

M. C. E. Guillaume, and "Nouvelles déterminations des mètres étalons du Bureau international," by the same authors.

WE have received the 22nd and 23rd Annual Reports of the Geological and Natural History Survey of Minnesota (for 1893 and 1894). Among the contents of the latter are a criticism on the late Dr. G. H. Williams's explanation of the Archæan greenstones, by N. H. Winchell; a preliminary report on the gold region of Rainy Lake, by H. V. Winchell and U. S. Grant; an historical sketch of Lake Superior mining, by H. V. Winchell; and a study of the late Glacial earth-movements of the St. Lawrence basin, by Warren Upham. Geologists will be interested to know of the issue of an official "List of Publications" of the Geological Survey of Canada (Ottawa: 1895), which includes all reports, with their separate contents, maps, and certain papers on Canadian geology, reprinted from various publications.

THE ninth annual report of the Liverpool Marine Biology Committee contains an account of much useful work done at the Port Erin Station during the past year. (1) In his consideration of the submarine deposits of the Irish Sea, Prof. Herdman suggests the recognition of a neritic group of deposits in addition to the pelagic and terrigenous deposits defined by Murray. The neritic deposits are largely organic in origin, formed from the remains of plants and animals living on the bottom, and so differ on the one hand from the terrigenous deposits derived from the waste of land, and on the other from the deep-sea varieties due chiefly to the accumulation of the remains of pelagic organisms. (2) So far as experiments with drift-bottles have been able to show, the prevailing currents on the west of the Isle of Man seem to be towards the Irish coast, and on the east towards the Lancashire, Cheshire, and Cumberland coasts; these observations are interesting on account of the existence of flat-fish spawning grounds in the neighbourhood of the Manx coast. (3) The report also furnishes additional evidence in favour of the Darwinian view that closely-related species are not, as a rule, found together. In addition to the investigations on these general problems, the report includes various contributions in regard to the local fauna.

THE 1896 edition of that very comprehensive volume, the "Annuaire du Bureau des Longitudes," has now been issued. To say that no year-book is of greater service to astronomers and physicists than this "Annuaire," is but to record the opinion of all workers in the domain of physical science. The present edition has been brought thoroughly into line with recent knowledge. M. Lœwy has added a brief note on the proper motion of the sun, and the apex of the sun's way. M. Cornu contributes two new notes—one on the bright lines in the spectrum of the chromosphere recently identified with those of terrestrial substances, and the other on the identification of lines in stellar spectra. The list of minor planets has been brought up to 416; and some changes have been made in the list of double-star orbits. M. Moureaux gives the values of the magnetic elements determined at 644 points in France; and M. Cornu contributes new chapters on specific heats, and on the latent heats of fusion and vaporisation of water. Among the articles, we notice one on action at a distance and waves, and another on Fresnel's works, both by M. Cornu; and there is also an article on the proposed magnetic survey of the earth, by Captain de Bernardières; and an account, by M. Janssen, of his third ascent to the observatory on the top of Mont Blanc.

MESSRS. DULAU AND CO. have made arrangements to publish a work on "The Coccidæ of Ceylon," by Mr. E. E. Green. All the species at present recognised in Ceylon, including several new genera and numerous new species, will be described, and illustrated by 120 coloured plates. The work will be published in four parts, for which Messrs. Dulau are now inviting sub-

scriptions. In the prospectus announcing the proposed publication is an inset, in which the opinion of members of the B.A. committee on the Coccidæ of Ceylon is set forth. It is there pointed out that what is known of the distribution of this cosmopolitan group justifies the belief that many of the new species from Ceylon described by Mr. Green will prove, as inquiry advances, to be world-wide. The Committee therefore recommend the work to the consideration of subscribers, believing that it "will be of great assistance to gardeners and to naturalists generally, and of considerable value to those engaged in economic entomology or in the management of plantations in any part of the world, as well as to systematic entomologists and morphologists."

SEVERAL new editions of scientific works have lately been received. Messrs. E. and F. N. Spon have published the third edition of Prof. J. H. Cotterill's classic volume on "The Steam Engine considered as a Thermodynamic Machine." A few slight changes and additions have been made in the appendix, but the book has been practically reprinted without substantial alteration. The eleventh edition of "Discoveries and Inventions of the Nineteenth Century," by Mr. Robert Routledge, has been published by Messrs. G. Routledge and Sons. The text has been emended, and the volume has been enlarged by a few pages of notes, and by new sections dealing with some of the engineering achievements and scientific discoveries of the last five years. The final part (vol. iii. part iv.) of the tenth edition of "Quain's Elements of Anatomy" (Longmans, Green, and Co.), edited by Profs. Schäfer and Thane, has now appeared. Its subject is Splanchnology; the anatomical descriptions belonging to which have been revised, and in many cases rewritten, by Dr. J. Symington, while the histological portion has been re-edited by Prof. Schäfer. It is proposed to issue a chapter on superficial anatomy, in the form of an appendix to the work. The fourth edition has been issued of Mr. W. T. Lynn's slender book on "Remarkable Comets." From the useful list of the dates of the returns of interesting comets, we see that, in the spring of this year, Faye's comet (period $7\frac{1}{2}$ years) is due, and in the spring or summer, Brook's comet (period 7 years). All the information in the book has been carefully brought up to date.

THE additions to the Zoological Society's Gardens during the past week include a Black-faced Kangaroo (*Macropus melanops*, ♀) from Australia, presented by Mr. E. Mitchell; a Himalayan Bear (*Ursus tibetanus*, ♀) from Upper Burma, presented by Captain Gale; a Slow Loris (*Nycticebus tardigradus*) from Upper Burma, presented by Captain J. W. Carrothers; a Salt-water Terrapin (*Clemmys terrapin*) from the West Indies, presented by Mr. J. Lea Smith; Seven Galliot's Lizards (*Lacerta galloti*), a Delalande's Gecko (*Tarentola delalandii*) from Madeira and Tenerife, presented by Mr. H. B. Hewetson, two Indian Jerboas (*Alactaga indica*) from Baluchistan, purchased.

OUR ASTRONOMICAL COLUMN.

THE DOUBLE STAR 70 OPHIUCHI.—Of the numerous orbits which have been computed for this well-known double star, that derived by Dr. Schur in 1893 is perhaps entitled to greatest confidence. Nevertheless, even in the short interval which has since elapsed, Dr. See finds that the companion is several degrees in advance of the theoretical position based on Schur's orbit. In explanation of this, as well as of other departures from the orbit which appear on close investigation, Dr. See suggests that the companion is attended by a dark satellite, moving in a retrograde direction with a period of about thirty-six years, the period of the visible pair being a little less than ninety years. The distance of the companion from the centre of gravity of itself and satellite is probably about $0''.3$; and a circular orbit with node and inclination identical with the similar elements of the visible pair sufficiently explains the observed changes of position angle and distance. Adopting the parallax $0''.2$, the

semi-axis major of the primary orbit is 22.74 astronomical units, while that of the secondary orbit is 1.5 astronomical units, and the combined mass is 1.6 times that of the sun. The whole system of 70 Ophiuchi is thus contained in a space less than that occupied by the solar system; the orbit of the bright companion being intermediate in size between those of Uranus and Neptune, while the action of the dark satellite causes it to describe a secondary orbit corresponding in size with that of Mars (*Astronomical Journal*, No. 363).

MINOR PLANET PHOTOGRAPHY.—The great value of the photographic method of recording the positions of known minor planets, and in searching for new ones, is admirably illustrated by the results obtained by M. Charlois (*Bulletin Astronomique*, January). Between November 18, 1894, and August 29, 1895, forty-one plates were exposed by him at the Nice Observatory on suitable parts of the sky, and only nine of these failed to show traces of the objects sought. In the remaining photographs forty-four known planets and eleven new ones were recognised. Four of the new ones were of the 11th magnitude, three of the 12th, one of the 13th, and three of the 14th, while eleven of the old planets were of 10th magnitude or brighter. The newly-discovered planets are thus among the smallest of this class of bodies. Up to the end of last year the patience of M. Charlois had been rewarded by the discovery of eighty-three minor planets, or a little more than one-fifth of the total number at present known.

THEORY OF COMETS' TAILS.—It has long been imagined that the phenomena of comets' tails are in some way due to a solar electrical repulsion, and additional light is thrown on the subject by recent physical researches. Several investigators have shown that when ultra-violet light falls on an uncharged body the surface disintegrates, the particles which fly off being charged negatively, while the body itself becomes positively charged. Applying this to the case of a comet, Prof. Fessenden suggests that negatively charged particles are emitted from that side of a comet which is turned towards the sun, while the nucleus has a positive charge (*Astrophysical Journal*, vol. iii. No. 1). According to J. J. Thomson's experiments, the fact that the C line of hydrogen is brighter than the F line indicates that the sun's chromosphere is negatively electrified, and hence the disintegrated particles of the comet will be subjected to four forces; namely, the force due to gravitation, a second force to the repulsion of the negative charge on the sun, a third due to the attraction of the positively charged nucleus, and a fourth due to the repulsion of all the other similarly electrified particles. The shape of the tail is the resultant effect of these four forces. The observed effects do not demand an improbably great solar potential, the value calculated being 15,000 volts. Accepting the theory, the contraction of the head, the partition of comets, multiple tails, and other appearances seem to find a reasonable explanation. The increasing positive charge of the nucleus as the sun is approached will result in an increased solar electrical attraction, and the effect will be the same as that which would be produced by a resisting medium; that is, the period will be shortened, as in the case of Encke's comet.

The fact that the most frequently observed spectrum of a comet's tail is like that of a candle flame, indicates, according to J. J. Thomson's experiments, that the particles of carbon are negatively electrified, and this is quoted in favour of the theory. It may be pointed out, however, that there is no such direct evidence to show that the nucleus is positively charged, as required by the theory.

THE ROTATION PERIOD OF VENUS.—A valuable contribution to the study of the rotation period of Venus has been made by Prof. Tacchini (*Atti Reale Acad. Lincei*, vol. v. p. 3). Observations made at the Collegio Romano during last summer, tended in favour of Schiaparelli's view that the rotation period of the planet is 224.7 days, that is, equal to the sidereal revolution. He now announces that continued observations, made under the best atmospheric conditions towards the end of 1895, have led to the same conclusion. The observations terminated on December 19, and on some occasions they extended over very considerable intervals on the same mornings. On November 28, for example, work was commenced at 5.45 and continued until 11 o'clock, and during this time the same features were constantly observed on the illuminated part of the planet. A nebulous arc on the dark part of the planet, near the southern cusp, observed in September last, was not seen in the recent observations.

THE INTERNATIONAL GEODETIC CONGRESS AT BERLIN.

LAST month, in the new Reichstag palace, in Berlin, the official international Congress of Geodesy met together. The members represented seventeen States of Europe, Asia, and America.

At this conference the delegates of France were: MM. H. Faye, Vice-President of the Bureau des Longitudes; Tisserand, Director of the Paris Observatory; Bouquet de la Grye, the retired Engineering Hydrographer in charge of the Marine; Bassot, Superintendent of the Geodetic Section of the Geographical Service of the Army; and Ch. Lallemand, Director of the General Levelling of France.

The Congress was welcomed, in the name of the Prussian Government by Dr. Bosse, Minister of Public Instruction. After recalling the fact that the International Geodetic Association was founded by the Prussian General Baeyer, Dr. Bosse briefly sketched the history of progress made in the different sections of geodesy during the last ten years, under the happy influence of the Association.

In reply to the Minister, M. Faye, President of the Association, very appropriately remarked that although Germany has done much for geodesy in the last fifty years, still France has the honour of having, during the last century, set the example.

Following this Prof. Foerster, Director of the Berlin Observatory (President of the Congress), described the recent discovery of the variation of latitude.

M. Fergola (Director of the Naples Observatory) has proposed since 1883 that observations should be organised in a permanent manner in observatories equally distributed round the earth, and situated at more or less the same latitude, in order to observe the small possible movements of the terrestrial axes. The first signs of these movements, noticed by M. Küstner at the Berlin Observatory, were reported to the Conference held at Salzburg in 1888 by the International Geodetic Association. The Association took up the question, and instituted two years afterwards an astronomical station of observations at Honolulu (Sandwich Isles), to control the results made in Europe. The success of this undertaking has now led the permanent commission of the Association to propose the realisation of M. Fergola's plan. This realisation will be greatly facilitated by the recent construction of a special photographic telescope, of which the first results were very interesting.

We will confine ourselves to naming some of the principal scientific communications made to the Congress. M. de Kalmar (Austrian delegate, and reporter on accurate levelling) announced the fact that, in the last three years, the total length of these levellings in Europe has increased from 20,000 kilometres, and exceeds to-day 120,000 kilometres. Colonel Bassot reported that three geodetic bases have just been measured in Roumania with the instruments of the Geographical Service, and with the help of French officers. Another base must be measured next in Turkey under the same conditions. M. Bouquet de la Grye announced that the Bureau des Longitudes have just undertaken, with the help of the officers of the French Marine, the execution of a new magnetic map of the world. M. Lallemand reported, amongst the principal networks of accurate levellings of Europe, the existence of systematic errors—the cause as yet unknown—the probable value of which, although much greater than those of accidental errors, only considered up till now, is calculated to be between 0.1 mm. and 0.2 mm. per kilometre for the French, Spanish and Prussian networks. This being so, the researches and efforts of those in charge of great levelling undertakings should certainly aim at reducing the systematic errors.

According to verifications made in Austria by Colonel Sterneck, and confirmed by other observers, the intensity of gravity has a slight diurnal oscillation. The communication of the captain of the ship *Von Kalmar* states that the officers of the Austrian Marine have determined the intensity of gravity in thirty-nine stations, situated in different seas of the world. Prof. Vogler, of Berlin, exhibited an accurate levelling instrument (*niveau de précision*) constructed on the principle of the cathetometer, and metallic levelling rods, formed of two rods of steel coupled with a rod of zinc, and covered with a layer of aluminium. These new arrangements would permit the inventor to reduce the accidental errors of the levelling; but it is doubtful if it would be the same for systematic errors.

The principal and most laborious task of the Congress consisted in drawing up a new diplomatic convention, in place of