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SYSTEMATIC EXPLORATION AT DEIR-EL-BAHARI.

The Eleventh Dynasty Temple at Deir-el-Bahari. Part i. By Eduard Naville, with chapters by H. R. Hall and E. R. Ayrton. Pp. ix+75; 31 plates. (London: The Egypt Exploration Fund, 1907.) Price 25s.

IN 1893, Prof. Naville undertook for the Egypt Exploration Fund the work of clearing Queen Hatshepsut's celebrated temple at Deir-el-Bahari at the foot of the cliffs bounding the western side of the necropolis of Thebes. This work was completed in 1903, but during the progress of the clearing certain relics of the eleventh dynasty were unearthed which led M. Naville to believe that under the sand and rubbish mounds on the south side of Hatshepsut's temple lay concealed a building or cemetery of the Early Middle Kingdom. In these southern mounds of Deir-el-Bahari, Prof. Naville and Mr. H. R. Hall began to excavate in 1903, and they soon brought to light the platform of what they conjectured to be another and an earlier temple. Continuing their excavations, they found a number of slabs of stone and columns bearing the cartouches of King Neb-hatep-ra Mentu-hetep, and it was not long before they had cleared enough of the building to show that the ruin before them must be the mortuary temple of that eleventh-dynasty King. The clearing was steadily continued during the winter seasons until 1907, and the volume before us is the first part of the record of a patient and thoroughly systematic piece of exploration. In the writing of the memoir Prof. Naville has been assisted by Mr. H. R. Hall, of the British Museum, and by Mr. E. R. Ayrton, one of the Egypt Exploration Fund officers.

In the first chapter Prof. Naville deals with the difficult question of the sequence of the eleventh-dynasty kings. The Royal Canon of Turin preserves the names of only the last two: (1) Neb-hatep-ra (Mentu-hetep) and (2) Se-ankh-ka-ra (Mentu-hetep) The order of three other kings of this dynasty is now established from a newly acquired stele in the British Museum quoted by M. Naville; this gives (1) Uah-ankh Antef-aa, (2) Nekht-neb-tep-nefer Antef, and (3) Se-ankh-ab-taui Mentu-hetep. The only other well-authenticated sovereign of this Theban line of princes is Neb-taui-ra Mentu-hetep, whose place is probably between Se-ankh-ab-taui Mentu-hetep and Neb-hatep-ra Mentu-hetep. To this list of six kings Prof. Naville would add another Mentu-hetep whom he calls Mentu-hetep III., but the separate existence of this sovereign is extremely problematical; he only differs in his "Horus" name from Neb-hatep-ra (M. Naville's Mentu-hetep II.), his prenomen and nomen are the same, and the difference in the Horus-name may well be due to his further territorial conquests. Another King Mentu-hetep discovered by M. Naville (pl. xii. i) certainly belongs to the later intermediate period between the end of the twelfth dynasty and the beginning of the eighteenth; the prenomen cannot be read on the published fragment Se-kha-en-ra as the explorer suggests, although that prenomen certainly occurs on another block found in the temple (pl. xii. j). Se-kha-en-ra, it may be pointed out, is the prenomen of a Hyksos king, and to the Hyksos period or thereabouts also belong the vassal Kings Dudu-mes (p. 3) and Senb-ma-iu (Naville in E.E.F., Arch. Report, 1906–7, p. 6), monuments of whom M. Naville and Mr. Hall have found in the eleventh-dynasty temple at Deir-el-Bahari.

In the second chapter Mr. Hall deals with the temple and its excavation. He points out that although the mortuary temple of Neb-hatep-ra has been found, the actual *tomb* of the king, which we know from the Abbott Papyrus was intact as late as the time of Rameses IX., has as yet eluded the explorers' search. The name of the temple was Akh-asût-Neb-hatep-ra, "Brilliant are the seats of Neb-hatep-ra," and it is often mentioned in the hieroglyphic inscriptions. The second mortuary temple, named Men-asût, "Firm are the seats," referred to on p. 11, was that of Queen Ahmes-nefret-ari, and was discovered in 1896 on the edge of the desert at Kurneh—a fact which seems to have escaped Mr. Hall's notice. Dating from the beginning of the Middle Empire, this temple discovered by the officers of the Egypt Exploration Fund is the earliest Theban temple known to us, and it is consequently of great interest. It seems to have been the prototype of Hatshepsut's temple, for, like it, it is constructed in terraces, the approaches to which are a ramp or inclined plane flanked by colonnades of square pillars having the cartouche of the king. The ramp leads to a platform which supported the front part of the temple, while the rear portion was cut out of the living rock. In the middle of the upper court is a large superstructure of rough stones which bore a small pyramid—a mere architectural erection—about sixty feet square at the base. This was surrounded by an ambulatory of octagonal sandstone columns, many of which still remain in position. The walls were covered with painted reliefs of religious and civil scenes, and at the back of the central superstructure were found remains of shrines of certain priestesses of Hathor under the eleventh dynasty. The painted reliefs discovered have a curious archaistic appearance. Some depict men gathering reeds, driving animals, sowing and reaping, and so forth, for the maintenance of the royal funerary cult. Others give scenes from the ceremonies of the Sed-festival, and show processions of priests and warriors. The most important, however, are those which relate to a campaign of Neb-hatep-ra against the *Aamu* (pls. xiv., xv.) and the *Reten-reru* (pl. xv. F), both peoples of Asia. The patron goddess of the temple was Hathor, and it is curious that Amon does not appear to find a place in the reliefs, although Set is represented on the wall of the western court in his traditional guise.

In the third and fourth chapters the authors describe very carefully the various tombs found during the course of the excavations: "they are all, with one possible exception, of the eleventh dynasty, and there-

fore contemporary with the temple," though certain of them contained secondary burials. The sarcophagi of the Princesses Kensit and Kauit will henceforth rank as important examples of the eleventh-dynasty workmanship.

The fifth chapter, by Prof. Naville, is devoted to the twelfth-dynasty monuments found in the temple area, and to the worship, in the later periods of Egyptian history, of King Neb-hatep-ra, the founder of the temple. The most important monument of the twelfth dynasty unearthed was a red granite stela of Senusret III. (why do the authors retain the obsolete transliteration Usertsen?) recording a royal decree to the priest of Amon and to the officials of Thebes, "ordering rations of bread, and beer over and above what had been given before, in order to increase the offerings of his forefather Neb-hatep-ra." This stela, more than one and a half metres high, has since been removed to the Cairo Museum.

In the last chapter, M. Naville deals with his discovery of the famous Hathor Shrine containing the Cow-statue, at present one of the chief objects of interest in the museum at Cairo. This splendid specimen of the Egyptian sculptor's work M. Naville believes dates from the reign of Thothmes III., but it bears the name of his son, Amenhetep II. A fine coloured reproduction of it is given in pl. i., from a water-colour drawing by Mr. Reach.

Several of the photographic plates are poorly reproduced, but a word of praise ought to be given to the line drawings of Madame Naville, which, as always, are excellent.

BIOGRAPHY OF AN INVENTOR.

Thomas Alva Edison: Sixty Years of an Inventor's Life. By Francis Arthur Jones. Pp. xvi+375; with 22 illustrations. (London: Hodder and Stoughton, 1907.) Price 6*s.* net.

"IT is estimated," so Mr. Francis Arthur Jones tells us, "that if everything that has ever been written and published about Edison were collected and re-published in book form, it would make a library of a thousand volumes—each volume containing an average of a hundred thousand words." The present biography is a most readable and interesting book, which gives a very good insight into Edison's life in the space of 375 pages. It is written for the general rather than the scientific reader. It would be a capital book to place in the hands of schoolboys, and if juvenile readers were to play at setting up make-believe printing presses in railway trains in emulation of Edison's first attempts at educating himself the amusement would be a harmless and instructive one, if they did not reproduce the fiasco which first put the youthful inventor "down on his luck."

This biography should do much to disillusion the impressions which are so commonly formed about successful men, that they only have to invent something in order to make a fortune. It shows clearly that the only road to success is through failure. His career as telegraphic operator was most precarious, and one of his first inventions—a vote-recording machine for election purposes—was refused, really because it was too ingenious and perfect; in fact, it could not be tampered with. His resolve never to invent anything which was not wanted by the community at large helped him greatly, but still the telegraph companies would not seriously consider his systems of multiplex telegraphy until he had done something more. That something was to help them out of difficulties when a breakdown occurred. His successes in obtaining his first cheque from the Gold Indicator Company, and in securing the adoption of his improvements in telegraphy, were only achieved when he had shown his capacity of being handy man in an emergency. Then the success of his inventions in connection with the telephone and phonograph was only bought at the cost of long and patient attempts at trying first one substance and then another for the transmitter of the former and the cylinder of the latter. As to the continual litigation which fell on Edison's shoulders in order to protect his patents, Mr. F. A. Jones's information regarding the large staff of solicitors employed in Edison's legal department bears abundant testimony.

In the later chapters we see how even success brought troubles with it in the form of a crowd of reporters, interviewers, cranks and faddists, and it cannot be doubted that Edison's good humour and ready wit, of which we have here many amusing instances, no less than his indomitable energy and perseverance, were greatly needed in order to enable him to cope with all the work that fell on his shoulders. His biographer is also at considerable pains to disillusion the reader as to the wild and fantastic inventions attributed by unscrupulous newspaper reporters to "the wizard of Menlo Park," and to which the name "Munchausen science" has been given. Unfortunately, many of these tall stories have been read and widely believed in England, and no one is stronger in his condemnation of such fictions than Edison himself.

It would be very desirable that a further book should some day be published dealing more especially with the scientific aspect of Edison's work. It would undoubtedly be a difficult task to write such a book. If Edison did not study at a university in the accepted meaning of the term, he certainly appears to have made a university for himself in his workshops, in which he was his own professor, and it cannot be denied that the training he underwent under these conditions was fully as efficient, and in many ways better, than a course modelled on conventional lines. His education was undoubtedly thoroughly scientific in the best sense of the word, but it was different in the matter of technicalities from that of the ordinary science student. Consequently Edison nowhere figures as a contributor of papers in transactions and periodicals. Some evidence is given in this book that results published elewhere as "researches" were well known to him years previously. His "notion books," couched though they be in a mysterious language of their own, must contain a lot of important new results, and it will be a pity if no steps are taken to render these results accessible to scientific workers at

some future time, if not now. The statement that Edison is now devoting himself exclusively to pure science thus becomes welcome news.

The book is illustrated in the approved style with "Edison at the age of four," "Edison at nineteen," "Edison at forty," and so forth, also "Mr. and Mrs. Edison in the laboratory"; altogether more than a score of illustrations.

We think that one person is kept rather more in the background than is really necessary in this book, that person being Mr. Francis Arthur Jones. He shows such an intimate knowledge of and friendship with Mr. and Mrs. Edison that some further reference to his personal relations with them would not only be justifiable, but would give an added interest to the biography.

We must, however, direct attention to the statement on the last page:—

"Of the force hidden in coal about 15 per cent. only is available, the other 85 per cent. being wasted. That is why it requires so many hundreds of tons of coal to propel a liner across the Atlantic. When the problem of generating electricity direct is solved, then two or three tons of coal only will be needed for the same purpose."

"Many hundreds of tons" is, of course, a somewhat elastic term, and we do not know whether Mr. Edison or Mr. Francis Arthur Jones is responsible for the above statement, but taking, say, five hundred tons by way of argument, it is surely a little unnecessary for either of those gentlemen to imperil his reputation for the sake of seventy-two tons of coal.

G. H. BRYAN.

A FRENCH TREATISE ON GEOLOGY.

Traité de Géologie. I. *Les Phénomènes géologiques.* By É. Haug. Pp. 536; 195 figs., 71 plates. (Paris: Armand Colin, 1907.) Price 12.50 francs.

AMONG the most important of the perpetual needs of geology is the frequent renewal of the international supply of advanced text-books, from which the general conclusions of foreign authorities and the outlines of the geology of foreign lands may be learnt apart from the now overwhelming mass of original literature. In such books the interests of the local students, to whom illustrations of normal phenomena are most important, to some extent conflict with the requirements of foreign geologists, who will profit by the description of exceptional occurrences; but fortunately most authors of advanced works may be trusted to enliven their books by a sufficient number of special cases to make them useful to foreign geologists. The issue of an extensive treatise on geology by Prof. Émile Haug, of the University of Paris, is, therefore, to be warmly welcomed by British geologists, as we may expect it to give an instructive account of geological phenomena in France, a guide to the original literature, and a clear exposition of the current state of geological thought in that country.

Prof. Haug's first volume deals with geological processes and materials. In his statement of the relations of geology to allied sciences he lays stress on the essential importance in geology of the succession of phenomena; and this idea finds frequent expression in the book, from the first chapter on the geological cycle to the last on theories of orogenesis. The volume opens with an account of the general morphology of the earth, and he says that "the geological history of our planet is nothing else than the history of its successive cycles"; and he regards the three main subdivisions of geological history, for which he uses the names Primary, Secondary and Tertiary, as each a great cycle beginning with very active sedimentation, followed by intense crustal movements, and closing with a period of great consequent denudation. He suggests that the "pre-primary" was a similar cycle, and that the "post-tertiary" will be another."

In his description of rocks he follows the guidance of the same principle by describing them under the headings of lithogenesis, orogenesis, and glyptogenesis, *i.e.* their formation, modification, and destruction. He then proceeds to biological geology, discussing the life of the continents and the distribution of botanical and zoological provinces. The author attaches no value to the theory of the permanence of oceans and basins; and although he notices the objections of Koken and Frech to the assumed Pacific continent, he warmly maintains its former existence. According to Prof. Haug, there were five great continents in Secondary times—the North-Atlantic continent, the South Atlantic or Brazilio-African continent, the Sino-Siberian continent, the Austral-Indian-Madagascan continent, and the Pacific continent. He maintains the Mesozoic existence of these continents, and the fundamental difference from the present distribution of land and water, as a necessary consequence, both of the tectonic structure of the earth and of the distribution of animals and plants. He maintains that:—

"The enigmas of zoological geography are absolutely insoluble if one regards only the existing state of things. But as soon as one admits that the distribution of lands and seas was not, in geological epochs anterior to our own, the same as it is to-day, all these facts become clear in a new light."

After three chapters dealing with the sedimentary rocks, and one on mineral-fuels, the author discusses tectonic geology, crustal movements, and the phenomena of volcanoes and earthquakes. The chapter on fuels shows the author's thorough chemical knowledge of his subject. The excellent chapters on mountain structure are illustrated by numerous clear diagrams to explain the views and terms of Suess, and by artistic photographs of those French Alpine regions where the author has made important researches.

In the treatment of so wide a range of subjects there are naturally a few slips; thus the author four times refers to Ceratodus as living in Tasmania instead of Queensland, and he follows another important recent text-book in the statement that the New Zealand geysers were destroyed by the eruption of 1884. That eruption, however, though it destroyed the sinter

terraces of Rotomahana, actually increased the activity of the New Zealand geysers, until they culminated in the eruptions of Waimangu, the greatest of known geysers. Some of the opinions expressed by the author may not be generally followed. He holds that the diamond-bearing block of nickel-iron found in the Diablo Canyon was of volcanic origin, and not a meteorite. According to him, the lateral secretion hypothesis "ne compte plus guère d'adeptes"; and he refers to the impregnation theory for the banket of the Rand as if it were universally accepted, although during recent years the majority of the Rand mining engineers who have had previous experience of placer deposits have rejected the theory.

Each chapter is followed by a bibliographic list, of which one striking feature is the rarity of reference to British geologists even when dealing with British rocks and problems. Thus the chapter upon coals and lignites includes several references to British materials, but there is no mention of British authors on palæobotany or its problems; and though the rock classification accepted follows the lines established by the British school of petrography, a student might read the chapter on igneous rocks and its bibliographic list without a suspicion that any British author had ever taken any interest in petrography.

At the close of the volume the author discusses the displacement of shore lines, the possible instability of sea-level, and the views of Prof. Suess, and he gives an interesting statement of the tetrahedral theory. Though he confesses that the bases of this theory are still uncertain, he thinks that tetrahedral deformation of the earth may be the solution of the hitherto unsolved problems of orogenetic movements.

J. W. G.

BOTANICAL PHOTOGRAPHS.

Vegetationsbilder. Edited by Dr. G. Karsten and Dr. H. Schenck. Series iii. (parts 4–8), iv. (parts 1–8); v. (parts 1–8). (Jena: Gustav Fischer, 1906–7.) Price 20 marks each series, or 4 marks for separate parts.

NOTICES of earlier series of this excellent publication, that is due to the enterprise of the publishing firm of Gustav Fischer, appeared in NATURE of November 2, 1905 (vol. lxxiii., p. 4). Any doubts that may have existed as to the success of the venture have been dispelled, and it may be expected that series will follow series for some time to come. Each number containing one or more parts is complete in itself, and the various numbers in a series refer, as a rule, to different countries.

Dr. H. Schenck contributes the photographs reproduced in series iii., part 4, of trees characteristic of the Mediterranean region, of which the olive and cypress are the most important. The island of Socotra furnishes the subject of the next part. Although explored with successful results by the Forbes-Ogilvie expedition, Austrian botanists on a more recent visit also obtained many new plants. About one-third of the flowering plants are endemic, including the curious trees *Dendrosicyos socotrana* and *Adenium socotranum*, with conical swollen stems. Dr. E. Zederbauer provides the illustrations of the dry inner regions of Asia Minor. A typical scene shows scattered cushions of Astragalus and Acantholimon with interspersed plants of *Verbascum olympicum*. A double number is devoted to the small island Koh Chang, near Bangkok, where Dr. J. Schmidt obtained very successful photographs of the pneumatophores of Avicennia, Sonneratia, and Xylocarpus; a singular plant is the orchid *Eria semiconnata*, bearing button-like tubers that are studded over the rocks.

The fourth series opens with an account of myrmecophilous plants found by Mr. E. Ule in the Amazon region; species of Cecropia, Triplaris, and Tachigalia are illustrated. Two separate parts referring to German territory in West Africa are contributed by Dr. W. Busse. The former deals with primitive forests and modern steppe formations in the southern part of Togo; the other depicts economic trees such as the oil palm and shea-butter tree. Mr. C. Skottberg is responsible for a double number in which Tierra del Fuego, the Falkland Isles, and the island of South Georgia are illustrated. On the mainland, trees of Nothofagus give form to the landscape; on the islands the umbelliferous plant *Bolax glebaria*, tussock-grass, *Poa flabellata*, and *Acaena adscendens* furnish characteristic formations. Photographs of algal vegetation in the Færöe Islands have been supplied by Mr. F. Börgesen. Scenes from Arizona represent the work of Mr. C. A. Purpus. They include photographs of pines and some markedly xerophytic types, such as *Cereus giganteus*. Mr. A. Th. Fleroff has selected the water and swamp vegetation of mid-Russia for reproduction in the last part of the series.

A double number containing a continuous ecological account of the formations in the districts of the Eifel and Venn begins the fifth series. The authors, Drs. M. Koernicke and F. Roth, have shown great skill in their photographs of the ground vegetation. A number made up of three parts is devoted to photographs in northern Russia, some representing conditions in the coniferous region, others taken from the subarctic zone, that depict *Rubus chamaemorus*, *Senecio arcticus*, and "tundra" moors. Photographs of Spanish vegetation by Dr. M. Rikli illustrate the only indigenous European palm, *Chamaerops humilis*, the date palm, and esparto-grass, *Macrochloa tenacissima*. The dry season in the country around Ugogo, in German East Africa, furnishes the subject of another part contributed by Dr. W. Busse. Commiphora trees, bushes of *Adenium obtusum*, and *Acacia spirocarpa*, one of the "umbrella" Acacias, are selected for illustration. The final number in the series deals with the vegetation of the Mexican mountains Ixtaccihuatl and Popocatepetl. The author, Mr. C. A. Purpus, has selected illustrations of *Pinus Hartwegii* growing at the tree limit, and of *Senecio calcareus* and grasses in the subalpine region. *Draba Pringlei*, *Arenaria bryoides*, and *Alchemilla pinnata* are shown in the photographs of the higher Alps.

PAINTS AND PIGMENTS.

Analysis of Mixed Paints, Colour Pigments, and Varnishes. By Dr. C. D. Holley and Prof. E. F. Ladd. Pp. xii+235. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 10*s.* 6*d.* net.

Modern Pigments and their Vehicles. By Frederick Maire. Pp. xi+266. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 8*s.* 6*d.* net.

THE book written by Dr. Holley, with the assistance of Prof. Ladd, on the analysis of mixed paints, colour pigments, and varnishes, should prove of considerable practical value, especially in America, and should be of assistance to analysts who have work of this kind to do, as it brings together much information which is otherwise scattered, and contains a good deal which is not to be found in the well-known manual by the late Mr. Hurst. Owing to the very large development of the ready-mixed paint trade in the United States, and the recent legislation there dealing with adulteration, the analysis of ready-mixed paints is of far more frequent occurrence than it is in this country, where it is very rare for a public body or an architect to have a proper examination made of the pigments and varnishes that they use.

The part of the book which deals with the determination of the covering power and tinting power of a pigment might certainly have been more developed. For a great many practical purposes this is a most important question. If, for instance, we take an ochre which is going to be used either to cover a surface by itself or to be mixed with white, the analysis of the ochre gives us little information of any practical value compared with its careful examination for covering power and tinting strength, yet comparatively little is said in the text-books about this method of assaying pigments. The most useful practical instrument for this purpose up to date has been the Lovibond tintometer, which enables the whole matter to be reduced to the plotting of comparative curves of tinting power, and also enables the actual covering power of a white lead to be exactly and accurately measured. The Lovibond tintometer is, however, an instrument which requires a great deal of practice before accurate results can be obtained, and recently Mr. Ives has introduced a new tintometer which may possibly replace the Lovibond tintometer for such purposes. The experiments that were made in this direction by Captain Abney resulted in the development of a most ingenious application of the spectrum, but in practice the Lovibond tintometer has so far proved the more useful instrument.

There is another direction in which the information in the book is somewhat imperfect, and that is the practical testing of varnishes, although the authors can hardly be blamed for this, as so little has yet been done to make the testing of varnishes thoroughly complete and efficient. The practical difficulties are great, and weather tests in the hands of different observers have proved to be very delusive. One of the most important questions on which there is need for far more accurate information is the durability of paints, prepared from different pigments and with different vehicles, when used for the protection of iron and steel structures. This is rapidly becoming a very serious question, as the use of steel in construction is greatly on the increase, and it is not yet possible to give very accurate information upon this matter. While, therefore, this book by Mr. Holley and Prof. Ladd may be regarded as bringing up to date the information both on the analysis of pigments and vehicles, and on the practical testing of their properties, to which the attention of chemists might well be directed, it reveals very clearly that in this department of applied chemistry a great deal more information is required to enable us to determine the facts upon which the suitability and durability of various vehicles depend.

The little book by Mr. Maire does not pretend to be a scientific treatise, but merely brings together much helpful information about modern vehicles and pigments, which is stated in a simple manner, without going into chemical details, and it should therefore prove of use to architects and house-painters and decorators who wish to have some general information as to the materials they use from day to day, and who are yet unable to understand a thoroughly scientific treatise. A fair number of the pigments which are mentioned by Mr. Maire belong rather to the artist's palette than to painters and decorators, but there is no reason why these should not be included and some reference made to them. The main difficulty of the modern decorator is, however, due to the introduction of a large number of pigments which are prepared from coal-tar dyes, fresh ones constantly coming into the market, which may be fugitive or have the property of bleeding, and about which he necessarily has no information. These pigments are introduced with fancy names, each colour maker choosing such names as may suit himself, and consequently a great deal of trouble has resulted in the painting and decorating trade. It is hardly possible for any text-book to deal efficiently with this subject, beyond giving certain general warnings that before using any new pigments, outside those already recognised, careful tests should be made by the architect and decorator.

Both these books can be regarded as thoroughly useful, the one for the analyst and the other for the architect and decorator, and should do something to encourage a more scientific study of these questions in this country.

A. P. LAURIE.

OUR BOOK SHELF.

A Dictionary of Spanish and Spanish-American Mining, Metallurgical, and Allied Terms, to which some Portuguese and Portuguese-American (Brazilian) Terms are Added. By E. Halse. Pp. xiii+380. (London: C. Griffin and Co., Ltd., 1908.) Price 10*s.* 6*d.* net.

IN view of the magnitude of the mining industries of Spain, Mexico, Central America, Peru, Chile, Bolivia, and other South American countries, there can be no doubt that there is a large and increasing

number of English and American mining engineers who will appreciate a good dictionary of mining terms, and certainly the author has spared no pains to make his dictionary as complete as possible. He has diligently studied the Spanish literature of mining and metallurgy, and his long residence in Mexico and in the United States of Colombia has enabled him to include a very full list of the terms used in these republics. Some Portuguese and Brazilian terms are also added.

It is curious to note that many terms have different meanings in different districts of South America. Thus, the well-known term *Caliche*, applied in Chile and Peru to the impure native nitrate of soda which is mined on a vast scale, denotes in the Uco district of Peru a thin layer of clayey soil capping auriferous veins, in Mexico felspar, and in Antioquia, Colombia, a recently-discovered mineral vein. It is probable that with the development of railway intercommunication many of these terminological differences will disappear, and that the most convenient terms will survive. In all cases the locality where a particular term is in use is noted by the author, and the authority is duly recorded. Small sketches, seventy-six in number, are added when necessary to elucidate a definition. The whole work has been compiled with scrupulous accuracy, and deserves unstinted praise. It is perhaps to be regretted that an English index to the Spanish terms has not been included in the scheme of the work.

Immanuel Kants Metaphysik der Sitten. Herausgegeben von Karl Vorländer. Price 4.60 marks.

Kirchners Wörterbuch der philosophischen Grundbegriffe. Neubearbeitung von Dr. Carl Michaëlis. Price 8 marks.

B. de Spinoza's kurzgefasste Abhandlung von Gott, dem Menschen und dessen Gluck. Übersetzt von C. Schaarschmidt.

G. W. F. Hegel's Phänomenologie des Geistes. Jubiläumsausgabe. Herausgegeben von Georg Lasson. Price 5 marks. (Leipzig: Durr'schen Buchhandlung, 1907.)

THE first three of these volumes are new editions of works that have been reprinted at various times in the "Philosophische Bibliothek," a series which does for the German student of philosophy what Ostwald's well-known "Klassiker der exakten Wissenschaften" do for the German student of the sciences. Hegel's famous treatise has been added to the series in celebration of the centenary of its original publication in 1807.

The books are admirably printed, and are provided with excellent introductions, often by men of first-rate authority. Many of them are, in addition, briefly but helpfully annotated, while most are equipped with a useful index. More conspicuously moderate in price even than Ostwald's reprints, these wonderful volumes, by their very existence, render almost unthinkable any English series comparable with them in scope and importance.

The Spectroscope: its Uses in General Analytical Chemistry. By T. Thorne Baker. Pp. viii+130. (London: Baillière, Tindall and Cox, 1907.)

THIS volume contains a fair amount of information useful to those wishing to purchase and set up spectroscopic apparatus for chemical research, but it seems to us to be ill-assorted and indifferently arranged. The author plunges straightway into the elementary mathematics of the prism and plane and concave gratings, and then describes the various parts of spectroscopes; yet on p. 78 it is thought necessary to inform the reader that a 12-inch focus telescope lens will give a much shorter spectrum than an 18-inch focus lens. There are, however, in the various discourses on adjustments, refractive indices, resolving power, the methods of producing radiation, sensitive plates, &c., numerous hints which will be found useful by those who have only a general knowledge of physics and wish to take up spectroscopy. It is for such readers that the book is intended. The notes on "series" and the Zeeman effect would probably be better left to the more advanced works on spectroscopy. There are a few uncorrected misspellings and one or two curious terms, which suggest that the author's acquaintance with real, practical laboratory work has been either too brief or too restricted. The astrophysical side of the subject is not dealt with at all, the idea being to restrict the book entirely to the chemical side. W. E. R.

Der Bedeutung der Reinkultur. Eine Literaturstudie. By Dr. Oswald Richter. Pp. viii+128. (Berlin: Gebrüder Borntraeger, 1907.) Price 4.40 marks.

THIS essay, with true German thoroughness, gives a very complete, though necessarily brief, survey of the various microscopic organisms that have been obtained in pure cultivation. The organisms are dealt with in groups (and not individually), partly according to their biological position, partly according to the changes they produce. The green and blue algæ and diatoms are first considered, then the bacteria—the nitrifying forms, cellulose fermenters, sulphur bacteria, &c.—and lastly the yeasts and protozoa. In the final portion of the book the subjects of pleomorphism and systematic position of these organisms are discussed. The bibliography is a very full one, and it is probable that this part of the compilation will be most appreciated. R. T. H.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Coloration of Birds' Eggs.

IN NATURE of May 14 Mr. R. L. Leslie asks if it is known how and why birds' eggs become coloured, and whether they illustrate Mendelian phenomena.

Something is known as to the nature of the pigments from which the colours are derived. The late Dr. H. C. Sorby in 1875 investigated their origin by means of the spectrum analysis. He discovered seven substances in the pigments accounting for every form of coloration. These substances are oorhodeine (red), oocyan, banded ooycan (blue), yellow ooxanthine, rufous ooxanthine (yellow and reddish-yellow), a sixth substance of a brown tint, and lichenoxanthine, found in many plants, lichens, and fungi, and perhaps due to microscopic fungi. According to older theories, the pigments were secretions from the blood and bile, and in the case of the first three Sorby was disposed to agree (*cf.* the origin of pigments in coloration of molluscan shell). The ground-colour is laid on the shell just before the extrusion of the egg, and in eggs not of a purely uniform colour the markings are then superposed, being originally rounded, but by movement of the bird they become blurred and blotched. The intensity of coloration varies with age up to a certain point. Eggs of young birds are often unspotted. No doubt absence of markings is due to deficiency of pigmentation. The last egg or eggs of a second brood, in fact, often lack normal coloration or markings. Age and health thus control coloration, which is brilliant in a healthy but indistinct in an unhealthy bird's egg. Whether albino birds lay eggs differing from those of birds typical in every way has not been noticed apparently.

Little is known definitely as to why eggs are coloured.

In the early days of ornithology oology played its part in classification, but though the eggs of plovers, gulls, &c., characterise their suborders, this is rather exceptional than otherwise, and Huxley has settled the question of avian taxonomy upon a sound morphological basis. Coloration of eggs seems to have no connection with inherent hereditary tendencies, nor is it apparently the result of acquired characters in the birds themselves. In a large number of cases it can be traced to the necessity for a protective resemblance, just as in shells of mollusca. This would serve to ensure escape from the jaws or beaks of natural enemies, *e.g.* hedgehog, snakes, and egg-sucking birds and mammals, or (in recent times) from the collecting instinct of man. Where eggs exhibit brilliant or conspicuous markings, for no purpose apparently, we may perhaps assume that the nesting-site has been modified, or that, like the colour of the plumage, that of the egg is a source of attraction, and connected with courtship, or, more probably, as a means of identification by the individual of its own nest and eggs, when the process would naturally be hereditary (memory and heredity being intimately allied), the instinct employed in distinguishing similar clutches characterised by merely slight differences being likewise acquired.

No two clutches of eggs of the same species are exactly alike, particularly amongst birds nesting in colonies, *e.g.* guillemots, penguins, &c., but each bird knows its own egg. A few general principles may be recognised in the coloration of birds' eggs. Usually white eggs are laid by birds nesting in holes in trees or in dark situations, where light seldom penetrates, as by the barn owl, woodpeckers, and some pigeons, which build sometimes in the open, though usually in dark woods (wood-pigeon), sometimes in holes in trees, or in rabbit-burrows (stock-dove). Though all owls lay white eggs, not all of them nest in holes in trees, *e.g.* long-eared owl, snowy owl. This rule, then, holds good in a large number of cases, but not invariably. Most birds nesting on or near the ground lay eggs of a uniform olive-green or brown ground-colour, *e.g.* pheasant, partridge, nightingale, &c., the eggs harmonising with the ground or vegetation.

The eggs of grouse, ptarmigan, &c., resemble the heather amongst which they are hid. Those of the ringed plover, little tern, and oyster-catcher resemble sand and shingle on the beach. The lapwing's eggs closely simulate bare soil or dried bents. In these eggs secondary markings break up the ground-colour, and further help to render the eggs quite invisible except to an eye trained to detect slight differences. The experienced field naturalist can find his way to the immediate whereabouts of a nest by noticing the existence of some distinctive mark in the surroundings, *e.g.* a stick, boulder, bush, mole-heap, &c., indicating to the birds themselves at a distance the vicinity of the nest, and thus enabling them to return quickly and stealthily without laying themselves open to observation by long searching for the nest. The same protective resemblance occurs amongst the chicks of these birds. Adaptation to external surroundings, now or in the past, seems to explain this matter of coloration in a large number of cases, and exceptions to the rule are usually simply examples of reversions to, or rather survivals of, ancestral traits before protection was called for. In seeking for the causes of variation, &c., the influence of environment or external conditions seems to have been largely overlooked, too great prominence having been given to the influence of the inherent tendency to vary. In the case of the colours of birds' eggs we have an instance in which, I think, external conditions have played the greatest part.

Whether all birds' eggs were originally white, and the pigmentary layer has since been added to aid in concealment or to counteract the heat of the sun's rays, is not definitely known. The number of eggs ornamented with spots, &c., is very great. The creepers, nut-hatch, &c., lay spotted eggs in holes in trees, &c., possibly after originally having had some other nesting-site.

Summing up the general conclusions drawn from the coloration of birds' eggs, we find different species of birds of the same genus in a large number of cases lay eggs of much the same type, *e.g.* warblers, tits, nut-hatches, creepers, plovers, ducks, pigeons, gulls, terns, &c. In very many cases, however, this is not the case, and an exception in any genus may generally be traced to influence of environment. Amongst the Turdidæ, the eggs of the missel-thrush, thrush, and blackbird are very dissimilar, though their nesting sites are much alike. Variation in the colours of eggs goes, in fact, largely with difference in nesting-site. The starling and jackdaw lay blue eggs like the three last-named birds in holes in trees. Probably these birds have only recently betaken themselves to such nesting quarters. The influence of man and his habitations, and the conversion of dark forests into fields simply enclosed with *lines* of trees into which light readily penetrates, may have induced alterations in some instances, if not in coloration of the egg, at least in nesting-sites, of many birds intimately associated with human undertakings.

A. R. HORWOOD.

Leicester Corporation Museum, May 26.

Electrical Action of Sodium.

IN a recent letter (NATURE, May 28) I directed attention to the fact that a negatively electrified body lost its charge in air when held near to a clean surface of sodium.

I have now ascertained that different portions of the same rod may show the effect to a greater or less extent owing to inequalities of temperature. Diminishing the oxidation by cooling the metal produced a more complete diselectrification, and this result seemed, at first sight, to point to a cause other than chemical action. The influence of a current of air, as well as the fact that even a soap film stopped the discharging action, supported the view that an electrified gas was emanating from the metal. A bright surface of potassium gave no appreciable discharging effect when cooled with a mixture of ice and salt. In all cases the surfaces could be seen in the dark to be glowing strongly.

Further experiment has shown that no active gas can be driven from sodium by heat, and that the true explanation of the action lies in the positive electrification of the air surrounding the freshly cut surface. With warm sodium it is seen that the gold leaf falls rapidly for a very short distance, while after cooling the action is more prolonged. It is clear, therefore, in the first case, that the action, although violent, is so transient, owing to the whole surface being rapidly oxidised, as to appear of small amount. The far larger discharging action was obtained with reduced oxidation owing to the effect being more prolonged.

CHARLES E. S. PHILLIPS.

Castle House, Shooters Hill, Kent.

Tabular Accuracy.

I DO not know whether you will consider the following suggestion suitable for publication. Though obvious, I do not remember meeting with it.

All are agreed upon the enormous importance of securing accuracy in mathematical tables, and of making known any errors, but I am not aware of any definite centralised method of registering mistakes, and publishing, in an easily accessible form, corrections of them.

What I venture to suggest is that, in connection, say, with the National Physical Laboratory, there should be a department dealing with mathematical tables. When an error is discovered in any recognised table, the discoverer should at once send a note of the fact to this department, which would duly investigate the matter. Then, at suitable intervals, the department would publish a list of errors, with their corrections, in a form purchasable by those interested. By some such arrangement he might hope in time to secure the accuracy so essential to the numerical data employed in scientific calculations.

C. T. WHITMELL.

Invermay, Hyde Park, Leeds, June 2.

The "Sky-coloured Clouds."

THERE was a very feeble display of "sky-coloured clouds" here on May 27 from 10 to 11.15 p.m. This is the first time I have seen this phenomenon since July 19, 1906. Since May 27 the sky has not been clear enough for them to be visible.

T. W. BACKHOUSE.

West Hendon House, Sunderland, June 4.

SOME SCIENTIFIC CENTRES.

No. XIII.—The Mechanics Laboratory of the Imperial College of Science and Technology.

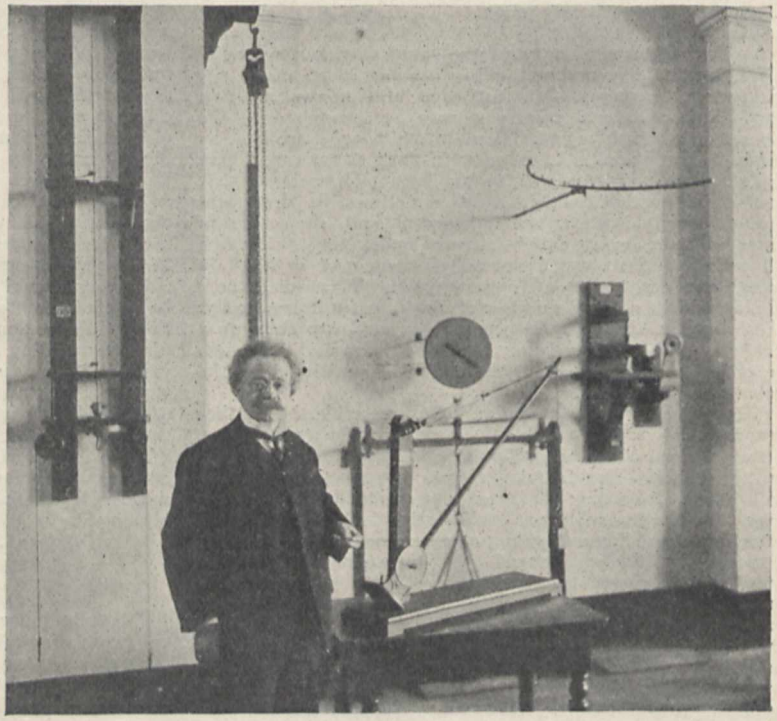
THIS description of the mechanics laboratory of the Imperial College of Science and Technology may not improbably appear to some readers as premature, in consideration of the fact that the college was so recently founded and the new rector, Dr. Bovey, appointed only within the last few months. It was as the mechanics laboratory of the Royal College of Science that until lately it was known, and under that name it achieved the great success that time and Prof. Perry brought to it. What that laboratory has been for the past ten or more years to engineering students in London will not readily be forgotten by Prof. Perry's old students, and a piece of creative work of this kind is too valuable to be lost. It is therefore a matter for congratulation that the laboratory has found a place in the new Imperial College, and in doing so it has, we hope, taken a new lease of life and usefulness.

The new Imperial College will assume also the control of certain engineering laboratories, but it must be remembered that the study of mechanics is not the same thing as the study of engineering. Not all who attend a mechanics course become engineers, though, while they are pursuing that study, the more they conform to the engineer's mental attitude, the better will they understand what they are doing, and the more effective use will they make of the time spent on this subject.

Engineering laboratories are now so numerous that they must be familiar to all who are interested in scientific work. As a type, probably the best example is to be found in the University of Cambridge. In that laboratory, for instance, there are steam engines, dynamos, motors, gas engines, boilers, oil engines, storage cells, indicating instruments, and all the hundred-and-one accessories. The atmosphere is far more nearly that of the power-station or the test-bench of a works than that of the college class-room. To complete an engineering course it is necessary to spend some time in these surroundings at Cambridge or elsewhere, but unless the student has some preliminary training in mechanics the soil will be but ill prepared for the seed.

When in 1896 Prof. Perry was appointed to the chair of mechanics and mathematics in the old Royal College of Science, he set himself to organise and equip a laboratory for the study of mechanics. It was extraordinary how the course could have prospered before without something of the kind, and the new departure meant a good deal of hard work in getting it carried out. In spite of all difficulties, however, the scheme was successfully carried through, and visitors to the college have for some years been able to see what is the model mechanics laboratory of this country. Prof. Perry himself states that his laboratory methods of teaching are based on those introduced by Prof. Ball (now Sir Robert Ball, of Cambridge University) when at the Royal College of Science in Dublin, and were gradually developed by him at Clifton College between the years 1870 and 1874. A further opportunity of development occurred during his tenure of an engineering chair in Japan from 1875 to 1879, with the consequence that by the year 1880 they blossomed out into a matured scheme of teaching at the Finsbury Technical College. It is a remarkable fact that almost all the technical institutes in this country now have, or are in process of forming, mechanics laboratories which, like the one which forms the subject of this article, are based upon the model of "Finsbury." The idea at the basis of this teaching is that students should test for themselves the truth of the theories they learn, and not get into the frame of mind which looks on all theories as equally true because all are put forward with a generally similar show of authority.

To take a simple instance of this, the problem presented by the phenomenon of friction may be cited.



Prof. Perry in his laboratory at the Imperial College of Science and Technology.

In the days before engineering had become a scientific study, the phenomenon of friction was part of the domain of the mathematical physicists, who, being chiefly desirous of finding quickly relations between different variables which would enable the data to be put into the mathematical mill to the end that results might be ground out, did not scrutinise with nearly sufficient care the results of their experiments. This was not altogether their own fault, as the apparatus used was rarely well designed to give accurate results, and their own training was extremely ill fitted for such work. For good or ill, however, the theories, such as they were, were formulated, received the name of "laws," and then there came into being those curious survivals known as the "laws of friction," so familiar to all who were still students ten or more years ago. In the early days of scientific engineering education, let us say during the 'fifties and 'sixties of last century, when the Prince Consort gave so nobly his assistance to the furtherance of the

new movement, young engineers found themselves required to learn for the purpose of examinations "facts" which they were well aware from their own experience to be misrepresentations of the real state of affairs. Among the men who have since helped to put these students into the right path and to help them on the way, none were more prominent or are more deserving of praise than Prof. Perry.

In his laboratories the phenomenon of friction, to take this same instance, is dealt with in such a way as to give the student opportunity to exercise all his knowledge of mechanics. Thus he has to test the effects of friction in every part of a mechanism—he is not allowed to forget its existence or to have his mind taken away from it, as may happen so easily when working among the large and complicated machines of the engineering laboratory. Even in so simple a case as that of the spinning of a horizontal fly-wheel by means of the unwinding from its axis of a rope which passes over a pulley, and carries a weight at its far end, the number of problems that arise is very numerous. To instance the variety of information which can be derived even from such a simple experiment as this, we may quote the following from Prof. Perry's "England's Neglect of Science":—

"Let us take this well-used fly-wheel. The M of a fly-wheel, multiplied by the square of its number of revolutions per minute, gives the kinetic energy stored up in it in foot-pounds. You are asked to measure experimentally the M of this fly-wheel; the loop at the end of a cord goes over the pin A on the spindle, and is wrapped n times round the spindle, then goes over the pulley B, and has a weight W at its end. At time O the wheel is let go; in t_1 minutes—carefully observed—the cord drops off; in t_2 minutes from starting the wheel has been brought to rest again by friction. The weight W lb. multiplied by the height in feet through which it has fallen gives the energy stored up in the wheel at time t_1, so that if the speed were then known M could at once be calculated. But as we have no speed indicator, we take it that the motion is uniformly accelerated till the cord drops off or we take $2\frac{n}{t_1}$ as the revolutions per minute at the time t_1. The corrections are of more interest. We have first to deduct the kinetic energy of W when the cord drops off. Then we must make experiments on the friction of the pulley B, for the pull in the cord at C is less than what it is at D, and these experiments are themselves very interesting, for they are made with the two parts C and D vertical, so that the parallelogram of force principle must be brought in to make them available. Next we correct for the friction at the pivots E and F. And here we observe that the average speed from t_1 to t_2 is the same as from O to t_1, and hence that from t_1 to t_2 the motion is uniformly retarded, and hence that there is as much energy wasted in any one revolution as in any other. If, then, we know the number of revolutions from t_1 to t_2 we know the energy wasted in one revolution, and we can correct for friction before the cord drops off, and so we make one correction after another, and there is hardly any limit to the amount of ingenuity required, as the corrections get less and less important. I remember that four grey-headed men worked together once at this piece of apparatus in the evening for five weeks, and when at length they had satisfied themselves with their corrections they had practically used many times every important principle of mechanics, and they had acquired a handy working knowledge of all these principles."

It is hardly possible to set bounds to the usefulness of such calculations as the above in making students think for themselves and, if they have even a moderate acquaintance with mathematics, in assisting them to find themselves, even unwittingly, engaged on what is really an original piece of research.

A mechanics laboratory is by its constitution less adapted than an engineering laboratory to research work of the usual kind, but during the last few years an important piece of original work on the air friction of rotating paper discs has been carried out. A note on the preliminary experiments was read before the Southport meeting of the British Association in 1904 by Mr. W. Odell. Mr. Odell's experiments consisted in measuring electrically the torque necessary to keep in uniform rotary motion circular discs of paper which were mounted on a horizontal shaft. These discs were 15, 22, 27 and 47 inches in diameter, and the torque was measured for (1) different speeds, (2) different diameters. The very interesting result was found that, once the critical speed was passed, the torque was proportional to the nth power of the speed, and that n was about 2·5. It was further found that the critical speed was roughly proportional to the square of the diameter when different discs were used. For a given speed the torque increased with the 5·5th power of the diameter, and this striking result leads to the deduction that, 6 watts only being required to keep a 27-inch disc moving steadily at 550 r.p.m., no less than 32 h.p. would be necessary to keep a 9-feet disc rotating at the same speed. This deduction has a very important bearing on the design of high-speed generators and other machines in which the rotating parts have considerable diameter. Roughly, a one per cent. increase in diameter would lead to an increase in the necessary torque for the same speed to be obtained of no less than $5\frac{1}{2}$ per cent.

A similar plan is followed in the laboratory with regard to problems connected with the torsion of shafts, the flow of water, the bending of beams, the efficiency of mechanisms, the swinging of pendulums, and others of the same kind. The result of such a training on students is that they acquire a kind of instinct in mechanical matters, one which is difficult to describe, but which develops alertness, and would, for instance, lead such a student to doubt immediately the accuracy of the usual measurement of horse-power by means of the average indicator. Even with such a well-made instrument as the Hopkinson reflecting indicator he would not omit to make calculations as to the effect of inertia lag when rapid explosions were being recorded, the effect of damping, and other points. After doing this he would appreciate the more the modest claim of the inventor of a 2 per cent. accuracy, and contrast it with the far more heavily drawn claims of instruments much less carefully designed. To instil this attitude of mind into young students, that they should "test all things" and take nothing for granted, is to lay the basis of a scientific way of thinking which is of fundamental importance to them in after years.

H. E. W.

THE MILKY WAY.[1]

IT may be that the limitations imposed upon us by restrictions in time and space will never allow a complete solution of the problems offered by the study of the sidereal universe. But the effort to comprehend the processes that have contributed to its structure, or

[1] (1) "La Distribution des Étoiles par rapport à la Voie lactée d'après la Carte et le Catalogue photographiques du Ciel." Par Paul Stroobant. Extrait des Annales de l'Observatoire royal de Belgique, Annales astronomiques, Tome xi., Fascicule ii.

(2) "Die Milchstrasse." By Prof. Max Wolf. Pp. 48. (Leipzig: J. A. Barth, 1908.) Price 4 marks.

to penetrate the mystery that conceals its destiny, will not be abandoned on account of the difficulty of the problem or the dearth of pertinent facts. There may be little hope that our observations and those of our predecessors will prove adequate to the task of reading the riddle, but the human mind needs very little information to tempt it to form conjectures concerning the order of creation in its widest extent. In this department of science, history unfortunately bears witness rather to the richness of our imagination than to our skill in securing facts. But in recent times, as the contents of the two works under notice show, the tendency has been to limit our excursions into the unknown, and to substitute exact inquiry directed to a definite end, in place of the loose, but possibly plausible, suggestions that did duty for critical examination. In the first-mentioned work M. Stroobant is content to count the stars the positions of which have been recorded in connection with the scheme for the construction of the photographic chart of the heavens. Such work is no doubt tedious and unheroic, but it is eminently useful, and more welcome than any random speculations, however brilliant or startling they might be. The object the author had in view in undertaking this wearisome task was to determine the law of stellar distribution, both on the chart and in the catalogue, according to variation of galactic latitude. For the present the research is limited to the stars in the zones taken at the observatories of Paris, Bordeaux, Toulouse, Algiers, and San Fernando. Of the star charts 879 have been used, containing the total of 985,430 images; and of the catalogue negatives 535, which show the places of 163,009 stars. The celestial surface scrutinised contains 4126 square degrees, approximately one-tenth of the entire surface of the sphere.

One of the by-products of the research is to indicate that the mean magnitude of the faintest stars recorded on the catalogue plates is 11·5 mag., and that of the faintest stars on the chart 13·5 mag., or taking into account the loss of images, unavoidable in reproduction, 13·7 mag. These figures show, so far as this inquiry is trustworthy, that the original proposals for the construction of the international chart have been adhered to very faithfully. A further conclusion is that the total number of stars we may expect to find in the complete catalogue is 2,676,000, and on the chart 9,854,000. These totals are more modest than early and less informed estimates, and M. Stroobant gives reason to think that these numbers will be exceeded when some of the unpublished charts become available. The data supplied from each observatory are discussed separately and fully, but space will not permit more than the reproduction of the final result, which exhibits the conclusions drawn from the whole material under discussion :—

Galactic Latitude	No. of stars in square degree		Stellar density	
	Chart	Catalogue	Chart	Catalogue
+90 to +70	91	30	0·14	0·19
+70 ,, +50	83	29	0·13	0·18
+50 ,, +30	140	48	0·21	0·30
+30 ,, +10	337	90	0·51	0·57
+10 ,, −10	660	159	1·00	1·00
−10 ,, −30	344	83	0·52	0·52
−30 ,, −50	130	39	0·20	0·25
−50 ,, −70	111	24	0·17	0·15

The want of exact regularity in the change of these numbers with the latitude is doubtless due to insufficient data, but considering the number of stars involved and the care taken to secure uniformity, the result is probably more trustworthy than that drawn from Herschel's gauges, which indicate a much more rapid increase in stellar density as the latitude diminishes. Further examination shows that the number of stars on the chart increases uniformly in both hemispheres, but that if the faintest stars be excluded and the research limited to those that appear in the catalogue, the density is more marked in the northern than in the southern hemisphere. It is not possible to make any complete inquiry as to the variation of density depending on galactic longitude, but from a preliminary investigation of those regions of the Milky Way where it cuts the celestial equator, M. Stroobant shows that at the ascending node of the Galaxy, the northern border is richer in stars than the southern, and that at the descending node this relation is reversed. It is further pointed out that the increase in the number of stars on the photographic chart does not correspond with the contour lines drawn in naked-eye representations of the Milky Way, and in conclusion the author directs attention to regions of the sky which are very rich in stars, though fairly remote from the central line of the Milky Way, to the pole of which are assigned the coordinates $\alpha = 12$h. 46m., $\delta \pm 28°$.

Prof. Max Wolf addresses himself to a scientific congress, mainly composed of medical men, and necessarily his paper is of a more popular character. He frankly admits that we have but very little knowledge of the true construction of the Milky Way, and that speculation has supplied the place of exact information. By means of excellent photographs he shows the great variety of structure running throughout the Galactic Belt, and indicates the difficulties which any theory of the Milky Way has to surmount. Prof. Max Wolf is intimately acquainted with the literature of the subject, knows the strength and the weakness of the various hypotheses that have been advanced, and treats the many problems that arise in a luminous and interesting manner.

He glances at the various studies that have been made to solve the problem of the possible geometrical form of the Galaxy, from the time when Herschel began his laborious task of counting the stars visible in the field of his telescope, down to that later period when the resources of photography have supplied more information, but at the same time revealed a more complex structure, offering fresh difficulties for solution. Of the different attempts that have been made to represent its true shape, concealed as it is by the curious bifurcations, rifts, condensations, and lacunæ, that suggested by Dr. Easton, of Amsterdam, meets with the greatest favour. In this scheme the Spiral Nebula in Ursa Major has admittedly supplied the model. A nucleus is placed in the constellation Cygnus, and from this central condensation radiate streamers, which can be arbitrarily arranged so that the combined effect can be made to resemble the general aspect of the Milky Way. The objection the author raises to the scheme is that Cygnus does not present that close agglomeration of stars which such an hypothesis requires. It might further be added that in the sketch given, the sun occupies too much the place of a detached spectator, and is apparently quite disconnected from the system.

A feature of great prominence in many photographs of nebulæ is the comparative scarcity of stars in the immediate neighbourhood of the nebula, and Dr. Max Wolf discusses the probable physical connection between the dark lacunæ and the brilliant condensations adjoining. This effect is real, and not due to contrast, for by counting the stars on a photograph within a definite area, and shading the different parts of that area according to the number of images impressed on the film, it is possible to exhibit statistically the relative density of stars surrounding the different nebulæ. This plan has been adopted with great suc-

cess in the most important nebulæ and clusters, and the diagrams reproduced show the completeness of the connection. The most conspicuous, as it is one of the most interesting instances, is that known as the "cocoon" nebula, where the complex nebulous structure lies concealed at the end of a long channel, extending more than two degrees into the luminous clouds. The author suggests that we have here to do with an absorptive phenomenon, and certainly the appearance warrants the suggestion. But such instances, if less pronounced, are not rare, and therefore it is legitimate to imagine that the whole heavens are more or less hidden by the results of processes still in progress. In that case the Milky Way itself may be regarded as a remnant of an earlier much more extended universe. This hypothesis, as any other we may form, may be quite misleading, but into whatever errors our assumptions may conduct us, it is certain that the Milky Way offers a grand and sublime problem, indicating the action of processes and forces for the adequate description of which we still lack rudimentary conceptions. We stand face to face with a great mystery without the partial unveiling of which our pictured scheme of the cosmos must remain an imperfect patchwork.

SIR JOHN EVANS, K.C.B., F.R.S.

BY the death of Sir John Evans, British archæology has lost one who was amongst its foremost figures for more than fifty years. The son of the late Rev. A. B. Evans, D.D., he was born at Britwell Court in 1823, educated at Market Bosworth School, and entered the business of his maternal uncle, Mr. John Dickinson, F.R.S., the founder of the famous paper factory at Nash Mills. From school young Evans brought with him a genuine love of classical literature and history, and presently he developed a no less strong taste for science, whilst he at once showed business capacity of no ordinary kind. Very soon he directed his attention to geology. Practical reasons may have hastened a natural tendency, as he was led to this study by a dispute respecting the water rights of his uncle's firm, and in a comparatively short time he mastered the principles of that science. He became an active member of the Geological Society, of which he was elected president in 1874.

Sir John Evans's scientific training had a very important bearing on his work as an archæologist, and in no little degree enabled him to make those great advances in British archæology which that science owes to him. Scientific method, combined with his love of historical literature, gave him an equipment for antiquarian studies possessed by but few of his contemporaries. Evans's interests were of the widest, but in his early years they chiefly lay in the coins of the ancient Britons. Though from Camden onwards much had been written about them, Evans for the first time coordinated the entire mass of material, and worked out systematically the evolution of the British types, as Lelewel had done for the Gaulish series and partially attempted for Britain. When, in 1864, Evans published his "Coins of the Ancient Britons," it was at once recognised, not only as a masterly example of learning and minute accuracy of detail, but also as a model of method. He published a supplement to it in 1890, and though his chronology, based on the time supposed to be necessary for the degradation of the original type of the gold stater of Philip II. of Macedon, may not now commend itself, the book must always remain one of our chief authorities for the early history of this island.

But his attention was not confined to the period between the occupation of south-eastern Britain by the Belgæ and the Roman conquest. He worked incessantly at the remains of prehistoric man both on the Continent and in these islands, following the method of the great Scandinavian archæologists. The first results of these labours were embodied in "The Ancient Stone Implements," &c., of Great Britain, published in 1872 (second edition in 1897). Here, of course, his geological knowledge came into play, more especially in reference to the relics left by Palæolithic man in the fluviatile gravels of our own island. Yet all this time he had been working incessantly at the first beginnings of the use of metal, and the fruits of his work in this all-important field were put forth in "The Bronze Implements of Great Britain and Ireland," in 1881. All his three great works are largely based upon and illustrated from his own magnificent collections in the several departments, though these were but a fraction of his vast treasures, which comprised a great series of Greek, Roman, English, and other coins, medals, rings, enamels, and most other classes of antiquities. At a time when so many objects which form an integral part of our national history are constantly finding their way across the Atlantic, it is pleasant to think that the collections amassed at Nash Mills are not to be dispersed under the auctioneer's hammer.

Besides his three master-works, Evans wrote innumerable papers in *Archaeologia*, the *Numismatic Chronicle*, and various other journals, all of which are distinguished by the same rigorous accuracy and keen insight as his larger publications. It is hard for us in this generation to realise clearly all that he did to advance the study of archæology in this country. Though Worsaae and his school had already firmly laid down the principles of archæology in Scandinavia when Evans began his career, in this country such studies were almost entirely in the hands of the Oldbucks and the Simpkinsons, whose fatuities, credulities and wild speculations were scorned by serious historians and mocked at by the general public. Evans's strong common sense, his scientific training, and his instinctive love of historical records soon made him a powerful steam-hammer which pulverised mercilessly the trivialities and inanities of the old antiquarians. To his influence is due in no small degree the hold which scientific archæology has been able to get on the respect of men of science, historians, and the general public. The fact that he was a most successful man of business, and at the same time took the lead in the public affairs of his county, contributed in no small degree to this result. It was felt by men of the world and men of science alike that if so powerful and practical a mind could find its chief interests in the pursuit of archæology, these studies deserved better than to be the mere pastime of pedants or enthusiasts.

Evans's great characteristics were his strong common sense, his courage, and his extraordinary mastery of details, though the last became sometimes even a weakness. Thus, whilst his books on the Stone and Bronze ages are vast storehouses of facts and minute and accurate details, he sometimes lost sight of the general principles, and did not always lay sufficient stress on the importance of associated groups of objects to which the younger generation attaches so much value. But make what deductions we may, the fact remains that Sir John Evans must always hold his place along with John Kemble, Wollaston Franks, Greenwell, and Boyd Dawkins in the front rank of those who have set British archæology on a scientific basis. Vigorous in defence of his own views, yet from his innate love of truth ready to modify them and accept those of others when his

reason was convinced, his strong and masterful disposition made him a leader of men, and thus he became in due course president or chairman of almost every society, association, or public body of which he was a member. His delightful humour and inexhaustible fund of good stories made him the best of companions. Time dealt with him kindly; he bore lightly his burden of more than four-score years, and to the last his mind retained its youthful spring. The sturdy old oak continued green and vigorous until the axe was laid to its root. His genial presence will long be missed at the British Association and numberless other bodies at which he has been a familiar figure for more than half a century. W. R.

NOTES.

THE Albert medal of the Royal Society of Arts for the present year has been awarded to Sir James Dewar, F.R.S.

ON May 30 Her Majesty the Queen of Holland nominated Sir William Ramsay, K.C.B., as a member of the Dutch Academy of Amsterdam in succession to the late Lord Kelvin.

IN the House of Commons on June 3 Sir William Anson asked the President of the Board of Education whether, having regard to the insufficiency of the present temporary buildings at South Kensington for the housing and display of the collections of scientific instruments and apparatus belonging to the Government, and to the importance of making these collections useful to teachers and students of science, and to the Imperial College of Science and Technology, he would consider the advisability of erecting a suitable building for a science museum on the site of the existing temporary galleries. In reply, Mr. McKinnon Wood said:—"I think it would be eminently desirable that there should be a science museum properly housed in immediate propinquity to the Imperial College of Science and Technology, and if the Commissioners of the 1851 Exhibition feel themselves in a position to cooperate, I should be happy to bring the matter under the notice of the Chancellor of the Exchequer; but it is obvious that any steps requiring the financial assistance of the Government could only be undertaken with due regard to the general calls upon the Exchequer."

IT was announced some time ago that the Zoological Society of London was arranging for a special exhibition of Australian and New Zealand animals in the society's gardens. Dr. P. Chalmers Mitchell, F.R.S., now informs us that the Governments of New Zealand and New South Wales have each made presents to the society of some of their peculiar birds, mammals, and reptiles, and a very fine collection has been got together from the various Australian colonies. Mr. Seth-Smith, a member of the council of the society, proceeded to Australia last December to make the final arrangements for getting the collection together, and two keepers followed him early in the year to take out a number of animals from the gardens in Regent's Park for the Australian gardens, and to take charge of the returning collection under the direction of Mr. Seth-Smith. The animals left Australia in the White Star liner *Persic* in April, and arrived at Tilbury on Saturday evening. The detailed list is not yet to hand, but from advices the society has received it is certain that the collection will be the most representative one of marsupial mammals and peculiar birds and reptiles of Australia ever got together either in Australia or in Europe.

BY the death of Admiralitäsrath Carl Koldeway, which occurred at Hamburg on May 19, Germany has lost a distinguished seaman whose scientific investigations have proved of great practical value. Captain Koldeway was born on October 26, 1837, at Bücken, Hanover, and commenced his career as a sailor in 1853. In 1866 he studied at the polytechnic at Hanover, and in 1867 at Göttingen. He commanded two German North Polar Expeditions during the years 1868–70, the first to Spitsbergen, and the second, with two ships, to north Greenland, where he wintered and made important discoveries. In 1871 Captain Koldeway was appointed first assistant to the Seewarte at Hamburg, and four years later became director of the second section for magnetism, and for the testing of nautical and meteorological instruments. He was specially interested in magnetism, and was entrusted with the compensation of compasses for deviation on board ships of the mercantile marine. In addition to the accounts he published in reference to his voyages to the Arctic regions, he was the author of many valuable papers on magnetism, meteorology, and oceanography, among which may be mentioned "Change of Magnetism in Iron Ships, based on Observations for Deviation" (*Deutsche Seewarte Arch.*, 1879), "Results of Meteorological Observations at Spitsbergen and East Greenland" (*Zeitschrift Meteorol. Vienna*, 1876), "Surface Temperature in the Equatorial Regions of the Atlantic Ocean" (*Annalen Hydrogr.*, 1875).

A LETTER by Dr. W. N. Shaw, F.R.S., in Saturday's *Times* contains some cogent reasons against the adoption of the proposals in the Daylight Saving Bill, to which reference has been made in these columns on several occasions. In the first place, Dr. Shaw remarks that a large number of meteorological instruments in many parts of the country are designed to record continuously day and night. Are these instruments to run an hour wrong for six months or are meteorologists to use a time system different from that in use in the country? All the operations of meteorological observers would be affected by the change contemplated by the promoters of the Bill, and the passing of an Act to change the standard time twice a year would have to be followed by an instruction to meteorological observers to adhere to the old times for their observations, whatever it might be called according to the clocks. Part of the work of the Meteorological Office, Dr. Shaw points out, is represented by a system of daily telegraphic reports of synchronous observations upon which the weather reports are based. The system is an international one, and this year an important step is being made towards the ideal of international as well as national synchronism. It is important, therefore, that there should be no misunderstanding as to the time standards employed. Dr. Shaw writes feelingly when he says that no one who is concerned with the preservation of records for long series of years to be consulted when all possibility of clearing up ambiguities has passed away can regard the idea of a dual time system with anything but blank dismay. It is curious that in this connection he does not refer to the impossibility of comparing thermometer readings in summer and winter if the change were adopted. The seasonal meddling with the clocks cannot, in fact, be justified from a scientific point of view, and would lead to hopeless confusion in records in which time is a factor. There is no reason why individuals should not practise self-deception to the extent of putting their clocks back or forward as they wish, but for a nation to be compelled to do this by legislation would be the height of folly. It is too much to expect that men of science busy with their

own affairs should have to devote their time to the preparation of evidence to show the Select Committee upon the Bill the disturbing nature of the scheme proposed; but as to the weight of competent opinion against the Bill there can be no question.

THE Institution of Electrical Engineers will hold a conversazione at the Natural History Museum, South Kensington, on Thursday, June 25.

To a new species of amphipod crustacean inhabiting sand at the roots of trees at Punta Arenas, Costa Rica, the Rev. T. R. R. Stebbing (Proc. U.S. National Mus., vol. xxxiv., p. 241, No. 1609) gives the name *Orchestoidea biolleyi*.

As the result of recent legislation for regulating the importation of wild animals which might possibly become acclimatised in the United States, the Zoological Society of Philadelphia, according to its report for 1907, finds a marked diminution in the number of specimens received during the year. Although, runs the report, the wisdom of preventing the introduction of objectionable animals is not to be questioned, "regret may be expressed that the minute and vexatious details which must be complied with on bringing into the country even single specimens by casual travellers or steamship-employes, imposes this serious limitation upon zoological gardens."

FROM America we have received a batch of pamphlets dealing with the protection and encouragement of birds. Among these is one issued by the National Association of Audubon Societies on the winter-feeding of wild birds, and a second on the best methods of constructing and placing artificial nesting-places. Statutory bird-protection in Massachusetts forms the subject of a pamphlet sent out by the Board of Agriculture for that State, while some of the commoner birds of Oregon are described and figured in a tract issued by the Oregon State biologist. The claim of the Virginian quail to considerate treatment by the agriculturist is urged by Miss E. A. Reed in a leaflet published by the aforesaid association under the title of "Bob White the Farmer's Friend"; while, finally, we have the first annual report (illustrated by an excellent coloured plate of the wood-duck) of the good work by the Audubon Society of South Carolina during its (at present) short career.

To the *Century Magazine* for June, Mr. G. H. Thayer contributes an article on the concealing (protective) coloration of animals. The article, which discusses the problem from the point of view how and to what extent—and not why—animals are protected by their colouring, is mainly based on the experiments conducted by the well-known artist Mr. Abbott H. Thayer, which were reviewed in NATURE in April, 1902, and are represented by a case with models in the natural history branch of the British Museum. The author re-asserts the claim of this artist to have discovered that the arrangement of light and dark colours on the upper and lower surfaces of the bodies of animals is a factor of much more importance in rendering them invisible than is an agreement between their own colouring and that of their environment. This is graphically illustrated by means of photographs.

NEARLY the whole of the April number of the *American Naturalist* is taken up with the report of a "symposium" on the species-question which took place at a meeting of the American Botanical Society held at Chicago in January last, where various speakers discussed the topic from the point of view of their own special line of study. The first speaker urged that we are in danger of destroying the usefulness of taxonomy in our zeal for describing every differing form as a separate species. We have lost sight of the primitive reason for the formation of species, namely, that we should have fewer things to hold in mind. A second referred to the statement made by ornithologists to the effect that a species may differ by characters which cannot be put into words, so that it can only be recognised when placed alongside specimens of its nearest relatives. In opening a general discussion on all the papers submitted to the meeting, Prof. J. M. Coulter remarked that all the speakers seemed in accord as to the need for action of some kind, and that the idea of a species must be modified. He himself favoured the plan of continuing to name easily recognised forms, calling them species if desired, and then to indicate minor distinctions by numbers. By this the excessive multiplication of names would be avoided, while an exact record would be established. This plan is to a great extent a modification of trinomialism—with the important difference that the third term in the name is discarded in favour of a number.

THE degree to which trees, especially in the seedling stage, will flourish under shade is a consideration of some importance in the regeneration of forests. Mr. R. S. Pearson contributes to the *Indian Forester* (April) a list of Indian trees roughly classed in five sections, according to their light-demanding requirements. Teak, *Terminalia tomentosa*, *Bassia latifolia*, and *Boswellia serrata* are noted as strong light demanders, while the ironwood tree, *Xylia dolabriformis*, *Nyctanthes arbor-tristis*, and *Aegle marmelos* are placed among the heavy shade bearers. A note appended by the editor to an article on Eucalyptus trees offers the practical hint that leaves of the blue gum and other species boiled in cylinders or boilers will be found useful in removing any hard incrustation of lime.

OPINIONS with regard to the limits, sources, and possibilities of Indian cottons are so widely divergent that nothing short of detailed experimental cultivation undertaken by an experienced specialist seems likely to meet with general acceptation. Mr. H. M. Leake publishes in the Journal of the Asiatic Society of Bengal (vol. iv., part i.) a short account of some experiments in the nature of an introductory note. The criterion selected is a "leaf-factor," according to which a leaf may be distinguished as narrow or broad-lobed. Crosses were made between *Gossypium arboreum* or *Gossypium neglectum* and *Gossypium indicum*. The conclusion is arrived at that plants with an intermediate leaf-factor are crosses, and other facts are cited tending to support the view that natural crosses between cotton plants do occur.

IT is always a difficult matter to identify the trees that yield the timber imported from new countries. In this connection it may be said that the sources of West African mahogany have been mainly conjectural, so that it is useful to have the identifications based on the authority of Mr. H. N. Thompson, conservator of forests in northern Nigeria, that are published in the *Kew Bulletin* (No. 4). The three species *senegalensis*, *grandifolia*, and *Punchii* of the genus Khaya furnish "Benin" mahogany; similar timber from *Entandophragma Candollei*, and "Sapeli" mahogany from a species of Pseudocedrela, are also in demand. "Batum" mahogany is obtained from *Mimusops multinervis*, and a red ironwood said to resist white ant and terido worm is derived from a species of Lophira. Other trees furnish timber that is classed as mahogany, satinwood, cedar, and greenheart.

THE April number of the Journal of the Gypsy Lore Society is mainly devoted to a protest against the action of the Continental Governments who are starting a crusade against vagrancy, and against the attempt in this country, under the Movable Dwellings Bill, to enforce the registration of caravans and to compel the residents in them to send their children to school. This action will, it is said, if pushed too far, drive the Gypsy into city slums, where he will suffer from ill-health and lose his national identity. At the same time, the useful chronicle in the same number of the adventures during the year 1906 of the bodies of Continental Gypsies who took refuge in this country demonstrates the necessity of bringing such people under control. It is difficult to see how any system of regulation, such as that proposed, is consistent with the maintenance of the nomadic life, a picturesque phase of our social system which few would wish to destroy.

IN the Journal of the Franklin Institute (vol. clxv., No. 5) Dr. C. B. Thwing describes a new radiation pyrometer based on the measurement of the total energy of radiation by means of the current generated in a sensitive thermocouple by the radiations concentrated upon it. In the same number Mr. C. L. Huston gives the results of experiments undertaken in order to secure for practical purposes a more accurate knowledge of the interior character and structure of steel.

THE Queensland Geological Survey has issued a second report (Publication No. 204) on the West Moreton (Ipswich) coalfield, with special reference to the Bundamba district. The report, which has been written by Mr. W. E. Cameron, covers thirty-seven pages, and is illustrated by two large coloured geological maps, one plate, and eight illustrations in the text. The West Moreton coalfield is at present the chief producing coalfield in Queensland, its importance being due to the generally useful character of its coal and to its proximity to the chief industrial centre and most important shipping port of the colony. The investigations described in the report show that the resources of the area under consideration will be sufficient to meet any increase likely to occur in the demand for some years.

THE past week has experienced weather changes of an exceptional character. Sharp thunderstorms occurred in nearly all parts of the country. In London and the suburbs the storm experienced on June 4 was unusually severe, and was accompanied, over the southern parts of the metropolis especially, by a heavy fall of large hail and a copious downpour of rain. At Croydon the rainfall exceeded an inch in half an hour. The shade temperature in London on June 4 rose to 81°, and on the following day there was a sharp fall of the thermometer over the entire country. On Saturday, June 6, the highest temperature in London was 59°, 22° lower than two days previous. The colder weather was brought about by the setting in of a northerly wind over the whole of the British Islands, the supply of air being drawn from the neighbourhood of Iceland. On the night of June 6 the exposed thermometer fell almost to the freezing point in the south-east of England.

THE frequency of different forms of clouds during the years 1903–5 is discussed in Appendix i. to the observations made at Batavia Observatory in 1905. The general results of the observations, made four times a day during the three years, show that the percentage of occurrence of cumulus was 35·3, of cirrus 21, and of strato-cumulus 11·3. With reference to the diurnal period, attention is directed to the predominance of stratus and cirrus forms and of clear sky in the morning, of the cumulus forms about noon, and of nimbus forms at the close of the day. The daily change in the amount of each cloud form is nearly the same for both dry and wet seasons, except that during the latter period (October–March) there is a greater prevalence of the nimbus forms in the morning. Also the cirro-stratus form preponderates during the wet season.

IN another interesting appendix to the above-mentioned volume, Dr. W. van Bemmelen (acting director) discusses the influence of days of bright sunshine on the various meteorological elements at Batavia (1889–1906 August 1). Among the results arrived at, he finds that the clearness of the sky decreases the fluctuation of air-pressure in the early morning and emphasises it during the day; in the case of temperature, as one would naturally expect, the air is greatly cooled in the early morning and heated (to about the same degree) in the early afternoon, but the maximum is not retarded. The daily oscillation of relative humidity is strongly emphasised, especially in the wet season. The sea-breeze is much stronger, and the predominance of northerly components is much more conspicuous, but there is no evidence of a strengthening of the feeble land-breeze.

A NORTH WALES branch of the Mathematical Association has lately been formed. Three meetings have already been held in Bangor, and have proved highly successful in stimulating discussions between those engaged in teaching mathematics in secondary and elementary schools in North Wales. The secretary of the branch is Mr. T. G. Creak, Bron Eryri, Llanberis.

SEVERAL papers on aëronautics and on meteorological experiments of aëronautical interest have reached us lately. Prof. L. Palazzo has sent a reprint from the *Bolletino della Società aeoronautica Italiana* describing the results of experiments with kites and *ballons sondes* in the Gulf of Genoa, conducted on board the torpedo-boat *Fulmine*. Prof. Cleveland Abbe has suggested somewhat original methods of studying atmospheric circulation by means of models as well as maps (Bull. Amer. Math. Soc., xiii., 10, and *Monthly Weather Review*, December, 1907). The winds in the Straits of Messina are dealt with by Dr. Filippo Eredia in the *Rivista marittima* for March.

THE International Association for promoting the study of Quaternions and allied Systems of Mathematics has issued its annual report (Lancaster, Pennsylvania: New Era Printing Co., March, 1908). The president, Dr. A. Macfarlane, gives an interesting biography of his predecessor, the late Prof. Charles Casper Joly, with especial reference to his work on quaternion methods. An important feature of the report is the bibliography of recent and recently catalogued literature classified under the heads of matrices, linear substitutions, quadratic forms, bilinear forms, complex numbers, equipollences, vector analysis, commutative algebras, quaternions, biquaternions, linear associative algebras, and general algebra and operations.

MR. E. STANHOPE KITCHIN, Woodford Green, Essex, writes to us directing attention to the prevailing lack of true scientific method on the part of those who are engaged in aëronautical experiments. He gives instances in which experiments have been described on air resistance of rotating planes, where the author of the paper has entirely ignored the necessity of specifying the conditions, and has failed to appreciate the difference between maintaining the torque or the power of the motor constant.

He also mentions that such statements as that the drift is proportional to the velocity, and not to its square, as demonstrated by Langley, find their way into print and are allowed to pass unchallenged. That inaccuracies such as Mr. Kitchin mentions are far too common in papers on aëronautical subjects is probably well known, with the result that the problem of flight is being worked out at the cost of a greater number of failures than would be necessary if more mathematical accuracy could be brought to bear on the work.

In an article on the discharge of electricity through gases in the May number of the *Journal de Physique*, M. P. Villard, after a critical examination of the present view that the luminous phenomena are due to ionisation or recombination, comes to the conclusion that the opposite is the case, ionisation producing darkness rather than light. His own experiments lead him to the further result that the positive column is not an assemblage of independent particles, but an object of the nature of a vortex filament behaving like a flexible and extensible conductor, only capable of existing in gas ionised to an extent lying between certain limits, but within these limits becoming more prominent and stable as the current is increased. The arc and electric spark, according to M. Villard, are intense discharges in which the positive column plays the most important *rôle*, the negative phenomena having disappeared, while in the vacuum-tube discharge the opposite holds.

It has been recognised for some time that when an electric discharge passes through a gas the product of the length of the spark into the pressure of the gas at which the spark passes most easily is a quantity characteristic of the particular gas used, and very nearly proportional to the mean free path of the molecules of the gas. Dr. E. Lohr, of Vienna, finds, further (*Sitzungsberichte der Wiener Akademie*, 1907, p. 1281), that the above-named product is inversely proportional to the refraction constant $n-1$ of the gas. Since the mean free path is proportional to the viscosity of the gas, Dr. Lohr draws the somewhat startling conclusion that the velocity of propagation of light in a gas is a function of the viscosity of the gas, and is, *ceteris paribus*, the greater the greater the viscosity.

So many experimenters are now interested in the accurate measurement of the alternating currents used in wireless telegraphy that it may be worth while to reproduce a portion of a table of relative sensitiveness of some of the best known of the instruments suitable for such work, given by Von Espinosa in the "Jahrbuch der drahtlosen Telegraphie," p. 328:—

Instrument	Resistance in ohms	Watts necessary to give standard deflection
Hot wire air-thermometer with thin copper wire	0·8	... $2·5 \times 10^{-2}$
Hot wire air-thermometer with thin manganin wire	34	... $2·0 \times 10^{-2}$
Bolometer with iron wire in air ...	1·8	... $2·5 \times 10^{-4}$
,, ,, vacuum	2·2	... 9×10^{-6}
Thermo-couple of iron-eureka (Konstantan) in vacuum	5·1	... 2×10^{-4}
Duddell thermo-galvanometer ...	18 to 100	... 5×10^{-6}

The Board of Education is endeavouring to encourage practical work in the geography teaching of schools, and has suggested exercises of various kinds suitable for the pupils themselves to work. These exercises include a daily record of the pressure and temperature of the atmosphere, the amount of rainfall, the direction of the wind, and so on. To assist teachers in securing a permanent record of these observations, Messrs. George Philip and Son, Ltd., have published a Meteorological Calendar consisting of fifty-two weekly sheets, each of which includes suitable barometer, thermometer, and rainfall tables, and a chart for recording wind direction. The calendar costs 2*s*. net, and the publishers are prepared to supply the sheets in quantity for the use of pupils. The sheets should prove useful in schools.

The volume of "Extracts from Narrative Reports of Officers of the Survey of India" for the season 1905–6 deals, as usual, with a variety of topics. The progress made with the magnetic survey under the immediate direction of Captain R. H. Thomas, R.E., has been slower than in recent years, owing to the greater remoteness of the districts dealt with. It is hoped, however, that by the end of 1908 the "preliminary" survey will have been completed; by this apparently is meant a survey sufficient to indicate the general magnetic character of India, leaving for the future a detailed survey of any districts that may prove to be specially disturbed or otherwise of exceptional interest. A variety of magnetic information is given in tabular form, including the diurnal variation from selected "quiet" days for the observatories at Dehra Dun, Barrackpore, Kodaikanal, and Toungoo. As usual, considerable space is devoted to the comparison of instruments and their various defects. Pendulum observations were made, as previously, under the direction of Major Lenox Conyngham, R.E. To eliminate so far as possible the disturbing effects of temperature, observations were never taken, as in previous years, in a tent, but only where a house of some kind was available. Notwithstanding all precautions, irregularities still arise which it seems difficult to account for. During the year nine stations had self-recording tide gauges at work. The observations for 1905 were reduced by harmonic analysis at Dehra Dun, while full particulars of the observed values during 1904, with values of the tidal constants for 1908, were transmitted to the National Physical Laboratory, where the tidal predictor is at work. Particulars are given of the comparison of observed and predicted tidal results for 1905. Levelling operations were carried out by two parties, but call for no special remark.

The Clarendon Press, Oxford, has published "A Chart of English Speech Sounds, with Key-words and Notes," by Mr. Daniel Jones, lecturer in phonetics at University College, London. The pronunciation of the key-words is that usually adopted by educated people in London and the neighbourhood. The price of the chart is 4*d*. net.

Messrs. Macmillan and Co., Ltd., have published a third English edition of Prof. Wilhelm Ostwald's "Scientific Foundations of Analytical Chemistry treated in an Experimental Manner." The work has been translated by Dr. George M'Gowan from the fourth German edition, with further alterations and additions by Prof. Ostwald. The price of the volume is 6*s*. net.

A sale by auction will take place in Berlin on June 20 next of scientific and mathematical manuscripts and books of the sixteenth to the eighteenth centuries. We have received a catalogue of the sale from Mr. W. Junk, Berlin W., Kurfürstendamm 201, with whom those persons unable to attend the sale, yet anxious to procure books or manuscripts, should correspond.

OUR ASTRONOMICAL COLUMN.

BRIGHT METEOR.—Mr. Denning at Bristol saw a bright meteor of about first magnitude at 11h. 12m. on June 2 with path from 301°+50° to 265°+55°, and directed from the shower of Pegasids at 334°+28°, to which he recently directed attention in NATURE. The meteor left a streak of about 10° amongst the stars of Cygnus and Draco. At Bristol the midnight sky of June 2 was magnificent, the stars being unusually bright and the firmament remarkably dark, and comparable with some of the evenings of early autumn.

THE TOTAL SOLAR ECLIPSE OF MAY 8, 1910.—In a letter to the *Observatory*, Mr. J. F. Tennant points out the availability of Tasmania as an observing station for the eclipse of the sun due to take place on May 8, 1910. The duration of the total phase will be something like three minutes, but the sun will, at most places, apparently be at a low altitude; in fact, except at the extreme N.W., the sun sets partially eclipsed. Particulars as to times are given in the letter, and the writer states his intention to obtain particulars concerning the climatic probabilities, &c. (the *Observatory*, No. 397, p. 250, June).

THE DARK D_3 LINE IN THE SUN.—In the June number of the *Observatory* (p. 250) Mr. Buss returns to the discussion anent the presence of the helium absorption line in the solar spectrum. Among other things, he points out that, according to Mr. Evershed's recent letter, the position of the dark D_3 line is now given as being on the red side of the bright chromospheric line, whereas it was previously stated to be on the more refrangible side.

Mr. Buss adds that of 358 observing days in 1906 and 1907 he made spectroscopic observations on 317 days, and was able to detect the D_3 absorption on 236 days, or on about 75 per cent. of the total number. This indicates that the phenomenon of helium absorption over active solar areas is not so rare as has been thought, and Mr. Buss suggests that, with a more refined equipment than his, a practical permanency of the phenomenon over such areas, with or without spots, might be established.

It is interesting to note with regard to this that at the meeting of the British Astronomical Association held on April 29, Father Cortie expressed the opinion that for this class of work a telescope of not very large aperture and a spectroscope of moderate dispersion were required.

POSITION OF THE AXIS OF MARS.—In No. 4251 of the *Astronomische Nachrichten* (p. 39, May 29) Prof. Lowell gives the results obtained from his measures of the position of the axis of Mars during 1907. Between September 23 and December 16, 1907, 198 determinations of the position-angle of the south polar cap were made by Prof. Lowell and seventy-nine by Mr. Lampland. The measures were made in three different ways:—(1) with the micrometer thread cutting off equal segments below the cap; (2) with the thread tangent externally to the cap; and (3) with the thread tangent internally to the cap, and on collating the results it was seen that each method is subject to systematic errors. To throw some light on the question of these errors, an artificial planet was devised by Mr. Lampland on which measures were made by both observers, under conditions as far as possible identical with the true conditions. The results of these observations showed that the dichotomy measures are more trustworthy than the tangential, that they are decreased by phase, and that the tangency measures are too large.

Combining the results for the measures made during 1901–7, Prof. Lowell obtains as the general mean for the position of the axis R.A.=315° 38′, dec.=54° 39′, and for the obliquity of the Martian ecliptic 23° 8′. He then gives a table comparing his results with others obtained since 1781, and points out that there is apparently a steady decrease in the obliquity if Cerulli's observations of 1896–7 be excepted; of this phenomenon he offers no explanation.

THE ORBIT OF α ANDROMEDÆ.—From spectrograms taken at the Potsdam Observatory during the period 1901–7, Herr Ludendorff determined an orbit for the spectroscopic binary α Andromedæ, and now publishes his discussion in No. 4250 of the *Astronomische Nachrichten* (p. 23, May 21). For the period he finds 96·7 days, a value which he considers certain to within 0·1 day. In the discussion he confirms Sir Norman Lockyer's remarks as to changes in the spectrum, and records that he has on several plates observed the Mg line at λ 4481 doubled.

THE ECCENTRICITIES OF COMET ORBITS.—In No. 113, vol. xix. (pp. 67–71), of the Publications of the Astronomical Society of the Pacific, which we have just received, there is an interesting address by Prof. Leuschner on the probable general form of comet orbits. Prof. Leuschner raises strong objections against the prejudice which assumes all cometary orbits to be parabolic unless it can be proved very certainly that they are elliptic or hyperbolic. In support of his suggestion that the parabola may be the exception, and not the rule, he gives two tables, the first of which shows the percentage of parabolic orbits of comets appearing in three different periods. For the last period (1846–95) only 54 per cent. of the determined orbits had the eccentricity 1·0, and therefore it seems no more probable that a comet's path should be parabolic than that it should not. The second table classifies the orbits according to the duration of visibility of the comets, and here it appears that the longer the comet is observed the more probable it becomes that the orbit cannot be satisfied by a parabola. Of comets observed for more than 240 days, it is doubtful whether any had parabolic orbits.

THE ROYAL OBSERVATORY, GREENWICH.

THE annual visitation by the Board of Visitors of the Royal Observatory, Greenwich, was held on Wednesday, June 3, when the customary report was presented by the Astronomer Royal dealing with the work carried out during the twelve months ending 1908 May 10. A summary of the chief points of the report is given below.

Among other matters, it is interesting to note that various national undertakings of importance were, or are being, facilitated by the loan of instruments by the observatory authorities. Thus the observers attached to the British Antarctic Expedition (1907) are using the 4-inch Simms' telescope No. 2, Captain Monro, R.N., used the transit instrument D in the determination of the longitude of Ascension, whilst a very interesting collection of historical and modern astronomical and meteorological instruments, models, photographs, &c., illustrating the past and present work of the observatory, is being exhibited in the Science Section of the Franco-British Exhibition.

Referring to the work done with the transit circle, the report states that the system of inclined wires formerly used has been replaced by a system of two close vertical wires and one horizontal wire, and the method employed for illuminating the field has been changed to that applied so successfully to the altazimuth last year. A series of observations is now being carried out in order to compare the results obtained under the respective conditions of illumination, and it is hoped that a discussion of the results may throw some light on the question of the magnitude equation in the observation of the fainter stars.

The transit was employed for the usual observations of the sun, moon, planets, and fundamental stars, the working list being made up by the inclusion of stars of the ninth magnitude and brighter between the parallels of north declination +24° to +32°, which will serve as reference stars for the Oxford astrographic zones. Eight thousand seven hundred and twenty-three transits and 7960 circle observations were taken during the year.

From the observations made in 1905, applying Bessel's refractions, 38° 31′ 21″·70 was determined as the co-latitude, whilst those made in 1906, with Pulkowa refractions, gave the value 38° 31′ 21″·67. The reduced solar observations of 1906 show the correction to the tabular values for the obliquity of the ecliptic to be −0″·09, and the observations of the summer and winter solstices indicate that the mean of the observed distances from the pole to the ecliptic is apparently 0″·005 too great.

Each day, when practicable, three or more observations of level and nadir were made, and it was found that the diurnal changes of level ranged from +0″·13 at noon, to 0″·00 at 6 p.m., to +0″·18 at midnight; the corresponding values for the nadir were found to be +0″·17, 0″·00, and

+0″·14. The mean error of the moon's tabular place, determined from eighty-two observations and computed from Hansen's tables with Newcomb's corrections, was −0·383s. in R.A. and −0″·15 in N.P.D. for 1906. From 104 observations in 1907 the error is −0·401s. in R.A.

Part i. of the Second Nine-year Catalogue, epoch 1900, dealing with fundamental and zodiacal stars, is already in the printer's hands, and part ii., giving the astrographic reference stars, will be ready for the press shortly.

The new method of illuminating the altazimuth field, as described in the previous report, has proved very satisfactory, and has now been adapted to the transit instrument. The altazimuth was used for meridian and extra-meridian observations throughout the year, and the observations of the lunar crater Mösting A, commenced in 1905, were continued whenever practicable; these serve to connect the observations of the first and second limbs made before and after full moon, and, when discussed with the similar observations that are being made at the Cape Observatory, will provide data for the determination of the lunar parallax. Forty-three observations of the N.P.D. and of the R.A. of the crater were made during the year. That both the transit-circle and altazimuth observations are satisfactory is shown by their agreement.

From the altazimuth observations in 1907 the mean errors of the moon's tabular place are:—moon's limb, in meridian, −0·36s.; Mösting A, in meridian, −0·35s., moon's limb, extra meridian, −0·42s.

The larger scheme of reflex-tube observations, mentioned in the preceding report, was prosecuted throughout the year, 1545 double and forty-four single observations being made; the total number of stars observed, including β and γ Draconis and i^2 Cygni, which are observed throughout the year, was eighty-five. With the view of determining the variation of latitude, the discussion of the observations from 1903 onwards has been commenced, but owing to the variation of the instrument's scale value from night to night, caused by minute alterations in the distance between the mercury surface and the object-glass, there are serious difficulties to be overcome in the discussion. This distance can be adjusted to within about 0·01 inch by means of the focussing rod, but an error of that amount would introduce errors quite inadmissible in the deduced zenith distances of the stars at a distance from the centre of the field. For example, in the case of β Draconis, which is 53½′ from the zenith, the error would amount to ±0″·56.

The 28-inch refractor was employed for observing double stars, primarily those pairs discovered by Mr. Hough, and measures were made on 105 nights as compared with eighty-six nights last year; κ Pegasi was measured on fifteen, δ Equueli on thirteen, and 70 Ophiuchi on sixteen nights. Complete sets of measures of the polar and equatorial diameters of Jupiter were made, first with the filar and then with the double-image micrometer, on seventeen nights, whilst with the filar micrometer the diameters of the satellites were determined on two nights.

It was mentioned in the last report that a system of twelve lignum-vitæ wedges had been employed to fix rigidly the mirror of the 30-inch Thompson reflector. Whilst the method has proved very satisfactory in fixing the mirror, there is a tendency to produce slight distortion, so it is proposed to introduce a further modification of the support the next time the mirror is dismounted for re-silvering. Cast-iron blocks, shaped to fit the steel supporting band round the edge of the mirror, are to be introduced, the pressure being applied by screws passing through the cell; in this way the strain may be adjusted as required.

Thirty-one photographs of Neptune and its satellite were secured with the 26-inch refractor, using the occulting shutter as in previous oppositions, on sixteen nights; photographs of Saturn's, and of Jupiter's distant, satellites were also taken. In regard to the latter, Mr. Melotte and the Greenwich observers generally are to be heartily congratulated upon the discovery of Jupiter's eighth satellite, first noted on a photograph taken on February 28. Altogether twelve photographs showing this object were secured between January 27 and April 24, and the measurements show that the newly discovered satellite is very much more distant from Jupiter than the sixth and seventh satellites, and is perhaps not quite so faint as the seventh. Of J. vi. and vii., respectively, thirty-eight and twenty-two photographs were secured during the opposition.

The 30-inch reflector was also used to photograph fifty-four minor planets, and comets 1907*d* and *e*. Several long exposures on comet 1907*d* (Daniel) produced negatives in which the structure of the tail is of great interest. Four long exposures were made in an unsuccessful search for Halley's comet, and this search, for which an ephemeris, based on the perturbations calculated at Greenwich, has been prepared, will be resumed during the coming autumn.

With the astrographic equatorial, 128 satisfactory plates were taken during the year to replace plates which, although satisfactory in other respects, are unsuitable for reproduction of large prints. Positives have been made and passed for 192 plates which cover the zones 75°–78°, and 109 plates in zones between 79° and the pole. Only fifteen chart plates remain for reproduction, and these have to be replaced by more suitable negatives.

The work of the Greenwich section of the Astrographic Catalogue is complete so far as the publication of the measured rectangular coordinates and the data necessary to convert them into Right Ascension and Declination is concerned. The conversion of the coordinates of such stars as are in Carrington's Catalogue has been commenced. Vol. ii. of the Greenwich Astrographic Catalogue was published during the year, and contains 98,738 stars. The report contains an interesting table, too large to reproduce here, comparing the number of stars which appear on the plates for each zone and for the three different exposures, and also comparing these numbers with the number of stars shown in the same zones of the Bonn Durchmusterung; the total number of stars shown on the forty-minutes' plates is 719,088, or 344·4 per square degree.

The perturbations of Halley's comet, which are being computed by Messrs. Cowell and Crommelin, and the data necessary for determining the time of next perihelion passage, are nearly complete, but some further investigation of the close approaches of the comet to Jupiter in 1834 and 1837, when the perturbations appear to have been considerable, is necessary; 1910 April 8 appears to be the most probable date for the occurrence of the next perihelion passage. Mr. Crommelin has confirmed Dr. Hind's identifications of the comet with three exceptions (1223, 912, and 837), and the perturbations have been carried back to 760.

Photographs of the sun were taken with the Thompson photoheliograph on 210 days, and with the Dallmeyer photoheliograph alone on two days.

Some remarkable fluctuations of the solar activity during 1907 are reported. From July onwards an increased activity occurred, and several naked-eye groups were observed.

The usual magnetic observations were carried out during the year, and the principal results for the magnetic elements for 1907 are given as follows:—

Mean declination	... ...	15° 59′·8 West
Mean horizontal force	...	4·0195 (in British units) 1·8533 (in metric units)
Mean dip (with 3-in. needles), 66° 56′ 4″		

In 1907 there was one day of great magnetic disturbance and sixteen of lesser disturbance.

The meteorological results show that the summer of 1907 was exceptionally windy, and that the mean temperature of the year was 49°·4, or 0°·2 below the average of the sixty-five years 1841–1905. The rainfall of the year ending 1908 April 30 was 23·14 inches, being 0·98 inch below the sixty-five-year average.

The testing of chronometers and chronometer watches showed a serious falling off in the performance of the former and an improvement in that of the latter instruments.

The danger which threatened the observatory from the working of the L.C.C. generating station on the northern meridian has been averted to a great extent by the two years' working agreement with the Council. Apparently the close, double-star observations with the 28-inch refractor are not affected prejudicially, but it is still desirable that the trouble arising from the outflow of heated gases, which interfere with the observation of northern stars on the meridian, should be mitigated.

VISUAL ILLUSION AND FIXATION.

A REMARKABLE new visual illusion is described by Dr. James Fraser in the *Journal of Psychology* for January. In the first form of the illusion a word (such as "LIFE") is printed in capital letters on a chequered background of black, grey, and white squares. The double outline of the letters is not traced in continuous lines, but is constituted by a band consisting of short lines, alternately black and white, slightly inclined to the direction of the limbs of the letter. This band may conveniently be regarded as representing a cord made of two strands, black and white, twisted together. In these circumstances the letters appear, in general, to be inclined several degrees from their actual directions, the sense of the deviation varying with the direction of the constituent lines of the

FIG. 1.

illusory band (see Fig. 1). A number of figures are given illustrating variants of this form of the illusion, and facilitating a study of the limits within which it persists.

In a second form of the experiment concentric circles or ellipses made of the "twisted cord," and laid upon a chequered surface of peculiar construction, are shown to suffer apparent distortion of an extraordinary character (see Fig. 2).

The paper (which is excellently illustrated) concludes with a short discussion in which the author points out the factors which appear to him to determine the presence and disappearance of the illusion.

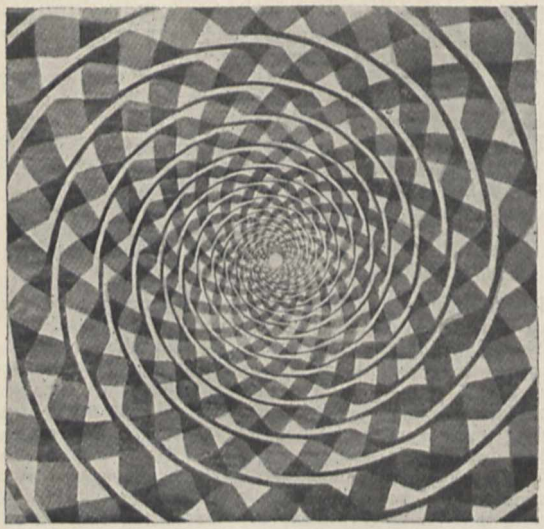


FIG. 2.

Upright letters of appropriate size and concentric circles of appropriate diameter, drawn on tracing paper and superimposed upon the figures, will demonstrate the character of the illusion in each case.

The *Psychological Review* has published, as a monograph supplement (November, 1907), an account of an experimental study of visual fixation conducted by Prof. Raymond Dodge in the psychological laboratories of Wesleyan University. The main result of this careful and interesting work is to render untenable the traditional assumption of an identical anatomical and functional centre of the retina, to which all visual processes are referred or referable. Prof. Dodge shows (following, in part, Delabarre and McAllister) that during supposed fixation there is continuous movement of the point of regard over a variable area of appreciable extent. This is the result of uncompensated disturbances produced by the pulse and respiration, and by irregular head and body movements. On the other hand, the investigation has brought to light a number of eye-movements compensatory of movements of head and trunk, the perfection of which (since the reaction time of the eye is relatively slow) points to the existence of highly organised motor systems embracing both ocular and somatic muscles. The discovery that there is, strictly, not a fixation point, but merely a fixation area, renders improbable the current hypothesis that assumes a tendency to transfer every peripheral stimulus to the centre of the fovea. Actual experiment shows, in fact, that when a given word is read the point of regard may rest indifferently in many situations. These observations have, obviously, an important bearing upon the question of retinal space-perception, and Prof. Dodge uses them to discredit the theory that the motor-impulse by which a peripheral object of regard would be brought to a supposed constant intra-foveal fixation point is a "local sign" differentiating the retinal point stimulated from every other. He proposes to substitute for it the conception of a differentiated organisation of the retinal groups, and shows how such an organisation might be brought about by the agency of the fixation movements.

SOME RECENT PETROLOGICAL PAPERS.

A DETAILED study of the granite of Brixen has been contributed by Herr Bruno Sander to the *Jahrbuch der k.k. geologischen Reichsanstalt*, vol. lvi. (1906), p. 707, which involves many interesting questions of the intimate penetration of sediments by igneous rocks, and directs fresh attention to the marginal facies known as tonalite-gneiss (pp. 726–34). The author shows that a foliated structure existed in this rock before deformation by pressure occurred. Dr. Trener, on the other hand (*ibid.*, pp. 415 and 458), in a paper on the Presanella group, containing many petrographic details, treats tonalite-gneiss as a product of pressure, and the basic inclusions in it as segregations. One of Sander's most suggestive observations is the finding of amphibolites, closely resembling the tonalite-gneiss, in the old limestone series that has been invaded by the granite; and he is led to ask (p. 734) whether the occurrence of tonalite-gneiss does not in some way depend on the horizon selected by the granite for its intrusion continuously from Meran to Mauls.

Dr. Trener's paper, just referred to, contains (p. 484) a valuable appendix on graphite, in which Luzi's "graphitite" and Sauer's "graphitoid"—a graphite in metamorphic rocks—are both opposed as mineral species.

Mr. Joseph Barrell's "Geology of the Marysville Mining District, Montana" (U.S. Geological Survey, Prof. Paper No. 57, 1907) is also "a study of igneous intrusion and contact metamorphism," dealing particularly with a great batholithic inflow of granite among pre-Cambrian strata at the opening of Cainozoic times. Various igneous rocks, from gabbros to aplites, appear as subsidiary intrusions. The contact-phenomena have been studied to advantage in mine-sections down as far as 1300 feet. A strong case is made out for the occurrence of "stoping," by the falling in of blocks "10 to 200 feet or more in thickness and of considerably greater length" (p. 172), and the consequent rise of the granite into its former cover of Algonkian rocks.

Mr. R. A. Daly, another strong advocate of "stoping," in a paper on the Okanagan composite batholith of the Cascade Mountain system (Bull. Geol. Soc. America, vol. xvii., 1906, p. 329), urges that this batholith actually replaces an equal or approximately equal mass of the older solid rock. Those of us who have been maintaining this somewhat natural view from field-observations on batholiths in our own islands must join with Mr. Daly in hail-

ing its growing acceptance, though many will still hesitate before his conclusions (p. 373) as to the profound modification of a gabbro-magma by absorption of pre-existing acid masses. He admits, with other writers, a "gravitative differentiation of the compound magma of assimilation," and urges that at each stage in the intrusion of the Okanagan batholith a magma more basic than the average of the rock invaded became enriched with silica by assimilation, and also by this gravitational draining away of the denser material. Dynamic and accompanying hydrothermal actions are said to have produced gneisses from the intrusive Okanagan "granodiorite," and it is held that in many places mineral material, especially from the more basic constituents, "has been leached out from the granulated rock and has re-crystallised in strong shear zones to which the solutions have slowly travelled" (compare pp. 345–6). This would seem in accord with Lehmann's view of the development of biotite along shear zones; and, as even a tentative explanation of the formation of a strikingly banded gneiss out of a homogeneous "granodiorite," it has considerable petrographic interest.

Messrs. E. C. Andrews and J. C. H. Mingaye, assisted by the careful petrographic descriptions of Mr. G. W. Card, discuss the granites of northern New England in part iv. of their description of the New England plateau of New South Wales (Records Geol. Survey N.S.W., vol. viii., 1907, p. 196). They conclude that their granitic masses are mostly "bathyliths." At Hillgrove they find a diorite (p. 232) that passes insensibly through a fine-grained granite rich in biotite into silicified slates, which further pass into true black slates. "The biotite-granite is thus possibly a compromise between the slates and the diorite." The authors urge (pp. 234 and 237) that the "bathyliths" have occupied their present positions at the expense of the older rocks, and they are advocates of stoping as a means of carrying away derived material. In part v. of the memoir (*ibid.*, p. 239), Mr. Andrews explains the structure of the deposits of wolfram, cassiterite, and molybdenite as a "replacement of granite by [the products of] solutions and gases rising along the intersecting joints" (p. 241), and spreading at times from "an incredibly small core." Mr. Card contributes "Mineralogical and Petrographical Notes, No. 10" (*ibid.*, p. 257), referring his rocks to the American system of classification, on the basis of the thorough analyses provided by Mr. Mingaye's laboratory. We hope that some day these notes may be brought together into a general petrographic study of the colony, so that we may learn the part that each rock has played in the broad sequence of geological events.

A fine example of that rare rock, orbicular granite, is described from the Transvaal Bushveld by Mr. W. J. Gau (Trans. Geol. Soc. of S. Africa, vol. ix., 1906, p. 70).

The mining district of Pitkäranta on Lake Ladoga, in Finland, has been thoroughly investigated by Mr. Otto Trüstedt from a mineral and petrographic point of view (*Bull. de la Comm. géol. de Finlande*, No. 19, 1907). His fine memoir, written in German, of more than 300 pages, lays special stress on three zones of "skarn"—a somewhat forbidding word in Swedish—which here means a calciphyre formed from crystalline and usually dolomitic limestones. These limestones are part of an ancient amphibolitic and sedimentary series, now highly metamorphosed, into which granites and pegmatites intruded in early pre-Cambrian times, followed in much later, but still pre-Cambrian, times by the great mass of Rappakiwi-granite. The "skarn," chiefly composed of salite and garnet, is believed (p. 91) to have arisen through the influence of magmatic waters circulating from the earlier intrusive bodies. Earth-movements then broke it up in many places into blocks, round which singular modifications have taken place. Serpentinisation, acting through a long period, has spread inward from their surfaces (*e.g.* pp. 218 and 235), producing an eozoönal structure, built up of salite, serpentine, and calcite. This banded structure is well shown in the photographic plates and figures. The Rappakiwi-granite ultimately invaded the whole series of rocks, and became solid. During the last phases of the eruptive activities of which it forms the climax, metallic ores, including cassiterite, were deposited in its zone of contact. Magnetite, zinc-blende, and sulphides of iron and copper now began to replace certain layers of the "eozoön," and the outer portions of some of the lumps of "skarn," or "Salitaugen," pass into pure ore. Even garnets (p. 138) have been dissolved away along certain of their zones of growth, and these zones have been replaced by metallic minerals. The author agrees with Vogt (p. 315) that the Pitkäranta ore-deposits belong to the true contact-metamorphic type, and occupy a middle position between the iron and copper deposits of Christiania and the tin and copper deposits of Cornwall.

Mr. Curt Fircks's paper, written in English, on the occurrence of gold in Finnish Lapland (*ibid.*, No. 17, 1906), describes ferruginous veins traversing granulite as the mother-lodes of the alluvial gold; but it is not clear why they are called (p. 33) "a new type of gold veins, not yet observed in other parts of the world."

Messrs. Johnson and Warren (American Journal of Science, vol. xxv., 1908, p. 1) revive our interest in Wadsworth's "cumberlandite" in their account of the geology of Rhode Island. This rock becomes a "rhodose" in accordance with the new system of classification (p. 25); it has the high specific gravity of 4, owing to its groundmass of inter-grown magnetite and ilmenite, enclosing hyalosiderite (p. 19), an olivine rich in iron. The olivine has retained grains of the iron ore within it, and Mr. Warren suggests that these were prevented from joining the main mass by the decreasing mobility of the separating olivine, and he favours the supposition that the minerals became immiscible before their freezing point was reached (p. 22).

An unusual group of rocks, for which ultra-basic intrusive masses seem primarily responsible, is described from the Vizagapatam district of Madras by Messrs. T. L. Walker and W. H. Collins (Records Geol. Survey of India, vol. xxxvi., 1907, p. 1). The ultra-basic igneous border of a mass of granulites and garnetiferous granites (charnockite series) is believed to have mingled with sillimanite-schists. Rocks rich in green spinel and magnetite thus pass into others where the spinel is largely replaced by sapphirine, and sapphirine is regarded (p. 11) as a product of the interaction of spinel and sillimanite. A mineral hitherto described as hypersthene in the charnockite series, with a pleochroism "sky-blue to red or red-brown" (p. 14), is shown to have frequently oblique extinction. The authors seem to throw doubt on the existence of "a rhombic pyroxene with the properties usually assigned to hypersthene"; but surely they mean merely to ask whether rhombic pyroxene ever has a "sky-blue" axis-colour.

Before leaving ultra-basic igneous rocks, it may be mentioned that Dr. Corstorphine further defends his view, criticised in South Africa and elsewhere, as to the concretionary nature of the eclogite masses in the diamond-pipes of Kimberley (Proc. Geol. Soc. of S. Africa, 1907, p. lxi). The tenth volume of the Transactions of the Geological Society of South Africa, which these Proceedings accompany, contains contributions by Messrs. Voit, Merensky, and J. P. Johnson on the same subject, and an interesting rejoinder by Prof. T. G. Bonney to Messrs. Corstorphine and Voit, all being included in the part for July to December, 1907.

Mr. L. L. Fermor, in describing rhyolites and basalts from Pávágad Hill, Bombay Presidency (*ibid.*, vol. xxxiv., 1906, p. 148), points out differences between the former and the Maláni rhyolites of Rájputana described by Mr. La Touche, in spite of some points of striking resemblance. In consequence, he is able to suggest that the Pávágad rocks, both basic and acid, were poured out as differentiation-products from one caldron in Cretaceous times, the alternative being that the basalts form intrusive sills in a far older rhyolitic series. A vertical section of 2400 feet of rock is exposed, to which Mr. Fermor invites the attention of future visitors who can undertake its detailed exploration.

From five weeks' study in the field, Mr. James Currie has drawn up an illustrated list, arranged topographically, of the minerals in the basaltic Færöes, which will especially appeal to students of zeolites (Trans. Edinburgh Geol. Soc., vol. ix., 1906, p. 1).

Coming now to sedimentary deposits, Herr Meigen has continued his researches on calcium carbonate, which have

been so practically fruitful (*Ber. naturforsch. Gesell. zu Freiburg i. Br.*, Bd. xv., 1907, pp. 38–74). His precipitates of aragonite globules or needles from various solutions pass for the most part into calcite, with characteristic rhombohedral forms, in periods varying from twenty-four hours to three months. A few, from dilute hot solutions, remain unaltered, at any rate for the period of observation, which in one case is as long as four months. Experiments to determine the composition of the coloured deposits produced by the action of calcium carbonate on salts of cobalt showed (p. 57) that calcite assumes a violet colour *when in the form of an impalpable powder* and treated in a distinctly dilute solution of cobalt nitrate. Ordinary fragments remain uncoloured, or become blue on continued boiling in a concentrated solution, while aragonite under all conditions becomes, as is now well known, violet. Though the violet colour arises in powdered calcite more slowly than in aragonite, this new discovery serves as a warning to be regarded in the application of Meigen's test. The author determines (p. 74) the violet precipitate on aragonite from a concentrated solution of cobalt nitrate as $2CoCO_3+3Co(OH)_2+H_2O$, and the blue one on calcite as $CoCO_3+3Co(OH)_2$.

Prof. R. B. Young, in describing the calcareous rocks of Griqualand West (Trans. Geol. Soc. of S. Africa, vol. ix., 1906, p. 59), shows how oolitic dolomites have been converted into granular quartzites, and supports the late Mr. Rutley's views as to the origin of certain "metasomatic quartzites." Mr. G. Abbott illustrates many of the well-known forms of concretion in the Durham dolomite in a general paper on concretions (Trans. South-Eastern Union of Sci. Societies, 1907).

Messrs. T. M. Reade and Philip Holland continue their researches on our much-neglected sedimentary rocks with the analysis and discussion of a series collected near Ludlow. A full analysis of the Titterstone Clee dolerite is also given (Proc. Liverpool Geol. Soc., 1907).

Lastly, Mr. R. A. Daly's paper on the limeless ocean of pre-Cambrian time (Amer. Journ. Sci., vol. xxiii., 1907, p. 93) raises many important questions as to the mode of origin of pre-Cambrian sedimentary rocks. The author holds that the land-areas of Eozoic times were of insufficient extent to supply enough lime to the ocean for the demands of shell-forming organisms. The continuous decay of abundant soft-bodied animals precipitated, moreover, as calcium carbonate what little lime entered the seas; the magnesian limestones so frequently found in pre-Cambrian sediments were also deposited as inorganic rocks by the prolonged action of the ammonium carbonate after the lime salts had been dealt with. It was only when, in Cambrian times, land-areas became more pronounced that shell-forming animals could become common; hence the rather abrupt transition from beds almost devoid of fossils to those with an abundant fauna. All this gives the reader food for meditation, and brings the petrographer, as is fitting, into the field of evolutionary geology.

G. A. J. C.

THE INSTITUTION OF MINING ENGINEERS.

THE forty-eighth general meeting of the Institution of Mining Engineers was held on June 4 and 5 in London in the rooms of the Geological Society. Mr. C. E. Rhodes read his presidential address, in which he stated that steps were being taken to transfer the headquarters of the institution to London. The main portion of his address was devoted to a consideration of some of the problems with which the rising generation of mining engineers will have to deal, namely, the sinking of deep shafts through water-bearing strata, the depth to which tubbing can be put in, improved methods of splitting the air which will be required at great depths for cooling down the working places, and the method of dealing with dust, which in all probability will be abundant in deep mines.

The first paper read described the mineral resources of Trinidad. The author, Mr. John Cadman, gave a brief account of the gold ore, iron ore, graphitic schist, limestone, and coal known to exist, and dwelt more fully upon the bituminous minerals, which are of great economic importance. In a mine of the bitumen known as manjak an explosion occurred in 1904, causing the death of seventeen miners. A sample of gas examined by the author contained 14·00 per cent. of oxygen, 11·10 per cent. of carburetted hydrogen, 1·60 per cent. of hydrogen, and 73·30 per cent. of nitrogen. It is suggested that the deficiency in oxygen is due to the absorptive properties of the manjak. During the meeting several other papers of scientific interest were read. Mr. J. B. Tyrrell described the recently discovered mineral veins of cobalt in Ontario. Mr. Greville Jones gave an account of the various types of calcining kilns for iron ore. Mr. C. B. Wedd and Mr. G. C. Drabble described the occurrence of fluor-spar in Derbyshire. The longest paper read was by Mr. S. L. Thacker, on winding-engine tests. He recorded the results of his own experience, pointed out some sources of loss, and suggested the lines on which winding-engine tests should be carried out.

In connection with the meeting, excursions were arranged on June 4 to a diving demonstration at Lambeth under the supervision of Dr. J. S. Haldane, on June 5 to the mining and metallurgical section of the Franco-British Exhibition under the guidance of Mr. Bennett H. Brough, and on June 6 to the South Metropolitan Gas Company's tar works. A new self-contained diving apparatus suitable for work in mines was exhibited for the first time. The supply of oxygen is automatic, and is furnished to the diver mixed with 60 per cent. of air. At the Franco-British Exhibition Sir Hugh Bell received the visitors in the Machinery Hall, and gave an account of the collective pig-iron exhibit and the other objects of interest in the iron and steel section. The French mining section, in which the scientific aspects of working are well shown, was much appreciated.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—On Monday, June 8, Mr. William Bateson, F.R.S., was elected to the chair of biology, which has been established for five years largely owing to the generosity of an anonymous benefactor. Mr. Bateson, who was born in 1861, is a son of the late Rev. W. H. Bateson, D.D., Master of St. John's College, and has been a fellow at the same foundation since 1885. He was educated at Rugby School, and held the Balfour studentship from 1887 to 1890; for many years he has been one of the leading workers in England on heredity and variation, and has published several important treatises on these subjects. In 1904 he received the Darwin medal of the Royal Society.

Mr. A. R. Hinks has been re-appointed chief assistant of the observatory for a period of five years from June 24, and Mr. W. E. Hartley has been re-appointed an assistant of the observatory for a period of five years from July 13.

Prof. Thomson gives notice that the new building of the Cavendish Laboratory will be opened by the Chancellor on Tuesday, June 16, at 4 p.m. In consequence of the limited accommodation, admission will be by ticket only.

In the forty-second annual report the museums and lecture-rooms syndicate records a gift of 500*l.*, made by Mr. Frank Smart, for the purchase of additional furniture and fittings in the museum of botany. The library in the department of physiology has been materially increased by many books formerly in the possession of Sir Michael Foster; the library of the medical school has also received many additions, including a large number of pamphlets and books presented by Sir T. Clifford Allbutt, K.C.B. The Woodwardian professor records several important additions to the museum, especially a fine series of slates, marbles, and rocks of economic value, which have been presented by Mrs. J. F. Walker, of York. The syndics' accounts for the year show a balance in favour of the maintenance fund of 330*l.* 4*s.* 4*d.*

The prize of 50*l.* out of the Gordon-Wigan fund for a research in chemistry has been awarded to Mr. L. A. Levy for his research entitled "Investigations on the Fluorescence of Platinocyanides."

Notice is given that a prize of 50*l.* out of the Gordon-Wigan fund will be awarded at the end of the Easter term, 1909, for a research in chemistry, of sufficient merit,

carried out in the University. The research may be in any branch of chemistry. The dissertation, with the details of the research, must be sent to the professor of chemistry not later than the division of the Easter term, 1909.

LIVERPOOL.—At the graduation ceremony on July 11 the honorary degree of LL.D. will be conferred upon Sir John Brunner, Principal Macalister, and Prof. Vinogradoff; of D.Sc. upon Mr. Francis Darwin and Prof. J. L. Todd; and of D.Eng. upon the Hon. C. A. Parsons.

MANCHESTER.—On the occasion of the installation of Viscount Morley of Blackburn as Chancellor of the University, on July 9, the honorary degree of Litt.D. will be conferred upon Mr. A. J. Evans, F.R.S., of D.Sc. upon Prof. Baldwin Spencer, F.R.S., and Prof. A. Gamgee, F.R.S., and of M.A. upon Mr. William Burton, for his scientific investigations and art productions in pottery. H.M. Treasury has allowed the grant of 12,000*l.* to remain at that figure for another year instead of reducing it to 10,000*l.* It is hoped that the grant will be continued on the higher basis, and possibly increased.

OXFORD.—Dr. B. P. Grenfell has been appointed extraordinary professor of papyrology.

The Rolleston memorial prize for 1908 has been awarded to Mr. C. C. Dobell, Trinity College, Cambridge; Mr. W. K. Spencer and Mr. C. H. G. Martin, B.A., both of Magdalen College, Oxford, were honourably mentioned by the examiners.

The Romanes lecture for 1908 will be delivered by Canon Scott Holland in the Sheldonian Theatre on Saturday, June 13, at 5 p.m. The subject of the lecture is "Bishop Butler."

The Robert Boyle lecture was delivered by Prof. Rutherford on Friday, June 5, in Balliol College Hall, the subject of the lecture being "The Transformation of Radio-active Matter."

A CONVERSAZIONE will be held at the East London College (University of London) on Wednesday next, June 17. The college departments will be open from 8 to 9.30 p.m.

A SHAW studentship for research, the gift of Mrs. Bernard Shaw, of the value of 100*l.* a year for two years, will be awarded in July by open competition at the London School of Economics and Political Science, Clare Market, W.C. Particulars of the scholarship can be obtained from the director of the school.

THE Bill "to make further provision with respect to the University of Durham" has now been printed. It proposes to appoint a body styled the University of Durham Commissioners. These Commissioners are to hold office until the end of 1909, but their powers may be continued by the King in Council, but not beyond the end of 1911. Their powers are to make statutes regulating the constitution of the University and the powers and duties of its authorities and constituent bodies and the disposition of its property in accordance with a scheme scheduled as an appendix to the Bill. Provision is made for the affiliation to the University in the faculty of science of the Sunderland Technical College, subject to its satisfying the conditions specified by the Senate of the University. The Senate is to consist of thirty-seven persons, namely, the Chancellor, six persons nominated by the Crown, the Dean and Chapter of Durham, together with so many other persons appointed by the council of the Durham colleges as shall make six in all, six appointed by such professors, tutors, and lecturers of the Durham division of the University as are not members of the Chapter, four appointed by the College of Medicine, Newcastle, four by the council of Armstrong College, and four by the professors of Armstrong College, and six appointed by Convocation, three being past students of the Durham division and three past students of the Newcastle division. Full powers are assigned to the Senate over the property, conditions of study, examinations, and degrees of the University. The Newcastle division of the University is to consist of the University College of Medicine and Armstrong College, Newcastle, but no council is set up for this division.

THE twenty-eighth annual report of the council of the City and Guilds of London Institute, dealing with the work of 1907, has now been published. The reports of the dean of the Central Technical College, of the principal of the Finsbury Technical College, of the South London Technical Art School, and of the department of technology constitute important appendices. The total income of the institute for 1907 amounted to 46,036*l.*, as compared with 44,848*l.* in 1906. A table showing the amount of the donations and subscriptions to the funds of the institute since its foundation provides much interesting information. In 1878 the total amount of such donations and subscriptions was 12,102*l.*, while in 1907 the amount reached 22,343*l.*, a gratifying increase of more than 10,000*l.* Since its foundation the institute has received from this source the large sum of 778,365*l.*, to which the table shows there have been fifty-three contributors. The largest total benefactions received in the period mentioned are from the Goldsmiths' Company, 135,314*l.*; the Fishmongers' Company, 112,270*l.*; the Clothworkers' Company, 111,750*l.*; the Mercers' Company, 75,000*l.*; the Drapers' Company, 51,500*l.*; the Skinners' Company, 50,862*l.* Previous reports of the council have directed attention to causes which impede progress in the technical instruction of artisans, and in the report on the department of technology this year the matter is referred to again. The impediments which continue to exist are, first, the difficulty of finding competent teachers, and, secondly, the unduly large proportion of artisan students who enter technical classes without the preliminary knowledge necessary to take full advantage of the instruction they receive. We have referred on many occasions in these columns to the necessity for serious continuation-school work after the elementary school has been left if young artisans are to derive full benefit from technical courses later in life. It is quite clear that the gap between the day school and the technical institute must be bridged in some way if the money expended on technical instruction is to produce its best results.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society. March 26.—"Note on the Ascent of Meteorological Balloons and the Temperature of the Upper Air." By A. **Mallock**, F.R.S.

The recent investigation of the upper atmosphere by means of india-rubber balloons has led to the discovery that an almost constant temperature is reached when the pressure has decreased to about 150 mm. The lowest pressure reached in England is a little under 50 mm., and the corresponding height about 20 kilometres.

The note examines from a theoretical point of view what the behaviour of balloons such as are used in meteorological work must be as regards the possible heights to which they might ascend and the variations of their velocity as they rise. The determining factors are:—

(1) The relative density of the gas in the balloon and of the outer air at the same pressure.

(2) The ratio of the dead weight of the balloon and fittings to the total lifting force at ground-level.

(3) The compression, by the elasticity of the balloon, of the gas it contains.

It is shown that the velocity of the balloon at first increases as the one-sixth power of the ratio of the density of the air at the elevation attained to the density at ground-level,[1] and that when the elastic compression is small the upward velocity reaches its maximum not far from the greatest elevation to which the balloon can attain.

The results of the equations are traced in Diagram I., the values for the ratio of dead weight to lifting force and the elastic compression being such as are likely to be met with in practice. It is remarkable how rapidly the velocity decreases as the minimum pressure is approached.

To connect the pressure with the height at which it is experienced, the temperature at every point of the ascent

[1] The reason being that the decrease in density rather more than compensates for the effect of the increased cross-section.

must be known, and this information is furnished by the automatic recorder attached to the balloon.

A comparison is made between the actual temperatures and the adiabatic temperatures, *i.e.* the temperature which a given volume of dry air would have if transported from ground-level to a given height and allowed to expand without receiving or losing heat.

The height at which the pressure p is found in these circumstances is (if H = height of homogeneous atmosphere)

$$h = H\frac{\gamma}{\gamma-1}\left(1 - m^{-\frac{\gamma-1}{\gamma}}\right), \quad \text{(where } m = p/p_0\text{)}, \quad \text{which gives}$$

a finite limit to the height of the atmosphere at 27 kilometres nearly. The ratio of the absolute temperatures at p and p_0 is $\theta/\theta_0 = (1/m)^{\frac{\gamma-1}{\gamma}}$.

For isothermal expansion $dh = dH p_0/p$, and if the arbitrary relation between temperature and pressure found from the balloon records is $\theta/\theta_0 = \phi(p)$, the actual value of dh is $dH\phi(p)p_0/p$, the integral of which can readily be found graphically.

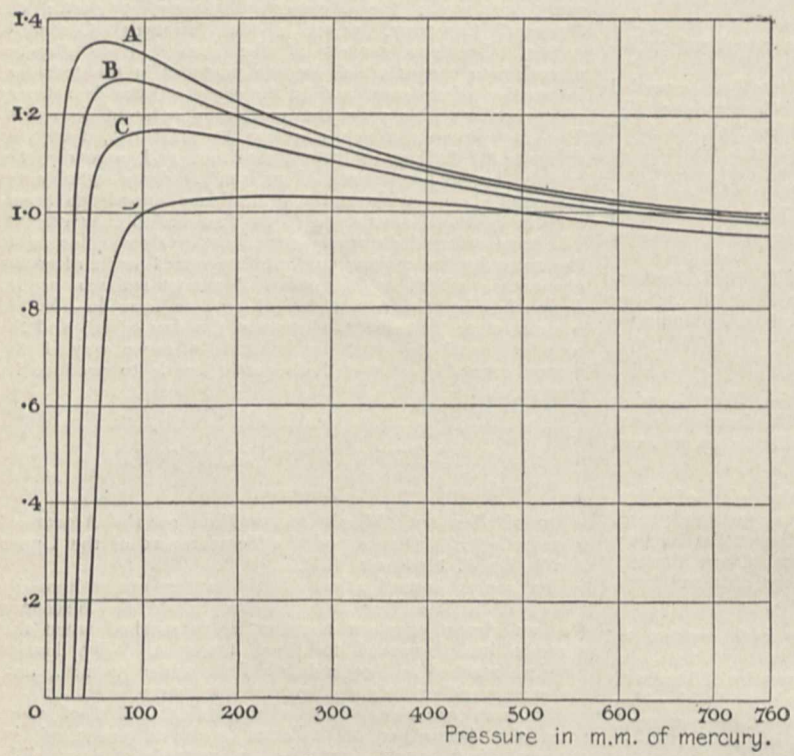


DIAGRAM I.—Velocity of ascent of balloons. The ordinates give the ratio of the velocity of a balloon in air at pressure p, carrying a load 0·6 F_0, and with internal pressure $= p + \frac{p_0}{n}\left(\frac{p_0}{n}\right.$ being the elastic compression and F_0 the total lifting force at ground level), to the velocity at p_0 of the same balloon if devoid of weight, and with the external and internal pressures equal. For A, $n = 100$; for B, C, and D respectively $n = 75$, 50, and 30.

The relations of the height corresponding to a given pressure on the supposition of (1) constant temperature, (2) temperature as observed, (3) adiabatic temperature are given, and it is noted that the observed decrement of temperature is almost exactly 0·7 time the adiabatic decrement down to a pressure of rather less than 200 mm., corresponding to a height of 11 kilometres.

Heights approaching 40 kilometres could probably be reached if the balloons were made more expansible, *i.e.* if the unfilled balloons were of thinner material and larger in volume than those at present in use, as this would allow of the same lifting force for the given quantity of gas and give more scope for expansion with diminished pressure.

Geological Society, May 20.—Prof. W. J. Sollas, F.R.S., president, in the chair.—Some fossil fishes discovered by Prof. Ennes de Souza in the Cretaceous formation at Ilhéos, State of Bahia (Brazil): A. S. **Woodward**, F.R.S. The Lower Cretaceous formation of Bahia extends along the coast to a point 130 miles south of the area previously described. The fish remains are referable to new species of the genera Mawsonia, Lepidotus, and Scombroclupea. Mawsonia seems to have been scaleless, and differs from all known Jurassic and Cretaceous cœlacanth fishes in lacking denticles on the fins. The Lepidotus resembles the European Wealden *L. mantelli* in proportions, but is more strongly ornamented. The Scombroclupea is peculiar, in exhibiting only scales where the anal finlets usually occur.—The Bala and Llandovery rocks of Glyn Ceiriog (North Wales): Dr. T. **Groom** and P. **Lake**. The authors have mapped the district around Glyn Ceiriog on the 6-inch scale. The succession of strata is tabulated, and the characteristics of each bed given. No indication of the overlap or overstep of the Wenlock, Tarannon, and Llandovery beds mapped by the officers of the Geological Survey or described by previous observers was found, although there is probably an unconformity at the base of the Fron-Frys Slates. The beds of the district dip northwards at an almost uniformly low angle, but the structure is complicated by a series of faults, most of which have hitherto escaped notice, some being very elusive. The most important east-and-west fault is the Ddolhir fault, which dips at an angle of 20° nearly with the bedding, and may be either a thrust-plane or a lag-fault. Of the N.N.W. and S.S.E. or N. and S. faults, the most remarkable is the Caemor fault, on the east side of which the rocks have been raised nearly a mile, and shifted horizontally to the south for nearly three miles.

Faraday Society, May 26.—Sir J. Swan in the chair.—*Presidential address*: Some aspects of the work of Lord Kelvin: Sir Oliver **Lodge**. The president commenced by pointing out the difficulty of doing justice in the course of a short address to a man who, from an early age to an old age, had turned out such a prodigious amount of work, embracing practically all branches of physical science. Lord Kelvin had calculated the age of the earth, worked in the domain of electrostatics, optics, elasticity, telegraphy, beside many other practical subjects. These, however, had been dealt with by other appreciators. Sir Oliver himself would not touch upon the practical side of Lord Kelvin's work, but upon the more recondite and abstruse branches of his activity. He was not entirely able to agree with some of Lord Kelvin's assumptions, neither did he always consider that his practical work entirely bore out his conclusions. For instance, in the case of the kinetic theory of solidity, Kelvin seemed to consider that solids could be made from fluids and fluids from solids, and that matter might be ether in motion. But more recently he seemed to have rather changed his views, or at any rate modified them, and seemed satisfied with the postulate of action at a distance through space without the intervention of a connecting medium. Sir Oliver Lodge himself was unable to accept the explanation of action at a distance without the intermediary of some form of matter. Nothing in Lord Kelvin's work was finer than his publications in 1851, or showed the extraordinary keenness of mind aided by the tremendous natural powers which he possessed. His prescience was, at that date, even greater than that of Helmholtz. Posterity will probably consider that the greatest of all his work was that upon the conservation of energy and his enunciations upon the laws of thermodynamics. This part of the discussion was illustrated on the blackboard by mathematical formulæ. Reference was also made to

the importance of his work upon absolute measurements, and Sir Oliver Lodge pointed out that some persons appeared to think that absolute measurements meant the metric system, but it did not matter in the least what units were employed so long as they were understandable.

Zoological Society, May 26.—Prof. E. A. Minchin, vice-president, in the chair.—Mammals collected by Mr. C. H. B. Grant near Tette, Zambesia, being the tenth and last of the series of papers on Mr. C. D. Rudd's exploration of South Africa: Oldfield **Thomas** and R. C. **Wroughton.** The importance of this collection was due to the fact that Tette was the place where Dr. Peters obtained most of the specimens on which his "Säugethiere von Mossambique" (1852) was based, and the specimens now collected were therefore topotypes of his species, and in consequence of great value in working out South African mammals in general; 104 specimens were referred to, belonging to thirty-two species. The exploration had lasted five years, and its results formed the largest and most complete collection that the National Museum had ever received from any one source. Besides duplicates, 1541 specimens had been registered in the museum, a large number of new species and subspecies had been discovered and described, and many more old and inexactly described species were now represented by good series of well-prepared skins and skulls. The collection had, in fact, revolutionised our knowledge of South African mammalogy, and it was impossible to exaggerate the benefit that such an exploration was to zoology in general and to the National Museum in particular.—The small collection of terrestrial Isopoda made by Dr. Cunnington on the third Tanganyika expedition: Rev. T. R. R. **Stebbing.** The collection consisted of four species. For two of these the author instituted the new genus Anchiphiloscia, distinguished by more penicils on the mandibles and a different cleavage of the second maxillæ from Philoscia as founded by Latreille in 1804. The paper insisted on the need of some enthusiast able and willing thoroughly to revise all the forms which had clustered under and about the generic name Philoscia.—The anatomy of Antechinomys and some other marsupials, with special reference to the intestinal tract and mesenteries of these and other mammals: F. E. **Beddard.** With the aid of a series of diagrams, the author described four grades or types into which he divided the modes of suspension of the mammalian intestinal tract.—The dermal armour of the extinct reptiles of the genus Pareiasaurus: Prof. H. G. **Seeley.** The existence of a dermal armour in Pareiasaurus had been doubted by some authors, but Prof. Seeley was able to exhibit some actual specimens of scutes which had been obtained by Mr. J. Van Renen south of Fraserberg, Cape Colony.—Prof. **Seeley** also exhibited the skull of an extinct reptile of the genus Diademodon, on which he proposed to found a new species, and gave an account of the further evidence which it afforded of the structure and dentition of these South African reptiles.—Descriptions of many new species of Siphonaptera: Hon. N. Charles **Rothschild.**

DUBLIN.

Royal Dublin Society, May 19. — Prof. Young, F.R.S., in the chair.—Mendelian characters among Shorthorn cattle: Prof. J. **Wilson.** The author showed that in the matter of colour Shorthorn cattle display Mendelian phenomena, and that the reds and whites are the parent races, while the roans are intermediate hybrids. In support of this he quoted data collected for another purpose by Miss Barrington and Prof. Karl Pearson, which were published in *Biometrika* (vol. iv.). For the purpose of his paper the author pointed out that Barrington and Pearson's data were not complete, inasmuch as they left out of account several factors that cause the registration of Shorthorn cattle to be inaccurate. The author collected new data, in which the inaccuracies are eliminated as far as possible. He also gave a short account of the origin of Shorthorn cattle and of the history of the three races of cattle now found in the British Isles, viz. the black Celtic race, the white Roman race, and the red Saxon race.—Injurious insects and other animals observed in Ireland during the year 1907: Prof. G. H. **Carpenter.** The paper included records of several insects feeding on tobacco, including the caterpillars of *Mamestra oleracea* and *M. brassicae*, and a springtail—*Isotoma tenella*, Reuter—new to the Britannic fauna. The storehouse beetle, *Ptinus tectus*, Boield., lately introduced into Great Britain, has now appeared also in the suburbs of Dublin.

PARIS.

Academy of Sciences, June 1.—M. H. Becquerel in the chair.—The fossils of Patagonia. Economy in nature: Albert **Gaudry.** A comparison of the remains of mammals of the Patagonian region with those of this hemisphere shows no reason for supposing that there were two centres of creation; but during Tertiary times evolution has taken place in the two hemispheres differently, continuing in the one and being arrested in the other.—New observations on Etna: A. **Lacroix.** The eruption has been studied from the observatory, situated at an altitude of 2942 metres, and at the foot of the terminal cone, 1 kilometre from the crater. The clouds emitted are compared with those of Mont Pelée, and details are given of the field within which fresh openings have been produced, and of the materials projected by the explosions of the central crater.—Some points relating to the pathogeny of congenital deformities of the face: M. **Le Dentu.** A general review of the theories of malformation is given, the statistics relating to the influence of heredity being considered in some detail.—The stability of auto-excited alternators working in parallel: M. **Dumoulin.** A study of the effect of adjusting the brushes of the rectifier supplying the inducing current.—Two different states of the iron arc: H. **Buisson** and Ch. **Fabry.** The first state of the arc, which is stable only when the current is intense, can be made to pass over into the other by introducing a large resistance into the circuit, the electromotive force being high, 220 to 440 volts. The phenomena observed are compared with those shown by the arc between carbon poles.—The hydrates of the fatty acids determined from measurements of the viscosity of their solutions: D. E. **Tsakalotos.** These measurements lead to the conclusion that there is no combination between formic acid and water, whilst acetic, propionic, and butyric acids form molecular combinations containing one molecule of water to one molecule of the acid.—The action of ammonia upon phosphorus chloronitride: MM. **Besson** and **Rosset.** With dry liquid ammonia the product of the reaction is $PN(NH_2)_2$; gaseous ammonia acting on a solution of the chloronitride in carbon tetrachloride gives a different substance,

$$P_2N_2Cl_3(NH_2),$$

soluble in carbon tetrachloride.—The acid phosphoric esters of guaiacol: V. **Auger** and P. **Dupuis.**—The mechanism of cyclic formation in the geranic series; the synthesis and structure of dihydromyrcene: M. **Tiffeneau.**—Researches on protoplasmic hydrolysis: A. **Étard** and A. **Vila.** It is pointed out that the current methods of separating and determining the nitrogenous products of the hydrolysis of protoplasmic substances entail unavoidable losses.—The relations between the microgranites and the diabases of the Meuse valley: J. **de Lapparent.** It is concluded that the eruption of the microgranites of the valley of the Meuse is of a later date than that of the diabases. At the moment of the eruption of the microgranites the magma of the diabases had not consolidated.—A new genus, *Lecythodytes paradoxus*, a parasite of the Chrysomonadineæ: P. A. **Dangeard.**—The propagation of some species of mosses of the genus Barbula under certain experimental conditions: Jacques **Maheu.**—The pallial defensive glands in *Scaphander lignarius*: Rémy **Perrier** and Henri **Fischer.**—The most recently discovered drawings in the Portel (Ariège) grotto: A. **Breuil,** L. **Jammes,** and R. **Jeannel.** In a branch of the main cavern, unnoticed until recently, a fresh set of palæolithic drawings has been found. These include pictures of a small bison and a horse, reindeer, and wild goat. Evidence of the presence of small bears in this cave has also been found.—The entoptoscope, an instrument for examining the macula: Paul **Fortin.**—Radioscopy in forensic medicine: F. **Bordas.** In determining whether an infant has breathed or not, radiography cannot be substituted for the methods in current use. It is, however, of service in

furnishing the expert with a photographic document, which may be used as supplementary evidence.—A new thermo-pulveriser worked by means of compressed air: M. **Guyenot.** The various forms of apparatus in current use for producing sprays of aqueous solutions for therapeutic purposes cannot be used for a higher temperature than 25° C. In the apparatus described and figured in the present paper, any temperature up to 50° C. can be maintained at will.—Researches on the food of the typhoid bacillus: H. **Dunschmann.** A comparison of the nutritive effects of bile salts on the typhoid and coli bacilli.—The utilisation of concentrated saline solutions for the differentiation of bacteria. The separation of *Bacillus typhosus* from *Bacterium coli*: A. **Guillemard.** A strong saline solution, such as one containing 20 per cent. of sodium sulphate, causes differences in the growth of cultures of the typhoid and coli bacilli, by means of which they can be readily differentiated. Other bacilli have been studied from the same point of view.—The presence of Hippurite grit at Vence, Alpes-Maritimes: V. **Paquier.**—The Cretaceous and Tertiary strata in the region of Constantine, Algeria: E. **Joleaud.**—The use of Daguin's *acoustèle* for the detection of subterranean sounds: F. **Diénert,** A. **Guillerd,** and M. **Marrec.** An account of the application of this instrument to the tracing of currents of underground water by means of the sound produced by the stream. The method is only successful in a few limited cases.—The influence of the wind on the filling up of the bed of the ocean: M. **Thoulet.**—Contribution to the study of the Landwasser river and the Davos valley: Gabriel **Eisenmenger.**

DIARY OF SOCIETIES.

THURSDAY, JUNE 11.

MATHEMATICAL SOCIETY, at 5.30.—Electrical Resonance: Prof. H. M. Macdonald.—Relations between the Divisors of the First n Numbers (second paper): Dr. J. W. L. Glaisher.—The Formation of Fundamental Harmonics: Prof. A. E. H. Love.

FRIDAY, JUNE 12.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Considerations on the Form and Arrangement of New Tables of the Moon: Simon Newcomb.—On the Orbit of β 416: J. Voûte.—An Example of Prof. Karl Pearson's Calculation of Correlation in the Case of Periodic Inequalities of Long Period Variables: H. H. Turner.—On the Paral'ax and Proper Motion of the Double Star Krueger 60: E. E. Barnard.—Observations of Daniel's Comet (*d* 1907): Radcliffe Observatory, Oxford.—The Lunar Bright Rays: H. G. Tomkins.—Observations of Helium D_3 Absorption in the Neighbourhood of Spots in 1907: Capt. R. A. C. Daunt.—The Radius of the Moon for Libration $-4''{\cdot}5$: Walter Heath.—*Probable paper*: Report on Observations of the Total Solar Eclipse of 1908 January 3: F. K. McClean.

ARISTOTELIAN SOCIETY (at Cambridge).—Symposium: The Nature of Mental Activity: Profs. S. Alexander, James Ward, Carveth Read, and G. F. Stout.

PHYSICAL SOCIETY, at 8.—Experiments on a Directive System of Wireless Telegraphy: Messrs. Bellini and Tosi.—On the Lateral Vibration and Deflection of Clamped Directed Bars: Dr. Morrow.—On the Resistance of a Conductor of Uniform Thickness whose Breadth Suddenly Changes, and on the Shapes of the Stream-lines: Prof. Lees.—On the Self-inductance of Two Parallel Wires: Dr. Nicholson.—On Homogeneous Secondary Radiation: Dr. Barkla and Mr. Sadler.—Notes on the Motion of a Corpuscle and on Cloud Formation: Prof. Morton.

GEOLOGISTS' ASSOCIATION, at 8.—Origin of Mountain Tarns: Prof. E. J. Garwood.

MONDAY, JUNE 15.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Journey on the Upper Salwin: George Forrest.

TUESDAY, JUNE 16.

ROYAL STATISTICAL SOCIETY, at 5.

ZOOLOGICAL SOCIETY, at 8.30.—The Duke of Bedford's Zoological Exploration of Eastern Asia.—X. List of Mammals from the Provinces of Chi-li and Shan-si, N. China: Oldfield Thomas, F.R.S.—On a Case of Imperfect Development in *Echinus esculentus*: James Ritchie and D. C. McIntosh.—Observations on the Minute Structure of the Spicules of Calcareous Sponges: Prof. E. A. Minchin and D. J. Reid.—Two New Genera and a New Species of Indian Lycænidæ: Dr. T. A. Chapman.—A Contribution to the Knowledge of *Rhinoderma darwini*: F. E. Beddard, F.R.S.—Some Notes upon the Anatomy of *Chiromys madagascariensis*, with References to other Lemurs: F. E. Beddard, F.R.S.—*Leucocytozoön musculi*, sp. n., a Parasitic Protozoön from the Blood of White Mice: Miss Annie Porter.

MINERALOGICAL SOCIETY, at 8.—On a Nickel-iron Alloy Common to the Meteoric Iron of Youndegin and the Meteoric Stone of Zomba: L. Fletcher, F.R.S.—Kaolinization and other Changes in West of England Rocks: F. H. Butler.—On Schwartzembergite, and the Drawing of Light Figures: Dr. G. F. Herbert Smith.—The Chemical Composition of Seligmannite: Dr. G. T. Prior.

WEDNESDAY, JUNE 17.

GEOLOGICAL SOCIETY, at 8.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—An Elementary Explanation of Correlation, Illustrated by Rainfall and Depth of Water in a Well: R. H. Hooker.—The Hong Kong Typhoon, September 18, 1906: L. Gibbs.

ROYAL MICROSCOPICAL SOCIETY, at 8.—On Cycloloculina, a New Generic Type of the Foraminifera: E. Heron-Allen and A. Earland.—Illuminating Apparatus for the Microscope: J. W. Gordon.—*Exhibits*: A New Lens for High Power Microscopy: Mr. Gordon and H. Fletcher Moulton.—The Development of the Chick: A. Flatters.

THURSDAY, JUNE 18.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: (1) An Electrical Method of Counting the α Particles from Radio-active Matter; (2) The Charge and Nature of the α Particles: Prof. E. Rutherford, F.R.S., and Dr. Hans Geiger.—The Scattering of the α Rays by Matter: Dr. Hans Geiger.—Studies of the Processes Operative in Solutions. Part VI., Hydration, Hydrolation and Hydrolysis as Determinants of the Properties of Aqueous Solutions; VII., The Relative Efficiencies of Acids as deduced from their Conductivities and Hydrolytic Activities; VIII., The Influence of Salts on Hydrolysis and the Determination of Hydration Values; IX., The Determination of Optical Rotatory Power in Solutions; X., The Changes Effected by the Reciprocal Interference of Cane-Sugar and other Substances (Salts and Non-electrolytes): Prof. H. E. Armstrong, F.R.S., and others.—The Electrolytic Properties of Dilute Solutions of Sulphuric Acid: W. C. D. Whetham, F.R.S., and H. H. Paine.—The Giant Nerve Cells and Fibres of *Halla parthenopeia*: Dr. J. H. Ashworth.

CHEMICAL SOCIETY, at 8.30.—The Thermal Decomposition of Hydrocarbons, Part I., Methane, Ethane, Ethylene and Acetylene: W. A. Bone and H. F. Coward.—The Rusting of Iron: W. A. Tilden.—Studies on Elementary Zirconium: E. Wedekind and S. J. Lewis.—(1) The Constituents of Canadian Hemp. Part I., Apocynin; (2) A New Synthesis of Apocynin: H. Finnemore.—The Constitution of the Diazonium Perbromides: F. D. Chattaway.—Cholestenone: C. Dorée and J. A. Gardner.—A New Form of Potash Bulb: A. E. Hill.—Solubility of Silver Chloride in Mercuric Nitrate Solutions: B. H. Buttle and J. T. Hewitt.

LINNEAN SOCIETY, at 8.

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