

about 30° above the horizon. It was of the form of a darting flame, parallel to the earth's surface from east to west. The head was of dazzling whiteness, the middle bright yellow, and the tail violet. It ended in a train of brilliant sparks of about 2° in length, and was visible about two minutes. The whole sky was of a rosy colour, and particularly in the east. The same tinge was visible in the evening at half-past seven.

A SCIENTIFIC sanitary question has arisen in India. On the ground of necessity, public offices have been supplied with anti-thermic arrangements; but the economical fit, still strong, has led to a government decree that it cannot afford such provision, and that kuskus windows and their essentials must be provided at the expense of the officials. This will afford an additional pressure on the agitation for transferring the public departments to the English towns, sanitarium, or tea plantations in the hills.

It is stated that Assurance Companies in India have declined to accept the lives of the officers of the Geological Department there on account of the exposure to which they are subjected.

A UNITED Service Institution for India has been formed, and it is gratifying to observe that it is to be established at Simla in the Himalayas, in a healthy district instead of an unhealthy place.

THE severe earthquake of the 25th of February in Chile has called attention to the views of Mr. Darwin and Prof. Rudolph Falb of Prague. Mr. Darwin was in Chile in the great earthquake of February 20, 1835. It is observed that the recent earthquake began at the same time, 11.30 A.M. Mr. Darwin considered that the space from under which the volcanic matter was erupted in Chile was 720 miles in one line and 400 in another, and that the existence was indicated by a subterranean table of lava of the area of the Black Sea. Prof. Falb maintained that the influence of the moon is the chief cause of earthquakes, and in a letter to NATURE of the 14th of April, 1870, he explained and defended his doctrine, and referred to the earthquakes of Manilla, the volcano of Puraco in Columbia, and convulsions in Peru. His prophecies of a great earthquake in Peru, which occasioned so much alarm, were not realised. The Manilla earthquake, he says, took place two hours and a half after the culmination of the moon. It is affirmed that the late earthquake in Chile had no relation to the culmination of the moon. It is to be noted that the great earthquake in Honolulu in the Hawaiian Islands took place on the night of February 19, six days before that of Chile.

AN earthquake was felt at Rawul Pindee and Murree, in the Himalayas, in April.

THE Russian Government are believed to be organising an expedition to New Guinea for the purposes of scientific research and exploration. It is, however, believed in Australia that this is only an indirect method of obtaining a foothold in that country, and it is proposed that the Government of Victoria should send an expedition to New Guinea, in order to obtain by treaty certain portions of territory for purposes of settlement. Should this design be carried into effect, it is to be hoped that every facility will be given to Naturalists to accompany the expedition into this large and comparatively unknown country.

THE *Friend of India* states that from the report on the general state of the weather in the North-West Provinces and Oudh during March, it appears that the direction of the wind, as in the preceding two months, was for nearly the whole month from the north-west in the N.W. portion of the provinces, and west elsewhere. During the first half of the month a tendency to change to the east was occasionally perceptible, and this was especially the case during the time of the barometric depression from the 13th to the 20th. The month as a whole was much drier than usual.

MR. BENTHAM'S ANNIVERSARY ADDRESS TO THE LINNEAN SOCIETY

(Continued from page 114)

IN geographical biology Denmark proper is of no great importance except as a connecting link, on the one hand, between the Scandinavian peninsula and Central Europe, and, on the other, as the separating barrier between the Baltic and the North Seas. Low and flat, without any great variety in its physical features, it is unfavourable for the production or maintenance of endemic organisms, and forms an inseparable portion of the region of Central Europe. But the Arctic possessions included in the kingdom, Greenland, Iceland, and the Faroe Islands, are of great interest; and Denmark itself is remarkable for the number of eminent naturalists, zoologists as well as botanists, produced by so small a state. Its reputation in this respect, established by the great names mentioned in my review of Transactions in my Address of 1865, is being well kept up by Bergh, Krabbe, Lütken, Mörch, Reinhardt, Schiödte, Steenstrup, and others in zoology; whilst Lange, Ersted, and Warming are among the few who now devote themselves more or less to systematic botany. Their general zoological collection, when I last visited it, many years since, was not extensive, although rich in northern animals, and very well arranged under the direction of Steenstrup, and the insects in the Storm Gade Museum were very numerous; whilst at the University was deposited the typical collection of Fabricius. The Herbarium at the Botanic Garden, valuable for the types of Vahl and other early botanists, has been in modern times enriched by the extensive Mexican collection of Liebmann, the Brazilian ones of Lund and others; whilst Ersted's Central-American and Warming's Brazilian plants are also at Copenhagen, but whether public or private property I know not. The botanical and zoological gardens are of no great importance, but the biological publications are kept up with some spirit, especially the Transactions of the Royal Society of Science, Schiödte's continuation of Krøyer's "Tidsskrift," and the "Videnskabelige Meddelelser" of the Natural History Society; and some of the authors have adopted a practice strongly recommended to those who write in languages not understood by the great mass of modern naturalists, that of giving short *résumés* of their papers in French. On the most important contributions to systematic zoology since those mentioned in my address of 1868, I have received the following memoranda:—Prof. Reinhardt, in publishing in the Transactions of the Royal Danish Academy (1869) nine posthumous plates, executed under the direction of the late Prof. Eschricht, illustrating the structure of various cetacea, has accompanied them with short explanations. Prof. Reinhardt has further published, in the "Videnskabelige Meddelelser" for 1870, a list of the birds inhabiting the Campos district of central Brazil; notes on the distribution, habits, and synonymy are copiously added; and the introductory remarks on the geographical distribution, &c., are very suggestive, and ought to be translated for the benefit of the friends of ornithology in England and elsewhere. The same "Videnskabelige Meddelelser" contains an essay by Dr. Lütken on the limits and classification of ganoid fishes, chiefly from a palæontological point of view, accompanied by a synopsis of the present condition, in systematical and geological respects, of that important branch of palæichthyology. In Mollusca, Dr. Bergh has published, in Krøyer's "Tidsskrift" for 1869, one of his elaborate, anatomical, and systematic monographs of the tribe Phililidæ, with many plates, of which a detailed notice is given in the "Zoological Record," vol. vi. p. 559. In insects, Prof. Schiödte, in the same journal for 1869, has given an elaborate essay containing new facts and views on the morphology and system of the Rhynchota, analysed in the "Zoological Record," vol. vi. p. 475. To Dr. Krabbe we owe the description of 123 species of tapeworms found in birds, an elaborate monograph accompanied by ten plates, and printed in the Transactions of the Royal Danish Society for 1869, with a French *résumé*. (Noticed in "Zoological Record," vol. vi. p. 633.) In Echinoderms, Dr. Lütken's valuable essays on various genera and species of Ophiuridæ, recent and fossil, with a Latin synopsis of Ophiuridæ and Euryalidæ, and a general French *résumé*, forming the third part of his "Additamenta ad Historiam Ophiuridarum," in the Transactions of the Royal Danish Society for 1869, have been analysed in the "Zoological Record," vol. vi. pp. 369, 462, &c. No

contribution to systematic botany of much importance has appeared in Denmark since those mentioned in my Address of 1868.

There exists no general Danish Fauna; but I have a rather long list of detached works and essays from which the Danish inhabitants of the different classes of animals may be collected. Of these the most recent are Collin's *Batrachia*, in Krøyer's "Tidsskrift" for 1870, and Mörch's marine Mollusca, publishing in the "Videnskabelige Meddelelser" for the present year.

With regard to Iceland, the only works mentioned are Steenstrup's terrestrial mammals, or rather mammal, of Iceland, in the "Videnskabelige Meddelelser" for 1867; and Mörch's Mollusca in the same journal for 1868. C. Müller's account of the birds of Iceland and the Faroe islands dates from 1862, and Lütken's of the Echinoderms from 1857, and I find no mention of any special account of the insects of the island; whilst in botany, C. C. Bahington has given us, in the eleventh volume of our Linnean journal, an excellent revision of its flora, the phænogamic portion of which may now be considered as having been very fairly investigated; and E. Røstrup, in the fourth volume of the *Tidsskrift* of the Botanical Society of Copenhagen, has enumerated the plants of the Faroe Islands.

The Scandinavian peninsula is, on several accounts, of great interest to the biologist. It includes a lofty and extensive mountain-tract, with a climate less severe than that of most parts of the northern belt at similar latitudes, and the uniformity of the geological formation is broken by the limestone districts of Scania. It thus forms a great centre of preservation for organic races between the wide-spread tracts of desolation to the east and the ocean on the west, and has therefore been treated as a centre of creation, whence a Scandinavian flora and fauna has spread in various directions. As the home of Linnæus it may also be considered as classical ground for systematic biology, the pursuit of which is now being carried on with spirit, as evidenced by such names as Holmgren, Kinberg, Liljeborg, Malm, Malmgren, G. O. Sars, Stal, Torell, and others in zoology; and Agardh, Andersson, Areschoug, Fries, Hartmann, and others in botany. Two of the academies to whose publications Linnæus contributed, those of Upsala and Stockholm, continue to issue their Transactions and Proceedings; and to these are now added the memoirs published by the University of Lund. They lost Linnæus's own collections, and the Zoological Museum at Upsala, when I saw it many years since, was poor, that of Stockholm better, and in excellent order. In the herbaria, Thunberg's and Afzelius's collections are deposited at Upsala, and Swartz's at Stockholm, where the herbarium of the Academy of Sciences has been of late years considerably increased under the care of Dr. Andersson.

The Scandinavian Fauna and Flora have been generally well investigated. The numerous Floras published of late years show considerable attention on the part of the general public. I observe that Hartmann's *Handbook* is at its tenth edition; Andersson has published 500 woodcut figures of the commoner plants, taken chiefly from Fitch's illustrations of my *British Handbook*; and my lists contain many papers on Swedish Cryptogams. The relation of the Scandinavian vegetation to that of other countries has also been specially treated of by Zetterstedt, who compared it with that of the Pyrenees, and by Areschoug, Andersson, Ch. Martins, and others, as alluded to in more detail in my Address of 1869. Many works have succeeded each other on the Vertebrate Fauna since the days of Linnæus; amongst which those of Liljeborg as to Vertebrata in general and of Sundeyall as to Birds are still in progress. The Crustacea, Mollusca, and lower animals have been the subjects of numerous papers, the marine and freshwater faunas having been more especially investigated by the late M. Sars and by G. O. Sars; and Th. Thorell, in the Upsala Transactions, has given an elaborate review of the European genera of spiders, evidently a work of great care, preceded by apposite remarks on their generic classification, and a general comparison of the Arachnoid fauna of Scandinavia and Britain, all in the English language although published in Sweden. This work, however, does not extend to species, beyond naming a type (by which I trust is meant an example, not the type) of each genus; nor is the geographical range of the several genera given. There appears to be no general work on Scandinavian insects.

The fauna and flora of Spitzbergen have specially occupied Swedish naturalists. To the accounts of the Vertebrata by Malmgren, and of the Lichens by T. M. Fries, have now been added, in recent parts of the Transactions or Proceedings of the

Royal Swedish Academy, the Insects by Holmgren, the Mollusca by Mörch, the Phænogamic Flora by T. M. Fries, and the Algæ by Agardh.

An excellent and elaborate monograph of a small but widely spread genus of Plants, entitled "Prodromus Monographiæ Georum," by N. J. Schultz, has appeared in the last part of the Transactions of the Academy of Upsala. Several interesting features in the geographical distribution of some of the species are pointed out, amongst which one of the most curious is the almost perfect identity of the *G. coccineum* from the Levant and the *G. chilense* from South Chile, the differences being such only as would scarcely have been set down as more than varieties had both come from the same country. The whole memoir is in the Latin language; the specific diagnoses are rather long, but the observations under each section and species point out the connection with and chief differences from the nearest allies.

The whole of the botanical literature published in or relating to Sweden has been regularly recorded in annual catalogues, inserted by T. O. B. N. Krok in the "Botaniske Notiser" of Stockholm.

The chief interest in the biology of Russia consists in its comparative uniformity over an enormous expanse of territory. Extending over more than 130 degrees from East to West, and above 20 degrees from South to North, without the interposition of any great geological break in mountain* or ocean, all changes in flora or fauna, in the length and breadth of this vast area are gradual; whilst the mountains which bound it to the south and to the east, and the glacial characters of the northern shores, offer to the Russian naturalist several more or less distinct biological types, such as the Caucasian, the Central Asiatic, the Manchurian, and the Arctic, all blending into the great European-Asiatic type, and the three first-named, at least apparently, constituting great centres of preservation. By the careful discrimination of the various races which give to each of these types its distinctive character, the study of their mutual relations, of the areas which each one occupies without modification, of the complicated manner in which these several areas are interwoven, of the gradual changes which distance may produce, of the cessation of one race and the substitution of another without apparent physical cause, the Russian, even without travelling out of his own country, can contribute, more than any other observer, valuable materials for the general history of races. In botany I have on former occasions referred to Ledebour's "Flora Rossica" as the most extensive complete flora of a country which we possess, and to the numerous papers by which it has been supplemented. Several of these are still in progress, chiefly in the bulletin of the Society of Naturalists of Moscow, and I have notes of local floras and lists from various minor publications. The last received volume of the Memoirs of the Academy of Petersburg include the botanical portion of Schmidt's travels in the Amur-land and Sachalin, in which the geographical relations of the flora are very fully treated of; and the first part of a very elaborate "Flora Caucasica" by the late F. J. Ruprecht, which may be more properly designated Commentaries on the Caucasian Plants than a flora in the ordinary sense of the word. It is an enumeration of species, with frequent observations on affinities, and a very detailed exposition of stations in the Caucasus, but without any reference to the distribution beyond that region; above 300 large 4to pages only include the Polypetalæ preceding Leguminosæ, and the lamented death of the author will probably prevent the completion of the work. N. Kaufmann, Professor of Botany at the University of Moscow, an active botanist of great promise, whose death last winter is much deplored by his colleagues, had published a Flora of Moscow in the Russian language, which had met with much success. In the zoology of Russia the most important recent work is Middendorff's "Thierwelt Sibiriens," analysed in the "Zoological Record," vi. p. 1, which, with the previously published descriptive portion and the botany of the journey by Trautvetter, Ruprecht, and others, forms a valuable exposition of the biology of N.E. Siberia, a cold and inhospitable tract of country, where organisms, animal as well as vegetable, are perhaps poorer in species and poorer in individuals than in any other region of equal extent not covered with eternal snows. Middendorff's observations on this poverty of the

* The celebrated chain of the Oural, which separates Asia from Europe, is, in the greater part of its length, too low, and the ascent too gradual to have much influence on the vegetation. The so-called ridge between Perm and Katerinburg is, according to Ermann, not 1600 feet above the level of the sea, and rises from land which, for a breadth of above 120 miles, is only 700 feet lower.

fauna of Siberia, its uniformity and conformity to the European fauna, on the meaning to be given to the species, on their variability and on the multiplicity of false ones published, on the complexity of their respective geographical areas, on their extinction and replacement by others, &c., are deserving of the careful study of all naturalists. L. v. Schrenck's Mollusca of the Amur land or Manchuria (reviewed in the "Zoological Record," iv. p. 504) is equally to be recommended for the manner in which the specific relations, the variability, affinities, and geographical distribution of Manchurian Mollusca are treated. The publications of the first meeting of the Association of Russian Naturalists include a review of the Crustacea of the Black Sea by V. Czerniavski, an account of the Annulata Chætopoda of the Bay of Sebastopol by N. Bobretzki, and a paper on the zoology of the Lake of Onega and its neighbourhood by K. Kessler, including a review of the fishes, Crustacea, and Annulata of the Lake of Onega, and of the Mollusca collected in and about the Lakes Onega and Ladoga, and a list of the butterflies of the Government of Olonetz. The historical and scientific memoirs published by the University of Kazan, of which several volumes have recently reached us, include a systematic enumeration and description of the birds of Orenburg (329 species), with detailed notes of their habits, &c., by the late Prof. E. A. Eversmann, edited after his death by M. N. Bogdanoff, forming an 8vo volume of 600 pages in the Russian language.

There is not in Russia at the present moment sufficient encouragement on the part of the public to induce the publication of independent biological works beyond a few popular handbooks; but the Imperial Academy of Petersburg has, on the other hand, been exceedingly liberal in the assistance it affords, and active in its issue of Transactions with excellent illustrations, as well as of its bulletin of proceedings. The volumes recently received include J. F. Brandt's "Symbolæ Sirenologicæ" and researches on the genus *Hyrax* (reviewed in "Zoological Record," v. p. 3, and vi. p. 5), A. Strauch's Synopsis of Viperidæ, with full details of their geographical distribution, E. Metschnikoff's studies on the development of Echinoderms and Nemertines, and N. Miklucho-Maclay's Memoir on Sponges of the N. Pacific and Arctic Oceans, with remarks on their extreme variability inducing the multiplication of false species. In botany, Bunge's Monograph of the Old-World species of *Astragalus* is the result of many years labour and careful investigation. The eight sub-genera and 104 sections into which this extensive genus is divided appear to be very satisfactory; but the species (971) are probably very much too numerous, and we miss that comparison with American forms which, considering the very numerous cases of identity or close affinity, is essential for the due appreciation of the N. Asiatic species. Bunge has also published a monograph of the *Heliotropia* of the Mediterranean-Oriental region in the Bulletin of the Society of Naturalists of Moscow, which continues its annual volumes. The parts recently received continue several of the botanical enumerations already noticed, together with various smaller entomological papers.

(To be Continued)

GEOLOGY

On the Supposed Legs of the Trilobite, *Asaphus platycephalus**

AT the request of Mr. E. Billings, of Montreal, I have recently examined the specimen of *Asaphus platycephalus* belonging to the Canadian Geological Museum, which has been supposed to show remains of legs. Mr. Billings, while he has suspected the organs to be legs so far as to publish on the subject,† has done so with reserve, saying, in his paper, "that the first and all-important point to be decided, is whether or not the forms exhibited on its under side were truly what they appeared to be, locomotive organs." On account of his doubts, the specimen was submitted by him during the past year to the Geological Society of London; and for the same reason, notwithstanding the corroboration there received, he offered to place the specimen in my hands for examination and report.

Besides giving the specimen an examination myself, I have submitted it also to Mr. A. E. Verrill, Prof. of Zoology in

* From the American *Journal of Science and Arts*, Vol. 1, May, 1871.

† Q. J. Geol. Soc., No. 104, p. 470, 1870, with a plate giving a full-sized view of the under surface of the trilobite, a species that was over four inches in length.

Yale College, who is well versed in the Invertebrates, and to Mr. S. I. Smith, assistant in the same department, and excellent in crustaceology and entomology. We have separately and together considered the character of the specimen, and while we have reached the same conclusion, we are to be regarded as independent judges. Our opinion has been submitted to Mr. Billings, and by his request it is here published.

The conclusion to which we have come is that the organs are not legs, but the semi-calcified arches in the membrane of the ventral surface to which the foliaceous appendages or legs were attached. Just such arches exist in the ventral surface of the abdomen of the *Macrura*, and to them the abdominal appendages are articulated.

This conclusion is sustained by the observation that in one part of the venter three consecutive parallel arches are distinctly connected by the intervening outer membrane of the venter, showing that the arches were plainly in the membrane, as only a calcified portion of it, and were not members moving free above it. This being the fact, it seems to set at rest the question as to the legs. We would add, however, that there is good reason for believing the supposed legs to have been such arches in their continuing of nearly uniform width almost or quite to the lateral margin of the animal; and in the additional fact, that although curving forward in their course toward the margin, the successive arches are about equidistant or parallel, a regularity of position not to be looked for in free-moving legs. The curve in these arches, although it implies a forward ventral extension on either side of the leg-bearing segments of the body, does not appear to afford any good reason for doubting the above conclusion. It is probable that the two prominences on each arch nearest the median line of the body, which are rather marked, were points of muscular attachment for the foliaceous appendage it supported.

With the exception of these arches, the under surface of the venter must have been delicately membranous, like that of the abdomen of a lobster or other macruran. Unless the under surface were in the main fleshy, trilobites could not have rolled into a ball.

JAMES D. DANA

SCIENTIFIC SERIALS

Annales de Chimie et de Physique. The whole of the last part of the "Annales" is occupied by M. Berthelot's *Méthode universelle pour réduire et saturer d'hydrogène les composés organiques*, which is a résumé of the elaborate and exhaustive researches on the action of hydriodic acid on organic substances in which he has been engaged for the last three or four years. Most of the results have been already published from time to time in the *Bulletin de la Société Chimique de Paris*, and this classical research is now completed by the publication of the details of the methods of analysis and the thermochemical considerations involved. The author has found that any organic compound can be transformed into a saturated hydro-carbon, having, in general, the same number of atoms of carbon as the original substance, by heating it for a sufficient length of time to a temperature of 275°C., with a large excess of an aqueous solution of hydriodic acid of the specific gravity of 2.0. The proportion of the acid is varied according to the nature of the substance submitted to its action, twenty or thirty parts being sufficient to reduce an alcohol of the fatty series, whilst a member of the aromatic series and such substances as bitumen, wood charcoal, and coal, require, at least, one hundred times their weight; the large excess of acid serving the purpose of dissolving the iodine set free during the reaction, thus preventing its destructive action on the organic compound, and also in allowing the quantity of hydriodic acid necessary for the reduction of the substance, to be withdrawn from the solution without reducing its strength so far that the reaction ceases. One of the most remarkable results exhibited in the application of this method is that of the direct transformation of benzene into the saturated hydrocarbon, hexylene hydride, $C_6H_6 + 8HI = C_6H_{14} + 8I$, affording, as it does, an instance of a direct passage from the aromatic to the fatty series. When other members of the phenyl series are treated with hydriodic acid, the ultimate product is the same; but there is an intermediate step in the reaction, resulting in the formation of benzene, which, by the continued action of the acid, is transformed into the corresponding saturated hydrocarbon. The fifth and last part of the paper is