admirable maps on natural curvature produced recently under M. Reclus' direction), and a report by Dr. E. von Drygalski, dated Cape Town, on the progress of the German South Polar Expedition.

THE Queensland Geological Survey, under the direction of Mr. William H. Rands, has forwarded *Bulletins* Nos. 13 to 17 (1901). In these we have additional notes on the Cretaceous fossils of Queensland by Mr. Robert Etheridge, jun., and reports on mining districts by Mr. Rands and Mr. B. Dunstan. Referring to the Mount Morgan mine, Mr. Dunstan remarks that it is impossible to tell by appearances whether the stone is rich or poor, as of two samples which might be absolutely the same in texture, colour, structure, specific gravity and visible mineral constituents, one would perhaps yield as many ounces of gold to the ton as the other would pennyweights. In an account of Diglum Creek, in the Gladstone district, Mr. Dunstan describes the production of garnet, wollastonite, epidote and chert where granite has come in contact with limestone. We have also received folio reports on the Gympie gold field by Mr. Rands, and on the Hamilton, Coen and Jordan Creek gold fields by Mr. Lionel C. Ball. Permo-Carboniferous coal-bearing beds occur in the valleys of the Dawson and Mackenzie rivers, and outcrops of anthracitic coal have been traced by Mr. Dunstan. The Dawson coal, which is a ten-foot seam, is reported to be suitable for general purposes and as absolutely smokeless. In central Queensland there is an area of upwards of 5000 square miles which may be coal-bearing; hence a closer and more detailed examination of this region is desirable.

MESSRS. CASSELL AND Co. have commenced the publication, in fortnightly parts, of "Familiar Wild Flowers," by Mr. F. E. Hulme The complete work contains 280 coloured pictures, including 40 which have been specially prepared for the new edition, and will be completed in twenty-four parts at sixpence each.

MR. W. WESLEY, of Essex Street, Strand, sends us a "Catalogue of Zoological Literature" (No. 140, in two parts). As it includes the late Mr. S. P. Hanley's conchological library, as well as the entomological library of Mr. H. Christoph and the works on Cœlentera collected by the late Prof. G. J. Allmann, it is worth careful attention on the part of those interested in such subjects.

MORE than forty years after his first determinations of the transport numbers of the ions in the passage of electricity through solutions of electrolytes, W. Hittorf describes, in the *Zeitschrift für physikalische Chemie*, some interesting experiments relating to the influence, exercised by the diaphragms separating the anode and kathode solutions, on the measured values of these transport numbers. When a porous clay diaphragm is used, the volume of the solution at the anode decreases in all cases investigated. When, however, an animal membrane separates the anode and kathode solutions, it is found that with solutions of the chlorides of potassium, ammonium and sodium, cataphoresis takes place in the direction of the current, whilst with dissolved chlorides of the alkaline earth metals and of cadmium, the cataphoric effect is in the opposite direction. In the latter case, the volume of the solution at the anode increases. At the animal membrane, apparently a separation of the original solution into a solution more concentrated and one more dilute takes place. This behaviour of animal membranes results in considerable errors in the determination of transport numbers, and Hittorf is able to account for the deviations between the results obtained by himself in the late fifties and those more recently obtained by other investigators who have not made use of animal membranes in their experiments.

THE additions to the Zoological Society's Gardens during the past week include a Pluto Monkey (*Cercopithecus leucampyx*, ♂) from Uganda, a Leopard Tortoise (*Testudo pardalis*) from British East Africa, presented by Major C. Delmé Radcliffe a Vulpine Phalanger (*Trichosurus vulpecula*) from Australia, presented by Mr. T. W. Dye; three Bengal Red-vented Bulbuls (*Pycnonotus bengalensis*) from India, presented by Mr. Frank Finn; a Ludio Monkey (*Cercopithecus ludio*) from West Africa, two young Lions (*Felis leo*, ♂ ♀) from British East Africa, four Prjevalsky's Horses (*Equus prjevalski*, ♂ ♂, ♀ ♀) from Mongolia, a Red Lory (*Eos rubra*) from Moluccas, a Green Conure (*Conurus leucopthalmus*) from Trinidad, an Angulated Tortoise (*Testudo angulata*) from South Africa, deposited; an English Wild Cow (*Bos taurus*) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF THE CHROMOSPHERE.—At the recent meeting of the Astronomical and Astrophysical Society of America, held at Washington, Mr. S. A. Mitchell read a paper on the observations made during the total solar eclipse in Sumatra on May 18, 1901. The spectrum photographs were obtained with an objective grating spectrograph; the grating had a ruled surface $3\frac{1}{2} \times 5$ inches, with 15,000 lines to the inch, the objective being a quartz lens of a little more than $3\frac{1}{4}$ inches aperture and about 72 inches focal length. Light from the eclipsed sun was reflected into this instrument by a cœlostat. The adjustments were such as to ensure a "normal" spectrum, this being the case when grating and photographic plate were each perpendicular to the diffracted beam. The first order was employed, from λ 3000 to λ 6000. Although the sky was never clear during the period of totality of 5 min. 41 secs., eight exposures were made—one before and one just after totality for the cusp spectra, one at first and one at second flash, and four with varying exposures during the total phase. The second flash appeared fully exposed, and the plate has been carefully measured. The dispersion is such that from $H\beta$ to H_ϵ occupies a length of 95·4 mm., *i.e.* 1 tenth-metre corresponds to about 0·1 mm. In the region mentioned, $H\beta$ to H_ϵ, 363 lines have been determined. Of these, 269 have been identified with lines on Rowland's map.

Tables have been made of the ratios between the intensities of lines in this flash spectrum and in the ordinary Fraunhofer spectrum, and also of the ratios of the number of lines of each element identified to the whole number of solar lines for that metal. Both these sets of ratios appear to show systematic variation, and they are grouped into three classes, their behaviour being considered in conjunction with the atomic weights of the elements.

The variations in intensity are considered as chiefly due to the various heights to which the different metals ascend in the chromosphere. It is thought that the metals of group II. extend very high and are nowhere very condensed, and their flash lines will be true reversals of the corresponding solar lines. The metals of groups I. and III. are denser near the sun's surface and do not extend so high, and hence their flash lines are to be regarded as only partial reversals of the Fraunhofer lines. These facts lead the author to conclude with a renewal of faith in the existence of the "reversing layer."

PHOTOGRAPHIC DETERMINATION OF LONGITUDE.—In the *Comptes rendus*, vol. cxxxiv. pp. 387–389, M. G. Lippmann describes a new method for the photographic determination of longitude, using an apparatus originally designed by M. Fabry (*Bulletin Astronomique*, p. 148, 1895) for visual observation only. The arrangement was extended by M. Lippmann so as to permit of photographic registration, and described in *Comptes rendus*, cxxxiv. pp. 205–208. The principle of the method consists of making simultaneous records of the zenith at each station, the required longitude being the difference in right ascension observed. The apparatus is similar to that employed for nadir observations. Light from an adjustable horizontal collimator falls on a half-silvered mirror inclined at 45° to the vertical, and is reflected to the surface of a bath of mercury. After its reflection from the mercury, the light is again reflected from the mirror into the collimator, giving an image of the slit or cross-wires which may be adjusted to coincide with the source.

When this is done, a telescope is employed to photograph the region about the zenith as reflected from the upper surface of the silvered mirror. In this position the photographic telescope will lie in the same direction as the fixed collimator, and thus it can be arranged to have a suitable exposing screen, by which, at any instant, a short exposure is given to a strong light placed near the collimator slit, which will give an image of the slit superposed on the region near the zenith, the centre of this image indicating the instrumental zenith. All that remains to be done is to provide a duplicate apparatus at a second station, and by operating the exposing shutters of their respective collimators by electric means, the zenith of each place will be automatically recorded. The difference of longitude between the two stations will be equal to the difference of the right ascensions of the two collimator images. The chief corrections will be owing to the possible prismatic form of the reflecting mirror and the catalogue errors introduced in computing the right ascensions.

INDIAN SURVEYS.[1]

THE Report on Indian Surveys for the year 1899–1900 is now before the public, and the resolution of the Government of India which concludes this report pronounces it to be one which reflects great credit on the "able and effective administration" of Colonel St. G. Gore, R.E., the present Surveyor-General. Field operations were carried on by one double and fifteen ordinary parties and four detachments. Eight of these parties were employed on topographical (including geographical) surveys, only one on trigonometrical work, and the remainder included cadastral and traverse surveys and special geodetic investigations. A large area of forest survey was also completed. The total outturn amounted to nearly 150,000 square miles, of which more than 120,000 square miles were "reconnaissance" or geographical surveys, on the ¼-inch or smaller scales, in Burma and on the north-west frontier. The total area of rigorous surveys on all scales was 29,418 square miles. The normal scale for topographical surveys in India is 1 inch = 1 mile, and the cost of these surveys (which are based on rigid triangulation) is from 25 to 30 rupees per square mile—a cost which compares favourably with that of American surveys conducted under similar physical conditions, but with a very different staff of employés. The cheapness of Indian surveys is doubtless due to the general employment of skilled native labour. In this connection it is satisfactory to note that natives are now being instructed to triangulate and that the magnetic party which has been lately inaugurated will be placed under a native observer.

The general increase in the outturn on that of the previous year is due to the accession of an unusually large area of geographical mapping, full details of which are not published. Topography, conducted on rigorous methods, was chiefly confined to Burma and Sind, two countries which, whilst they balance each other geographically on the east and west, afford a useful contrast for comparison of cost rates and methods of survey. Of the special work undertaken by the Department, that which resulted in a comparison of the values of level deflection by means of observed latitudes on Great Arc stations receding gradually from the Himalaya is most instructive, and special attention is called by the Government of India to Captain Lenox Conyngham's discussion of the results obtained. Experiments were made with the Bridges-Lee photo-theodolite, and with the Jaderin base measuring apparatus which promises, if not to supersede the complicated adjustment of compensation bars altogether, at least to simplify the process of measuring bases for all but the most rigidly accurate geodetic purposes. The former is pronounced to be a very promising auxiliary to the plane table (especially in mountainous countries), "but it will never supersede it." This, it may be remarked, is nearly coincident with the opinion of Canadian surveyors who have tested photo-topography far more exhaustively than has been done in India. As regards the Jaderin apparatus, an unfortunate uncertainty about the value of the coefficients of expansion in the metals forming the tape has deferred an expression of opinion on its success or otherwise.

Record is made of a most useful invention in the printing office by a R.E. foreman which enables the process of photography to be eliminated from the cumbersome method of map reproduction by photo-zincography. There can be little doubt of the value of the invention, which is fully described, and which has been patented in India. It has already enabled the printing office to deal with a vast number of maps in excess of the normal outturn. We are glad to observe that the invention has met with prompt recognition by the Government of India. The report contains three or four excellent photogravure illustrations, one of which is a suggestive view of a railway bridge on the Mandalay-Kunlon line, which is now under construction.

The map illustration is perhaps the most unsatisfactory feature in the report. One map at the commencement of the volume purports to show the "progress of the Imperial surveys," and exhibits a special colour to denote "geographical reconnaissance on various scales." According to this map a large area of the Madras province has never even been "geographically reconnoitred"—which is a very astounding fact if it is true—for it is blank white paper. And the fact that no surveys are shown in Baluchistan must be due either to an affectation that British Baluchistan and Quetta have nothing to do with India, or else it is a deficiency in the illustration, for it leaves an enormous area of the outturn of the Department which is included in the body of the report absolutely unaccounted for. The triangulation chart adjoining shows a very satisfactory-looking series extending to Kandahar from the Indus, and another series reaching half way through Makrán. Triangulation usually carries topography on its back, and doubtless it does so in the present instance. Why the extent of transfrontier "geographical reconnaissance" (to say nothing of exact detailed topography) should not be shown in the chart it is difficult to imagine.

[1] General Report of the Operations of the Survey of India Department, 1899-1900.

MILROY LECTURES ON TYPHOID FEVER.

IN his second and third (final) lectures at the Royal College of Physicians, Prof. Corfield gave detailed descriptions of a number of outbreaks of typhoid fever which had been traced to specific contamination of drinking water, and exhibited a table which he had prepared demonstrating the fact that during the ten years 1891 to 1900 (with the exception of 1897) typhoid fever has been more prevalent in St. George's, Hanover Square, in November and December than in August, September and October, the months when it is normally prevalent, the average number of cases per month for November and December having been 7·2, and for August, September and October only 4·2. This excess of typhoid fever in November and December was coincident, he said, with the increase in organic matter in the water supplied by the Thames companies when the river was in flood. He pointed out that Mr. Shirley Murphy, the Medical Officer of Health of the London County Council, had drawn attention to the fact that in 1894 there was an excess of typhoid fever in November and December in the London districts supplied by all the water companies, except the East London and the Kent companies, and that this followed exceptional floods in the rivers Thames and Lea. Dr. Corfield stated that he was satisfied from these facts that the distribution of inefficiently filtered river water during November and December was the cause of the increase in the number of typhoid fever cases which occurred among persons especially liable to the disease.

Among the cases of polluted well water described by him, perhaps the most interesting and remarkable was one which he had recently investigated at a country house where there had been a case of typhoid fever, and where, by a peculiar arrangement of the suction pipes of a pump, water was, in certain circumstances, siphoned automatically from a pond polluted with the house sewage into the well supplying drinking water.

Dr. Corfield then described a number of outbreaks in which the poison of typhoid fever had been distributed by means of milk, oysters, cockles and mussels, ice-creams, ginger-beer, and even oranges and grapes, these fruits having been thrown, because they were decaying, into an ash-pit where typhoid excreta had been previously put, and having been picked up and eaten by a number of children.

Among the reports quoted were some from Belgium, France and Germany, kindly sent him by Dr. Kuborn, of Seraing-Liége, Dr. Brouardel, of Paris, and Dr. Pistor, of Berlin, respectively, and also some from different parts of the United States, and others by Dr. J. Ashburton Thompson, the President of the Board of Health of New South Wales.

In concluding his account of the communication of the disease