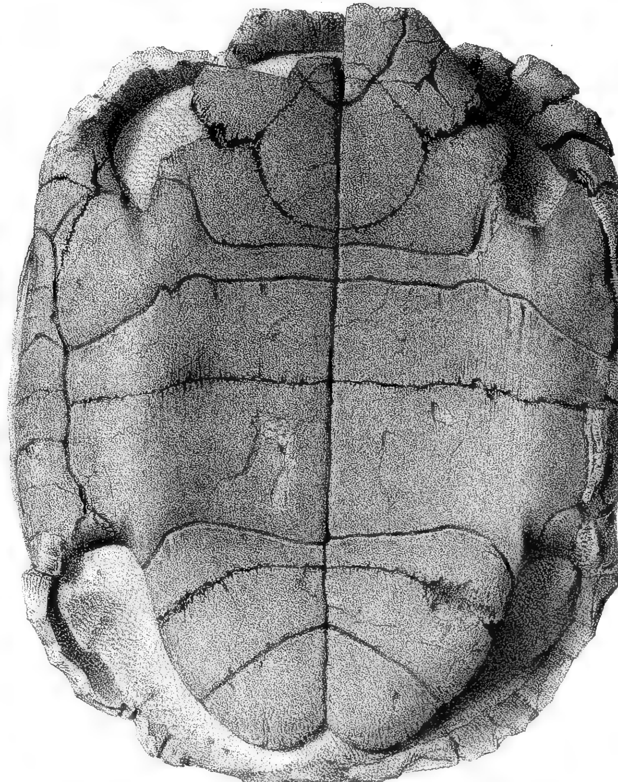
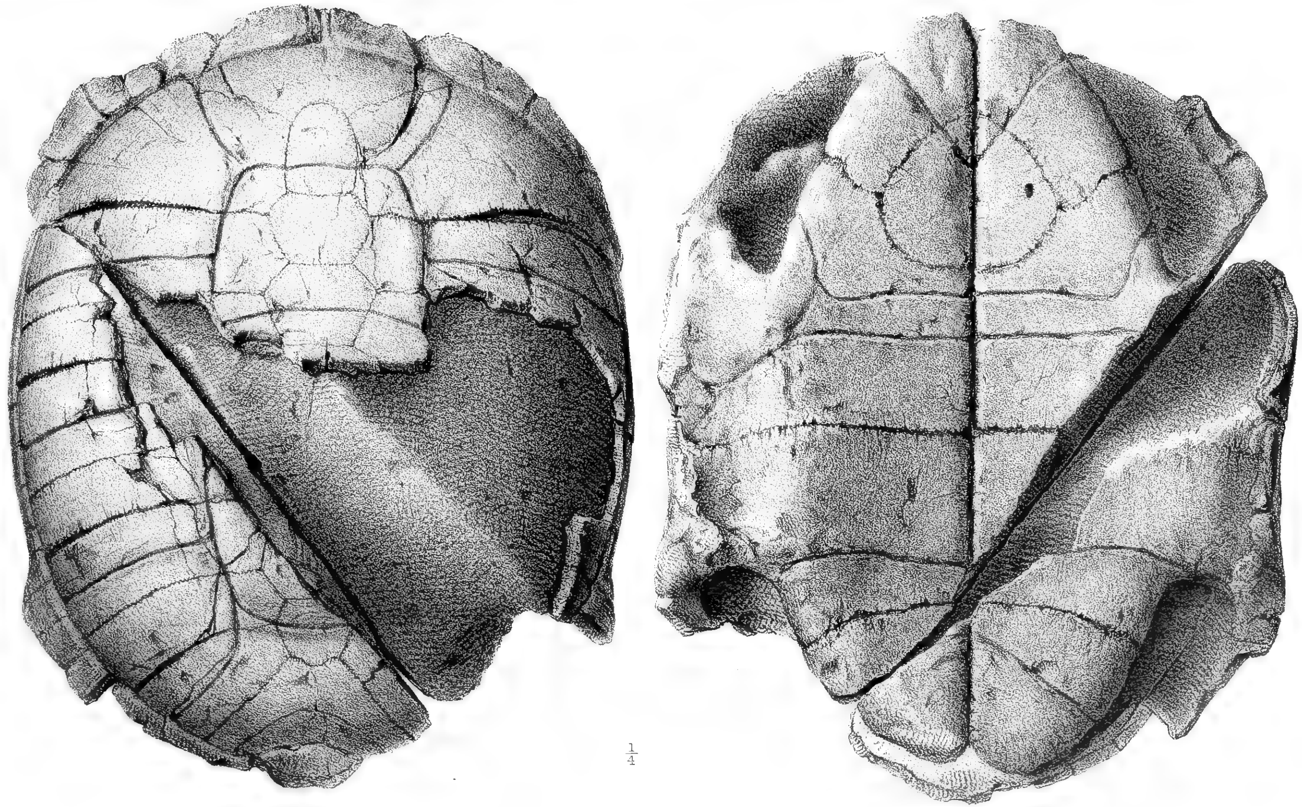


1/3

TESTUDO CULBERTSONII Leidy.

T. Sinclair's Lith. Phila.

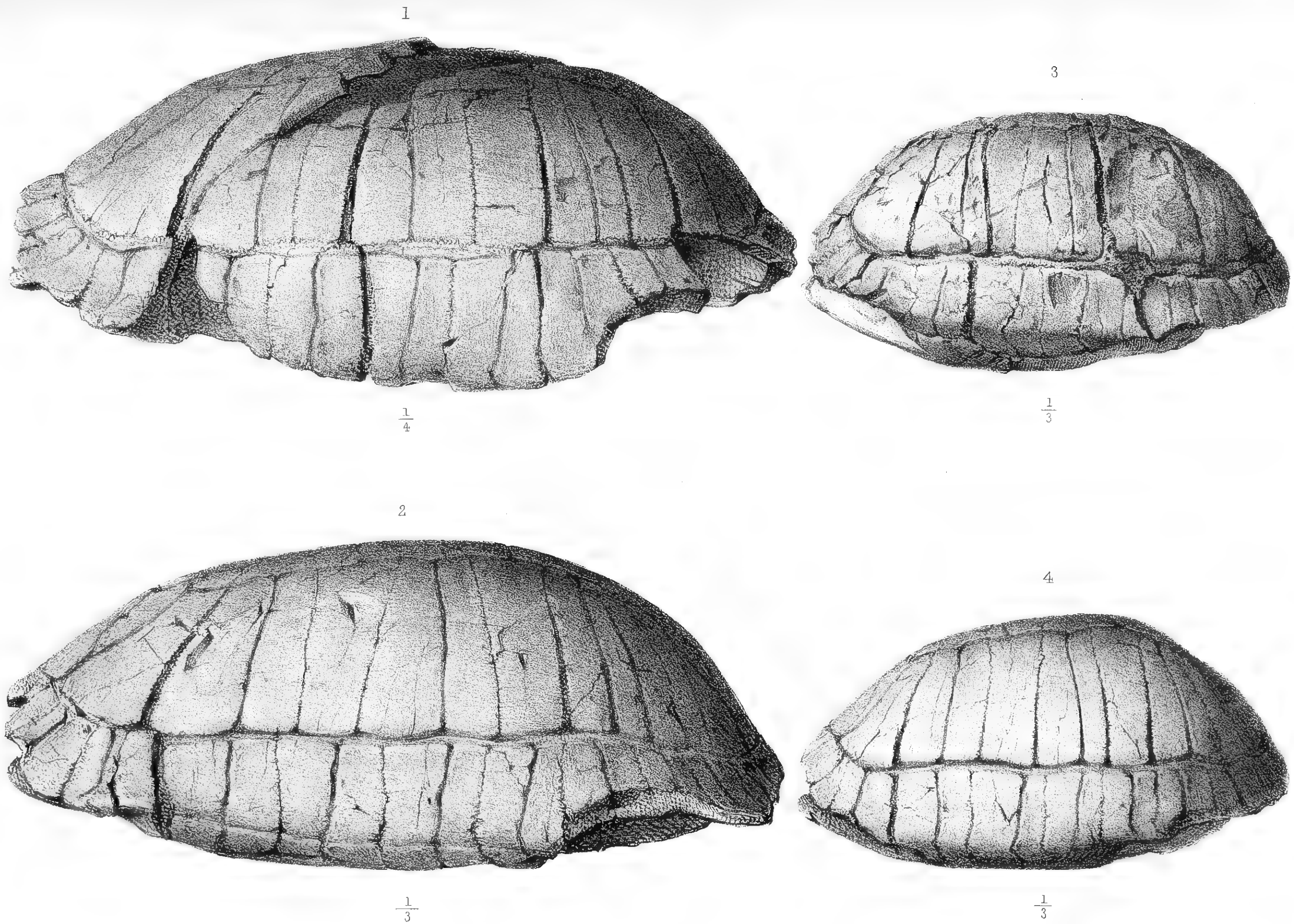
1 2



1/4

A. Frey, del. — TESTUDO LATA, Leidy. — P. Sinclair's Lith. Phila.

Plate XXIV.



A. Frey Del.

1. T. LATA. 2. T. CULBERTSONII.
3. T. HEMISPHERICA. 4. T. OWENI.

T. Sinclair's Lith. Phila.

OCCULTATIONS

OF

PLANETS AND STARS BY THE MOON,

DURING THE YEAR

1853.

COMPUTED BY JOHN DOWNES,

AT THE

EXPENSE OF THE FUND APPROPRIATED BY CONGRESS

FOR THE ESTABLISHMENT OF A

Nautical Almanac,

AND PUBLISHED BY THE SMITHSONIAN INSTITUTION.

WASHINGTON.
1853.

Smithsonian Institution.

PREFACE.

For the purpose of facilitating the accurate determination of the geographical position of important points in the United States, the Regents of the Smithsonian Institution authorized the preparation of lists of occultations and co-ordinates of reduction to particular places for the years 1848 and 1849. Congress has, since, ordered the publication of an American Nautical Almanac; and, as lists of Occultations will form a regular part of this ephemeris, Mr. Preston, the late Secretary of the Navy, directed that the expense of computing these tables for 1850 should be defrayed from the appropriation for the almanac—the printing and distribution to be done by the Smithsonian Institution. A similar order has been given by Mr. Kennedy, the present Secretary of the Navy, relative to the tables for 1853.

Copies of these elements will be forwarded to all persons disposed to advance the science of geography, with the request, that the results of the observations which may be made, be sent to the Smithsonian Institution, or published in some accessible scientific journal.

The following remarks will give a more definite idea of the nature and object of this publication.

JOSEPH HENRY, *Secretary S. I.*
CHARLES H. DAVIS, *Superintendent of the Nautical Almanac.*

The present lists of occultations are very much extended by the introduction of occultations visible on any part of the earth. The form of the list is also somewhat altered; that which is now adopted will probably be retained in the astronomical ephemeris.

Bessel's formulæ (Astron. Nachr., No. 145, and Astron. Jahrbuch for 1831) are preserved unaltered. The several columns of the general list now contain, 1, the date; 2, the star's name; 3, the star's magnitude; 4, the limiting parallels of visibility; 5, Washington mean time of the moon's true conjunction with the star in right ascension; 6, Washington hour angle, in time, of the star at the time of true conjunction; 7, co-ordinate q at the time of true conjunction; 8, hourly variation p' of co-ordinate p; 9, hourly variation q' of co-ordinate q; 10, logarithmic sine of the star's declination; 11, logarithmic cosine of the star's declination.

At the time of true conjunction $p = 0$; for any other time $\sigma + (t), p = (t)\, p'$, and $q = y + (t)\, q'$.

H being for true conjunction, $h = H +$ sidereal equivalent of (t), and, for the same reason, $T = \sigma + (t)$. The notation is made to correspond to these changes.

The sign + will hereafter be given to west longitudes, and the sign − to east longitudes. The value of the constant k has been changed by retaining Mr. Airy's correction of the lunar parallax, and rejecting the correction of $\frac{1}{360}$ part of semi-diameter, which was before applied. The small table containing the values of log. $A = \frac{1 - e^2}{\sqrt{(1 - e^2 \sin^2 \varphi)}}$ and of log. $B = \frac{1}{\sqrt{(1 - e^2 \sin^2 \varphi)}}$ is retained.

The object in increasing the general list is, to provide the means of frequent determinations of the longitude throughout the earth; to make it especially useful to geographers in general, to the boundary and other surveyors of the Government in the interior, to the coast survey of the United States on both oceans, and to the explorers of unknown parts of the continent.

At the close of the general list will be found Bessel's formulæ, and an example of their use, together with some suggestions as to the manner in which the lists may be rendered more convenient to those who resort to them habitually.

CHARLES HENRY DAVIS, *Superintendent.*

ELEMENTS

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. Northern.	Limiting Parallels. Southern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. H	Y	p′	q′	Log sin D	Log cos D
			°	°	h. m.	h. m. s.					
Jan. 1	π Virginis	5	−15	−83	0 05.9	+ 6 57 40	−0.9927	0.5396	−.2321	+9.1119	9.9963
1	c Virginis	5	+53	−28	9 20.5	+ 8 05 49	+0.2242	.5404	−.2378	+8.8577	.9989
1	11 Virginis	6	−30	−83	4 27.6	+11 10 48	−1.1814	.5398	−.2356	+9.0621	.9971
3	94 Virginis	6	+82	+ 9	10 38.3	− 8 25 35	+0.8884	.5504	−.2346	−9.1534	.9956
3	95 Virginis	6	+81	+39	10 49.9	− 8 14 20	+1.2688	.5494	−.2345	−9.1751	.9951
4	ξ¹ Libræ	6	− 8	−90	7 59.2	−11 49 02	−0.8134	.5643	−.2205	−9.2919	.9915
4	o¹ Libræ	6	+65	−11	19 22.9	− 0 49 48	+0.5342	.5677	−.2017	−9.4134	.9849
4	o² Libræ	6	+31	−43	20 14.8	+ 0 00 08	−0.0487	.5700	−.2003	−9.4016	.9857
4	ζ¹ Libræ	4	+74	+26	22 25.6	+ 2 06 11	+1.1151	.5681	−.1974	−9.4456	.9824
4	ζ³ Libræ	6	+74	−18	23 26.9	+ 3 05 16	+0.8160	.5692	−.1959	−9.4430	.9826
5	ζ⁴ Libræ	6	+74	−14	0 23.4	+ 3 59 42	+0.8806	.5699	−.1944	−9.4495	.9821
5	η Libræ	4½	−37	−90	5 05.2	+ 8 31 04	−1.1657	.5790	−.1863	−9.4186	.9845
5	θ Libræ	4½	−12	−90	9 05.8	−11 37 16	−0.8065	.5809	−.1795	−9.4480	.9822
5	ν Scorpio	4	+71	−24	16 29.0	− 4 30 52	+0.6979	.5804	−.1665	−9.5143	.9755
5	ψ Ophiuchi	5	+59	−11	21 22.0	+ 0 10 52	+0.5249	.5840	−.1564	−9.5275	.9739
5	χ Ophiuchi	5	−49	−90	22 34.7	+ 1 20 43	−1.2348	.5906	−.1543	−9.4927	.9779
6	JUPITER		+68	+ 8	10 00.8	−11 40 00	+0.8351	.5817	−.1265	−9.5698	.9678
6	B.A.C. 5758	6	+20	−70	14 00.6	− 7 49 41	−0.1053	.5952	−.1179	−9.5613	.9691
6	VENUS		+20	−46	15 07.2	− 6 45 45	−0.0950	.5456	−.1087	−9.5640	.9687
6	ξ Ophiuchi	5	−46	−90	19 46.1	− 2 18 03	−1.1553	.6020	−.1055	−9.5533	.9703
6	B.A.C. 5866	6	−30	−90	21 12.4	− 0 55 15	−0.9521	.6021	−.1004	−9.5602	.9693
10	φ Capricor.	6	+69	+12	15 55.7	− 9 48 25	+0.8960	.5682	+.1337	−9.5595	.9694
11	ε Capricor.	5	+70	+23	1 12.8	− 0 51 17	+1.0457	.5599	+.1513	−9.5366	.9727
11	κ Capricor.	5	+70	+ 6	3 39.9	+ 1 30 36	+0.8100	.5595	+.1548	−9.5243	.9743
11	B.A.C. 7666	6	+48	−23	12 32.8	+10 04 58	+0.3095	.5535	+.1692	−9.4823	.9790
12	56 Aquarii	6	+43	−30	1 31.1	− 1 22 36	+0.1725	.5428	+.1866	−9.4225	.9843
12	τ¹ Aquarii	6	+75	+35	9 43.8	+ 6 33 55	+1.2148	.5346	+.1958	−9.4083	.9853
12	τ² Aquarii	4	+76	+11	10 38.6	+ 7 27 03	+0.9036	.5343	+.1968	−9.3948	.9862
12	74 Aquarii	6	− 9	−90	12 32.5	+ 9 17 14	−0.8121	.5362	+.1987	−9.3319	.9897
12	ψ¹ Aquarii	5½	−40	−90	23 33.8	− 4 02 01	−1.2439	.5288	+.2083	−9.2349	.9935
13	ψ² Aquarii	5	−14	−90	0 36.1	− 3 01 41	−0.9241	.5264	+.2094	−9.2392	.9934
13	ψ³ Aquarii	5	+18	−61	1 07.4	− 2 31 20	−0.3567	.5255	+.2094	−9.2572	.9928
13	30 Piscium	4½	+74	−10	23 13.1	− 5 05 09	+0.5665	.5119	+.2214	−9.0756	.9969
14	33 Piscium	5	+80	− 6	0 59.8	− 3 21 28	+0.6357	.5110	+.2220	−9.0561	.9972
15	20 Ceti	5	+57	−24	2 32.4	− 2 32 23	+0.2939	.5028	+.2255	−8.5309	.9997
15	33 Ceti	6	+18	−65	12 05.2	+ 6 44 26	−0.4128	.5012	+.2244	+8.4619	.9998
15	*f* Piscium	6	− 4	−87	16 02.4	+10 35 05	−0.8194	.5006	+.2236	+8.6945	.9995
16	ν Piscium	5	+37	−42	4 57.9	− 0 50 52	−0.0454	.5018	+.2203	+8.9172	.9985
16	ξ¹ Ceti	5	+35	−44	22 09.2	+ 8 08 10	−0.0982	.5025	+.2115	+9.1518	.9956
17	ξ Arietis	5½	0	−79	4 31.3	− 1 56 47	−0.7382	.5028	+.2078	+9.2371	.9934
17	B. A. C. 755	6	+15	−66	5 34.2	− 0 55 36	−0.4742	.5035	+.2071	+9.2352	.9935
17	B. A. C. 830	6	+90	+21	14 01.2	+ 7 17 03	+1.0146	.5084	+.2004	+9.2444	.9932
19	ω¹ Tauri	6	+10	−71	10 31.2	+ 2 28 19	−1.0882	.5252	+.1525	+9.5174	.9751
19	Rumk. 1159	5	+90	+50	16 34.7	+ 8 20 34	+1.2451	.5342	+.1437	+9.4878	.9785
19	Rumk. 1162	6	+90	+34	16 38.0	+ 8 23 41	+1.0842	.5335	+.1437	+9.4916	.9780
19	B.A.C. 1361	6	+84	+ 4	18 17.2	+ 9 59 51	+0.6190	.5335	+.1407	+9.5060	.9764
19	ε Tauri	3½	+90	+ 9	20 03.7	+11 42 57	+0.7018	.5343	+.1392	+9.5093	.9761
20	ι Tauri	4½	+38	−27	12 26.4	+ 3 34 08	−0.0264	.5425	+.1109	+9.5617	.9690
20	105 Tauri	6	+44	−21	14 42.0	+ 5 45 16	+0.0764	.5439	+.1073	+9.5642	.9687
20	*n* Tauri	5½	+48	−17	19 57.5	+10 50 19	+0.1361	0.5481	+.0961	+9.5724	9.9674

ELEMENTS

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. Northern.	Limiting Parallels. Southern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p′*	*q′*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Jan. 20	o Tauri	5	+88	+11	23 48.6	− 9 26 20	+0.6397	0.5512	+.0903	+9.5699	9.9678
21	1 Geminor.	5	+55	− 6	16 14.7	+ 6 26 06	+0.2469	.5594	+.0553	+9.5966	.9632
21	η Geminor.	4	+90	+65	21 02.6	+11 03 59	+1.2685	.5656	+.0444	+9.5837	.9655
23	κ Geminor.	4	−28	−65	11 46.1	+ 0 26 14	−1.0797	.5665	−.0442	+9.6218	.9582
24	γ Cancri	4½	+37	−27	13 02.0	+ 0 45 04	−0.0509	.5701	−.1045	+9.5735	.9672
26	η Leonis	3½	+11	−63	1 48.0	−11 47 23	−0.5321	.5591	−.1753	+9.4776	.9795
27	ι Leonis	4	−31	−79	12 35.7	− 2 10 56	−1.1806	.5468	−.2218	+9.2935	.9914
27	ξ Virginis	5	−24	−81	22 31.2	+ 7 24 44	−1.1046	.5462	−.2304	+9.1979	.9945
27	ν Virginis	4½	+79	− 7	22 47.9	+ 7 40 52	+0.5994	.5473	−.2304	+9.1071	.9964
28	π Virginis	5	−24	−83	5 48.0	− 9 32 52	−1.1161	.5438	−.2352	+9.1118	.9963
28	11 Virginis	6	−43	−83	10 06.4	− 5 23 01	−1.3059	.5428	−.2379	+9.0620	.9971
28	c Virginis	5	+45	−35	14 56.3	− 0 42 40	+0.0877	.5437	−.2402	+8.8575	.9989
30	80 Virginis	6	+70	−13	2 02.4	+ 9 14 17	+0.5082	.5449	−.2407	−8.9086	.9986
30	94 Virginis	6	+80	0	16 11.3	− 1 05 09	+0.7411	.5478	−.2335	−9.1528	.9956
30	95 Virginis	6	+81	+12	16 23.1	− 0 53 43	+1.1233	.5475	−.2336	−9.1752	.9951
31	ξ^1 Libræ	6	−18	−90	13 49.3	− 4 11 28	−0.9681	.5582	−.2144	−9.2919	.9915
Feb. 1	o^1 Libræ	6	+57	−19	1 26.3	+ 7 01 01	+0.3964	.5614	−.1992	−9.4134	.9849
1	o^2 Libræ	6	+24	−51	2 19.2	+ 7 52 04	−0.1921	.5637	−.1976	−9.4016	.9857
1	ζ^1 Libræ	4	+74	+16	4 32.9	+10 00 59	+0.9851	.5607	−.1947	−9.4456	.9824
1	ζ^3 Libræ	6	+73	− 3	5 35.6	+11 01 25	+0.6832	.5624	−.1932	−9.4430	.9826
1	ζ^4 Libræ	6	+72	+ 1	6 33.5	+11 57 13	+0.7494	.5628	−.1916	−9.4495	.9821
1	η Libræ	4½	−57	−90	11 21.8	− 7 24 52	−1.3158	.5706	−.1837	−9.4186	.9845
1	θ Libræ	4½	−21	−90	15 28.3	− 3 27 16	−0.9499	.5729	−.1770	−9.4480	.9822
1	ν Scorpio	4	+64	− 8	23 03.1	+ 3 50 41	+0.5781	.5724	−.1624	−9.5143	.9755
2	ψ Ophiuchi	5	+52	−17	4 04.0	+ 8 40 25	+0.4071	.5757	−.1526	−9.5275	.9739
2	B.A.C. 5758	6	+14	−53	21 11.4	+ 1 08 41	−0.2144	.5860	−.1154	−9.5613	.9691
3	JUPITER		+39	−25	2 05.0	+ 5 50 55	+0.2654	.5793	−.1030	−9.5803	.9660
3	ξ Ophiuchi	4½	−61	−90	3 07.1	+ 6 50 36	−1.2720	.5928	−.1011	−9.5533	.9703
3	B.A.C. 5866	6	−38	−90	4 35.9	+ 8 15 58	−1.0649	.5924	−.0987	−9.5602	.9693
3	c^2 Ophiuchi	5	+66	+54	7 12.3	+10 46 16	+1.2703	.5837	−.0913	−9.6067	.9613
3	B.A.C. 5954	6	−38	−90	10 10.3	−10 22 48	−1.0457	.5947	−.0837	−9.5702	.9677
3	4 Sagittarii	5	+40	−20	18 25.7	− 2 26 55	+0.3558	.5906	−.0631	−9.6059	.9614
3	B.A.C. 6088	6	−20	−90	19 17.2	− 1 37 27	−0.7387	.5957	−.0605	−9.5878	.9648
3	7 Sagittarii	6	+66	+ 5	19 37.2	− 1 18 16	+0.7709	.5889	−.0605	−9.6140	.9598
3	B.A.C. 6161	6	+20	−39	23 07.2	+ 2 03 26	+0.0174	.5932	−.0499	−9.6046	.9616
4	24 Sagittarii	6	+23	−34	7 48.5	+10 24 02	+0.1115	.5936	−.0284	−9.6117	.9603
4	B.A.C. 6343	6	− 8	−72	9 38.0	−11 50 53	−0.4695	.5962	−.0230	−9.6028	.9620
4	26 Sagittarii	6	+ 8	−49	10 56.1	−10 35 49	−0.1485	.5947	−.0176	−9.6087	.9608
4	B.A.C. 6369	6	+65	+28	12 04.2	− 9 30 30	+1.0469	.5891	−.0149	−9.6285	.9567
4	B.A.C. 6448	6	−31	−90	16 13.1	− 5 32 14	−0.8341	.5978	−.0040	−9.5982	.9629
5	B.A.C. 6576	6	+34	−22	0 09.5	+ 2 06 03	+0.3123	.5914	+.0176	−9.6165	.9593
5	χ^1 Sagittarii	5½	+65	+ 5	3 59.7	+ 5 47 09	+0.7702	.5883	+.0283	−9.6225	.9580
5	χ^3 Sagittarii	6	+29	−28	4 06.1	+ 5 53 16	+0.2153	.5909	+.0283	−9.6135	.9599
5	h^1 Sagittarii	6	+65	+37	8 15.5	+ 9 52 51	+1.1604	.5835	+.0388	−9.6266	.9572
5	B.A.C. 6864	6	+ 7	−56	18 27.5	− 4 19 04	−0.2541	.5845	+.0643	−9.5943	.9636
9	ψ^1 Aquarii	5½	−27	−90	8 57.6	+ 7 09 43	−1.1122	.5309	+.2113	−9.2349	.9935
9	ψ^2 Aquarii	5	− 6	−90	9 59.3	+ 8 09 35	−0.7911	.5301	+.2121	−9.2392	.9934
9	ψ^3 Aquarii	5	+25	−53	10 30.4	+ 8 39 41	−0.2244	.5290	+.2121	−9.2572	.9928
10	30 Piscium	4½	+81	0	8 23.4	+ 5 53 08	+0.7471	.5159	+.2244	−9.0756	.9969
10	33 Piscium	5	+83	+ 3	10 09.0	+ 7 35 38	+0.8011	0.5148	+.2250	−9.0561	9.9972

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. North-ern.	Limiting Parallels. South-ern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p′*	*q′*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Feb. 11	33 Ceti	6	+29	−51	20 50.2	− 6 42 42	−0.2016	0.5054	+.2272	+8.4619	9.9998
12	*f* Piscium	6	+ 8	−79	0 44.8	− 2 54 40	−0.6034	.5046	+.2263	+8.6945	.9995
12	ν Piscium	5	+50	−30	13 32.4	+ 9 31 29	+0.1776	.5040	+.2221	+8.9172	.9985
13	ξ¹ Ceti	5	+47	−31	6 35.6	+ 2 06 02	+0.1336	.5047	+.2131	+9.1517	.9956
13	ξ Arietis	5½	+13	−68	12 55.4	+ 8 15 10	−0.5041	.5048	+.2083	+9.2371	.9934
13	B. A. C. 755	6	+26	−51	13 57.6	+ 9 15 35	−0.2422	.5055	+.2076	+9.2352	.9935
15	ω¹ Tauri	6	− 9	−71	18 55.6	−11 19 24	−0.8676	.5229	+.1505	+9.5174	.9751
16	Rumk. 1162	6	+90	+61	1 04.7	− 5 21 45	+1.3053	.5319	+.1417	+9.4914	.9780
16	B.A.C. 1361	6	+90	+17	2 44.5	− 3 45 04	+0.8373	.5308	+.1402	+9.5060	.9764
16	ε Tauri	3½	+90	+22	4 31.7	− 2 01 10	+0.9191	.5325	+.1371	+9.5093	.9761
16	ι Tauri	4½	+50	−16	21 02.0	−10 02 24	+0.1745	.5391	+.1084	+9.5617	.9690
16	105 Tauri	6	+57	−10	23 18.8	− 7 50 06	+0.2743	.5411	+.1050	+9.5642	.9687
17	*n* Tauri	5½	+67	− 6	4 37.1	− 2 42 16	+0.3302	.5440	+.0957	+9.5725	.9674
17	*o* Tauri	5	+90	+22	8 30.2	+ 1 03 11	+0.8302	.5480	+.0881	+9.5699	.9678
17	121 Tauri	6	−41	−66	12 02.5	+ 4 28 19	−1.1978	.5429	+.0802	+9.6082	.9609
18	1 Geminor.	5	+67	+ 2	1 05.4	− 6 55 21	+0.4161	.5555	+.0534	+9.5966	.9632
18	3 Geminor.	6	+90	+18	3 36.6	− 4 29 20	+0.6899	.5574	+.0491	+9.5942	.9636
18	5 Geminor.	6	0	−64	4 22.6	− 3 44 57	−0.6998	.5525	+.0469	+9.6168	.9592
18	6 Geminor.	6	+90	+46	4 46.3	− 3 22 02	+0.9570	.5589	+.0469	+9.5907	.9642
18	ε Geminor.	3	−35	−65	18 41.2	+10 03 37	−1.1410	.5564	+.0157	+9.6303	.9563
18	B.A.C. 2238	6	+75	+12	22 15.7	−10 29 25	+0.5110	.5649	+.0065	+9.6055	.9615
19	ω Geminor.	6	+29	−25	2 46.4	− 6 08 22	−0.1852	.5632	−.0029	+9.6165	.9593
19	48 Geminor.	6	+30	−25	7 07.4	− 1 56 43	−0.1715	.5650	−.0146	+9.6157	.9594
19	52 Geminor.	6	−22	−65	8 04.4	− 1 01 48	−1.0046	.5618	−.0169	+9.6283	.9568
19	ϰ Geminor.	4	−19	−65	20 53.8	+11 19 51	−0.9770	.5648	−.0478	+9.6218	.9582
20	μ¹ Cancri	6	+57	− 6	6 17.9	− 3 36 32	+0.2787	.5711	−.0692	+9.5928	.9639
20	γ Cancri	4½	+40	−24	22 08.9	+11 39 53	+0.0038	.5702	−.1062	+9.5735	.9672
22	η Leonis	3½	+10	−64	10 33.8	− 1 13 44	−0.5512	.5499	−.1792	+9.4776	.9795
23	ι Leonis	4	−39	−79	20 40.4	+ 7 41 31	−1.2682	.5538	−.2268	+9.2936	.9914
24	ξ Virginis	5	−33	−81	6 21.3	− 6 57 24	−1.2117	.5522	−.2359	+9.1978	.9945
24	ν Virginis	4½	+69	−14	6 37.6	− 6 41 43	+0.4690	.5546	−.2359	+9.1071	.9964
24	π Virginis	5	−35	−83	13 27.0	− 0 06 13	−1.2405	.5514	−.2409	+9.1118	.9963
24	*c* Virginis	5	+26	−43	22 20.8	+ 8 29 30	−0.0698	.5516	−.2455	+8.8575	.9989
26	65 Virginis	6	+86	+27	3 00.0	−11 49 26	+1.1566	.5516	−.2475	−8.8600	.9989
26	B.A.C. 4478	6	+86	+39	3 28.4	−11 21 57	+1.2806	.5512	−.2475	−8.8846	.9987
26	80 Virginis	6	+56	−25	8 31.7	− 6 28 58	+0.2875	.5525	−.2458	−8.9086	.9986
26	94 Virginis	6	+69	−14	22 20.8	+ 6 51 49	+0.5033	.5549	−.2377	−9.1537	.9956
26	95 Virginis	6	+81	+ 8	22 32.3	+ 7 02 54	+0.8814	.5542	−.2377	−9.1753	.9951
27	ϰ Virginis	4	+80	+33	1 16.5	+ 9 41 26	+1.2173	.5543	−.2353	−9.2216	.9939
27	ξ¹ Libræ	6	−37	−90	19 34.0	+ 3 20 34	−1.2084	.5641	−.2167	−9.2920	.9915
28	ο¹ Libræ	6	+42	−33	7 01.3	− 9 36 36	+0.1449	.5661	−.2000	−9.4134	.9849
28	ζ¹ Libræ	4	+73	0	10 05.8	− 6 38 48	+0.7311	.5655	−.1954	−9.4456	.9824
28	ζ³ Libræ	6	+58	−17	11 07.8	− 5 39 03	+0.4315	.5667	−.1937	−9.4431	.9826
28	ζ⁴ Libræ	6	+62	−13	12 05.1	− 4 43 50	+0.4971	.5671	−.1922	−9.4495	.9821
28	θ Libræ	4½	−42	−90	20 55.7	+ 3 47 22	−1.1978	.5759	−.1766	−9.4480	.9822
Mar. 1	β¹ Scorpii	2	+71	+27	1 43.7	+ 8 24 45	+1.1120	.5697	−.1690	−9.5213	.9746
1	β² Scorpii	5½	+71	+27	1 43.9	+ 8 24 57	+1.1084	.5698	−.1691	−9.5212	.9746
1	ν Scorpii	4	+48	−22	4 28.1	+11 03 05	+0.3298	.5737	−.1633	−9.5143	.9755
1	ψ Ophiuchi	5	+37	−31	9 28.4	− 8 07 54	+0.1615	.5763	−.1531	−9.5275	.9739
1	ω Ophiuchi	5	+69	+32	12 44.7	− 4 58 58	+1.1505	0.5734	−.1469	−9.5572	9.9697

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels.		Washington Mean Time of ☌.	At Washington Mean Time of ☌.					
			Northern.	Southern.		*H*	*Y*	*p'*	*q'*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Mar. 2	c^2 Ophiuchi	5	+66	+24	12 43.1	− 5 55 37	+1.0486	0.5807	−.0911	−9.6067	9.9612
2	Jupiter		+ 5	−60	14 18.3	− 4 24 06	−0.3181	.5827	−.0859	−9.5854	.9652
3	4 Sagittarii	5	+28	−32	0 03.8	+ 4 58 36	+0.1423	.5868	−.0606	−9.6059	.9614
3	7 Sagittarii	6	+54	− 8	1 16.2	+ 6 08 10	+0.5616	.5852	−.0580	−9.6140	.9598
3	24 Sagittarii	6	+11	−46	13 38.6	− 5 58 32	−0.1005	.5884	−.0263	−9.6116	.9603
3	B.A.C. 6343	6	−20	−94	15 29.9	− 4 11 36	−0.6699	.5909	−.0210	−9.6029	.9620
3	26 Sagittarii	6	− 2	−62	16 49.3	− 2 55 13	−0.3447	.5894	−.0184	−9.6087	.9608
3	B.A.C. 6369	6	+65	+11	17 58.6	− 1 48 43	+0.8618	.5836	−.0131	−9.6285	.9567
3	B.A.C. 6448	6	−44	−90	22 29.6	+ 2 31 45	−1.0283	.5917	−.0025	−9.5982	.9629
4	ψ Sagittarii	5	+65	+32	6 16.0	+10 00 00	+1.2511	.5798	+.0186	−9.6341	.9555
4	B.A.C. 6576	6	+24	−32	6 17.6	+ 9 01 34	+0.1392	.5849	+.0186	−9.6165	.9593
4	χ^1 Sagittarii	5½	+55	− 5	10 12.5	−10 12 36	+0.6077	.5818	+.0291	−9.6225	.9580
4	χ^3 Sagittarii	6	+20	−37	10 19.0	−10 06 24	+0.0477	.5844	+.0291	−9.6135	.9599
4	h^1 Sagittarii	6	+65	+22	14 33.6	− 6 01 37	+1.0123	.5788	+.0394	−9.6266	.9571
4	h^2 Sagittarii	4½	+65	+42	14 49.6	− 5 46 12	+1.1959	.5782	+.0394	−9.6293	.9566
5	B.A.C. 6864	6	− 1	−66	0 58.8	+ 3 59 46	−0.4032	.5808	+.0668	−9.5943	.9636
5	4 Capricor.	6	−21	−90	7 53.3	+10 38 43	−0.8030	.5789	+.0836	−9.5784	.9664
5	B.A.C. 7049	6	+37	−25	12 41.5	− 8 43 51	+0.2603	.5729	+.0929	−9.5897	.9644
5	17 Capricor.	6	+25	−40	19 45.7	− 1 55 14	+0.0048	.5698	+.1085	−9.5744	.9670
6	η Capricor.	5	− 8	−88	3 38.9	+ 5 40 52	−0.6454	.5678	+.1253	−9.5430	.9718
6	χ Capricor.	6	+68	+19	5 25.5	+ 7 23 39	+0.9943	.5604	+.1293	−9.5695	.9678
6	27 Capricor.	6	+48	−19	5 51.7	+ 7 48 57	+0.3821	.5630	+.1293	−9.5572	.9697
6	φ Capricor.	6	+69	+15	8 31.8	+10 23 21	+0.9480	.5592	+.1351	−9.5594	.9694
6	ε Capricor.	5	+70	+22	18 04.5	− 4 23 57	+1.0452	.5522	+.1535	−9.5366	.9726
6	κ Capricor.	5	+70	+ 6	20 35.3	− 1 58 24	+0.8160	.5521	+.1569	−9.5243	.9743
7	29 Aquarii	6	+51	−21	5 39.8	+ 6 47 44	+0.3459	.5479	+.1714	−9.4823	.9790
11	33 Ceti	6	+40	−41	5 05.7	+ 3 20 42	−0.0088	.5064	+.2296	+8.4619	.9998
11	*f* Piscium	6	+19	−64	8 59.7	+ 7 08 03	−0.4028	.5059	+.2287	+8.6945	.9995
11	ν Piscium	5	+64	−18	21 44.6	− 4 28 32	+0.4031	.5057	+.2247	+8.9171	.9985
12	ξ^1 Ceti	5	+63	−18	14 43.3	−11 58 28	+0.3866	.5069	+.2155	+9.1517	.9956
12	ξ Arietis	5½	+27	−51	21 01.4	− 5 50 59	−0.2425	.5071	+.2106	+9.2371	.9934
12	B. A. C. 755	6	+41	−36	22 03.8	− 4 50 26	+0.0228	.5077	+.2098	+9.2352	.9935
13	38 Arietis	5½	+34	−43	7 42.3	+ 4 31 38	−0.1162	.5090	+.2024	+9.3115	.9907
13	Saturn		−49	−76	14 29.2	+11 06 48	−1.3240	.5043	+.1945	+9.3877	.9867
15	ω^1 Tauri	6	+12	−60	3 17.9	− 1 09 19	−0.5168	.5229	+.1508	+9.5174	.9751
15	ω^2 Tauri	5½	−25	−70	6 57.8	+ 2 23 09	−1.0755	.5229	+.1448	+9.5384	.9724
15	B.A.C. 1361	6	+90	+39	10 47.8	+ 6 06 03	+1.1437	.5304	+.1402	+9.5060	.9764
15	ε Tauri	3½	+90	+48	12 35.6	+ 7 50 29	+1.2257	.5319	+.1371	+9.5093	.9761
16	ι Tauri	4½	+72	0	5 12.5	− 0 04 09	+0.4760	.5379	+.1083	+9.5617	.9691
16	105 Tauri	6	+81	+ 6	7 30.5	+ 2 09 24	+0.5757	.5390	+.1047	+9.5642	.9687
16	*n* Tauri	6	+88	+10	12 51.8	+ 7 20 09	+0.6365	.5414	+.0954	+9.5723	.9674
16	*o* Tauri	5	+90	+44	16 47.3	+11 08 04	+1.1308	.5450	+.0878	+9.5699	.9678
16	121 Tauri	6	−14	−66	20 21.8	− 9 24 28	−0.9120	.5396	+.0800	+9.6083	.9609
17	132 Tauri	5	−28	−65	2 37.2	− 3 21 35	−1.0809	.5414	+.0679	+9.6180	.9590
17	1 Geminor.	5	+90	+18	9 34.7	+ 3 21 50	+0.7040	.5513	+.0534	+9.5966	.9632
17	3 Geminor.	6	+90	+36	12 08.0	+ 5 49 57	+0.9775	.5538	+.0470	+9.5942	.9636
17	5 Geminor.	6	+16	−43	12 54.7	+ 6 35 04	−0.4221	.5487	+.0449	+9.6169	.9592
17	6 Geminor.	6	+90	+61	13 18.6	+ 6 58 11	+1.2454	.5550	+.0449	+9.5907	.9642
18	ε Geminor.	3	−12	−65	3 26.3	− 3 23 18	−0.8802	.5516	+.0141	+9.6303	.9563
18	B.A.C. 2238	6	+90	+27	7 04.6	+ 0 07 21	+0.7827	0.5598	+.0050	+9.6054	9.9615

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. Northern.	Limiting Parallels. Southern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p′*	*q′*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Mar. 18	37 Geminor.	6	−35	−64	8 29.2	+ 1 29 02	−1.1431	0.5521	+.0027	+9.6349	9.9553
18	ω Geminor.	6	+45	−10	11 39.6	+ 4 32 44	+0.0811	.5580	−.0041	+9.6164	.9593
18	48 Geminor.	6	+46	−11	16 05.0	+ 8 48 49	+0.0914	.5595	−.0156	+9.6156	.9595
18	52 Geminor.	6	− 3	−65	17 02.5	+ 9 44 17	−0.7480	.5563	−.0179	+9.6281	.9568
18	A Geminor.	6	−24	−65	21 14.3	−10 12 03	−1.0385	.5558	−.0272	+9.6313	.9561
19	κ Geminor.	4	− 3	−65	6 05.5	− 1 40 24	−0.7476	.5589	−.0482	+9.6218	.9582
19	μ^1 Cancri	6	+74	+ 6	15 39.3	+ 7 32 55	+0.5029	.5649	−.0690	+9.5928	.9639
20	γ Cancri	4½	+52	−14	7 45.3	− 0 55 37	+0.1979	.5645	−.1055	+9.5735	.9672
21	η Leonis	3½	+17	−57	20 33.7	+10 34 20	−0.4356	.5594	−.1805	+9.4776	.9795
23	ι Leonis	4	−35	−79	6 39.3	− 4 31 26	−1.2362	.5542	−.2298	+9.2936	.9914
23	ξ Virginis	5	−32	−81	16 15.1	+ 4 44 25	−1.2059	.5542	−.2398	+9.1978	.9945
23	ν Virginis	4½	+69	−14	16 31.1	+ 4 59 55	+0.4616	.5565	−.2397	+9.1071	.9964
23	π Virginis	5	−36	−83	23 15.5	+11 30 20	−1.2537	.5544	−.2452	+9.1118	.9963
24	c Virginis	5	+34	−46	8 01.0	− 4 02 13	−0.1179	.5559	−.2505	+8.8574	.9989
26	94 Virginis	6	+57	−23	6 49.8	− 6 51 25	+0.3222	.5635	−.2442	−9.1536	.9955
26	95 Virginis	6	+81	− 3	7 00.9	− 6 40 41	+0.6952	.5636	−.2434	−9.1753	.9951
26	κ Virginis	4	+80	+17	9 40.0	− 4 07 13	+1.0212	.5636	−.2418	−9.2216	.9939
27	μ Libræ	5	+76	+44	1 11.7	+10 50 48	+1.3017	.5681	−.2247	−9.3693	.9878
27	o^1 Libræ	6	+29	−45	14 27.2	− 0 23 06	−0.0873	.5761	−.2058	−9.4134	.9849
27	o^2 Libræ	6	− 1	−88	15 17.7	+ 0 25 44	−0.6657	.5781	−.2042	−9.4017	.9857
27	ζ^1 Libræ	4	+62	−14	17 25.6	+ 2 28 42	+0.4863	.5757	−.2008	−9.4456	.9824
27	ζ^3 Libræ	6	+44	−30	18 25.6	+ 3 26 27	+0.1891	.5768	−.1991	−9.4431	.9826
27	ζ^4 Libræ	6	+47	−27	19 21.1	+ 4 19 49	+0.2525	.5772	−.1973	−9.4495	.9821
28	β^1 Scorpii	2	+71	+ 7	8 33.9	− 6 57 29	+0.8455	.5800	−.1727	−9.5213	.9746
28	β^2 Scorpii	5½	+71	+ 7	8 34.1	− 6 57 20	+0.8420	.5800	−.1727	−9.5213	.9746
28	ν Scorpii	4	+34	−36	11 13.3	− 4 24 10	+0.0713	.5838	−.1664	−9.5143	.9755
28	ψ Ophiuchi	5	+24	−46	16 04.7	+ 0 15 56	−0.0987	.5861	−.1555	−9.5275	.9738
28	ω Ophiuchi	5	+69	+10	19 15.4	+ 3 19 13	+0.8758	.5834	−.1488	−9.5572	.9697
29	B.A.C. 5758	6	−13	−90	8 46.2	− 7 41 43	−0.7132	.5931	−.1178	−9.5613	.9691
29	b Ophiuchi	5	+66	+34	16 38.4	− 0 08 12	+1.1487	.5864	−.0973	−9.6099	.9606
29	c^2 Ophiuchi	5	+66	+ 4	18 37.6	+ 1 46 13	+0.7695	.5884	−.0921	−9.6066	.9613
29	Jupiter		−20	−90	23 37.1	+ 6 33 50	−0.7757	.5979	−.0793	−9.5872	.9649
30	4 Sagittarii	5	+13	−48	5 44.9	−11 32 57	−0.1289	.5929	−.0628	−9.6059	.9614
30	B.A.C. 6088	6	−51	−90	5 49.1	−11 28 55	−1.1746	.5976	−.0628	−9.5878	.9648
30	7 Sagittarii	6	+35	−24	6 56.0	−10 24 42	+0.2863	.5911	−.0574	−9.6140	.9598
30	λ Sagittarii	4	+64	+29	16 45.6	− 0 58 34	+1.0894	.5865	−.0329	−9.6340	.9555
30	24 Sagittarii	6	− 3	−64	19 07.4	+ 1 17 35	−0.3653	.5928	−.0247	−9.6117	.9603
30	B.A.C. 6343	6	−36	−90	20 57.3	+ 3 03 10	−0.9348	.5948	−.0192	−9.6029	.9620
30	26 Sagittarii	6	−17	−86	22 15.9	+ 4 18 40	−0.6102	.5932	−.0165	−9.6087	.9608
30	B.A.C. 6369	6	+52	− 7	23 24.4	+ 5 24 25	+0.5914	.5873	−.0138	−9.6285	.9567
31	ψ Sagittarii	5	+65	+20	11 35.7	− 6 53 01	+0.9879	.5822	+.0186	−9.6341	.9555
31	B.A.C. 6576	6	+10	−48	11 37.3	− 6 51 27	−0.1220	.5873	+.0186	−9.6165	.9593
31	χ^1 Sagittarii	5½	+37	−20	15 31.0	− 3 06 50	+0.3514	.5836	+.0291	−9.6226	.9580
31	χ^3 Sagittarii	6	+ 6	−53	15 37.4	− 3 00 40	−0.2075	.5861	+.0291	−9.6135	.9599
31	h^1 Sagittarii	6	+65	+ 3	19 51.1	+ 1 03 12	+0.7558	.5800	+.0395	−9.6265	.9571
31	h^2 Sagittarii	4½	+65	+16	20 07.1	+ 1 18 36	+0.9397	.5785	+.0421	−9.6292	.9566
Apr. 1	B.A.C. 6864	6	− 5	−90	6 15.8	+11 04 06	−0.6500	.5806	+.0672	−9.5943	.9636
1	4 Capricor.	6	−38	−90	13 11.2	− 6 16 09	−1.0438	.5780	+.0839	−9.5784	.9664
1	B.A.C. 7049	6	+25	−39	18 00.7	− 1 37 20	+0.0260	.5704	+.0953	−9.5896	.9644
2	17 Capricor.	6	+19	−47	1 07.5	+ 5 13 55	−0.1130	0.5664	+.1107	−9.5746	9.9670

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. North-ern.	Limiting Parallels. South-ern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p'*	*q'*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Apr. 2	B.A.C. 7197	6	+67	+51	2 02.5	+ 6 06 54	+1.2726	0.5603	+.1128	−9.5967	9.9631
2	η Capricor.	5	−21	−90	9 04.6	−11 06 05	−0.8630	.5636	+.1272	−9.5430	.9718
2	27 Capricor.	6	+36	−31	11 18.7	− 8 56 44	+0.1714	.5589	+.1311	−9.5572	.9697
2	φ Capricor.	6	+67	− 3	14 00.4	− 6 20 42	+0.6753	.5547	+.1369	−9.5598	.9693
2	ε Capricor.	5	+70	+ 8	23 39.8	+ 2 58 40	+0.8565	.5487	+.1531	−9.5366	.9726
3	κ Capricor.	5	+67	− 6	2 12.4	+ 5 26 08	+0.6305	.5471	+.1581	−9.5242	.9743
3	29 Aquarii	6	+41	−31	11 24.5	− 9 40 17	+0.1747	.5425	+.1721	−9.4822	.9790
4	56 Aquarii	6	+39	−35	0 41.8	+ 3 11 15	+0.0986	.5347	+.1897	−9.4224	.9843
4	τ¹ Aquarii	6	+75	+35	9 13.1	+11 26 26	+1.2218	.5265	+.1999	−9.4082	.9853
4	τ² Aquarii	5½	+76	+10	10 09.3	−11 39 09	+0.9131	.5265	+.2009	−9.3947	.9862
4	74 Aquarii	6	− 8	−90	12 05.8	− 9 46 15	−0.8085	.5289	+.2030	−9.3318	.9898
4	ψ¹ Aquarii	5½	−32	−90	23 20.5	+ 1 07 52	−1.1698	.5235	+.2129	−9.2349	.9935
5	ψ² Aquarii	5	− 8	−90	0 23.7	+ 2 09 12	−0.8407	.5225	+.2136	−9.2391	.9934
5	ψ³ Aquarii	5	+23	−56	0 55.6	+ 2 40 06	−0.2656	.5210	+.2144	−9.2572	.9928
5	30 Piscium	4½	+83	+ 3	23 16.1	+ 0 21 08	+0.8067	.5110	+.2273	−9.0755	.9969
6	33 Piscium	5	+83	+ 8	1 03.4	+ 2 05 25	+0.8876	.5104	+.2280	−9.0560	.9972
10	SATURN		−14	−75	3 53.8	+ 2 08 06	−0.9734	.5104	+.1900	+9.4152	.9848
11	ω¹ Tauri	6	+22	−49	10 04.5	+ 7 24 55	−0.3354	.5242	+.1525	+9.5174	.9751
11	ω² Tauri	5½	− 7	−70	14 05.4	+10 18 24	−0.8389	.5242	+.1465	+9.5384	.9724
12	ι Tauri	4	+90	+15	12 22.6	+ 8 53 33	+0.7382	.5380	+.1095	+9.5617	.9690
12	105 Tauri	6	+90	+21	14 41.1	+11 07 35	+0.8401	.5392	+.1058	+9.5642	.9687
12	n Tauri	6	+90	+26	20 03.8	− 7 40 05	+0.8980	.5421	+.0946	+9.5724	.9673
13	121 Tauri	6	+ 4	−62	3 36.7	− 0 22 01	−0.6476	.5389	+.0809	+9.6082	.9609
13	132 Tauri	6	− 7	−65	9 54.7	+ 5 43 33	−0.8160	.5411	+.0668	+9.6180	.9590
13	1 Geminor.	5	+90	+36	16 55.9	−11 29 18	+0.9826	.5501	+.0522	+9.5966	.9632
13	3 Geminor.	6	+90	+62	19 30.8	− 8 59 36	+1.2589	.5517	+.0480	+9.5942	.9636
13	5 Geminor.	6	+32	−27	20 17.9	− 8 14 03	−0.1509	.5467	+.0459	+9.6169	.9592
14	ε Geminor.	3½	+ 6	−54	11 00.3	+ 5 58 23	−0.6116	.5487	+.0131	+9.6303	.9563
14	37 Geminor.	6	−12	−64	16 07.7	+10 55 14	−0.8778	.5488	+.0019	+9.6349	.9553
14	ω Geminor.	6	+63	+ 4	19 21.0	− 9 58 07	+0.3574	.5544	−.0048	+9.6164	.9593
14	48 Geminor.	6	+64	+ 4	23 50.8	− 5 37 37	+0.3668	.5550	−.0138	+9.6156	.9595
15	52 Geminor.	6	+13	−44	0 49.8	− 4 40 40	−0.4808	.5516	−.0161	+9.6281	.9568
15	A Geminor.	5½	− 5	−65	4 45.4	− 0 53 13	−0.7789	.5511	−.0252	+9.6313	.9561
15	κ Geminor.	4	+13	−47	14 07.3	+ 8 09 05	−0.4853	.5534	−.0479	+9.6218	.9582
15	μ¹ Cancri	6	+90	+21	23 53.2	− 6 25 23	+0.7721	.5589	−.0705	+9.5928	.9639
16	λ Cancri	6	−47	−66	6 10.6	− 0 21 09	−1.2437	.5508	−.0838	+9.6174	.9591
16	γ Cancri	4½	+70	− 1	16 22.0	+ 9 28 53	+0.4536	.5571	−.1056	+9.5735	.9672
17	B.A.C. 3138	6	−23	−68	5 53.7	− 1 27 35	−1.0520	.5504	−.1350	+9.5715	.9675
18	η Leonis	3½	+28	−45	6 06.4	− 2 04 59	−0.2314	.5512	−.1801	+9.4776	.9795
18	B.A.C. 3579	6	+66	−13	15 51.7	+ 7 20 18	+0.4088	.5520	−.1948	+9.4156	.9848
18	*i* Leonis	6	+59	−18	17 23.8	+ 8 49 13	+0.3158	.5516	−.1981	+9.4098	.9852
18	*k* Leonis	6	−22	−75	23 51.8	− 8 56 04	−1.0765	.5476	−.2069	+9.4121	.9850
19	ι Leonis	4	−23	−79	16 56.6	+ 7 33 55	−1.1000	.5476	−.2301	+9.2936	.9914
20	ξ Virginis	5	−21	−81	2 41.4	− 7 01 04	−1.0894	.5486	−.2391	+9.1979	.9945
20	ν Virginis	4½	+78	− 8	2 57.7	− 6 45 19	+0.5834	.5508	−.2402	+9.1070	.9964
20	π Virginis	5	−26	−83	9 47.3	− 0 09 42	−1.1527	.5493	−.2450	+9.1118	.9963
20	11 Virginis	6	−52	−87	13 57.9	+ 3 52 22	−1.3684	.5499	−.2485	+9.0620	.9971
20	c Virginis	5	+39	−42	18 37.9	+ 8 22 53	−0.0361	.5520	−.2509	+8.8573	.9989
22	κ Virginis	4	+80	+13	20 06.0	+ 8 06 55	+0.9643	.5675	−.2453	−9.2217	.9939
23	μ Libræ	5	+76	+32	11 20.2	− 1 12 37	+1.2023	0.5741	−.2296	−9.3693	9.9878

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels.		Washington Mean Time of ☌.	At Washington Mean Time of ☌.					
			Northern.	Southern.		*H*	*Y*	*p′*	*q′*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Apr. 24	ζ^1 Libræ	4	+54	−21	3 09.8	− 9 59 10	+0.3609	0.5845	−.2053	−9.4456	9.9824
24	β^1 Scorpii	2	+70	− 3	17 50.7	+ 4 07 18	+0.6861	.5896	−.1779	−9.5213	.9746
24	β^2 Scorpii	5½	+70	− 3	17 50.8	+ 4 07 20	+0.6825	.5896	−.1779	−9.5212	.9746
25	ν Scorpii	4	+26	−45	20 25.1	+ 6 35 29	−0.0803	.5940	−.1714	−9.5143	.9755
25	ψ Ophiuchi	5	+16	−56	1 06.8	+11 05 55	−0.2554	.5970	−.1600	−9.5275	.9739
25	ω Ophiuchi	5	+69	− 2	4 11.0	− 9 57 16	+0.6987	.5943	−.1529	−9.5573	.9697
25	B.A.C. 5658	6	−23	−90	17 13.7	+ 2 33 34	−0.8831	.6049	−.1199	−9.5612	.9691
25	B.A.C. 5831	6	+66	+32	21 41.2	+ 6 50 05	+1.1347	.5969	−.1091	−9.6076	.9611
26	*b* Ophiuchi	5	+66	+15	0 49.0	+ 9 50 12	+0.9391	.5981	−.1009	−9.6099	.9606
26	c^2 Ophiuchi	5	+56	− 9	2 43.9	+11 40 22	+0.5638	.6001	−.0953	−9.6067	.9613
26	Jupiter		−30	−90	7 10.7	− 8 03 54	−0.9328	.6096	−.0814	−9.5871	.9649
26	4 Sagittarii	5	+ 3	−61	13 27.6	− 2 02 33	−0.3306	.6046	−.0641	−9.6058	.9614
26	7 Sagittarii	6	+24	−36	14 36.2	− 0 56 48	+0.0777	.6027	−.0612	−9.6139	.9598
26	B.A.C. 6161	6	−17	−90	17 58.4	+ 2 17 01	−0.6616	.6059	−.0496	−9.6046	.9617
27	λ Sagittarii	3	+65	+10	0 05.5	+ 8 08 58	+0.8600	.5973	−.0322	−9.6340	.9555
27	24 Sagittarii	6	−14	−82	2 22.5	+10 20 20	−0.5769	.6039	−.0264	−9.6117	.9603
27	B.A.C. 6343	6	−51	−90	4 08.8	−11 57 44	−1.1358	.6059	−.0206	−9.6028	.9620
27	26 Sagittarii	6	−28	−90	5 24.8	−10 44 50	−0.8171	.6041	−.0177	−9.6087	.9608
27	B.A.C. 6369	6	+37	−20	6 31.0	− 9 41 20	+0.3656	.5983	−.0149	−9.6285	.9567
27	ψ Sagittarii	5	+64	+ 3	18 19.4	+ 1 38 14	+0.7509	.5917	+.0193	−9.6341	.9555
27	B.A.C. 6576	6	− 2	−62	18 20.9	+ 1 39 44	−0.3434	.5969	+.0193	−9.6165	.9593
27	χ^1 Sagittarii	5½	+23	−34	22 07.8	+ 5 17 26	+0.1188	.5926	+.0304	−9.6225	.9580
27	χ^2 Sagittarii	6½	+18	−39	22 10.4	+ 5 19 58	+0.0247	.5931	+.0304	−9.6210	.9583
27	χ^3 Sagittarii	6	− 6	−69	22 14.0	+ 5 23 27	−0.4330	.5952	+.0304	−9.6134	.9599
28	h^1 Sagittarii	6	+49	−11	2 20.5	+ 9 20 09	+0.5200	.5887	+.0413	−9.6265	.9572
28	h^2 Sagittarii	4½	+63	0	2 36.1	+ 9 35 03	+0.7010	.5879	+.0403	−9.6293	.9566
28	B.A.C. 6864	6	−27	−90	12 28.9	− 4 55 24	−0.8714	.5884	+.0675	−9.5943	.9636
28	4 Capricor.	6	−60	−90	19 14.7	+ 1 34 47	−1.2624	.5848	+.0849	−9.5784	.9663
28	B.A.C. 7049	6	+13	−53	23 57.9	+ 6 07 14	−0.2038	.5766	+.0966	−9.5896	.9645
29	17 Capricor.	6	+ 7	−62	6 56.4	−11 09 48	−0.3413	.5713	+.1124	−9.5745	.9670
29	B.A.C. 7197	6	+68	+22	7 50.4	−10 17 47	+1.0328	.5668	+.1125	−9.5967	.9632
29	η Capricor.	5½	−36	−90	14 45.7	− 3 37 40	−1.0725	.5691	+.1272	−9.5430	.9718
29	χ Capricor.	5½	+59	−10	16 31.7	− 1 55 27	+0.5513	.5612	+.1311	−9.5695	.9678
29	27 Capricor.	6	+24	−44	16 57.8	− 1 30 18	−0.0576	.5622	+.1330	−9.5571	.9698
29	ϕ Capricor.	6	+51	−17	19 37.3	+ 1 03 30	+0.4216	.5594	+.1371	−9.5594	.9694
29	33 Capricor.	6	+69	+34	23 22.4	+ 4 40 42	+1.1776	.5532	+.1445	−9.5635	.9688
30	37 Capricor.	6	+69	+28	4 09.4	+ 9 17 44	+1.1205	.5494	+.1534	−9.5491	.9709
30	ε Capricor.	5	+66	− 6	5 10.0	+10 16 10	+0.6288	.5504	+.1552	−9.5366	.9727
30	κ Capricor.	5	+53	−18	7 41.2	−11 17 47	+0.4059	.5499	+.1586	−9.5242	.9743
30	B.A.C. 7550	6	+70	+41	7 56.0	−11 03 28	+1.2437	.5458	+.1602	−9.5400	.9722
30	29 Aquarii	6	+29	−43	16 49.1	− 2 28 18	−0.0417	.5442	+.1728	−9.4822	.9790
May 1	56 Aquarii	6	+29	−47	6 03.7	+10 20 29	−0.1060	.5335	+.1913	−9.4223	.9843
1	τ^1 Aquarii	6	+75	+18	14 34.9	− 5 24 24	+1.0247	.5258	+.2003	−9.4083	.9853
1	τ^2 Aquarii	5½	+76	− 2	15 31.2	− 4 29 55	+0.7175	.5258	+.2013	−9.3947	.9862
1	74 Aquarii	6	−20	−90	17 27.9	− 2 36 50	−1.0005	.5280	+.2033	−9.3319	.9897
2	ψ^2 Aquarii	5	−19	−90	5 48.3	+ 9 21 07	−1.0186	.5207	+.2139	−9.2390	.9934
2	ψ^3 Aquarii	5	+14	−68	6 20.3	+ 9 52 09	−0.4427	.5190	+.2146	−9.2572	.9928
3	30 Piscium	4½	+82	− 5	4 49.9	+ 7 42 19	+0.6647	.5080	+.2273	−9.0755	.9969
3	33 Piscium	5	+81	− 1	6 38.1	+ 9 27 29	+0.7483	.5073	+.2280	−9.0561	.9972
4	33 Ceti	6	+39	−42	18 00.4	− 4 09 41	−0.0287	0.5013	+.2317	+8.4618	9.9998

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. Northern.	Limiting Parallels. Southern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p′*	*q′*	Log sin *D*	Log cos *D*
			°	°	*h. m.*	*h. m. s.*					
May 4	*f* Piscium	6	+19	−65	21 57.4	− 0 19 11	−0.4095	0.5012	+.2310	+8.6946	9.9995
5	ν Piscium	5	+68	−16	10 52.7	−11 45 22	+0.4565	.5023	+.2271	+8.9171	.9985
9	ι Tauri	4	+90	+22	18 38.6	− 7 02 58	+0.8636	.5398	+.1114	+9.5616	.9691
9	105 Tauri	6	+90	+29	20 56.9	− 4 49 06	+0.9685	.5416	+.1059	+9.5642	.9687
10	*n* Tauri	6	+90	+35	2 19.3	+ 0 22 55	+1.0316	.5437	+.0964	+9.5724	.9674
10	121 Tauri	6	+12	−52	9 52.0	+ 7 40 48	−0.5103	.5412	+.0806	+9.6082	.9610
10	132 Tauri	6	+ 2	−63	16 10.3	−10 13 26	−0.6737	.5424	+.0684	+9.6178	.9590
10	1 Geminor.	5	+90	+48	23 11.9	− 3 25 50	+1.1379	.5514	+.0538	+9.5966	.9632
11	5 Geminor.	6	+41	−19	2 34.2	− 0 10 16	+0.0022	.5476	+.0473	+9.6169	.9592
11	ε Geminor.	3½	+15	−42	17 21.7	− 9 52 46	−0.4510	.5492	+.0145	+9.6303	.9563
11	B.A.C.2238	6	+90	+14	21 02.3	− 6 19 45	+1.2382	.5564	+.0056	+9.6053	.9615
11	27 Geminor.	6	− 1	−63	22 28.6	− 4 56 21	−0.7158	.5487	+.0034	+9.6348	.9553
12	ω Geminor.	6	+78	+13	1 43.3	− 1 48 19	+0.5286	.5540	−.0034	+9.6163	.9593
12	48 Geminor.	6	+79	+13	6 15.1	+ 2 34 09	+0.5407	.5546	−.0146	+9.6155	.9595
12	52 Geminor.	6	+23	−33	7 14.5	+ 3 31 31	−0.3122	.5512	−.0169	+9.6281	.9568
12	A Geminor.	5½	+ 6	−55	11 12.1	+ 7 21 01	−0.6079	.5502	−.0259	+9.6311	.9561
12	κ Geminor.	4	+23	−36	20 39.7	− 7 30 54	−0.3117	.5516	−.0461	+9.6219	.9582
13	μ¹ Cancri	6	+90	+33	6 33.2	+ 2 02 13	+0.9607	.5560	−.0682	+9.5928	.9639
13	λ Cancri	6	−26	−66	12 56.5	+ 8 12 18	−1.0737	.5474	−.0836	+9.6174	.9591
13	γ Cancri	4½	+89	+10	23 18.6	− 5 46 49	+0.6422	.5527	−.1047	+9.5734	.9672
14	B.A.C.3138	6	−10	−68	13 07.6	+ 7 33 58	−0.8821	.5447	−.1330	+9.5714	.9675
15	η Leonis	3½	+38	−36	13 58.2	+ 7 34 32	−0.0577	.5431	−.1780	+9.4775	.9795
15	42 Leonis	6	+77	− 4	20 44.9	− 9 52 18	+0.5565	.5440	−.1875	+9.4327	.9835
16	B.A.C.3579	6	+80	− 3	0 00.8	− 6 42 52	+0.5865	.5431	−.1936	+9.4155	.9848
16	*i* Leonis	6	+72	− 9	1 35.7	− 5 11 04	+0.4914	.5429	−.1951	+9.4098	.9852
16	*k* Leonis	6	−11	−75	8 15.7	+ 1 15 41	−0.9260	.5386	−.2050	+9.4121	.9850
17	ι Leonis	4	−13	−79	1 53.2	− 5 41 33	−0.9638	.5381	−.2271	+9.2935	.9914
17	ξ Virginis	5	−12	−81	11 56.7	+ 4 02 11	−0.9625	.5389	−.2367	+9.1979	.9945
17	ν Virginis	4½	+90	0	12 13.5	+ 4 18 27	+0.7325	.5411	−.2367	+9.1070	.9964
17	A¹ Virginis	5½	−35	−81	13 11.5	+ 5 14 29	−1.2428	.5386	−.2375	+9.1971	.9945
17	π Virginis	5	−17	−83	19 15.8	+11 06 53	−1.0349	.5399	−.2424	+9.1118	.9963
17	11 Virginis	6	−36	−83	23 34.2	− 8 43 13	−1.2589	.5404	−.2450	+9.0609	.9971
18	*c* Virginis	5	+45	−36	4 22.5	− 4 04 32	+0.0846	.5427	−.2480	+8.8573	.9989
19	65 Virginis	6	+86	+22	9 09.3	− 0 15 48	+1.1043	.5519	−.2545	−8.8599	.9989
19	80 Virginis	6	+52	−30	14 36.3	+ 4 59 55	+0.2080	.5547	−.2534	−8.9085	.9986
20	95 Virginis	6	+81	− 4	4 16.1	− 5 49 05	+0.6984	.5619	−.2471	−9.1751	.9951
20	κ Virginis	4	+80	+16	6 54.9	− 3 16 01	+1.0106	.5632	−.2450	−9.2216	.9939
20	μ Libræ	5	+76	+34	22 16.3	+11 31 46	+1.2204	.5719	−.2303	−9.3692	.9878
21	ζ¹ Libræ	4	+53	−22	14 05.9	+ 2 45 15	+0.3524	.5851	−.2069	−9.4456	.9824
22	β¹ Scorpii	2	+69	− 5	4 40.1	− 7 15 06	+0.6528	.5929	−.1799	−9.5213	.9746
22	β² Scorpii	5½	+68	− 5	4 40.2	− 7 15 04	+0.6495	.5929	−.1799	−9.5213	.9746
22	ν Scorpio	4	+24	−47	7 12.6	− 4 48 47	−0.1126	.5979	−.1734	−9.5143	.9755
22	ψ Ophiuchi	5	+14	−58	11 50.4	− 0 22 13	−0.2929	.6008	−.1643	−9.5275	.9739
22	ω Ophiuchi	5	+66	− 5	14 51.8	+ 2 31 44	+0.6497	.5995	−.1546	−9.5573	.9697
23	*b* Ophiuchi	5	+66	+ 9	11 04.4	− 2 06 20	+0.8604	.6063	−.1012	−9.6099	.9606
23	c² Ophiuchi	5	+51	−13	12 56.4	− 0 19 01	+0.4873	.6086	−.0954	−9.6066	.9613
23	Jupiter		−18	−90	13 33.4	+ 0 16 23	−0.7610	.6193	−.0957	−9.5853	.9652
23	4 Sagittarii	5	− 1	−67	23 22.9	+ 9 40 44	−0.4072	.6140	−.0658	−9.6059	.9614
24	7 Sagittarii	6	+19	−41	0 29.5	+10 44 34	−0.0051	.6121	−.0628	−9.6139	.9598
24	9 Sagittarii	6	+21	−39	0 52.0	+11 06 03	+0.9359	0.6121	−.0598	−9.6150	9.9596

ELEMENTS

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. Northern.	Limiting Parallels. Southern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p'*	*q'*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
May 24	B.A.C. 6161	6	−21	−90	3 45.7	−10 07 35	−0.7374	0.6157	−.0537	−9.6046	9.9617
24	λ Sagittarii	4	+65	+ 3	9 41.7	− 4 26 50	+0.7568	.6079	−.0354	−9.6340	.9555
24	24 Sagittarii	6	−19	−90	11 54.4	− 2 19 46	−0.6613	.6142	−.0263	−9.6116	.9603
24	B.A.C. 6343	6	−58	−90	13 37.3	− 0 41 12	−1.2131	.6167	−.0232	−9.6028	.9620
24	26 Sagittarii	6	−33	−90	14 50.9	+ 0 29 15	−0.9007	.6150	−.0202	−9.6087	.9608
24	B.A.C. 6369	6	+30	−26	15 55.0	+ 1 30 38	+0.2636	.6086	−.0141	−9.6284	.9567
25	ψ Sagittarii	5	+55	− 4	3 20.0	−11 33 13	+0.6339	.6027	+.0190	−9.6340	.9555
25	B.A.C. 6576	6	− 7	−70	3 21.5	−11 31 45	−0.4430	.6080	+.0190	−9.6164	.9593
25	χ^1 Sagittarii	5½	+17	−40	7 00.7	− 8 01 45	+0.0091	.6034	+.0307	−9.6224	.9580
25	χ^2 Sagittarii	6½	+13	−46	7 03.2	− 7 59 18	−0.0834	.6039	+.0307	−9.6209	.9584
25	χ^3 Sagittarii	6	−11	−78	7 06.7	− 7 55 57	−0.5336	.6060	+.0307	−9.6133	.9599
25	h^1 Sagittarii	6	+41	−18	11 04.9	− 4 07 39	+0.4012	.5994	+.0422	−9.6265	.9572
25	h^2 Sagittarii	4½	+53	− 8	11 19.9	− 3 53 15	+0.5792	.5987	+.0422	−9.6292	.9566
25	B.A.C. 6864	6	−34	−90	20 52.5	+ 5 16 02	−0.9741	.5985	+.0698	−9.5943	.9636
26	B.A.C. 7049	6	+ 6	−61	7 58.3	− 8 04 33	−0.3228	.5869	+.0980	−9.5895	.9645
26	17 Capricor.	6	0	−71	14 43.3	− 1 35 16	−0.4610	.5828	+.1124	−9.5743	.9671
26	B.A.C. 7197	6	+67	+12	15 35.5	− 0 45 00	+0.8917	.5761	+.1147	−9.5966	.9632
26	η Capricor.	5½	−47	−90	22 17.6	+ 5 41 56	−1.1965	.5777	+.1300	−9.5430	.9718
27	χ Capricor.	6	+50	−18	0 00.4	+ 7 20 53	+0.4146	.5694	+.1341	−9.5695	.9678
27	27 Capricor.	6	+17	−52	0 25.7	+ 7 45 16	−0.1851	.5723	+.1342	−9.5571	.9698
27	φ Capricor.	6	+43	−25	3 00.3	+10 14 12	+0.2861	.5671	+.1402	−9.5592	.9694
27	37 Capricor.	6	+69	+16	11 17.6	− 5 46 31	+0.9736	.5577	+.1553	−9.5490	.9709
27	ε Capricor.	5	+57	−14	12 16.4	− 4 49 48	+0.4888	.5585	+.1571	−9.5365	.9727
27	κ Capricor.	5	+45	−26	14 43.5	− 2 27 54	+0.2685	.5578	+.1607	−9.5242	.9743
27	B.A.C. 7550	6	+70	+26	14 57.8	− 2 14 05	+1.0945	.5664	+.1623	−9.5399	.9722
28	29 Aquarii	6	+23	−51	23 37.2	+ 6 07 20	−0.1739	.5508	+.1752	−9.4821	.9790
28	56 Aquarii	6	+22	−54	12 34.1	− 5 21 43	−0.2358	.5396	+.1929	−9.4223	.9843
28	τ^1 Aquarii	6	+75	+ 8	20 55.2	+ 2 43 20	+0.8845	.5294	+.2029	−9.4081	.9853
28	74 Aquarii	6	−29	−90	23 44.5	+ 5 27 18	−1.1218	.5327	+.2050	−9.3316	.9898
29	ψ^2 Aquarii	5	−28	−90	11 53.5	− 6 46 14	−1.1379	.5225	+.2161	−9.2390	.9934
29	ψ^3 Aquarii	5	+ 8	−77	12 25.1	− 6 15 37	−0.5662	.5219	+.2162	−9.2569	.9928
30	30 Piscium	4½	+73	−12	10 41.2	− 8 38 59	+0.5440	.5087	+.2282	−9.0755	.9969
30	33 Piscium	5	+80	− 8	12 28.7	− 6 54 32	+0.6286	.5078	+.2290	−9.0557	.9972
31	33 Ceti	6	+34	−47	23 45.7	+ 3 23 04	−0.1218	.4999	+.2320	+8.4623	.9998
June 1	*f* Piscium	6	+15	−71	3 43.7	+ 7 14 29	−0.4967	.4996	+.2313	+8.6948	.9995
1	ν Piscium	5	+63	−20	16 41.0	− 4 09 40	+0.3794	.5003	+.2274	+8.9172	.9985
2	ξ^1 Ceti	5	+68	−15	9 53.3	−11 25 56	+0.4496	.5033	+.2180	+9.1518	.9956
2	ξ Arietis	5½	+33	−46	16 15.6	− 5 14 24	−0.1505	.5040	+.2143	+9.2371	.9934
2	B. A. C. 755	6	+47	−31	17 18.5	− 4 13 12	+0.1208	.5047	+.2136	+9.2353	.9935
7	ε Geminor.	3	+17	−40	23 07.7	− 2 19 22	−0.4185	.5516	+.0146	+9.6303	.9563
8	37 Geminor.	6	+ 1	−60	4 15.5	+ 2 37 57	−0.6819	.5512	+.0033	+9.6348	.9553
8	ω Geminor.	6	+81	+15	7 29.5	+ 5 45 13	+0.5648	.5564	−.0035	+9.6163	.9593
8	48 Geminor.	6	+83	+15	12 00.4	+10 06 50	+0.5790	.5569	−.0149	+9.6155	.9595
8	52 Geminor.	6	+25	−31	12 59.6	+11 04 01	−0.2748	.5536	−.0171	+9.6281	.9568
8	A Geminor.	5½	+ 8	−52	16 56.6	− 9 07 06	−0.5695	.5523	−.0262	+9.6312	.9561
9	κ Geminor.	4	+25	−34	2 23.2	− 0 00 02	−0.2703	.5535	−.0465	+9.6217	.9582
9	μ^1 Cancri	6	+90	+36	12 16.7	+ 9 33 01	+1.0076	.5574	−.0688	+9.5928	.9639
10	γ Cancri	4½	+90	+12	5 04.5	+ 1 46 28	+0.6929	.5528	−.1052	+9.5735	.9672
10	B.A.C. 3138	6	− 7	−68	18 58.8	− 8 47 25	−0.8377	.5438	−.1329	+9.5714	.9675
11	η Leonis	3½	+40	−33	20 07.5	− 8 28 41	−0.0083	0.5398	−.1766	+9.4776	9.9795

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. North-ern.	Limiting Parallels. South-ern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. H	Y	p′	q′	Log sin D	Log cos D
			°	°	h. m.	h. m. s.					
June 12	42 Leonis	6	+83	− 1	3 01.3	− 1 48 21	+0.6121	0.5395	−.1874	+9.4328	9.9835
12	B.A.C. 3579	6	+86	0	6 21.0	+ 1 24 47	+0.6424	.5390	−.1916	+9.4155	.9848
12	*i* Leonis	6	+76	− 6	7 57.8	+ 2 58 27	+0.5463	.5381	−.1945	+9.4098	.9852
12	*k* Leonis	6	− 9	−75	14 46.1	+ 9 33 35	−0.8882	.5336	−.2024	+9.4121	.9850
13	ι Leonis	4	−11	−79	8 49.7	+ 3 02 32	−0.9311	.5312	−.2231	+9.2936	.9914
13	ξ Virginis	5	−10	−81	19 10.4	−10 56 29	−0.9328	.5311	−.2332	+9.1979	.9945
13	ν Virginis	4½	+90	+ 3	19 27.7	−10 39 43	+0.7878	.5335	−.2332	+9.1070	.9964
13	A¹ Virginis	5½	−31	−81	20 27.4	− 9 41 56	−1.2061	.5309	−.2340	+9.1967	.9946
14	π Virginis	5	−15	−83	2 43.0	− 3 38 20	−1.0081	.5315	−.2384	+9.1118	.9963
14	11 Virginis	6	−33	−83	7 09.4	+ 0 39 40	−1.2368	.5320	−.2417	+9.0620	.9971
14	*c* Virginis	5	+48	−34	12 07.2	+ 5 27 54	+0.1259	.5338	−.2444	+8.8578	.9989
15	65 Virginis	6	+86	+26	17 52.7	+10 15 29	+1.1527	.5424	−.2503	−8.8599	.9989
15	66 Virginis	6	+86	+35	18 26.3	+10 47 58	+1.2546	.5419	−.2502	−8.8843	.9987
15	80 Virginis	6	+54	−28	23 30.8	− 8 17 37	+0.2396	.5449	−.2493	−8.9089	.9986
16	94 Virginis	6	+60	−22	13 26.3	+ 5 09 26	+0.3574	.5526	−.2434	−9.1536	.9956
16	95 Virginis	6	+80	− 1	13 37.7	+ 5 20 31	+0.7321	.5518	−.2433	−9.1752	.9951
16	κ Virginis	4	+80	+18	16 21.6	+ 7 58 42	+1.0469	.5533	−.2415	−9.2216	.9939
17	μ Libræ	5	+76	+37	8 10.2	− 0 46 18	+1.2511	.5636	−.2272	−9.3692	.9878
18	ζ¹ Libræ	4	+54	−21	0 23.1	− 9 09 24	+0.3666	.5777	−.2052	−9.4456	.9824
18	β¹ Scorpii	2	+69	− 4	15 13.6	+ 5 06 32	+0.6637	.5884	−.1777	−9.5213	.9746
18	β² Scorpii	5½	+69	− 4	15 14.1	+ 5 07 02	+0.6592	.5884	−.1777	−9.5214	.9746
18	ν Scorpio	4	+25	−47	17 48.3	+ 7 35 05	−0.1076	.5924	−.1736	−9.5143	.9755
18	ψ Scorpii	5	+14	−58	22 29.8	−11 54 41	−0.2895	.5970	−.1625	−9.5275	.9739
19	ω Ophiuchi	5	+67	− 4	1 33.2	− 8 58 41	+0.6567	.5952	−.1556	−9.5573	.9697
19	JUPITER		+ 3	−66	18 56.9	+ 7 41 47	−0.3995	.6155	−.1109	−9.5816	.9658
19	*b* Ophiuchi	5	+66	+ 9	21 52.7	+10 30 10	+0.8604	.6063	−.1007	−9.6099	.9606
19	*c*² Ophiuchi	5	+51	−13	23 44.7	−11 42 31	+0.4867	.6083	−.0979	−9.6066	.9613
20	4 Sagittarii	5	− 1	−67	10 09.4	− 1 44 28	−0.4083	.6160	−.0654	−9.6059	.9614
20	λ Sagittarii	4	+65	+ 3	20 23.6	+ 8 03 20	+0.7508	.6111	−.0348	−9.6340	.9555
21	ψ Sagittarii	5	+55	− 5	13 47.7	+ 0 42 38	+0.6253	.6088	+.0177	−9.6340	.9555
21	*h*² Sagittarii	4½	+52	− 8	21 38.8	+ 8 13 49	+0.5703	.6058	+.0418	−9.6292	.9566
22	B.A.C. 7049	6	+ 6	−61	17 49.2	+ 3 34 25	−0.3226	.5966	+.0974	−9.5896	.9645
23	17 Capricor.	6	+ 1	−71	0 23.7	+ 9 53 14	−0.4581	.5907	+.1148	−9.5743	.9671
23	B.A.C. 7197	6	+67	+10	1 14.6	+10 42 07	+0.8782	.5842	+.1172	−9.5966	.9632
23	η Capricor.	5	−45	−90	7 45.8	− 7 01 52	−1.1836	.5873	+.1311	−9.5430	.9718
23	χ Capricor.	6	+50	−18	9 25.7	− 5 25 46	+0.4075	.5790	+.1355	−9.5695	.9678
23	27 Capricor.	6	+17	−52	9 50.3	− 5 02 06	−0.1851	.5818	+.1355	−9.5571	.9698
23	φ Capricor.	6	+46	−22	12 41.2	− 2 17 41	+0.3296	.5768	+.1419	−9.5593	.9694
23	33 Capricor.	6	+69	+19	15 53.0	+ 0 45 50	+1.0158	.5698	+.1500	−9.5635	.9688
23	37 Capricor.	6	+69	+15	20 23.8	+ 5 07 41	+0.9598	.5665	+.1577	−9.5490	.9709
23	ε Capricor.	5	+57	−14	21 21.0	+ 6 02 44	+0.4816	.5674	+.1596	−9.5365	.9727
23	κ Capricor.	5	+44	−26	23 43.9	+ 8 20 24	+0.2645	.5666	+.1633	−9.5242	.9743
23	B.A.C. 7550	6	+70	+24	23 57.9	+ 8 33 57	+1.0802	.5621	+.1650	−9.5399	.9722
24	29 Aquarii	6	+23	−51	8 22.2	− 7 19 45	−0.1703	.5590	+.1784	−9.4821	.9790
24	56 Aquarii	6	+22	−54	20 56.6	+ 4 48 37	−0.2313	.5465	+.1966	−9.4223	.9843
25	τ¹ Aquarii	6	+75	+ 8	5 03.9	−11 20 09	+0.8758	.5370	+.2058	−9.4082	.9853
25	τ² Aquarii	5½	+69	−10	5 57.7	−10 28 12	+0.5758	.5367	+.2068	−9.3947	.9862
25	74 Aquarii	6	−36	−90	7 20.8	− 9 07 45	−1.2003	.5400	+.2079	−9.3316	.9898
25	ψ² Aquarii	5	−27	−90	19 39.5	+ 2 47 24	−1.1169	.5301	+.2186	−9.2390	.9934
25	ψ³ Aquarii	5	+ 9	−76	20 10.3	+ 3 17 14	−0.5522	0.5282	+.2192	−9.2569	9.9928

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels.		Washington Mean Time of ☌.	At Washington Mean Time of ☌.					
			Northern.	Southern.		*H*	*Y*	*p'*	*q'*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
June 26	30 Piscium	4½	+73	−12	17 56.6	+ 0 24 00	+0.5495	0.5129	+.2308	−9.0750	9.9969
26	33 Piscium	5	+80	− 7	19 42.0	+ 2 06 21	+0.6334	.5125	+.2312	−9.0556	.9972
28	33 Ceti	6	+35	−46	6 27.3	+11 52 12	−0.1046	.5018	+.2329	+8.4618	.9998
28	*f* Piscium	6	+16	−69	10 22.9	− 8 18 50	−0.4767	.5011	+.2319	+8.6950	.9995
28	ν Piscium	5	+64	−19	23 13.6	+ 4 10 26	+0.3950	.5010	+.2275	+8.9174	.9985
29	ξ¹ Ceti	5	+69	−14	16 20.6	− 3 11 13	+0.4662	.5029	+.2185	+9.1518	.9956
29	ξ Arietis	5½	+34	−45	22 41.6	+ 2 59 07	−0.1317	.5033	+.2144	+9.2371	.9934
29	B. A. C. 755	6	+48	−31	23 44.4	+ 4 00 08	+0.1387	.5038	+.2137	+9.2353	.9935
30	31 Arietis	5½	− 6	−78	4 59.0	+ 9 05 55	−0.8624	.5041	+.2090	+9.3110	.9907
30	38 Arietis	5½	+43	−35	9 27.1	−10 33 39	+0.0459	.5066	+.2057	+9.3116	.9907
July 1	SATURN		+41	−32	19 47.7	− 1 13 06	+0.0083	.5140	+.1677	+9.4825	.9790
2	ω¹ Tauri	6	+27	−44	4 47.9	+ 7 30 38	−0.2437	.5237	+.1556	+9.5174	.9751
2	ω² Tauri	5½	0	−69	8 48.3	+11 23 42	−0.7396	.5241	+.1496	+9.5385	.9724
2	MARS		−38	−69	14 19.3	− 7 15 36	−1.2156	.4950	+.1344	+9.5613	.9691
3	ι Tauri	4	+90	+22	7 00.6	+ 8 53 58	+0.8734	.5292	+.1109	+9.5616	.9691
3	105 Tauri	6	+90	+30	9 18.2	+11 07 11	+0.9786	.5426	+.1071	+9.5642	.9687
3	*n* Tauri	5½	+90	+36	14 39.0	− 7 42 28	+1.0442	.5453	+.0976	+9.5723	.9674
3	121 Tauri	6	+13	−51	22 09.3	− 0 27 00	−0.4915	.5435	+.0817	+9.6082	.9610
4	1 Geminor	5	+90	+49	11 22.6	−11 40 15	+1.1516	.5547	+.0545	+9.5966	.9632
7	γ Cancri	4½	+89	+10	10 50.5	+ 9 19 46	+0.6459	.5563	−.1047	+9.5736	.9672
8	B.A.C. 3138	6	−11	−68	0 38.0	− 1 20 51	−0.8902	.5469	−.1329	+9.5714	.9675
9	η Leonis	3½	+37	−36	1 39.4	− 1 09 28	−0.0755	.5417	−.1769	+9.4775	.9795
9	43 Leonis	6	+76	− 5	8 32.4	+ 5 30 03	+0.5420	.5410	−.1875	+9.4328	.9835
9	B.A.C. 3579	6	+79	− 4	11 51.9	+ 8 43 07	+0.5711	.5396	−.1932	+9.4155	.9848
9	*i* Leonis	6	+70	−10	13 28.8	+10 16 49	+0.4737	.5393	−.1945	+9.4098	.9852
9	*k* Leonis	6	−14	−75	20 17.6	− 7 07 28	−0.9692	.5337	−.2037	+9.4121	.9850
10	ι Leonis	4	−17	−79	14 26.7	+10 26 55	−1.0219	.5299	−.2236	+9.2934	.9914
11	ξ Virginis	5	−17	−81	0 53.3	− 3 26 09	−1.0292	.5288	−.2328	+9.1979	.9945
11	ν Virginis	4½	+90	− 2	1 10.8	− 3 09 12	+0.7031	.5310	−.2328	+9.1073	.9964
11	π Virginis	5	−22	−83	8 31.5	+ 3 57 40	−1.1089	.5286	−.2375	+9.1118	.9963
11	*c* Virginis	5	+42	−39	18 04.4	−10 47 26	+0.0326	.5299	−.2429	+8.8578	.9989
13	65 Virginis	6	+86	+19	0 28.6	− 5 21 04	+1.0718	.5351	−.2471	−8.8599	.9989
13	66 Virginis	6	+86	+28	1 03.1	− 4 47 42	+1.1754	.5354	−.2470	−8.8840	.9987
13	80 Virginis	6	+48	−33	6 15.8	+ 0 14 54	+0.1477	.5380	−.2459	−8.9089	.9986
13	94 Virginis	6	+54	−26	20 35.4	− 9 53 45	+0.2709	.5442	−.2396	−9.1536	.9956
13	95 Virginis	6	+80	− 6	20 47.3	− 9 42 19	+0.6512	.5435	−.2395	−9.1751	.9951
13	κ Virginis	4	+80	+13	23 36.2	− 6 59 05	+0.9721	.5447	−.2377	−9.2216	.9939
14	2 Libræ	6	+79	+44	4 22.7	− 2 22 16	+1.3155	.5469	−.2341	−9.2822	.9919
14	μ Libræ	5	+76	+31	15 54.9	+ 8 46 10	+1.1874	.5547	−.2227	−9.3692	.9878
15	ζ¹ Libræ	4	+50	−25	8 39.6	+ 0 54 55	+0.2986	.5679	−.2017	−9.4456	.9824
15	ζ³ Libræ	6	+33	−41	9 40.9	+ 1 53 56	−0.0129	.5697	−.2001	−9.4428	.9827
15	ζ⁴ Libræ	6	+36	−38	10 32.0	+ 2 42 58	+0.0577	.5703	−.1986	−9.4495	.9821
15	β¹ Scorpii	2	+66	− 7	23 58.4	− 8 20 45	+0.6112	.5795	−.1738	−9.5213	.9746
15	β² Scorpii	5½	+66	− 7	23 58.6	− 8 20 35	+0.6080	.5795	−.1738	−9.5213	.9746
16	ν Scorpii	4	+21	−51	2 37.9	− 5 47 25	−0.1695	.5835	−.1697	−9.5143	.9755
16	ψ Ophiuchi	5	+11	−62	7 27.8	− 1 08 42	−0.3501	.5882	−.1592	−9.5276	.9739
16	ω Ophiuchi	5	+64	− 7	10 36.6	+ 1 52 43	+0.6120	.5865	−.1526	−9.5573	.9697
16	B.A.C. 5758	6	−30	−90	23 51.3	− 9 24 26	−0.9877	.6019	−.1214	−9.5613	.9691
16	JUPITER		+19	−47	23 51.8	− 9 23 56	−0.1096	.6019	−.1204	−9.5780	.9664
17	39 Ophiuchi	5½	+66	+47	4 18.1	− 5 08 34	+1.2517	0.5952	−.1083	−9.6113	9.9603

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels.		Washington Mean Time of ☌.	At Washington Mean Time of ☌.					
			Northern.	Southern.		*H*	*Y*	*p′*	*q′*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
July 17	B.A.C. 5831	6	+66	+22	4 20.3	− 5 06 30	+1.0330	0.5963	−.1083	−9.6076	9.9611
17	*b* Ophiuchi	5	+66	+ 8	7 28.2	− 2 06 16	+0.8352	.5987	−.1002	−9.6099	.9606
17	c^2 Ophiuchi	5	+49	−15	9 22.9	− 0 16 20	+0.4590	.6016	−.0948	−9.6066	.9613
17	4 Sagittarii	5	− 3	−69	20 00.7	+ 9 54 49	−0.4348	.6104	−.0634	−9.6059	.9614
18	λ Sagittarii	4	+65	+ 2	6 25.3	− 4 05 54	+0.7447	.6069	−.0336	−9.6340	.9555
19	ψ Sagittarii	5	+56	− 4	0 01.4	−11 15 34	+0.6354	.6066	+.0211	−9.6340	.9555
19	h^2 Sagittarii	4½	+54	− 7	7 55.4	− 3 41 30	+0.5878	.6042	+.0449	−9.6292	.9566
20	η Capricor.	5	−39	−90	17 57.7	+ 4 58 06	−1.1254	.5894	+.1348	−9.5430	.9718
21	ε Capricor.	5	+61	−10	7 24.0	− 6 06 12	+0.5500	.5721	+.1620	−9.5365	.9727
21	κ Capricor.	5	+49	−22	9 44.9	− 3 50 27	+0.3368	.5713	+.1658	−9.5242	.9743
21	B.A.C. 7550	6	+70	+30	9 58.9	− 3 37 02	+1.1482	.5670	+.1676	−9.5399	.9722
21	29 Aquarii	6	+27	−46	18 15.7	+ 4 21 48	−0.0861	.5642	+.1814	−9.4821	.9790
22	56 Aquarii	6	+27	−48	6 37.1	− 7 42 50	−0.1319	.5537	+.1990	−9.4223	.9843
22	τ^1 Aquarii	6	+75	+14	14 35.2	− 0 00 55	+0.9745	.5440	+.2086	−9.4080	.9853
22	τ^2 Aquarii	5½	+75	− 4	15 27.9	+ 0 49 00	+0.6784	.5437	+.2097	−9.3946	.9862
22	74 Aquarii	6	−18	−90	17 17.1	+ 2 35 36	−0.9837	.5456	+.2118	−9.3317	.9898
23	ψ^1 Aquarii	5½	−46	−90	3 52.8	−11 09 21	−1.3080	.5365	+.2218	−9.2346	.9935
23	ψ^2 Aquarii	5	−17	−90	4 52.7	−10 11 26	−0.9860	.5354	+.2225	−9.2390	.9934
23	ψ^3 Aquarii	5	+15	−66	5 22.8	− 9 42 16	−0.4261	.5348	+.2226	−9.2568	.9928
24	30 Piscium	4½	+83	− 5	2 41.2	+10 56 30	+0.6832	.5198	+.2340	−9.0750	.9969
24	33 Piscium	5	+78	0	4 24.4	−11 23 25	+0.7674	.5183	+.2346	−9.0555	.9972
25	33 Ceti	6	+44	−38	14 28.9	− 2 18 26	+0.0548	.5062	+.2352	+8.4637	.9998
25	*f* Piscium	6	+24	−59	18 19.8	+ 1 25 52	−0.3154	.5055	+.2341	+8.6952	.9995
26	ν Piscium	5	+76	−11	6 59.2	−10 16 12	+0.5537	.5045	+.2291	+8.9173	.9985
26	ξ^1 Ceti	5	+82	− 5	23 53.2	+ 6 09 07	+0.6240	.5055	+.2190	+9.1520	.9956
27	ξ Arietis	5½	+47	−36	6 10.3	−11 44 27	+0.0470	.5057	+.2146	+9.2364	.9935
27	B. A. C. 755	6	+58	−22	7 12.5	−10 44 01	+0.2973	.5061	+.2138	+9.2353	.9935
27	38 Arietis	5½	+52	−22	16 50.3	− 1 22 47	+0.2021	.5077	+.2062	+9.3116	.9907
29	SATURN		+70	− 7	8 16.0	−11 06 44	+0.4556	.5202	+.1586	+9.4940	.9778
29	ω^1 Tauri	6	+35	−36	12 00.4	− 7 29 12	−0.1027	.5238	+.1534	+9.5172	.9751
29	ω^2 Tauri	5½	+ 7	−65	16 00.5	− 3 36 28	−0.6103	.5243	+.1473	+9.5384	.9724
30	ι Tauri	4½	+90	+29	14 12.0	− 6 06 58	+0.9774	.5403	+.1099	+9.5616	.9691
30	105 Tauri	6	+90	+37	16 29.7	− 3 53 45	+1.0799	.5415	+.1062	+9.5642	.9687
30	*n* Tauri	6	+90	+44	21 50.2	+ 1 16 22	+1.1389	.5441	+.0967	+9.5724	.9674
31	121 Tauri	6	+18	−45	5 19.9	+ 8 31 14	−0.4034	.5425	+.0808	+9.6082	.9610
31	132 Tauri	5	+ 8	−55	11 35.1	− 9 26 04	−0.5720	.5442	+.0685	+9.6180	.9590
31	MARS		+76	+ 6	14 03.5	− 7 02 39	+0.5124	.5198	+.0609	+9.6037	.9618
31	1 Geminor	5	+90	+57	18 32.7	− 2 42 32	+1.2229	.5540	+.0536	+9.5966	.9632
31	5 Geminor	6	+46	−14	21 52.9	+ 0 30 54	+0.0893	.5514	+.0449	+9.6169	.9592
Aug. 1	ε Geminor	3	+19	−37	12 27.4	− 9 24 36	−0.3808	.5536	+.0136	+9.6303	.9563
1	37 Geminor	6	+ 3	−56	17 32.1	− 4 30 28	−0.6515	.5536	+.0021	+9.6368	.9553
1	ω Geminor	6	+83	+16	20 43.8	− 1 25 24	+0.5817	.5594	−.0048	+9.6163	.9593
2	48 Geminor	6	+84	+15	1 11.5	+ 2 52 59	+0.5869	.5604	−.0164	+9.6155	.9595
2	52 Geminor	6	+26	−31	2 10.0	+ 3 49 27	−0.2630	.5571	−.0188	+9.6281	.9568
2	A Geminor	5½	+ 9	−51	6 03.9	+ 7 35 12	−0.5633	.5562	−.0281	+9.6313	.9561
2	κ Geminor	4	+25	−35	15 22.4	− 7 25 51	−0.2843	.5578	−.0490	+9.6219	.9582
5	B.A.C. 3579	6	+70	−10	18 01.4	− 7 19 54	+0.4644	.5437	−.1961	+9.4155	.9848
5	*i* Leonis	6	+63	−15	19 37.0	− 5 47 31	+0.3637	.5432	−.1974	+9.4097	.9852
6	*k* Leonis	6	−22	−75	2 20.4	+ 0 42 43	−1.0789	.5376	−.2068	+9.4120	.9850
6	ι Leonis	4	−27	−79	20 15.8	− 5 56 34	−1.1598	0.5335	−.2267	+9.2934	9.9914

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1853.	Star's Name.	Mag.	Limiting Parallels. Northern.	Limiting Parallels. Southern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p′*	*q′*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Aug. 7	ξ Virginis	5	−29	−81	6 35.7	+ 4 03 37	−1.1820	0.5320	−.2350	+9.1979	9.9945
7	ν Virginis	4½	+75	−11	6 53.0	+ 4 20 24	+0.5428	.5341	−.2358	+9.1071	.9964
7	π Virginis	5	−33	−83	14 09.7	+11 23 14	−1.2425	.5311	−.2403	+9.1118	.9963
7	c Virginis	5	+33	−48	23 38.4	− 3 26 06	−0.1450	.5320	−.2446	+8.8578	.9989
9	65 Virginis	6	+86	+ 6	5 58.4	+ 1 56 06	+0.8748	.5351	−.2475	−8.8595	.9989
9	66 Virginis	6	+86	+13	6 33.4	+ 2 29 58	+0.9768	.5347	−.2474	−8.8842	.9987
9	l^2 Virginis	6	+85	+33	10 06.0	+ 5 55 45	+1.2303	.5355	−.2463	−8.9811	.9980
9	80 Virginis	6	+37	−44	11 47.3	+ 7 33 47	−0.0558	.5368	−.2460	−8.9083	.9986
10	94 Virginis	6	+43	−37	2 12.8	− 2 28 59	+0.0658	.5424	−.2385	−9.1535	.9956
10	95 Virginis	6	+65	−17	2 24.8	− 2 17 24	+0.4483	.5417	−.2385	−9.1752	.9951
10	κ Virginis	4	+75	0	5 15.4	+ 0 27 33	+0.7707	.5425	−.2364	−9.2216	.9939
10	μ Libræ	5	+76	+15	21 47.1	− 7 34 15	+0.9931	.5495	−.2217	−9.3692	.9878
11	o^1 Libræ	6	+10	−70	11 43.9	+ 5 53 19	−0.4704	.5616	−.2037	−9.4135	.9849
11	o^2 Libræ	6	−26	−90	12 36.8	+ 6 44 19	−1.0624	.5639	−.2022	−9.4015	.9857
11	ζ^1 Libræ	4	+39	−35	14 50.4	+ 8 53 06	+0.1066	.5621	−.1993	−9.4456	.9824
11	ζ^3 Libræ	6	+23	−52	15 52.9	+ 9 53 25	−0.1987	.5648	−.1962	−9.4430	.9826
11	ζ^4 Libræ	6	+26	−49	16 50.7	+10 49 05	−0.1366	.5640	−.1961	−9.4495	.9821
12	β^1 Scorpii	2	+55	−17	6 30.1	− 0 01 28	+0.4362	.5717	−.1716	−9 5213	.9746
12	β^2 Scorpii	5½	+55	−17	6 30.3	− 0 01 19	+0.4356	.5719	−.1717	−9.5213	.9746
12	B.A.C. 5330	5½	+55	−17	6 30.3	− 0 01 19	+0.4328	.5720	−.1717	−9.5211	.9747
12	ω^1 Scorpii	4½	+70	+37	7 03.2	+ 0 30 19	+1.2179	.5699	−.1697	−9.5396	.9722
12	ν Scorpio	4	+12	−62	9 13.6	+ 2 35 51	−0.3512	.5768	−.1658	−9.5143	.9755
12	ψ Ophiuchi	5	+ 1	−76	14 11.0	+ 7 22 02	−0.5293	.5810	−.1555	−9.5276	.9739
12	ω Ophiuchi	5	+53	−16	17 24.8	+10 28 25	+0.4491	.5792	−.1491	−9.5573	.9697
13	JUPITER		+20	−47	5 26.7	− 1 57 42	−0.0958	.5889	−.1212	−9.5776	.9665
13	B.A.C. 5758	6	−44	−90	7 01.2	− 0 26 54	−1.1550	.5946	−.1163	−9.5613	.9691
13	39 Ophiuchi	5½	+66	+30	11 35.6	+ 3 56 39	+1.1218	.5867	−.1063	−9.6113	.9603
13	B.A.C. 5831	6	+66	+12	11 37.8	+ 3 58 41	+0.9001	.5878	−.1063	−9.6076	.9611
13	b Ophiuchi	5	+65	− 1	14 51.2	+ 7 04 21	+0.7028	.5899	−.0985	−9.6099	.9606
13	c^2 Ophiuchi	5	+41	−23	16 49.1	+ 8 57 34	+0.3250	.5942	−.0934	−9.6066	.9613
14	4 Sagittarii	5	−10	−81	3 45.1	− 4 32 59	−0.5663	.6013	−.0631	−9.6059	.9614
14	7 Sagittarii	6	+11	−50	5 54.6	− 3 26 20	−0.1553	.6003	−.0574	−9.6139	.9598
14	9 Sagittarii	4½	+14	−46	5 18.0	− 3 03 56	−0.0931	.5999	−.0574	−9.6154	.9595
14	B.A.C. 6161	6	−30	−90	8 18.7	− 0 10 36	−0.8917	.6045	−.0489	−9.6046	.9617
14	λ Sagittarii	3	+58	− 4	14 27.4	+ 5 42 56	+0.6460	.5984	−.0316	−9.6340	.9555
14	24 Sagittarii	6	−26	−90	16 44.3	+ 7 54 12	−0.7898	.6056	−.0258	−9.6116	.9603
14	26 Sagittarii	6	−42	−90	19 46.0	+10 48 26	−1.0240	.6070	−.0170	−9.6087	.9608
14	B.A.C. 6369	6	+24	−32	20 51.9	+11 51 36	+0.1603	.6016	−.0111	−9.6284	.9567
15	ψ Sagittarii	5	+51	− 8	8 31.3	− 0 57 46	+0.5643	.5991	+.0211	−9.6340	.9555
15	B.A.C. 6576	6	−11	−77	8 32.8	− 0 56 20	−0.5224	.6044	+.0211	−9.6164	.9593
15	χ^1 Sagittarii	5½	+14	−44	12 15.0	+ 2 36 40	−0.0555	.6014	+.0328	−9.6224	.9580
15	χ^3 Sagittarii	6	−14	−85	12 21.1	+ 2 42 34	−0.6023	.6041	+.0328	−9.6134	.9599
15	h^1 Sagittarii	6	+38	−21	16 21.5	+ 6 33 09	+0.3509	.5987	+.0444	−9.6265	.9572
15	h^2 Sagittarii	4½	+50	−11	16 36.8	+ 6 47 45	+0.5307	.5979	+.0444	−9.6292	.9566
17	η Capricor.	5	−40	−90	3 16.6	− 7 54 59	−1.1301	.5867	+.1354	−9.5430	.9718
17	ε Capricor.	5	+64	− 9	16 51.6	+ 5 09 27	+0.5852	.5709	+.1628	−9.5365	.9727
17	κ Capricor.	5	+51	−20	19 13.8	+ 7 26 23	+0.3758	.5688	+.1684	−9.5242	.9743
19	ψ^2 Aquarii	5	− 8	−90	14 23.2	+ 1 07 07	−0.8551	.5386	+.2253	−9.2390	.9934
19	ψ^3 Aquarii	5	+23	−58	14 53.2	+ 1 36 07	−0.2947	.5367	+.2260	−9.2568	.9928
20	30 Piscium	5	+83	+ 5	12 00.9	− 1 55 47	+0.8531	0.5228	+.2375	−9.0750	9.9969

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels.		Washington Mean Time of ☌.	At Washington Mean Time of ☌.					
			Northern.	Southern.		H	Y	p'	q'	Log sin D	Log cos D
			°	°	h. m.	h. m. s.					
Aug. 20	33 Piscium	5	+83	+10	13 43.0	−10 16 47	+0.9404	0.5226	+.2381	−9.0555	9.9972
21	33 Ceti	6	+57	+26	23 21.2	+ 8 21 43	+0.2821	.5107	+.2384	+8.4634	.9998
22	*f* Piscium	6	+46	−35	3 09.5	−11 56 32	+0.1001	.5098	+.2370	+8.6691	.9995
22	ν Piscium	5	+90	+ 2	15 37.9	+ 0 10 18	+0.7964	.5089	+.2322	+8.9175	.9985
23	ξ^1 Ceti	5	+90	+ 9	8 18.5	− 7 37 45	+0.8790	.5092	+.2215	+9.1520	.9956
23	ξ Arietis	5½	+58	−23	14 31.0	− 1 35 57	+0.2895	.5091	+.2168	+9.2372	.9934
23	B. A. C. 755	6	+77	− 9	15 32.5	− 0 36 17	+0.5571	.5094	+.2159	+9.2354	.9935
23	31 Arietis	5½	+18	−62	20 40.8	+ 4 23 08	−0.4340	.5087	+.2115	+9.3110	.9907
24	38 Arietis	5½	+69	−13	1 01.3	+ 8 36 02	+0.4560	.5112	+.2068	+9.3116	.9907
25	Saturn		+90	+22	19 19.8	+ 1 39 05	+0.9462	.5260	+.1543	+9.4994	.9772
25	ω^1 Tauri	6	+49	−23	19 56.1	+ 2 14 13	+0.1443	.5247	+.1529	+9.5174	.9751
25	ω^2 Tauri	5½	+21	−49	23 55.5	+ 6 06 27	−0.3552	.5248	+.1467	+9.5385	.9724
26	ι Tauri	4½	+90	+50	22 06.2	+ 3 34 55	+1.2151	.5398	+.1086	+9.5616	.9691
27	121 Tauri	6	+31	−32	13 15.7	− 5 45 15	−0.1816	.5412	+.0794	+9.6082	.9610
27	132 Tauri	6	+21	−41	19 31.7	+ 0 18 21	−0.3575	.5429	+.0670	+9.6180	.9590
28	5 Geminor	6	+59	− 3	5 51.5	+10 17 16	+0.2909	.5490	+.0456	+9.6169	.9592
28	ε Geminor	3½	+30	−26	20 29.1	+ 0 24 57	−0.1999	.5518	+.0121	+9.6303	.9563
29	37 Geminor	6	+14	−42	1 34.9	+ 5 20 09	−0.4722	.5518	+.0007	+9.6348	.9553
29	ω Geminor	6	+90	+25	4 47.3	+ 8 25 53	+0.7471	.5576	−.0062	+9.6163	.9593
29	48 Geminor	6	+90	+24	9 15.8	−11 14 55	+0.7484	.5586	−.0178	+9.6155	.9595
29	52 Geminor	6	+35	−22	10 14.4	−10 18 20	−0.1037	.5553	−.0201	+9.6281	.9568
29	A Geminor	5½	+18	−41	14 09.0	− 6 31 55	−0.4109	.5555	−.0295	+9.6312	.9561
29	κ Geminor	3½	+33	−27	23 28.7	+ 2 28 16	−0.1468	.5565	−.0503	+9.6217	.9582
30	μ^1 Cancri	6	+90	+41	9 13.2	+11 52 22	+1.0832	.5617	−.0733	+9.5928	.9639
30	λ Cancri	6	−17	−66	15 30.4	− 6 03 40	−0.9627	.5531	−.0869	+9.6174	.9591
31	γ Cancri	4½	+90	+13	1 42.4	+ 3 47 05	+0.7034	.5589	−.1090	+9.5736	.9672
31	B.A.C. 3138	6	− 9	−68	15 18.1	− 7 05 24	−0.8706	.5508	−.1385	+9.5714	.9675
Sept. 4	*c* Virginis	5	+26	−57	6 28.7	+ 5 11 51	−0.2909	.5374	−.2490	+8.8576	.9989
5	65 Virginis	6	+84	− 6	12 13.0	+ 9 58 13	+0.6606	.5404	−.2517	−8.8598	.9989
5	66 Virginis	6	+80	− 1	12 46.9	+10 30 59	+0.7628	.5400	−.2517	−8.8842	.9987
5	b^3 Virginis	6	+85	+15	16 15.5	−10 07 16	+1.0090	.5407	−.2504	−8.9816	.9980
5	80 Virginis	6	+26	−56	17 55.0	− 8 31 04	−0.2683	.5424	−.2497	−8.9083	.9986
6	94 Virginis	6	+30	−50	8 05.8	+ 5 11 24	−0.1672	.6470	−.2416	−9.1536	.9956
6	95 Virginis	6	+51	−30	8 17.5	+ 5 22 44	+0.2124	.5464	−.2416	−9.1752	.9951
6	κ Virginis	4½	+70	−13	11 05.4	+ 8 04 59	+0.5299	.5470	−.2393	−9.2215	.9939
6	2 Libræ	6	+79	+ 6	15 50.5	−11 19 38	+0.8714	.5477	−.2359	−9.2821	.9919
7	μ Libræ	6	+76	− 1	3 24.1	− 0 09 49	+0.7382	.5532	−.2232	−9.3692	.9878
7	ν^1 Libræ	5	+74	+38	10 58.4	+ 7 08 29	+1.2569	.5559	−.2129	−9.4319	.9835
7	o^1 Libræ	6	− 4	−90	17 13.6	−10 49 36	−0.7257	.5643	−.2040	−9.4135	.9849
7	ζ^1 Libræ	4	+26	−50	20 18.9	− 7 50 58	−0.1516	.5644	−.1994	−9.4456	.9824
7	ζ^3 Libræ	6	+10	−70	21 21.1	− 6 51 00	−0.4561	.5658	−.1977	−9.4430	.9826
7	ζ^4 Libræ	6	+13	−65	22 18.6	− 5 55 37	−0.3943	.5662	−.1961	−9.4495	.9821
8	β^1 Scorpii	2	+40	−31	11 56.0	+ 7 11 46	+0.1776	.5728	−.1705	−9.5213	.9746
8	β^2 Scorpii	5½	+40	−31	11 56.2	+ 7 11 55	+0.1741	.5728	−.1705	−9.5213	.9746
8	ω^1 Scorpii	4½	+70	+14	12 29.0	+ 7 43 33	+0.9598	.5696	−.1705	−9.5396	.9722
8	ω^2 Scorpii	4½	+70	+27	12 43.3	+ 7 57 19	+1.1218	.5690	−.1705	−9.5436	.9717
8	ν Scorpii	4	− 2	−84	14 39.5	+ 9 49 09	−0.6095	.5762	−.1664	−9.5143	.9755
8	B.A.C. 5395	6	+69	+42	15 18.8	+10 26 57	+1.2505	.5702	−.1644	−9.5548	.9701
8	ψ Ophiuchi	5	−13	−90	19 37.4	− 9 24 09	−0.7872	.5798	−.1560	−9.5274	.9739
8	ω Ophiuchi	5	+38	−30	22 51.9	− 6 17 08	+0.1943	0.5788	−.1472	−9.5573	9.9697

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			°	°	h. m.	h. m. s.					
Sept. 9	JUPITER		+ 5	−66	13 14.2	+ 7 31 50	−0.3854	0.5876	−.1139	−9.5817	9.9658
9	39 Ophiuchi	5½	+66	+10	17 10.5	+11 18 52	+0.8812	.5840	−.1039	−9.6113	.9603
9	B.A.C. 5831	6	+63	− 4	17 12.6	+11 20 56	+0.6586	.5851	−.1039	−9.6076	.9611
9	*b* Ophiuchi	5	+49	−15	20 28.1	− 9 31 18	+0.4635	.5868	−.0961	−9.6099	.9606
9	c^2 Ophiuchi	5	+27	−36	22 27.4	− 7 36 43	+0.0844	.5894	−.0908	−9.6066	.9613
10	4 Sagittarii	5	−24	−90	9 32.5	+ 3 01 47	−0.8017	.5966	−.0610	−9.6059	.9614
10	7 Sagittarii	6	− 1	−66	10 43.1	+ 4 09 32	−0.3845	.5948	−.0581	−9.6139	.9598
10	9 Sagittarii	4½	+ 2	−61	11 06.7	+ 4 32 16	−0.3236	.5950	−.0554	−9.6153	.9595
10	B.A.C. 6161	6	−39	−90	14 10.4	+ 7 28 35	−1.1251	.5991	−.0470	−9.6046	.9617
10	λ Sagittarii	3	+42	−17	20 25.6	−10 31 24	+0.4320	.5928	−.0299	−9.6340	.9555
10	24 Sagittarii	6	−41	−90	22 45.0	− 8 17 34	−1.0134	.5996	−.0243	−9.6116	.9603
11	26 Sagittarii	6	−62	−90	1 50.2	− 5 19 51	−1.2462	.6006	−.0157	−9.6087	.9608
11	B.A.C. 6369	6	+13	−44	2 57.4	− 4 15 25	−0.0502	.5951	−.0099	−9.6284	.9567
11	σ Sagittarii	2½	+64	+59	6 57.8	− 0 24 43	+1.2697	.5886	+.0015	−9.6491	.9519
11	ψ Sagittarii	5	+37	−20	14 51.6	+ 7 09 59	+0.3751	.5924	+.0215	−9.6340	.9555
11	B.A.C. 6576	6	−22	−90	14 53.1	+ 7 11 28	−0.7231	.5972	+.0243	−9.6164	.9593
11	χ^1 Sagittarii	5½	+ 4	−56	18 40.2	+10 49 29	−0.2455	.5943	+.0327	−9.6224	.9580
11	χ^3 Sagittarii	6	−26	−90	18 46.5	+10 55 30	−0.7949	.5969	+.0327	−9.6135	.9599
11	h^1 Sagittarii	6	+28	−31	22 52.4	− 9 08 24	+0.1713	.5910	+.0467	−9.6265	.9572
11	h^2 Sagittarii	4½	+38	−21	23 08.0	− 8 53 29	+0.3533	.5902	+.0467	−9.6292	.9566
12	B.A.C. 6864	6	−50	−90	8 55.8	+ 0 31 05	−1.1760	.5932	+.0738	−9.5943	.9636
12	B.A.C. 7049	6	0	−71	20 13.3	+11 22 07	−0.4604	.5849	+.1021	−9.5895	.9645
13	B.A.C. 7179	6	− 4	−80	3 01.9	− 6 04 50	−0.5640	.5812	+.1190	−9.5743	.9671
13	B.A.C. 7197	6	+67	+ 5	3 54.3	− 5 14 29	+0.7989	.5749	+.1213	−9.5966	.9632
13	η Capricor.	5½	−54	−90	10 37.7	+ 1 13 47	−1.2601	.5797	+.1350	−9.5430	.9718
13	χ Capricor.	6	+47	−21	12 20.4	+ 2 52 38	+0.3637	.5721	+.1393	−9.5694	.9679
13	27 Capricor.	6	+15	−55	12 45.6	+ 3 16 57	−0.2350	.5746	+.1393	−9.5571	.9698
13	φ Capricor.	6	+42	−27	15 19.8	+ 5 45 25	+0.2509	.5704	+.1457	−9.5592	.9694
14	33 Capricor.	6	+69	+19	18 57.0	+ 9 14 38	+1.0139	.5648	+.1539	−9.5634	.9688
14	37 Capricor.	6	+69	+16	23 33.2	−10 19 08	+0.9809	.5626	+.1617	−9.5490	.9709
14	ε Capricor.	4½	+59	−13	0 31.4	− 9 23 05	+0.5030	.5625	+.1638	−9.5365	.9727
14	κ Capricor.	5	+47	−25	2 56.6	− 7 03 04	+0.2967	.5619	+.1692	−9.5242	.9743
14	B.A.C. 7550	6	+70	+27	3 10.9	− 6 49 15	+1.1207	.5592	+.1692	−9.5399	.9722
15	56 Aquarii	6	+30	−46	0 18.2	−10 25 54	−0.0826	.5489	+.2025	−9.4223	.9843
15	τ^1 Aquarii	6	+75	+21	8 24.3	− 2 35 57	+1.0720	.5409	+.2124	−9.4080	.9853
15	τ^2 Aquarii	4	+69	+ 1	9 17.6	− 1 44 27	+0.7771	.5407	+.2135	−9.3947	.9862
16	ψ^2 Aquarii	4½	− 7	−90	22 50.2	+11 21 59	−0.8339	.5363	+.2263	−9.2390	.9934
16	ψ^3 Aquarii	5	+24	−56	23 20.5	+11 51 19	−0.2685	.5346	+.2271	−9.2568	.9928
17	30 Piscium	5	+83	+10	20 39.2	+ 8 30 21	+0.9406	.5225	+.2396	−9.0750	.9969
17	33 Piscium	5	+83	+16	22 21.8	+10 09 54	+1.0323	.5214	+.2403	−9.0555	.9972
18	33 Ceti	6	+68	−17	8 02.2	− 5 09 24	+0.4526	.5124	+.2413	+8.4637	.9998
18	*f* Piscium	6	+46	−36	11 49.7	− 1 28 27	+0.0986	.5120	+.2405	+8.6952	.9995
18	μ Piscium	4½	−21	−85	18 17.2	+ 4 47 51	−1.1041	.5104	+.2379	+8.9730	.9981
19	ν Piscium	5	+90	+15	0 14.7	+10 35 01	+1.0000	.5113	+.2350	+8.9176	.9985
19	ξ^1 Ceti	5	+90	+24	16 49.1	+ 2 40 40	+1.1115	.5123	+.2247	+9.1520	.9956
19	ξ Arietis	5½	+75	−10	22 58.9	+ 8 39 47	+0.5325	.5124	+.2191	+9.2372	.9934
19	B. A. C. 755	6	+90	+ 5	23 59.9	+ 9 39 00	+0.8015	.5129	+.2181	+9.2353	.9935
20	31 Arietis	5½	+31	−47	5 05.9	− 9 23 54	−0.1810	.5120	+.2136	+9.3110	.9907
20	38 Arietis	5½	+90	+ 1	9 27.0	− 5 10 28	+0.7230	.5143	+.2097	+9.3116	.9907
22	ω^1 Tauri	6	+69	− 7	4 03.4	−11 50 43	+0.4376	0.5265	+.1540	+9.5174	9.9751

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			°	°	h. m.	h. m. s.					
Sept. 22	ω^2 Tauri	5½	+38	−33	8 02.0	− 7 59 31	−0.0611	0.5265	+.1476	+9.5384	9.9724
22	τ Tauri	4½	−28	−67	20 08.2	+ 3 43 55	−1.1110	.5273	+.1272	+9.5860	.9651
23	103 Tauri	6	−43	−66	8 24.2	− 8 23 35	−1.2289	.5309	+.1050	+9.6104	.9605
23	121 Tauri	6	+48	−16	21 21.6	+ 4 08 29	+0.1096	.5406	+.0791	+9.6082	.9610
24	132 Tauri	5½	+37	−24	3 39.3	+10 13 37	−0.0697	.5419	+.0667	+9.6180	.9590
24	5 Geminor	6	+83	+12	14 02.4	− 3 44 04	+0.5751	.5479	+.0431	+9.6169	.9592
25	ε Geminor	3½	+46	−12	4 46.5	+10 30 08	+0.0724	.5490	+.0120	+9.6303	.9563
25	37 Geminor	6	+29	−26	9 55.0	− 8 31 55	−0.2114	.5493	−.0016	+9.6348	.9553
25	ω Geminor	6	+90	+42	13 09.2	− 5 24 24	+1.0186	.5546	−.0085	+9.6163	.9593
25	48 Geminor	6	+90	+41	17 40.4	− 1 02 32	+1.0125	.5553	−.0177	+9.6155	.9595
25	52 Geminor	6	+51	− 8	18 39.6	− 0 05 20	+0.1565	.5518	−.0199	+9.6281	.9568
25	A Geminor	5½	+32	−25	22 36.6	+ 3 43 32	−0.1553	.5511	−.0292	+9.6312	.9561
26	κ Geminor	3½	+47	−14	8 02.5	−11 10 09	+0.0983	.5528	−.0521	+9.6219	.9582
27	λ Cancri	6	− 1	−66	0 15.1	+ 4 28 53	−0.7404	.5493	−.0883	+9.6174	.9591
27	γ Cancri	5½	+90	+25	10 33.8	− 9 33 37	+0.9152	.5550	−.1101	+9.5736	.9672
28	B.A.C. 3138	6	+ 3	−67	0 17.8	+ 3 42 07	−0.6868	.5473	−.1393	+9.5714	.9675
29	η Leonis	3½	+40	−34	0 59.0	+ 3 33 19	−0.0213	.5455	−.1856	+9.4775	.9795
29	43 Leonis	6	+77	− 5	7 43.4	+10 04 13	+0.5462	.5461	−.1952	+9.4328	.9835
29	B.A.C. 3579	6	+77	− 6	10 58.4	−10 47 18	+0.5539	.5454	−.2014	+9.4155	.9848
29	i Leonis	6	+69	−12	12 32.9	− 9 15 53	+0.4476	.5449	−.2029	+9.4098	.9852
29	k Leonis	6	−16	−75	19 11.1	− 2 50 55	−1.0146	.5404	−.2129	+9.4121	.9850
30	ι Leonis	4	−28	−79	12 46.4	− 9 50 21	−1.1776	.5389	−.2334	+9.2934	.9914
Oct. 3	94 Virginis	6	+23	−59	15 55.9	− 9 10 48	−0.3113	.5547	−.2471	−9.1535	.9956
3	95 Virginis	6	+43	−38	16 07.3	− 8 59 46	+0.0650	.5541	−.2471	−9.1751	.9951
3	κ Virginis	4½	+60	−21	18 50.7	− 6 21 59	+0.3727	.5541	−.2454	−9.2214	.9939
3	B.A.C. 4765	6	+79	− 4	23 28.5	− 1 53 55	+0.6984	.5559	−.2410	−9.2822	.9919
4	μ Libræ	6	+69	−12	10 42.5	+ 8 56 09	+0.5462	.5613	−.2288	−9.3692	.9878
4	ν^1 Libræ	5	+74	+18	18 04.0	− 7 58 18	+1.0454	.5643	−.2178	−9.4319	.9835
5	o^1 Libræ	6	−15	−90	0 08.8	− 2 06 52	−0.9196	.5728	−.2084	−9.4135	.9849
5	ζ^1 Libræ	4	+15	−63	3 09.0	+ 0 46 39	−0.3578	.5729	−.2033	−9.4456	.9824
5	ζ^3 Libræ	6	− 1	−88	4 09.5	+ 1 44 53	−0.6592	.5744	−.2017	−9.4430	.9826
5	ζ^4 Libræ	6	+ 2	−82	5 05.3	+ 2 38 40	−0.5994	.5749	−.1999	−9.4495	.9821
5	κ Libræ	6	+70	+30	13 25.5	+10 40 01	+1.1585	.5733	−.1849	−9.5281	.9738
5	β^1 Scorpii	2	+28	−44	18 21.1	− 8 35 38	−0.0507	.5800	−.1747	−9.5213	.9746
5	β^2 Scorpii	5½	+28	−44	18 21.3	− 8 35 29	−0.0541	.5800	−.1747	−9.5213	.9746
5	ω^1 Scorpii	4½	+70	− 1	18 53.3	− 8 04 43	+0.7214	.5780	−.1726	−9.5396	.9722
5	ω^2 Scorpii	4½	+70	+ 9	19 07.2	− 7 51 18	+0.8812	.5773	−.1726	−9.5436	.9717
5	ν Scorpii	4	−15	−90	21 00.5	− 6 02 23	−0.8312	.5847	−.1682	−9.5143	.9755
5	B.A.C. 5395	6	+70	+17	21 38.8	− 5 25 30	+1.0051	.5774	−.1682	−9.5548	.9701
6	ψ Ophiuchi	5	−27	−90	1 51.1	− 1 23 01	−1.0113	.5871	−.1593	−9.5276	.9739
6	ω Ophiuchi	5	+25	−44	5 00.9	+ 1 39 24	−0.0436	.5856	−.1501	−9.5573	.9697
6	39 Ophiuchi	5½	+61	− 6	22 56.6	− 5 07 35	+0.6261	.5895	−.1045	−9.6113	.9603
6	B.A.C. 5831	6	+46	−19	22 58.8	− 5 05 32	+0.4054	.5906	−.1045	−9.6076	.9611
7	θ Ophiuchi	3½	+66	+38	0 28.2	− 3 39 40	+1.1984	.5871	−.1018	−9.6235	.9578
7	Jupiter		−23	−90	0 40.9	− 3 27 28	−0.8580	.5903	−.1013	−9.5887	.9646
7	b Ophiuchi	5	+34	−29	2 10.8	− 2 01 16	+0.2124	.5921	−.0964	−9.6099	.9606
7	c^2 Ophiuchi	5	+14	−51	4 08.1	− 0 08 41	−0.1638	.5946	−.0909	−9.6066	.9613
7	4 Sagittarii	5	−40	−90	15 03.4	+10 20 06	−1.0462	.6005	−.0600	−9.6059	.9614
7	7 Sagittarii	6	−14	−89	16 13.1	+11 26 59	−0.6316	.5987	−.0571	−9.6139	.9598
7	9 Sagittarii	4½	−10	−82	16 36.6	+11 49 28	−0.5714	0.5984	−.0571	−9.6153	9.9595

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. Northern.	Limiting Parallels. Southern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. H	Y	p′	q′	Log sin D	Log cos D
			°	°	h. m.	h. m. s.					
Oct. 8	λ Sagittarii	3	+27	−31	1 49.6	− 3 20 01	+0.1805	0.5950	−.0311	−9.6340	9.9555
8	B.A.C. 6369	6	0	−60	8 18.6	+ 2 53 08	−0.2974	.5965	−.0107	−9.6284	.9567
8	σ Sagittarii	2½	+64	+21	12 17.7	+ 6 42 34	+1.0184	.5894	+.0007	−9.6491	.9519
8	ψ Sagittarii	5	+23	−34	20 10.2	− 9 44 06	+0.1294	.5918	+.0238	−9.6340	.9555
8	B.A.C. 6576	6	−37	−90	20 11.7	− 9 42 35	−0.9670	.5970	+.0238	−9.6163	.9593
8	χ^1 Sagittarii	5½	− 8	−75	23 58.7	− 6 04 43	−0.4888	.5932	+.0352	−9.6224	.9580
9	χ^2 Sagittarii	6½	−13	−83	0 01.4	− 6 02 11	−0.5829	.5939	+.0352	−9.6209	.9584
9	χ^3 Sagittarii	6	−41	−90	0 05.0	− 5 58 41	−1.0404	.5959	+.0352	−9.6134	.9599
9	h^1 Sagittarii	6	+15	−45	4 11.2	− 2 02 20	−0.0691	.5899	+.0464	−9.6265	.9572
9	h^2 Sagittarii	4½	+24	−35	4 26.7	− 1 47 27	+0.1119	.5892	+.0464	−9.6292	.9566
10	B.A.C. 7049	6	−13	−90	1 39.1	− 5 24 43	−0.6885	.5817	+.1014	−9.5895	.9645
10	17 Capricor.	6	−17	−90	8 31.9	+ 1 12 32	−0.7861	.5774	+.1181	−9.5743	.9671
10	B.A.C. 7197	6	+59	− 9	9 25.2	+ 2 03 45	+0.5835	.5711	+.1203	−9 5966	.9632
10	χ Capricor.	6	+36	−33	17 57.4	+10 17 02	+0.1555	.5662	+.1402	−9.5692	.9679
10	27 Capricor.	6	+ 4	−70	18 23.0	+10 41 43	−0.4449	.5688	+.1402	−9.5570	.9698
10	φ Capricor.	6	+31	−39	20 59.3	−10 47 40	+0.0461	.5645	+.1463	−9.5592	.9694
11	33 Capricor.	6	+69	+ 5	0 39.8	− 7 15 11	+0.8183	.5601	+.1524	−9.5634	.9688
11	37 Capricor.	6	+69	+ 3	5 20.4	− 2 44 33	+0.7918	.5565	+.1620	−9.5490	.9709
11	ε Capricor.	4½	+47	−24	6 19.5	− 1 47 30	+0.3125	.5574	+.1639	−9.5365	.9727
11	κ Capricor.	5	+36	−35	8 47.2	+ 0 34 57	+0.1087	.5571	+.1675	−9.5242	.9743
11	B.A.C. 7550	6	+70	+12	9 01.7	+ 0 48 58	+0.9383	.5530	+.1692	−9.5399	.9722
11	29 Aquarii	6	+18	−57	17 41.0	+ 9 10 18	−0.2706	.5517	+.1828	−9.4821	.9790
12	56 Aquarii	6	+23	−55	6 32.7	− 2 23 56	−0.2373	.5425	+.2016	−9.4223	.9843
12	τ^1 Aquarii	6	+75	+11	14 47.9	+ 5 35 06	+0.9396	.5347	+.2113	−9.4080	.9853
12	τ^2 Aquarii	4	+74	− 7	15 42.3	+ 6 27 45	+0.6452	.5348	+.2125	−9.3944	.9862
12	74 Aquarii	6	−20	−90	17 35.6	+ 8 17 29	−1.0271	.5370	+.2147	−9.3316	.9898
13	ψ^1 Aquarii	4½	−41	−90	4 29.2	− 5 09 37	−1.2812	.5306	+.2253	−9.2346	.9935
13	ψ^2 Aquarii	4½	−13	−90	5 30.5	− 4 10 10	−0.9482	.5297	+.2261	−9.2390	.9934
13	ψ^3 Aquarii	5	+19	−64	6 01.4	− 3 40 15	−0.3779	.5280	+.2270	−9.2568	.9928
13	B.A.C. 8214	6	0	−90	14 17.6	+ 4 20 41	−0.7456	.5247	+.2328	−9.1577	.9955
13	B.A.C. 8274	6	+21	−62	20 51.8	+10 42 54	−0.3549	.5207	+.2368	−9.0976	.9966
14	30 Piscium	5	+83	+ 6	3 43.0	− 6 38 14	+0.8886	.5175	+.2396	−9.0755	.9969
14	33 Piscium	5	+83	+13	5 27.3	− 4 56 59	+0.9854	.5166	+.2404	−9.0555	.9972
16	μ Piscium	4½	−17	−85	1 54.2	− 9 47 29	−1.0568	.5089	+.2393	+8.9726	.9981
16	ν Piscium	5	+90	+19	7 54.0	− 3 57 58	+1.0693	.5104	+.2365	+8.9174	.9985
17	ξ^1 Ceti	5	+90	+33	0 32.6	−11 48 09	+1.2167	.5125	+.2267	+9.1520	.9956
17	ξ Arietis	5½	+86	− 5	6 43.1	− 5 48 19	+0.6479	.5127	+.2219	+9.2373	.9934
17	B. A. C. 755	6	+90	+11	7 44.2	− 4 49 00	+0.9196	.5133	+.2211	+9.2355	.9935
17	31 Arietis	5½	+40	−39	12 50.3	+ 0 08 15	−0.0188	.5129	+.2166	+9.3099	.9908
17	38 Arietis	5½	+90	− 9	17 11.5	+ 4 21 45	+0.8582	.5157	+.2117	+9.3116	.9907
18	B.A.C. 1096	6	+28	−47	18 16.4	+ 4 42 01	−0.2549	.5202	+.1821	+9.4745	.9798
19	ω^1 Tauri	6	+87	+ 3	11 42.5	− 2 23 57	+0.6369	.5283	+.1568	+9.5174	.9751
19	ω^2 Tauri	5½	+50	−22	15 40.4	+ 1 26 35	+0.1422	.5282	+.1503	+9.5385	.9724
19	κ^1 Tauri	5½	−37	−68	19 34.4	+ 5 13 16	−1.2148	.5253	+.1435	+9.5726	.9673
20	τ Tauri	4½	−10	−67	3 44.8	−10 51 47	−0.8971	.5289	+.1296	+9.5859	.9651
20	103 Tauri	6	−18	−66	16 04.6	+ 1 04 19	−0.9977	.5328	+.1052	+9.6104	.9605
21	121 Tauri	6	+63	− 4	4 57.5	−10 27 57	+0.3442	.5419	+.0790	+9.6082	.9610
21	132 Tauri	5½	+52	−12	11 15.9	− 4 22 06	+0.1676	.5426	+.0665	+9.6180	.9590
21	139 Tauri	5½	−33	−64	15 23.1	− 0 23 06	−1.1468	.5381	+.0579	+9.6408	.9539
21	5 Geminor	6	+90	+25	21 41.1	+ 5 42 22	+0.8189	0.5474	+.0449	+9.6169	9.9592

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. North-ern.	Limiting Parallels. South-ern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p'*	*q'*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Oct. 22	ε Geminor.	3½	+62	+ 1	12 30.8	− 3 57 52	+0.3178	0.5478	+.0115	+9.6303	9.9563
22	37 Geminor.	6	+43	−13	17 41.9	+ 1 02 42	+0.0328	.5473	+.0002	+9.6348	.9553
23	52 Geminor.	6	+68	+ 5	2 31.9	+ 9 34 39	+0.4033	.5493	−.0201	+9.6281	.9568
23	A Geminor.	5½	+47	−12	6 31.7	−10 33 40	+0.0891	.5481	−.0292	+9.6312	.9561
23	c Geminor.	6	−36	−64	15 53.4	− 1 31 03	−1.1660	.5427	−.0518	+9.6438	.9532
23	κ Geminor.	3½	+63	− 1	16 04.9	− 1 19 59	+0.3433	.5490	−.0518	+9.6217	.9582
24	λ Cancri	6	+13	−52	8 33.0	− 9 25 23	−0.5101	.5445	−.0871	+9.6173	.9591
24	v^3 Cancri	6	−25	−66	13 34.8	− 4 33 46	−1.0752	.5416	−.0979	+9.6188	.9588
24	γ Cancri	4½	+90	+43	19 03.2	+ 0 43 35	+1.1572	.5492	−.1106	+9.5734	.9672
25	ξ Cancri	5	−18	−67	7 04.1	−11 39 38	−1.0102	.5393	−.1349	+9.5853	.9652
25	79 Cancri	6	−19	−67	7 31.7	−11 13 00	−1.0186	.5395	−.1349	+9.5844	.9654
25	B.A.C. 3138	6	+16	−55	9 03.8	− 9 43 59	−0.4691	.5287	−.1388	+9.5714	.9675
26	η Leonis	3½	+52	−24	10 16.8	− 9 20 52	+0.1779	.5389	−.1838	+9.4775	.9795
26	42 Leonis	6	+90	+ 5	17 09.9	− 2 41 19	+0.7418	.5394	−.1950	+9.4325	.9835
26	B.A.C. 3579	6	+90	+ 5	20 28.9	+ 0 31 12	+0.7450	.5389	−.1995	+9.4153	.9848
26	i Leonis	6	+85	− 2	22 05.3	+ 2 04 30	+0.6360	.5383	−.2024	+9.4097	.9852
27	k Leonis	6	− 5	−75	4 52.0	+ 8 37 59	−0.8494	.5339	−.2123	+9.4121	.9850
27	ι Leonis	4	−17	−79	22 45.8	+ 1 57 10	−1.0402	.5336	−.2328	+9.2935	.9914
28	ξ Virginis	5	−23	−81	8 58.8	+11 50 25	−1.1282	.5343	−.2435	+9.1978	.9945
28	ν Virginis	4½	+78	−10	9 15.9	−11 53 03	+0.5765	.5365	−.2434	+9.1070	.9964
28	π Virginis	4½	−35	−83	16 24.8	− 4 58 01	−1.2653	.5351	−.2489	+9.1118	.9963
29	c Virginis	5	+30	−53	1 39.9	+ 3 59 01	−0.2176	.5380	−.2545	+8.8578	.9989
Nov. 2	β^1 Scorpii	2	+23	−51	3 17.5	+ 2 08 39	−0.1580	.5905	−.1792	−9.5213	.9746
2	β^2 Scorpii	5½	+22	−51	3 17.5	+ 2 08 42	−0.1615	.5905	−.1792	−9.5213	.9746
2	ω^1 Scorpii	4½	+65	− 9	3 48.5	+ 2 38 28	+0.6020	.5872	−.1792	−9.5396	.9722
2	ω^2 Scorpii	4½	+65	+ 1	4 02.0	+ 2 51 27	+0.7593	.5878	−.1769	−9.5436	.9717
2	ν^1 Scorpio	4	−21	−90	5 51.7	+ 4 36 47	−0.9324	.5942	−.1747	−9.5142	.9755
2	B.A.C. 5395	6	+69	+ 8	6 28.8	+ 5 12 21	+0.8772	.5880	−.1724	−9.5547	.9701
2	ψ Ophiuchi	5	−35	−90	10 32.9	+ 9 06 38	−1.1143	.5981	−.1630	−9.5274	.9739
2	ω Ophiuchi	5	+20	−51	13 36.4	−11 57 18	−0.1660	.5960	−.1557	−9.5573	.9697
3	39 Ophiuchi	5½	+51	−15	6 55.2	+ 4 38 43	+0.4721	.6010	−.1075	−9.6113	.9603
3	B.A.C. 5831	6	+38	−27	6 57.2	+ 4 40 41	+0.2551	.6022	−.1075	−9.6076	.9611
3	θ Ophiuchi	3½	+65	+21	8 23.6	+ 6 03 26	+1.0335	.5985	−.1047	−9.6235	.9578
3	b Ophiuchi	5	+26	−38	10 02.5	+ 7 38 15	+0.0617	.6039	−.0989	−9.6099	.9606
3	c^2 Ophiuchi	5	+ 6	−61	11 55.7	+ 9 26 44	−0.3106	.6063	−.0931	−9.6066	.9613
3	Venus		+64	+30	17 21.6	− 9 21 07	+1.1254	.5500	−.0744	−9.6382	.9545
3	4 Sagittarii	5	−51	−90	22 28.5	− 4 27 11	−1.1890	.6117	−.0632	−9.6059	.9614
3	7 Sagittarii	6	−22	−90	23 35.8	− 3 22 42	−0.7820	.6099	−.0601	−9.6139	.9598
3	9 Sagittarii	4½	−19	−90	23 58.5	− 3 01 00	−0.7230	.6099	−.0571	−9.6153	.9595
4	λ Sagittarii	4	+17	−41	8 53.1	+ 5 31 02	+0.0102	.6056	−.0295	−9.6340	.9555
4	B.A.C. 6369	6	− 9	−73	15 09.5	+11 31 39	−0.4650	.6068	−.0110	−9.6284	.9568
4	σ Sagittarii	2½	+64	+ 7	19 01.3	− 8 46 20	+0.8299	.5991	+.0122	−9.6490	.9519
5	ψ Sagittarii	5	+14	−44	2 39.7	− 1 27 00	−0.0505	.6013	+.0224	−9.6340	.9555
5	B.A.C. 6576	6	−50	−90	2 41.3	− 1 25 32	−1.1319	.6066	+.0224	−9.6164	.9593
5	χ^1 Sagittarii	5½	−17	−90	6 21.9	+ 2 05 57	−0.6619	.6022	+.0342	−9.6224	.9580
5	χ^3 Sagittarii	6	−55	−90	6 28.0	+ 2 11 47	−1.2061	.6047	+.0342	−9.6134	.9599
5	h^1 Sagittarii	6	+ 5	−57	10 27.6	+ 6 01 32	−0.2506	.5983	+.0459	−9.6265	.9572
5	h^2 Sagittarii	4½	+15	−46	10 42.7	+ 6 16 03	−0.0711	.5976	+.0459	−9.6292	.9566
6	17 Capricor.	6	−28	−90	14 12.1	+ 8 40 05	−0.9661	.5810	+.1198	−9.5743	.9671
6	B.A.C. 7197	6	+47	−20	15 04.5	+ 9 30 26	+0.3916	0.5760	+.1221	−9.5966	9.9632

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. North-ern.	Limiting Parallels. South-ern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. H	Y	p′	q′	Log sin D	Log cos D
			°	°	h. m.	h. m. s.					
Nov. 6	χ Capricor.	6	+25	−43	23 29.5	− 6 23 30	−0.0328	0.5700	+.1399	−9.5694	9.9678
6	27 Capricor.	6	− 5	−87	23 54.8	− 5 59 08	−0.6292	.5709	+.1420	−9.5571	.9698
7	φ Capricor.	6	+21	−50	2 29.3	− 3 30 18	−0.1409	.5677	+.1462	−9.5593	.9694
7	33 Capricor.	6	+65	− 7	6 07.5	− 0 00 08	+0.6266	.5612	+.1543	−9.5634	.9688
7	35 Capricor.	6	+68	+35	7 26.9	+ 1 16 25	+1.1995	.5585	+.1563	−9.5703	.9677
7	37 Capricor.	6	+64	− 8	10 45.6	+ 4 28 00	+0.6017	.5585	+.1620	−9.5490	.9709
7	ε Capricor.	4½	+37	−35	11 44.3	+ 5 24 34	+0.1261	.5592	+.1638	−9.5365	.9727
7	κ Capricor.	5	+27	−46	14 10.9	+ 7 45 57	−0.0757	.5569	+.1691	−9.5242	.9743
7	B.A.C. 7550	6	+68	0	14 25.3	+ 7 59 54	+0.7494	.5542	+.1691	−9.5399	.9722
7	29 Aquarii	6	+10	−69	23 02.2	− 7 41 14	−0.4350	.5502	+.1841	−9.4825	.9790
8	56 Aquarii	6	+14	−67	11 53.1	+ 4 43 48	−0.4093	.5398	+.2024	−9.4223	.9843
8	τ¹ Aquarii	6	+70	0	20 09.6	−11 15 50	+0.7729	.5314	+.2119	−9.4080	.9853
8	τ² Aquarii	4	+64	−16	21 04.3	−10 22 56	+0.4786	.5312	+.2129	−9.3947	.9862
8	74 Aquarii	6	−34	−90	22 57.6	− 8 33 10	−1.1934	.5333	+.2151	−9.3316	.9898
9	ψ² Aquarii	4½	−24	−90	10 57.9	+ 3 04 32	−1.1028	.5252	+.2259	−9.2390	.9934
9	ψ³ Aquarii	5	+10	−75	11 29.0	+ 3 34 42	−0.5315	.5246	+.2259	−9.2568	.9928
10	30 Piscium	5	+78	− 1	9 24.2	+ 0 50 18	+0.7625	.5124	+.2388	−9.0750	.9969
10	33 Piscium	5	+84	+ 4	11 09.8	+ 2 32 49	+0.8614	.5114	+.2394	−9.0556	.9972
11	33 Ceti	6	+66	−20	21 43.7	−11 52 46	+0.4069	.5054	+.2419	+8.4637	.9998
12	*f* Piscium	6	+45	−38	1 36.4	− 8 06 39	+0.0655	.5052	+.2411	+8.6955	.9995
12	μ Piscium	4½	−22	−85	8 12.0	− 1 42 16	−1.1223	.5044	+.2389	+8.9723	.9981
12	ν Piscium	5	+90	+15	14 16.2	+ 4 11 39	+1.0214	.5063	+.2363	+8.9174	.9985
13	ξ¹ Ceti	5	+90	+30	7 05.5	− 3 27 41	+1.1948	.5096	+.2265	+9.1521	.9956
13	ξ Arietis	5½	+84	− 5	13 19.5	+ 2 35 34	+0.6334	.5103	+.2219	+9.2372	.9934
13	31 Arietis	5½	+38	−41	19 29.8	+ 8 35 16	−0.6299	.5106	+.2168	+9.3110	.9907
13	38 Arietis	5½	+90	+ 9	23 52.8	−11 09 22	+0.8602	.5139	+.2122	+9.3116	.9907
15	ω² Tauri	5½	+53	−19	22 30.4	+10 04 08	+0.2003	.5294	+.1514	+9.5385	.9724
16	χ¹ Tauri	5½	−31	−68	2 24.3	−10 09 13	−1.1553	.5267	+.1447	+9.5726	.9673
16	τ Tauri	4½	− 6	−67	10 34.4	− 2 14 38	−0.8287	.5306	+.1306	+9.5859	.9651
16	103 Tauri	6	−12	−66	22 53.3	+ 9 40 32	−0.9179	.5348	+.1060	+9.6104	.9605
17	121 Tauri	6	+70	0	11 45.1	− 1 52 52	+0.4365	.5432	+.0817	+9.6082	.9610
17	132 Tauri	5½	+58	− 7	18 02.9	+ 4 12 26	+0.2640	.5446	+.0668	+9.6180	.9590
17	139 Tauri	5½	−24	−64	22 09.9	+ 8 11 14	−1.0505	.5400	+.0583	+9.6408	.9539
18	5 Geminor	6	+90	+32	4 27.8	− 9 43 28	+0.9241	.5490	+.0452	+9.6169	.9592
18	ε Geminor	3½	+71	+ 7	19 18.2	+ 4 37 02	+0.4302	.5489	+.0116	+9.6303	.9563
19	37 Geminor	6	+50	− 7	0 30.0	+ 9 38 20	+0.1467	.5479	+.0002	+9.6348	.9553
19	52 Geminor	6	+78	+11	9 21.9	− 5 47 44	+0.5228	.5494	−.0201	+9.6281	.9568
19	A Geminor	5½	+54	− 6	13 22.9	− 1 54 52	+0.2085	.5478	−.0292	+9.6312	.9561
19	c Geminor	6	−24	−64	22 48.4	+ 7 11 32	−1.0510	.5419	−.0493	+9.6437	.9532
19	κ Geminor	3½	+73	+ 5	23 00.0	+ 7 22 44	+0.4666	.5469	−.0515	+9.6217	.9582
20	ω¹ Cancri	6	−31	−64	6 32.6	− 9 19 55	−1.1303	.5406	−.0670	+9.6385	.9545
20	λ Cancri	6	+20	−44	15 38.1	− 0 32 40	−0.3882	.5419	−.0863	+9.6172	.9591
20	υ³ Cancri	6	−15	−66	20 43.9	+ 4 22 56	−0.9570	.5386	−.0968	+9.6188	.9588
21	ξ Cancri	5	−10	−68	14 30.6	− 2 25 32	−0.8888	.5347	−.1327	+9.5853	.9652
21	79 Cancri	6	−10	−68	14 58.7	− 1 58 23	−0.9001	.5343	−.1347	+9.5844	.9654
21	B.A.C. 3138	6	+22	−47	16 32.5	− 0 27 36	−0.3457	.5360	−.1366	+9.5714	.9675
22	η Leonis	3½	+60	−17	18 20.5	+ 0 30 35	+0.3045	.5315	−.1812	+9.4773	.9795
23	42 Leonis	6	+90	+13	1 24.9	+ 7 21 28	+0.8728	.5314	−.1919	+9.4328	.9835
23	B.A.C. 3506	6	+90	+12	4 49.5	+10 39 37	+0.8752	.5309	−.1962	+9.4153	.9848
23	*i* Leonis	6	+90	+ 5	6 28.7	−11 44 19	+0.7642	0.5301	−.1991	+9.4097	9.9852

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels.		Washington Mean Time of ☌.	At Washington Mean Time of ☌.					
			Northern.	Southern.		*H*	*Y*	*p'*	*q'*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Nov. 23	*k* Leonis	6	+ 1	−74	13 26.4	− 4 59 45	−0.7409	0.5256	−.2084	+9.4121	9.9850
24	ι Leonis	4	−11	−79	7 54.0	−11 06 41	−0.9462	.5243	−.2303	+9.2934	.9914
24	ξ Virginis	5	−16	−81	18 26.3	− 0 54 06	−1.0423	.5250	−.2395	+9.1975	.9945
24	ν Virginis	4½	+89	− 4	18 43.9	− 0 37 03	+0.6848	.5272	−.2394	+9.1070	.9964
24	A¹ Virginis	5½	−45	−81	19 44.7	+ 0 21 47	−1.3406	.5248	−.2403	+9.1971	.9946
25	π Virginis	4½	−27	−83	2 06.2	+ 6 31 25	−1.1866	.5260	−.2456	+9.1118	.9963
25	*c* Virginis	5	+34	−48	11 38.1	− 8 14 41	−0.1326	.5290	−.2510	+8.8570	.9989
26	65 Virginis	6	+83	− 8	17 36.8	− 3 13 52	+0.6452	.5404	−.2575	−8.8602	.9989
26	66 Virginis	6	+82	− 2	18 10.5	− 2 41 18	+0.7432	.5410	−.2575	−8.8849	.9987
26	*l*² Virginis	6	+85	+11	21 37.1	+ 0 38 27	+0.9665	.5421	−.2569	−8.9816	.9980
26	80 Virginis	6	+25	−59	23 15.4	+ 2 13 28	−0.3098	.5445	−.2565	−8.9089	.9985
27	94 Virginis	6	+25	−58	13 09.1	− 8 21 13	−0.2849	.5540	−.2501	−9.1536	.9956
27	95 Virginis	6	+44	−37	13 20.5	− 8 10 11	+0.0879	.5533	−.2501	−9.1752	.9951
27	κ Virginis	4½	+61	−21	16 03.4	− 5 32 54	+0.3859	.5553	−.2481	−9.2216	.9939
27	2 Libræ	6	+79	− 5	20 39.7	− 1 06 21	+0.6944	.5572	−.2449	−9.2822	.9919
28	ν¹ Libræ	5	+74	+14	14 57.4	− 7 28 33	+0.9849	.5719	−.2235	−9.4320	.9835
Dec. 1	9 Sagittarii	4½	−20	−90	10 05.8	+ 8 54 26	−0.7491	.6209	−.0590	−9.6153	.9595
2	B.A.C. 6369	6	−11	−76	0 46.6	− 1 03 14	−0.5023	.6193	−.0133	−9.6284	.9567
2	σ Sagittarii	2½	+64	+ 3	4 30.2	+ 2 30 35	+0.7709	.6116	−.0007	−9.6491	.9519
2	ψ Sagittarii	5	+11	−47	11 52.1	+ 9 33 20	−0.0984	.6133	+.0249	−9.6340	.9555
2	B.A.C. 6576	6	−52	−90	11 53.6	+ 9 34 45	−1.1623	.6187	+.0249	−9.6164	.9593
2	χ¹ Sagittarii	5½	−20	−90	15 26.1	−11 01 55	−0.7011	.6152	+.0344	−9.6224	.9580
2	χ³ Sagittarii	6	−59	−90	15 32.0	−10 56 17	−1.2365	.6179	+.0344	−9.6134	.9599
2	*h*¹ Sagittarii	6	+ 3	−60	19 22.7	− 7 15 27	−0.2976	.6250	+.0468	−9.6265	.9572
2	*h*² Sagittarii	4½	+12	−49	19 37.3	− 7 01 29	−0.1213	.6101	+.0468	−9.6292	.9566
3	B.A.C. 7049	6	−26	−90	15 34.8	− 7 53 48	−0.9107	.5990	+.1043	−9.5895	.9645
3	17 Capricor.	6	−31	−90	22 05.8	− 5 38 28	−1.0086	.5924	+.1223	−9.5742	.9671
3	B.A.C. 7197	6	+43	−23	22 56.3	− 4 50 01	+0.3261	.5856	+.1247	−9.5966	.9632
4	κ Capricor.	6	+23	−47	7 03.7	+ 2 58 23	−0.0915	.5797	+.1433	−9.5694	.9679
4	27 Capricor.	6	− 8	−90	7 28.5	+ 3 22 12	−0.6772	.5824	+.1436	−9.5571	.9698
4	φ Capricor.	6	+18	−53	9 57.4	+ 5 45 27	−0.1986	.5770	+.1498	−9.5592	.9694
4	33 Capricor.	6	+61	−11	13 28.3	+ 9 08 23	+0.5568	.5717	+.1563	−9.5634	.9688
4	35 Capricor.	6	+69	+27	14 45.1	+10 22 18	+1.1205	.5688	+.1583	−9.5701	.9677
4	37 Capricor.	6	+60	−12	17 57.5	−10 32 28	+0.5323	.5664	+.1662	−9.5490	.9709
4	ε Capricor.	4½	+34	−38	18 54.3	− 9 37 44	+0.0634	.5670	+.1680	−9.5365	.9727
4	κ Capricor.	5	+24	−49	21 16.4	− 7 20 35	−0.1354	.5661	+.1718	−9.5242	.9743
4	B.A.C. 7550	6	+69	− 4	21 30.4	− 7 07 24	+0.6776	.5635	+.1718	−9.5399	.9722
5	29 Aquarii	6	+ 6	−74	5 52.0	+ 0 56 13	−0.5044	.5578	+.1871	−9.4821	.9790
5	56 Aquarii	6	+11	−70	18 23.0	−10 58 49	−0.4639	.5468	+.2044	−9.4223	.9843
6	τ¹ Aquarii	6	+75	− 4	2 30.2	− 3 07 43	+0.7046	.5370	+.2138	−9.4080	.9853
6	τ² Aquarii	4	+60	−19	3 21.6	− 2 18 05	+0.4142	.5368	+.2149	−9.3947	.9862
6	74 Aquarii	6	−38	−90	5 12.8	− 0 30 31	−1.2382	.5385	+.2170	−9.3314	.9898
6	ψ² Aquarii	4½	−28	−90	17 00.0	+10 54 06	−1.1497	.5284	+.2275	−9.2390	.9934
6	ψ³ Aquarii	5	+ 8	−78	17 30.7	+11 23 47	−0.5834	.5278	+.2276	−9.2568	.9928
7	30 Piscium	5	+83	− 4	15 10.5	+ 8 24 02	+0.7058	.5129	+.2395	−9.0750	.9969
7	33 Piscium	5	+83	+ 1	16 55.3	+10 05 46	+0.8054	.5118	+.2401	−9.0555	.9972
9	33 Ceti	6	+63	−22	3 24.9	− 4 24 08	+0.3667	.5031	+.2412	+8.4637	.9998
9	*f* Piscium	6	+45	−38	7 18.3	− 0 37 20	+0.0714	.5029	+.2403	+8.6893	.9995
9	μ Piscium	4½	−24	−85	13 55.3	+ 5 48 26	−1.1566	.5016	+.2378	+8.9730	.9981
9	ν Piscium	5	+90	+13	20 01.2	+11 44 05	+0.9873	0.5035	+.2354	+8.9175	9.9985

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels. North-ern.	Limiting Parallels. South-ern.	Washington Mean Time of ☌.	At Washington Mean Time of ☌. *H*	*Y*	*p′*	*q′*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Dec. 10	ξ^1 Ceti	5	+90	+28	12 56.7	+ 4 10 55	+1.1679	0.5063	+.2252	+9.1520	9.9956
10	ξ Arietis	5½	+85	− 5	19 13.2	+10 16 43	+0.6476	.5071	+.2207	+9.2357	.9935
10	B. A. C. 755	6	+90	+11	20 15.3	+11 15 01	+0.9217	.5077	+.2200	+9.2339	.9935
11	31 Arietis	5½	+39	−41	1 26.2	− 7 40 56	−0.0485	.5077	+.2157	+9.3099	.9908
11	38 Arietis	5½	+90	+ 7	5 51.0	− 3 23 44	+0.8390	.5103	+.2121	+9.3117	.9907
12	Saturn		+90	+29	13 59.2	+ 3 47 36	+1.0887	.5275	+.1744	+9.4719	.9801
13	ω^1 Tauri	6	+90	+ 5	0 45.5	− 9 45 50	+0.6803	.5278	+.1581	+9.5174	.9751
13	ω^2 Tauri	5½	+53	−20	4 44.3	− 5 54 27	+0.1885	.5282	+.1517	+9.5385	.9724
13	τ Tauri	5	− 6	−67	16 50.1	+ 5 48 30	−0.8397	.5300	+.1311	+9.5859	.9651
15	132 Tauri	5½	+57	− 8	0 17.9	−11 45 03	+0.2548	.5458	+.0676	+9.6180	.9590
15	139 Tauri	5½	−25	−64	4 24.4	− 7 46 46	−1.0610	.5415	+.0589	+9.6408	.9539
16	ε Geminor	3½	+69	+ 6	1 29.0	−11 24 45	+0.4191	.5511	+.0117	+9.6303	.9563
16	A Geminor	5½	+53	− 7	19 30.3	+ 5 59 56	+0.1946	.5500	−.0292	+9.6313	.9561
17	κ Geminor	3½	+72	+ 4	5 06.0	− 8 43 50	+0.4525	.5499	−.0517	+9.6217	.9582
17	ω^1 Cancri	6	−33	−64	12 37.9	− 1 27 10	−1.1497	.5422	−.0672	+9.6385	.9545
17	λ Cancri	6	+19	−46	21 43.2	+ 7 19 54	−0.4082	.5431	−.0866	+9.6173	.9591
18	υ^2 Cancri	6	−12	−66	1 28.1	+10 57 15	−0.9110	.5401	−.0950	+9.6198	.9586
18	υ^3 Cancri	6	−17	−66	2 49.3	−11 44 13	−0.9804	.5396	−.0971	+9.6188	.9588
18	γ Cancri	4½	+90	+58	8 23.2	− 6 21 23	+1.2770	.5461	−.1093	+9.5734	.9672
18	ξ Cancri	5	−12	−68	20 39.5	+ 5 30 48	−0.9185	.5344	−.1326	+9.5853	.9652
18	79 Cancri	6	−12	−68	21 07.3	+ 5 57 44	−0.9290	.5339	−.1346	+9.5844	.9654
18	B.A.C. 3138	6	+21	−48	22 42.1	+ 7 29 29	−0.3731	.5357	−.1364	+9.5714	.9675
20	η Leonis	3½	+58	−19	0 45.5	+ 8 43 01	+0.2738	.5287	−.1800	+9.4774	.9795
20	42 Leonis	6	+90	+11	7 56.2	− 8 19 42	+0.8455	.5273	−.1915	+9.4326	.9835
20	B.A.C. 3579	6	+90	+10	11 24.3	− 4 58 05	+0.8470	.5264	−.1955	+9.4153	.9848
20	*i* Leonis	6	+90	+ 3	13 05.2	− 3 20 14	+0.7348	.5255	−.1983	+9.4097	.9852
20	*k* Leonis	6	− 1	−75	20 11.4	+ 3 32 49	−0.7889	.5204	−.2070	+9.4120	.9850
21	ι Leonis	4	−14	−79	15 04.7	− 2 08 23	−1.0014	.5172	−.2273	+9.2934	.9914
22	ξ Virginis	5	−20	−81	1 54.9	+ 8 22 05	−1.1018	.5170	−.2364	+9.1975	.9945
22	ν Virginis	4½	+85	− 6	2 13.0	+ 8 39 40	+0.6497	.5192	−.2364	+9.1070	.9964
22	π Virginis	4½	−33	−83	9 48.9	− 7 58 14	−1.2500	.5174	−.2411	+9.1114	.9964
22	c Virginis	5	+32	−51	19 39.6	+ 1 34 34	−0.1816	.5198	−.2467	+8.8570	.9989
24	65 Virginis	6	+80	−10	2 42.9	+ 7 40 07	+0.6089	.5295	−.2523	−8.8602	.9989
24	66 Virginis	6	+86	− 4	3 17.7	+ 8 13 53	+0.7089	.5301	−.2523	−8.8843	.9987
24	l^2 Virginis	6	+85	+ 9	6 52.1	+11 41 23	+0.9365	.5322	−.2517	−8.9816	.9980
24	80 Virginis	6	+22	−63	8 34.0	−10 39 58	−0.3606	.5335	−.2513	−8.9089	.9986
24	94 Virginis	6	+23	−61	22 58.2	+ 3 16 00	−0.3317	.5436	−.2450	−9.1536	.9956
24	95 Virginis	6	+42	−49	23 10.0	+ 3 27 25	+0.0472	.5430	−.2450	−9.1752	.9951
25	κ Virginis	4½	+59	−23	1 58.9	+ 6 10 39	+0.3502	.5449	−.2432	−9.2217	.9939
25	2 Libræ	6	+78	− 6	6 44.7	+10 46 47	+0.6651	.5466	−.2401	−9.2822	.9919
25	μ Libræ	6	+65	−16	18 12.1	− 2 09 42	+0.4794	.5573	−.2289	−9.3692	.9878
26	ν^1 Libræ	5	+74	+12	1 37.5	+ 4 59 42	+0.9594	.5617	−.2203	−9.4319	.9835
26	o^1 Libræ	6	−22	−90	7 42.4	+10 51 18	−1.0198	.5725	−.2117	−9.4135	.9849
26	ζ^1 Libræ	4	+10	−71	10 41.7	−10 16 07	−0.4639	.5740	−.2071	−9.4456	.9824
26	ζ^3 Libræ	6	− 7	−90	11 41.7	− 9 18 20	−0.7668	.5758	−.2055	−9.4431	.9826
26	ζ^4 Libræ	6	− 4	−90	12 37.1	− 8 25 03	−0.7089	.5769	−.2038	−9.4495	.9821
26	41 Libræ	6	+71	+39	15 00.9	− 6 06 41	+1.2520	.5738	−.1987	−9.5086	.9761
26	λ Libræ	6	+70	+17	20 50.1	− 0 30 52	+1.0205	.5785	−.1894	−9.5283	.9738
27	β^1 Scorpii	2	+21	−52	1 39.2	+ 4 06 55	−0.1866	.5876	−.1795	−9.5213	.9746
27	β^2 Scorpii	5½	+21	−53	1 39.3	+ 4 07 04	−0.1901	0.5876	−.1795	−9.5213	9.9746

For facilitating the Calculation of Occultations of Planets and Stars by the Moon, *for the Year* 1853.

1853.	Star's Name.	Mag.	Limiting Parallels.		Washington Mean Time of ☌.	At Washington Mean Time of ☌.					
			Northern.	Southern.		*H*	*Y*	*p'*	*q'*	Log sin *D*	Log cos *D*
			°	°	h. m.	h. m. s.					
Dec. 27	ω¹ Scorpii	4½	+63	−10	2 10.5	+ 4 37 02	+0.5754	0.5861	−.1774	−9.5396	9.9722
27	ω² Scorpii	4½	+69	− 1	2 24.1	+ 4 50 05	+0.7331	.5855	−.1774	−9.5436	.9717
27	ν Scorpii	4	−23	−90	4 14.3	+ 6 35 55	−0.9616	.5939	−.1732	−9.5143	.9755
27	B.A.C. 5395	6	+69	+ 6	4 51.6	+ 7 11 40	+0.8513	.5863	−.1731	−9.5548	.9701
27	ψ Ophiuchi	5	−38	−90	8 56.0	+11 06 20	−1.1445	.5995	−.1618	−9.5274	.9739
27	ω Ophiuchi	5	+18	−53	11 59.2	− 9 57 57	−0.1958	.5984	−.1547	−9.5573	.9697
31	B.A.C. 7049	6	−22	−90	2 13.9	+ 0 33 27	−0.8515	.6081	+.1077	−9.5896	.9645
31	17 Capricor.	6	−26	−90	8 33.5	+ 6 37 24	−0.9421	.6034	+.1240	−9.5743	.9671
31	B.A.C. 7197	6	+46	−20	9 22.5	+ 7 24 23	+0.3707	.5966	+.1266	−9.5965	.9632
31	χ Capricor.	6	+26	−43	17 14.8	− 9 02 20	−0.0296	.5907	+.1463	−9.5694	.9679
31	27 Capricor.	6	− 4	−85	17 38.5	− 8 39 37	−0.6077	.5935	+.1464	−9.5571	.9698
31	φ Ophiuchi	6	+21	−49	20 03.0	− 6 20 49	−0.1326	.5880	+.1533	−9.5594	.9694
31	33 Capricor.	6	+64	− 8	23 27.1	− 3 04 47	+0.6145	.5824	+.1600	−9.5634	.9688
32	35 Capricor.	6	+68	+32	0 32.3	− 2 02 24	+1.1708	0.5794	+.1621	−9.5703	9.9677

NOTES.

B. A. C.—British Association Catalogue.

Rumk.—Rumker's Catalogue.

PREDICTION OF OCCULTATIONS.

In the prediction of an occultation for a particular place, the principal objects of determination are, the instant of *immersion*, or of the star's disappearance behind the moon's limb; of *emersion*, or of the star's re-appearance; and the points on the moon's border where these appearances take place.

The calculations, according to the method of the late Professor Bessel, are greatly facilitated by means of the elements given in the preceding list. Those who may wish to consult Prof. Bessel's original paper on this subject, will find it in Schumacher's *Astronomische Nachrichten*, Vol. VII., page 1; also in the *Berliner Astronomisches Jahrbuch* for 1831, page 257. The process of computation is shown by the following equations:

d = Longitude from Washington, of the place, + West, − East.

φ = Geographical North Latitude of the place.

φ' = Geocentric North Latitude of the place.

r = Earth's radius at the place, or the distance of the observer's position from the earth's centre.

It is unnecessary to calculate φ' and r separately, as we have

$$r \sin\varphi' = \frac{(1-e^2)\sin\varphi}{\sqrt{(1-e^2\sin^2\varphi)}} \qquad r\cos\varphi' = \frac{\cos\varphi}{\sqrt{(1-e^2\sin^2\varphi)}}$$

in which e denotes the eccentricity of the earth's meridians.

The logarithms of $\dfrac{1-e^2}{\sqrt{(1-e^2\sin^2\varphi)}} = \log A$, and of $\dfrac{1}{\sqrt{(1-e^2\sin^2\varphi)}} = \log B$, derived from $e = {\cdot}081697$, according to the latest determination of Prof. Bessel, may be taken from the following table, where the geographical latitude of the place is the argument.

ϕ	Log A	Log B
0	9.9971	0.0000
10	9.9971	0.0000
20	9.9973	0.0002
30	9.9975	0.0004
40	9.9977	0.0006
50	9.9979	0.0009
60	9.9982	0.0011
70	9.9984	0.0013

$$r \sin \phi' = A \sin \phi$$
$$r \cos \phi' = B \cos \phi$$

$$a = r \cos \phi' \sin(h - d)$$
$$b = r \cos \phi' \cos(h - d)$$

$$\log \lambda = 9{\cdot}4192$$

$$u = a \qquad u' = b\lambda$$
$$v = r \sin \phi' \cos D - b \sin D \qquad v' = a\lambda \sin D$$

$$m \sin M = p - u \qquad n \sin N = p' - u'$$
$$m \cos M = q - v \qquad n \cos N = q' - v$$

$$\log k = 9{\cdot}4350$$

$$\cos \psi = \frac{m \sin(M - N)}{k}$$
$$Q = 270^\circ - N \mp \psi$$
$$t = -\frac{m}{n} \cos(M - N) \mp \frac{k \sin \psi}{n}$$

Upper signs for Immersion; under signs for Emersion.

$$c \sin C = u + t u'$$
$$c \cos C = v + t v$$
$$V = Q + C$$

Mean Solar Time of the Star's apparent contact with the moon's limb:

$$= T - d + t$$

Angle from *North Point* $= Q$

Angle from *Vertex* $= V$

The angle ψ is to be taken out positive and less than 180°. If $\log m \sin(M - N)$ be greater than $\log k$, $\cos \psi$ will evidently be greater than 1, or impossible, and there will be no occultation, except in some rare instances where the moon's limb passes very close to the star, when log cos ψ will result very near 0. In these cases, a re-calculation should be made according to the method which follows, using

$$t = -\frac{m}{n}\cos(M-N),$$

which may give log $m\sin(M-N)$ less than log k, when the star will be occulted. On the other hand, it may happen that in these cases of very near approach, a first determination may give a cos ψ less than 1, which a re-calculation will show to impossible. The angle ψ is then to be considered $= 0°$ when $m\sin(M-N)$ is positive, and we shall have $Q = 270°-N$. When $m\sin(M-N)$ is negative, $\psi = 180°$, or $Q = 270°-N+180°$. We shall also have, at the time of nearest approach,

$$\text{star's distance from moon's limb} = 57' \times \left(m\sin(M-N)-{\cdot}2725\right)\text{, nearly,}$$

the error in this computed distance increasing *with* the distance.

By *Angle from North Point*, is to be understood the arc included between the star when in contact, and the point where the limb is intersected by an arc of a great circle passing from the moon's centre to the North Pole; and by *Angle from Vertex*, the arc between the star at contact, and the point where the limb is intersected by an arc of a great circle passing from the moon's centre to the zenith. These angles are reckoned from the North point and from the vertex, towards the right hand round the circumference of the moon's disc, as seen with an inverting telescope. For *direct* vision, add 180° to the angles given by the equations.

The results obtained by the above equations are only approximate, yet the computed times of immersion and emersion will usually be within one or two minutes of the truth. The error generally increases with the star's distance from the apparent path of the moon's centre, and may, in some cases, amount to several minutes. For an immersion this error is not of much consequence; but for an emersion, especially of a small star, the time should be determined with greater precision. For this purpose, u' and v' must be computed with

$$h' - d = h - d + \tfrac{1}{2}\mu$$

μ being the symbol by which we express the sidereal equivalent of t in these equations.

$$u' = r\cos\phi'\lambda\cos(h'-d)$$
$$v' = r\cos\phi'\lambda\sin(h'-d)\sin D.$$

Then with these values of u' and v', recompute N, n, ψ, and t, by means of

$$n\sin N = p' - u'$$
$$n\cos N = q' - v'$$
$$\cos\psi = \frac{m\sin(M-N)}{k}$$
$$t = -\frac{m}{n}\cos(M-N) \mp \frac{k\sin\psi}{n}$$

using the M and m obtained by the first computation, and we shall have the time of contact $T - d + t$, generally within a few seconds of the truth.

As a check on the accuracy of the work, we might compute

$$u = r \cos \phi' \sin (h - d + \mu)$$

$$v = r \cos \phi' \cos D - r \cos \phi' \cos (h - d + \mu)$$

and we should have

$$(p + tp' - u)^2 + (q + tq' - v)^2 = k^2 = 0.0741.$$

But if $m \sin M$, $m \cos M$, $\log n \sin N$, and $\log n \cos N$, have been correctly computed, we shall have the following shorter and more convenient check on the subsequent calculations for the time of contact:

$$(m \sin M + t n \sin N)^2 + (m \cos M + t n \cos N)^2 = k^2 = 0.0741.$$

The elements of computation, published in our general list, are given for the instant of the moon's true conjunction with the star in right ascension. It is desirable, however, in computing an occultation for a particular place, to assume a time for the calculation near to the time of the nearest approach of the moon's centre to the star, as seen at that place, and to reduce the elements to this assumed time. This time, for which the nearest tenth of an hour will be sufficiently accurate, will not differ greatly from the time of *apparent* conjunction, as affected by parallax, which may be determined approximately by the following equations. Let $T - d$ be the time of apparent conjunction; then

$$(t) = \frac{\sin (H - d)}{p' \sec \phi - [9.4027] \cos (H - d)}$$

$$T - d = \text{time of true} ☌ - d + (t).$$

The elements corresponding to the time $T - d$ may then be obtained as follows:

$$h - d = H - d + (\mu)$$

$$p = (t)\, p'$$

$$q = Y + (t)\, q'$$

Where occultations are to be generally observed, as at astronomical stations, either temporary or permanent, the observer will find an advantage in looking over the list and selecting, beforehand, all those which may be visible at his station, by observing if his latitude be included between the *limiting parallels* for any given occultation, if the time $(T - d)$ be favourable as regards the absence of daylight, and if the star's hour-angle $(h - d)$ be not greater than its semidiurnal arc for the given latitude.

For obtaining the time

$$T - d = \sigma - d + (t),$$

it will be well to tabulate the values of

$$(t) = \frac{\sin\,(H - d)}{p' \sec\,\phi - [9.4027]\cos\,(H - d)}$$

for every half hour of $(H - d)$ as far as the greatest semidiurnal arc computed for the latitude of the station with a declination of 30°; and for all values of p', using two decimal figures, from 0.50 to 0.60.

It will also be found advantageous to have tabulated values of

$$u = r\cos\,\phi' \sin\,(h - d)$$
$$u' = r\cos\,\phi' \lambda \cos\,(h - d)$$

which should be given for every minute (in time) of $(h - d)$, from 0^h to 6^h. If $(h - d)$ exceeds 6^h, the argument will be $12^h - (h - d)$ instead of $(h - d)$. It will be seen by the equations that u will have the same sign as $\sin\,(h - d)$, and that u' will have the same sign as $\cos\,(h - d)$.

In the equation

$$v = r\sin\,\phi' \cos\,D - b\sin\,D$$

the term $r\sin\,\phi' \cos\,D$ may be tabulated for every tenth minute of declination, from 0° to 30°.

The practical application of the preceding formulæ will be seen by the following calculations for an occultation of the star h^1 Sagittarii, March 31st, 1853, as it will appear at San Diego, California; in north latitude $32°\,45' = \phi$, and west longitude from Washington $2^h\,40^m\,29^s = d$. The data for the computation are given on page 9, and, with the latitude and longitude of the place, are as follows:—

March 31st, 1853. h^1 Sagittarii.

ϕ	+ 32° 45′	H	+ 1 03 12	p'	+ 0.5800
	h. m.		h. m. s.		
d	+ 2 40.5	d	+ 2 40 29	q'	− 0.0395
σ	19 51.1	$H - d$	− 1 37 17	log sin D	− 9.6265
$\sigma - d$	17 10.6	Y	+ 0.7558	log cos D	+ 9.9571

Calculation of the time $T - d$, and reduction of the elements of computation.

	log p'	+ 9.763		(t)	− 0.9 h.
	log sec ϕ	+ 0.075	(Reduced to hours and minutes)	(t)	− 0 54 0 (h. m. s.)
log p' sec ϕ =	log (1)	+ 9.838	Sid. equiv. for (t)	(μ)	− 0 54 9
	log const	9.403		$H - d$	− 1 37 17
	log cos $(H - d)$	+ 9.960	$H - d + (\mu) =$	$h - d$	− 2 31 26
log [9.403] cos $(H - d)$ =	log (2)	+ 9.363		$\sigma - d$	17 10.6
	(2)	+ .231	$\sigma - d + (t) =$	$T - d$	16 16.6
	(1)	+ .689	$(t)p' = -0.9 \times 0.5800 =$	p	− 0.5220
(1) − (2) =	(3)	+ .458	$-0.9 \times 0.0395 =$	$(t)q'$	− 0.0355
	log (3)	+ 9.661		Y	+ 0.7558
	log sin $(H - d)$	− 9.615	$Y + (t)q'$	q	+ 0.7203
log $\frac{\sin\,(H - d)}{(3)}$ =	log (t)	− 9.954			

Calculation of the Times of Immersion and Emersion, etc.

(Table, page 28, Arg. ϕ)	$\log A$	9.9976
	$\log \sin \phi$	+9.7332
$\log A \sin \phi =$	$\log r \sin \phi'$	+9.7308
	$\log \cos D$	+9.9571
	$\log r \sin \phi' \cos D$	+9.6879
(Table, page 28, Arg. ϕ)	$\log B$	0.0005
	$\log \cos \phi$	+9.9248
$\log B \cos \phi =$	$\log r \cos \phi'$	+9.9253
	$\log \sin (h-d)$	−9.7879
$\log r \cos \phi' \sin (h-d) =$	$\log u = \log a$	−9.7132
	$\log \cos (h-d)$	+9.8974
$\log r \cos \phi' \cos (h-d) =$	$\log b$	+9.8227
	$\log \lambda$	9.4192
	$\log a\lambda$	−9.1324
	$\log \sin D$	−9.6265
	$\log b \sin D$	−9.4492
$\log a\lambda \sin D =$	$\log v'$	+8.7589
$\log b\lambda =$	$\log u$	+9.2419
	$\log m \sin M$	−7.7324
	$\log m \cos M$	−8.6848
	$\log \tan M$	+9.0476
	$\log \cos M$	−9.9973
	$\log m$	+8.6875
	$\log n \sin N$	+9.6079
	$\log n \cos N$	−8.2529
	$\log \tan N$	−1.3550
	$\log \sin N$	+9.9996
	$\log n$	+9.6083
	$-\log \frac{m}{n}$	−9.0792
	$\log \cos (M-N)$	−8.8251
	$\log \sin (M-N)$	+9.9990
	$\log k$	9.4350
	$\log \frac{m}{k}$	+9.2525
$\log \frac{m}{k} \sin (M-N) =$	$\log \cos \psi$	+9.2515
	$\log \sin \psi$	+9.9930
	$\log k \sin \psi$	+9.4280
$\log \frac{k \sin \psi}{n} =$	$\log (1)$	+9.8197
$-\log \frac{m}{n} \cos (M-N) =$	$\log (2)$	+7.9043

	$r \sin \phi' \cos D$	+ .4874
	$b \sin D$	− .2813
$r \sin \phi' \cos D - b \sin D =$	v	+ .7687
	q	+ .7203
$q - v =$	$m \cos M$	− .0484
	p	− .5220
$a =$	u	− .5166
$p - u =$	$m \sin M$	− .0054
	q'	+ .0395
	v'	+ .0574
$q' - v' =$	$n \cos N$	− .0179
	p'	+ .5800
	u'	+ .1746
$p' - u' =$	$n \sin N$	+ .4054
	M	186° 22′
	N	92 32
	$M - N$	93 50
	$270° - N$	177 28
	ψ	79 43
For Immersion, $270° - N - \psi =$	Q	97 45
	(2)	+ .0080
	(1)	+ .6603
For Immersion, (2) − (1) =	t_1	− .6523
For Emersion, (2) + (1) =	t_2	+ .6683
	$\log t_1$	−9.8144
	$\log u'$	+9.2419
	$\log t_1 u'$	−9.0563
	$\log v'$	+8.7589
	$\log t_1 v'$	−8.5733
	$t_1 v'$	− .0374
$v + t_1 v' =$	$c \cos C$	+ .7313
	$t_1 u'$	− .1139
$u + t_1 u' =$	$c \sin C$	− .6305
	$\log c \sin C$	−9.7996
	$\log c \cos C$	+9.8641
	$\log \tan C$	−9.9355

	$T - d$	16h 16.6m
(Reduced to hours and minutes)	t_1	− 0 39.1
IMMERSION: *San Diego Mean Time* - - - - - - - - - - - -	$T - d + t_1$	15 37.5
	C	− 40° 46′
Immersion *Angle from North Point* = - - - - - - - - - - - -	Q	97 45
Immersion *Angle from Vertex* = $Q + C$ = - - - - - - - - - -	V	56 59
	t_2	+ 0h 40.1m
EMERSION: *San Diego Mean Time* - - - - - - - - - - - -	$T - d + t_2$	16 56.7

Calculation of a more accurate Time, etc., of Emersion.

	$\log\cos(h'-d)$	$+9.9244$		$h-d$	$-$	2h 31m 26s
	$\log r\cos\phi'$	$+9.9253$	Sid. equiv. for $\frac{1}{2}\,t_2 =$	$\frac{1}{2}\mu$	$+$	0 20 06
	$\log\lambda$	9.4192	$h-d+\frac{1}{2}\,\mu=$	$h'-d$	$-$	2 11 20
$\log r\cos\phi'\lambda\cos(h'-d) =$	$\log u'$	$+9.2689$		q'	$+$	.0395
	$\log\sin(h'-d)$	-9.7342		v'	$+$	.0507
	$\log r\cos\phi'\lambda$	$+9.3445$	$q'-v'=$	$n\cos N$	$-$	.0112
	$\log\sin D$	-9.6265		p'	$+$	.5800
$\log r\cos\phi'\lambda\sin(h'-d)\sin D =$	$\log v'$	$+8.7052$		u'	$+$	.1858
	$\log n\sin N$	$+9.5957$	$p'-u'=$	$n\sin N$	$+$	.3942
	$\log n\cos N$	-8.0492		$\log t$	$+$	9.8386
	$\log\tan N$	-1.5465		$\log n\sin N$	$+$	9.5957
	$\log\sin N$	$+9.9998$		$\log tn\sin N$	$+$	9.4343
	$\log n$	$+9.5959$		$\log n\cos N$	$-$	8.0492
(From first determination)	$\log m$	$+8.6875$		$\log tn\cos N$	$-$	7.8878
	$-\log\frac{m}{n}$	-9.0916		$tn\cos N$	$-$	.0077
	$\log\cos(M-N)$	-8.9166	(From first determination)	$m\cos M$	$-$	.0484
	$\log\sin(M-N)$	$+9.9985$	$m\cos M+tn\cos N=$	(3)		.0561
(From first determination)	$\log\frac{m}{k}$	$+9.2525$		$tn\sin N$	$+$	.2718
$\log\frac{m}{k}\sin(M-N)=$	$\log\cos\psi$	$+9.2510$	(From first determination)	$m\sin M$	$-$	.0054
	$\log\sin\psi$	$+9.9930$	$m\sin M+tn\sin N=$	(4)		.2664
	$\log k$	9.4350		$(4)^2$		.0710
	$\log k\sin\psi$	$+9.4280$		$(3)^2$		.0031
$\log\frac{k\sin\psi}{n} =$	$\log(1)$	$+9.8321$	$(4)^2+(3)^2=k^2=0.0741$	Check		.0741
$-\log\frac{m}{n}\cos(M-N)=$	$\log(2)$	$+8.0082$		$\log u'$	$+$	9.2689
	(2)	$+\ .0102$		$\log tu'$	$+$	9.1075
	(1)	$+\ .6794$		$\log v'$	$+$	8.7052
(2) + (1)	t	$+\ .6896$		$\log tv'$	$+$	8.5438
		° ′		tv'	$+$	.0350
(From first determination)	M	186 22	(From first determination)	v	$+$	.7687
	N	91 38	$v+tv'=$	$c\cos C$	$+$	.8037
	$M-N$	94 44		tu'	$+$	.1280
	$270°-N$	178 22	(From first determination)	u	$-$	.5166
	ψ	79 44	$u+tu'$	$c\sin C$	$-$	.3886
For Emersion $270°-N+\psi=$	Q	258 06		$\log c\sin C$	$-$	9.5894
				$\log c\cos C$	$+$	9.9051
				$\log\tan C$	$-$	9.6843

	$T-d$		16h 16.6m
(Reduced to hours and minutes)	t	$+$	0 41.4
EMERSION: *San Diego Mean Time* - - - - - - - - - -	$T-d+t$		16 58.0
	C	$-$	25° 48
Emersion *Angle from North Point* - - - - - - - - - -	Q		258 06
Emersion *Angle from Vertex* $= Q + C =$ - - - - - - - - - -	V		232 18

Visible at Washington, D. C., during the Year 1853.

1853.	Star's Name.	Magnitude.	IMMERSION. Washington Sidereal Time.	IMMERSION. Washington Mean Time.	IMMERSION. Angle from N. Point.	IMMERSION. Angle from Vertex.	EMERSION. Washington Sidereal Time.	EMERSION. Washington Mean Time.	EMERSION. Angle from N. Point.	EMERSION. Angle from Vertex.
			h. m.	h. m.			h. m.	h. m.		
January 4	o^1 Libræ	6	13 11	18 11	90°	63°	14 16	19 16	208°	194°
5	ν Scorpii*	4	10 24	15 20	338	287	Star 1′.6 north of ☽'s limb.			
30	94 Virginis	6	11 54	15 12	26	357	13 02	16 20	266	251
Febr'y 3	4 Sagittarii	5	14 10	17 12	165	124	Star 3′.3 south of ☽'s limb.			
3	7 Sagittarii	6	15 17	18 19	85	55	16 34	19 36	247	230
13	ξ^1 Ceti	5	4 59	7 23	150	194	6 05	8 29	265	315
20	μ^1 Cancri	6	2 34	4 31	113	57	3 32	5 29	249	192
28	ζ^4 Libræ*	6	9 03	10 28	32	341	9 47	11 11	280	230
March 3	B. A. C. 6369	6	15 20	16 31	69	32	16 35	17 46	273	248
6	ε Capricor.*	5	15 20	16 20	42	352	15 53	16 53	335	285
16	ι Tauri	4½	4 01	4 23	72	42	5 17	5 39	326	340
16	105 Tauri	6	8 09	8 31	7	62	Star 1′.2 north of ☽'s limb.			
16	n Tauri*	6	13 14	13 36	97	139	14 04	14 25	271	311
17	1 Geminor.	5	10 39	10 56	257	314	Star 1′.7 north of ☽'s limb.			
17	3 Geminor.	6	13 12	13 29	357	44	Star 4′.8 north of ☽'s limb.			
20	γ Cancri	4½	6 26	6 32	91	40	7 49	7 55	247	119
29	b Ophiuchi	5	17 03	16 32	3	0	17 27	16 57	328	330
30	λ Sagittarii	4	16 34	15 59	24	2	17 18	16 43	318	305
April 24	β^1 Scorpii*	2	20 56	18 43	117	166	21 41	19 28	220	270
24	β^2 Scorpii*	5½	20 56	18 43	118	167	21 41	19 28	219	269
May 1	τ^2 Aquarii*	5½	16 26	13 46	147	97	17 12	14 31	245	230
12	48 Geminor.	6	10 20	6 57	47	105	11 22	7 59	292	350
17	ν Virginis	4½	16 53	13 10	109	161	17 32	13 49	197	249
22	ω Ophiuchi	5	19 26	15 23	104	139	20 27	16 23	235	278
23	b Ophiuchi	5	13 55	9 48	37	359	14 51	10 44	285	255
24	λ Sagittarii	4	12 22	8 12	28	338	12 57	8 47	309	259
25	h^1 Sagittarii*	6	13 55	9 41	166	116	14 05	9 50	185	136
25	h^2 Sagittarii*	4½	13 50	9 36	110	60	14 44	10 30	241	194
26	B. A. C. 7197	6	18 48	14 28	96	73	20 11	15 51	292	286
27	B. A. C. 7550	6	17 43	13 20	68	27	18 43	14 20	320	286
June 8	ω Geminor.	6	13 55	8 46	172	221	Star 1′.7 south of ☽'s limb.			
12	B. A. C. 3579	6	11 59	6 35	48	86	13 15	7 50	250	299
12	i Leonis	6	14 05	8 40	107	160	14 51	9 26	195	249
21	ψ Sagittarii	5	19 31	13 29	88	94	20 48	14 47	284	305
23	33 Capricor.	6	21 47	15 38	66	73	22 39	16 30	344	2
July 16	ω Ophiuchi	5	18 59	11 19	166	201	Star 2′.5 south of ☽'s limb.			
19	h^2 Sagittarii†	4½	14 04	6 14	113	63	14 58	7 07	239	193
21	B. A. C. 7550*	6	16 24	8 25	27	337	16 41	8 42	356	307
22	τ^1 Aquarii	6	21 50	13 46	90	78	23 00	14 56	334	338
22	τ^2 Aquarii	5½	23 14	15 11	125	133	0 39	16 36	301	327
30	ι Tauri†	4½	21 01	12 26	76	33	21 45	13 10	317	269
August 9	65 Virginis	6	15 34	6 20	65	98	16 46	7 32	231	274
9	66 Virginis	6	16 37	7 24	67	108	17 45	8 32	235	283
12	ω^1 Scorpii	4½	17 04	7 38	338	0	Star 1′.4 north of ☽'s limb.			
13	39 Ophiuchi*	5½	22 25	12 55	357	46	Star 3′.9 north of ☽'s limb.			
13	B. A. C. 5831*	6	22 00	12 30	58	106	22 53	13 22	296	346
15	ψ Sagittarii	5	17 39	8 01	178	160	Star 2′.9 south of ☽'s limb.			
17	ε Capricor.*	5	3 38	17 51	51	101	4 03	18 17	352	42
20	30 Piscium }	5	20 25	10 27	134	92	21 39	11 41	286	255
22	ν Piscium	5	0 59	14 52	77	64	1 53	15 47	358	4

Visible at Washington, D. C., during the Year 1853.

1853.		Star's Name.	Magnitude.	IMMERSION.				EMERSION.			
				Washington Sidereal Time.	Washington Mean Time.	Angle from N. Point.	Angle from Vertex.	Washington Sidereal Time.	Washington Mean Time.	Angle from N. Point.	Angle from Vertex.
				h. m.	*h. m.*			*h. m.*	*h. m.*		
Aug.	23	B. A. C. 755	6	0 37	14 27	128°	94°	2 03	15 53	303°	297°
Sept.	13	χ Capricor.	6	0 49	13 16	153	195	1 38	14 05	254	300
	15	τ^1 Aquarii	6	18 14	6 35	88	43	19 20	7 40	312	273
	15	τ^2 Aquarii	4	19 41	8 01	150	114	20 45	9 05	261	235
	20	38 Arietis†	5½	19 49	7 50	164	115	20 24	8 25	245	194
	24	5 Geminor.	6	0 23	12 08	100	45	1 27	13 11	288	230
	25	52 Geminor.	6	6 11	17 51	103	67	7 42	19 21	249	276
Oct.	10	B. A. C. 7197	6	23 12	9 54	130	160	0 20	11 02	275	316
	11	B. A. C. 7550	6	22 06	8 44	83	89	23 13	9 50	333	354
	16	ν Piscium	5	19 32	5 50	99	48	20 29	6 47	317	266
	17	B. A. C. 755†	6	19 34	5 48	123	74	20 29	6 43	288	237
	19	ω^1 Tauri	6	23 49	9 55	115	60	1 01	11 07	300	247
	19	ω^2 Tauri	5½	5 49	15 54	127	170	7 09	17 14	266	320
	22	ε Geminor	3½	0 57	10 51	150	94	1 38	11 32	232	175
	22	37 Geminor	6	7 55	17 48	139	83	8 46	18 39	209	163
	23	κ Geminor	3½	4 51	14 40	69	11	6 15	16 04	288	242
Nov.	2	ω^2 Scorpii	4½	19 27	4 39	112	151	20 21	5 33	221	265
	3	39 Ophiuchi*	5½	22 52	7 59	150	200	23 17	8 24	205	255
	7	33 Capricor.	6	21 06	5 57	167	165	21 55	6 47	241	249
	7	37 Capricor.*	6	2 52	11 43	61	111	3 26	12 17	345	35
	10	30 Piscium	5	0 25	9 05	96	104	1 34	10 14	340	6
	13	ξ^1 Ceti	5	20 40	5 08	57	5	21 09	5 37	0	309
	17	121 Tauri	6	1 55	10 07	106	48	3 15	11 26	293	239
	17	132 Tauri	5½	10 56	19 07	135	191	11 38	19 49	221	275
	19	52 Geminor†	6	23 34	7 38	120	75	0 23	8 27	252	201
	19	A Geminor	5½	3 43	11 46	113	53	5 02	13 05	255	200
	22	η Leonis	3½	10 01	17 51	104	105	11 02	18 52	195	224
	24	ν Virginis	4½	10 33	18 16	5	343	11 27	19 10	283	279
Dec.	2	σ Sagittarii	2½	21 44	4 57	98	132	22 51	6 04	279	322
	11	38 Arietis	5½	21 19	3 55	125	73	22 21	4 56	292	240
	25	μ Libræ	6	10 53	16 34	60	17	12 02	17 42	235	202

* Whole occultation below the horizon of Washington.

† Immersion below the horizon of Washington.

‡ Emersion below the horizon of Washington.

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