THURSDAY, JUNE 19, 1919.

## TEXT-BOOKS OF BOTANY.

(1) *Eléments de Botanique.* Par Prof. Ph. Van Tieghem. Tome i., "Botanique Générale." Cinquième édition, revue et corrigée par Prof. J. Costantin. Pp. xv+619. Tome ii., "Botanique Spéciale." Cinquième édition, remaniée et augmentée par Prof. J. Costantin. Pp. xx+743. (Paris: Masson et Cie, 1918.) Price 14 francs.

(2) *Botany: A Text-book for Senior Students.* By D. Thoday. Second edition. Pp. xx+524. (Cambridge: At the University Press, 1919.) Price 7*s.* 6*d.* net.

(3) *Lowson's Text-book of Botany (Indian Edition).* Revised and adapted by Birbal Sahni and M. Willis. With a preface by Dr. J. C. Willis. New and revised edition. Pp. xii+610. (London: W. B. Clive, University Tutorial Press, Ltd., 1919.) Price 8*s.* 6*d.*

(1) THE latest edition of Prof. Ph. Van Tieghem's text-book, edited by Prof. J. Costantin, is arranged on the same plan as previous editions. A serious omission from the point of view of the bibliographer is the absence of any prefatory note or introduction. The first volume is described on the title-page as "revue et corrigée," and the second as "remaniée et augmentée," but there is no indication as to the extent or nature of the changes or additions by virtue of which the present edition may be regarded as an advance on earlier ones. A careful comparison of the table of contents and the text is therefore rendered necessary. There is very little change in the first volume—that dealing with general botany. The first five chapters deal respectively with the body of the plant as a whole, the root, stem, leaf, and flower—in each case treated under two sections: (1) form and structure, and (2) function. This treatment will probably not commend itself to teachers in this country at the present time, if only from the difficulty it involves in presenting an account of the physiology of the plant as a living whole. In the next four chapters an account is given of the life-history of the four great subdivisions of the plant kingdom—Seed-plants, Vascular Cryptogams, Mosses, and Thallophytes. The difference between the origin or products of germination of the spore in the fern and in the moss, as contrasted with each other and with the seed-plant, is emphasised by the use of special terms—the spore and sporangium of the fern are termed "diode" and "diodange," those in the moss "tomies" and "tomiange," the whole sporogonium of the moss being a "tomiogone."

Vol. ii., "Special Botany," deals with classification. Two subkingdoms are recognised—Arhizophytes, or plants without roots, including the two great divisions Thallophyta and Bryophyta; and Rhizophytes, or plants with roots, including the great divisions Vascular Cryptogams and Phanerogams. The subdivision and systematic treatment of the first three divisions are on familiar lines, but those of the Phanerogams are widely different from other systems which have been generally used, such as that of Bentham and Hooker, which grew out of the French system of Jussieu and De Candolle, or that of Engler, which was a development of Eichler's system. The system employed in the present volume is based on that elaborated by Van Tieghem in his paper entitled "The Eggs of Plants considered as a Basis of Classification" (*Annales d. Sci. Natur.*, sér. 8, xiv.). The Astigmatées (Gymnosperms) fall into two classes—Natrices with motile male cells, and Vectrices with male cells non-motile. The Stigmatées (Angiosperms) include three classes—Monocotyledons, Liorhizal Dicotyledons, and Dicotyledons. The second is an extremely artificial group, containing the grasses and water-lilies (except Nelumbium). For the subdivision of the other two great groups of Angiosperms the details of the structure and development of the ovule are regarded as supplying the most important characters. Special stress is laid on the persistence or absorption of the wall at the upper part of the embryo-sac; if this remains intact up to the time of fertilisation, the ovule is described as "perpariété"; if, on the other hand, the wall has been absorbed before the arrival of the pollen-tube, the ovule is "transpariété." Space does not allow of a detailed criticism of the system, which provides many puzzles for the British botanist who approaches it with preconceived ideas of affinities based on a knowledge of either of the systems to which reference has already been made.

(2) The second edition of Mr. Thoday's admirable elementary text-book differs from the original edition of 1915 in the addition of a small supplementary section on Cryptogams arranged to cover the syllabus for the Cambridge Higher School Certificate and similar examinations. The fifty additional pages contain descriptions of the structure and life-history of selected algæ, fungi, mosses and liverworts, and ferns. The examples chosen are all common genera, and illustrate, so far as possible in the small space allotted, the variety in methods of reproduction among the algæ and fungi, while the relation between the sexual and spore-bearing generations of the two higher groups is treated in sufficient detail to emphasise the principle of alternation of generations, and to render possible a comparison between the life-history of the higher Cryptogams and the Seed-plants.

As in the former edition, the body of the text is divided into five sections. In the first section the functions of plant-organs and the work of nutrition are treated experimentally; the second deals with the form and structure of the vegetative organs of seed-bearing plants, and the third with the flower, seed, and seedling. Section iv., on "The Classification of Plants," comprises, first, a study of the floral types in the family Ranunculaceæ, to illustrate the concept of species, genus, and family, and the principles of floral evolution; and, secondly, a description of other floral types as illustrated by a judicious selection of fifteen

families of dicotyledons and monocotyledons. The fifth section, "Plants in Relation to their Environment," contains chapters on "fitness" or adaptation to environment, a very useful one on trees, one each on climbing plants and water-plants, and a brief introduction to the study of plant associations.

(3) The new edition of "Lowson's Text-book of Botany," adapted for the use of Indian students, represents a widely different type of text-book. It contains a great deal of information clearly expressed in numbered and headed paragraphs, which are illustrated by plain, carefully indexed diagrammatic sketches such as a lecturer would use for a class of elementary students. It suggests the lecture notes made by an accurate and conscientious student, and if regarded as such may serve a useful purpose provided the student can clothe the skeleton with the living and working tissue. But it is not a book to put into the unaided hands of a beginner, or to excite a love of botany in the heart of the amateur. Like the original, which is well known among a certain class of students, it is obviously written for examination purposes. In the new edition Mr. Sahni has introduced additional matter into the chapters on the natural orders dealing specifically with the Indian flora, and also a number of vernacular plant-names, which are separately indexed at the end of the volume. These are both useful additions, but when one recalls the richness of the Indian flora and its remarkable diversity, ranging from tropical to high alpine, and including biological groups of great variety and interest, one could wish for a more attractive and living introduction to its study.

## OPTICS AND MECHANICS.

(1) *Mirrors, Prisms, and Lenses. A Text-book of Geometrical Optics.* By Prof. James P. C. Southall. Pp. xix+579. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1918.) Price 17*s.* net.

(2) *Notes, Problems, and Laboratory Exercises in Mechanics, Sound, Light, Thermo-mechanics, and Hydraulics. Prepared for Use in Connection with the Course in Natural and Experimental Philosophy at the United States Military Academy.* By Prof. Halsey Dunwoody. Pp. v+369. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 13*s.* 6*d.* net.

SCIENTIFIC writers in the United States appear to have laboured under smaller difficulties due to war conditions than British authors. Here are two new American text-books, of which the first is sure to be welcomed by a wide circle of readers, whilst the second is adapted for a special class of students.

(1) Prof. Southall is known as the author of a treatise on "The Principles and Methods of Geometrical Optics." The present volume, although in some sense an abridgment of the larger work, contains a considerable mass of new and original material. It is intended to serve as an introduction to the theory of modern optical instruments, but only the simplest mathematical processes have been employed. In the earlier and more elementary portions of the subject the author has purposely entered into much detail, and he has been very successful in imparting fresh interest to an old and well-worn subject. The need for a text-book dealing with ophthalmology and applied optics on modern lines has long been felt, and there is no doubt that certain portions of this volume will be helpful to the modern oculist and optometrist. Thus, for example, the author has been at some pains to explain the fundamental principles of ophthalmic lenses and prisms. It is unfortunate that lack of space prevented the detailed description of any single optical instrument, and it may be suggested that an account of the microscope should be included in a future edition even at the expense of some other sections. The book is provided with a number of problems appended to each chapter, and with clearly executed diagrams. The photographic illustrations of reflection from plane mirrors are of special interest.

"Unfortunately, at present geometrical optics would seem to be a kind of Cinderella in the curriculum of physics, regarded perhaps with a certain friendly tolerance as a mathematical discipline not without value, but hardly permitted to take rank on equal terms with her sister branches of physics. On the contrary, it might be inferred that any system of knowledge which had already placed at the disposal of scientific investigators such incomparable means of research as are provided by modern optical instruments, and which has found so many useful applications in the arts of both peace and war, would be deserving of the highest recognition, and would be fostered and encouraged in all possible ways."

Prof. Southall's book should serve to stimulate the study of optics in our colleges and universities.

(2) It is difficult to understand the principles on which Prof. Dunwoody has arranged the miscellaneous contents of this volume. The title on the cover of the book is even more misleading than that on the title-page. It is "Laboratory Exercises, Notes, and Problems in Physics." Yet only about twenty pages are concerned with "Sound, Light, Thermo-mechanics," and about ten with "Hydraulics." The greater part of the contents is concerned with "Mechanics," about 150 pages being devoted to "Notes on Mechanics," including graphical statics and the mathematical treatment of translation and rotation in the case of a rigid body. About an equal number of pages is given to an extensive list of problems ranging in difficulty from those suitable for schoolboys beginning the subject to those requiring a knowledge of differential equations. In some cases hints for the solution of the problem are added.

Of the laboratory exercises, fifteen in all, thirteen are on mechanics, including one on the

viscosity of fluids, two on light, and one on sound. The exercises are illustrated by half-tones, but as no written description of the apparatus is given it is difficult in some cases to guess how the experiment is to be carried out. The student would often be at a loss if guided by these notes alone. H. S. ALLEN.

## SECRET OR MYSTERY?

(1) *The Secret of Personality: The Problem of Man's Personal Life as Viewed in the Light of an Hypothesis of Man's Religious Faith.* By Dr. George Trumbull Ladd. Pp. ix+287. (London: Longmans, Green and Co., 1918.) Price 7*s.* 6*d.* net.

(2) *The Philosophy of Mr. B*rtr*nd R*ss*ll. With an Appendix of Leading Passages from Certain Other Works.* Edited by Philip E. B. Jourdain. Pp. 96. (London: George Allen and Unwin, Ltd., 1918.) Price 3*s.* 6*d.* net.

(1) IT is said that the reader of a once famous book entitled "The Secret of Hegel" remarked when he closed the volume that whatever the secret might have been it had been very successfully kept. No difficulty of discovery is likely to baffle the reader of Dr. Ladd's "Secret of Personality." His secret is an open one, and in the author's genial treatment personality is not mysterious either in the sense of inspiring awe or in that of suggesting occult sources of knowledge. Philosophy itself throws a strange light on man's personality in the attraction it has for us in our youth and in our old age, with the eclipse of interest it undergoes in the stress of active life. So in this little book we feel the professor's keen enjoyment in his old age (he was born in the same year as M. Clemenceau), writing not to instruct us, not to guide us in metaphysical or psychological research, not even to console us, but to give expression to his own reflections on the problems of philosophy.

(2) Mr. Jourdain's satire on the work of a contemporary philosopher will afford much amusement to those who are familiar with that philosopher's method and with the kind of problems to the solution of which he devotes his energy and ingenuity. To those who do not know this work or are uninterested in it, not only will the humour be lost, but the object of the book will also be unintelligible. To such it will appear a cryptic puzzle not worth trying to solve. Yet some of the papers are excellent for their logical nonsense, and might themselves be set as subjects for a logical seminar. Particularly good is the one entitled "The Mortality of Socrates." What one cannot help feeling, however, in regard to the whole is that the author satirised is himself endowed with a very abundant fund of humour which makes its presence felt in the most ultra-mathematical and logical disquisitions, and many of Mr. Jourdain's brightest hits are jokes concerning his author's jokes. Moreover, a joke prolonged into a book tends to become so serious as to threaten to defeat its intention.

## OUR BOOKSHELF.

*Mikrographie des Holzes der auf Java vorkommenden Baumarten, im Auftrage des Kolonial-Ministeriums.* Unter Leitung von Prof. J. W. Moll, bearbeitet von Dr. H. H. Janssonius. Fünfte Lieferung. Pp. 337–764. (Leyden: E. J. Brill, 1918.)

THE present part completes the third volume (dealing with the calycifloral section of Dicotyledons) of the detailed description of the minute structure of the wood of the tree species occurring in Java. It comprises the families Rhizophoreæ, Combretaceæ, Myrtaceæ, Melastomaceæ, Lythrarieæ, Samydaceæ, Datisceæ, Araliaceæ, and Cornaceæ, and includes the description of 124 species and varieties. At the beginning of the account of each family are given a list of the literature, an enumeration of the material examined, and a summarised description of the general characters of the anatomy of the wood and its constituent elements. Then follow, first, a discussion of the bearing of the results of the investigation on the systematic grouping of the genera and species within the family; secondly, a table in the form of a key for the determination of the species by means of characters afforded by their wood-structure; and thirdly, a detailed description of the characters in each species, with a block illustration of the first species described for each genus. The authors have brought together much detailed information on the minute structure of the wood of the species examined, and the work when completed will form a valuable contribution to the systematic study of genera and species from a point of view which hitherto has been insufficiently recognised.

*Molecular Physics.* By Dr. James Arnold Crowther. Second edition. (Text-books of Chemical Research and Engineering.) Pp. viii+190. (London: J. and A. Churchill, 1919.) Price 6*s.* net.

THE fact that a second edition of Dr. Crowther's little volume has been required so soon shows that the praise given to the first edition in NATURE for March 25, 1915, was not undeserved. A complete revision of the material has been carried out, and, in spite of the conditions of a great war not being favourable to theoretical research, some additions have been made. In particular, the results obtained in the laboratory of Sir Ernest Rutherford have increased our knowledge of the structure of the atom, and the author has added a special chapter on this profoundly interesting subject, while the chapter on the chemistry of the atom has been almost completely rewritten from the point of view of Sir J. J. Thomson's theory of valency and chemical affinity. The complaint as to the absence of an index in the earlier edition has been at least partly met by a subject index occupying a couple of pages. In its revised form it is certain that the book will be well received, and will be read not only by physi-

cists, but also by those engaged in other scientific pursuits who desire trustworthy information as to the "new physics." H. S. A.

*Le Rocce. Concetti e Nozioni di Petrografia.* By Prof. E. Artini. Pp. xx+636+Tav. xxxii. (Milano: Ulrico Hoepli, 1919.) Price 18.50 lire.

PROF. ARTINI states in his preface that there has been no general treatise on rocks in the Italian language since that by Achiardi, published thirty years ago. He rightly remarks that a translation is always an indifferent expedient; a book for Italians should be rich in Italian examples. He looks on rocks from the point of view of a naturalist, and his use of landscapes among his illustrations makes us hope that he will some day give us a petrography of Italy that will connect mineral evolution with the scenery from Monte Bianco to Catania. The material here brought together is thoroughly up to date; we may cite, for instance, the remarks on *idrogels* (p. 186), on bipyramidal quartz (p. 338), and on the alleged gneissic *Grundgebirge* (p. 544). Graphic methods of representing rock-composition are illustrated. As an Italian detail, may we point out (p. 319) that *gabbro,* and not *eufotide,* is of Tuscan origin, the name of a Tuscan village having been utilised by von Buch? The treatment of sedimentary rocks is unusually adequate, and the photographic plates of thin sections are extremely clear and helpful. This compact volume is so full of fundamental *concetti* that it certainly should have been provided with an index. G. A. J. C.

*Agricultural Bacteriology.* By Dr. H. W. Conn. Third edition, revised by H. J. Conn. Pp. x+357. (Philadelphia: P. Blakiston's Son and Co., 1918.) Price 2 dollars net.

WHILE the general plan of this book remains the same as before, considerable changes have been introduced in the sections on soil bacteriology, on the control of milk supplies, on plant diseases, and on laboratory technique. In some cases, however, further information might have been given with advantage; thus under slimy or ropy bread practically no description is given of the causative organism. Under "tuberculosis" the illustration Fig. 50 is stated to depict "a bit of animal tissue"; what is actually shown is a giant cell only; the tubercles are stated to be "swollen masses of tissue," and among animals that suffer from tuberculosis dogs and cats are mentioned; actually these animals rarely suffer from the disease. The consideration of the bacteriology of the soil, of milk, and of milk products is adequate, and such details as protozoa in the soil and soil sterilisation and the possibility of the accumulation of toxic substances in "worn-out soils" are all referred to. In an appendix a scheme of laboratory work is given, with detailed exercises, which should be of value to the teacher. The book is freely illustrated and clearly printed, and forms a good elementary introduction to the wide subject of agricultural bacteriology.

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.]*

### Wireless Telephony.

REFERRING to my letter on this subject in NATURE of June 12, Mr. Godfrey Isaacs tells me that his wireless remarks with regard to secrecy were intended to apply, not to the apparatus actually in use on May 28, but to a new Marconi system, the apparatus for which is only now in course of manufacture. The scientific world will, I am sure, await with interest details of this new secret wireless telephone system.

A. A. CAMPBELL SWINTON.

40 Chester Square, London, S.W.1, June 17.

### Camouflage of Ships of War.

PROF. KERR, in the course of a letter which appeared in NATURE of May 15 under the above heading, paid me a high tribute by stating that, during the summer of 1917, "the value of the principle [*i.e.* obliterative colouring] was now recognised [by the Admiralty] and its application entrusted to skilled hands," but the main point in his letter was to show that the principle of obliterative colouring was no new thing, and was common knowledge to biologists: this no one will question. My aim in replying to his letter is with the view of showing that I was not working on biological lines, and is thus to remove a misapprehension.

I feel that Prof. Kerr has not thoroughly grasped the idea of the special form of camouflage on which I was engaged, and of which I still claim to be the originator. "Dazzle-painting," so called officially, had one purpose in view only, viz. to upset a submarine commander's estimate of a vessel's course, when carrying out an attack with torpedo. I was under no misapprehension as to its value for gunnery, and in my original submission to the Admiralty in May, 1917, I made no claim that it might be used for this purpose, as I felt certain that paint could not possibly have sufficient carrying power to stultify the enemy's range-finders at the great distances at which a modern action would probably be fought.

Subsequent experiments on dazzled ships with range-finders justified this belief.

The accurate estimation of a vessel's course is the prime factor required by a submarine commander to ensure successful attack. In every dazzle design this point was studied to the exclusion of all others, *i.e.* to frustrate accurate calculation of course. The mere breaking up of a vessel's form by strongly contrasting colours would not achieve this end without careful study of the perspective and balance of the design. I am not aware that this occurs in biology, *i.e.* the disguise of direction.

Surely the obliterative colouring of birds and animals is operative only so long as the bird or animal is in a state of rest; the moment movement commences the illusion is destroyed. The ship subject to torpedo attack is in constant movement. Again, in how many cases is Nature's scheme for protection successful when the subject is seen on a ridge silhouetted against the sky? Yet this is the only point of view from a submarine when observing a ship through the periscope.

My contention throughout has been that the degree of visibility of a vessel was of little consequence providing she could be seen at all. Prof. Kerr agrees that it is not possible to render a ship strictly invisible, but only to reduce her visibility. This in my view is not enough. A submarine commander, whose one object is to sink ships, will not be put off by reduced visibility. We know from some of the commanders themselves that they constantly located a vessel by its smoke when still hull down, *i.e.* before the vessel itself could be seen at all.

Prof. Kerr says that of the various methods which Nature makes use of, there are two alone of practical value for application to ships: (*a*) obliterative colouring; (*b*) compensative shading. I have endeavoured to show that the contrasting colours, as used in dazzle-painting, were not used in Nature's way, *i.e.* as obliterative colouring.

To turn to compensative shading, I must say, after extended observations at sea, I have failed to observe any gain in this method of painting. In a letter of this length it is not possible to go into all the causes of its failure, but only to state briefly one or two of the main objections. To take the practical side first, what shadows are there in our modern battleships to compensate which would retain white paint for more than a few hours? The various controls on the mast are in close juxtaposition to the funnel, and subject to constant heat and smoke. The hawse-pipes are rusty after a few hours' steaming, while the shadow cast by the flare of the bow is automatically compensated by reflected light thrown up from the bow wave. There is a small shelter deck amidships, far too deep shadow for any light paint to overcome.

In the case of the merchant vessel the same difficulties arise. No shadows cast by passenger decks can be overcome by the use of white paint, which is itself dependent on light for luminosity. These decks present a very different proposition from a bird's breast receiving reflected light from the ground or sand on which it stands, or from the glitter of water below. I am not theorising in making these statements; they are the direct outcome of observation at sea for some years.

There is one point I should like to emphasise in the matter of ships' camouflage, and that is, the practical application of a design to a ship. A scheme may be evolved which appears perfect on paper, but the result, when actually applied, will be most disappointing. Most theorists with whom I have come in contact—and they are many—only think in "one ship" when evolving a scheme for disguise. What has to be realised is that it is necessary to deal with hundreds of ships, painting simultaneously and at high pressure. The authorities concerned with shipping during the war could not think of any delay in unloading and getting vessels to sea in the shortest possible time. Consequently the painting of these vessels had to be carried out while loading or unloading, and under every other disadvantage, such as rain and coal dust. We were sometimes able to get a hose on to parts of a ship blackened with coal dust whilst painting, sometimes not. So that I fear so subtle a thing as compensative shading would have vanished before a vessel put to sea. It may be mentioned here that more than 3000 British ships alone were dazzle-painted in the last eighteen months of the war, and we sometimes had as many as a hundred vessels painting in one port simultaneously.

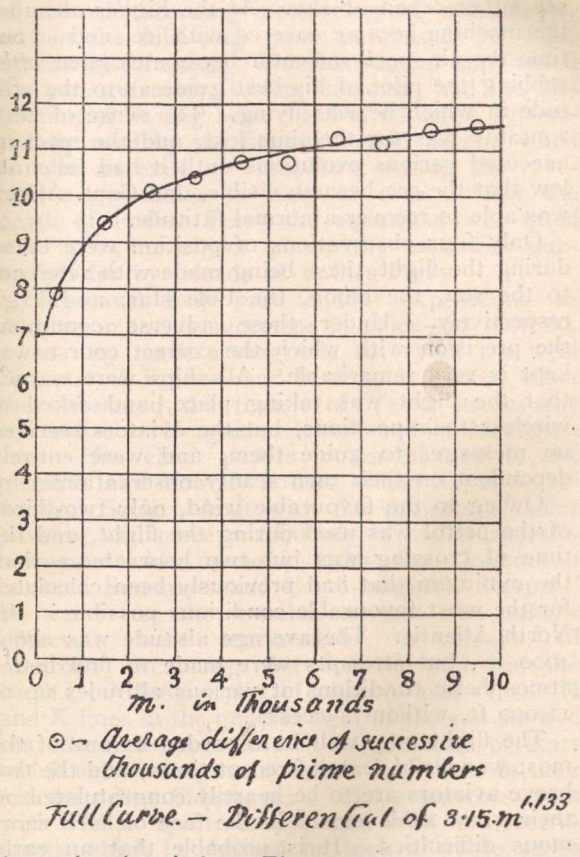
It should be remembered that dazzle-painting was adopted at a time when twenty to thirty ships were being sunk weekly, so that the life of the nation depended on turning ships round and getting them to sea again in the shortest possible time.

Dazzle-painting was never intended for use on "ships of the line," but only for merchantmen singly or in convoy and war vessels working with them; and, judging from the great number of reports received from merchant captains, who in the early stages of dazzle-painting were averse to it, but later came to see its object, there can be no question that it achieved its purpose. NORMAN WILKINSON.

## Question Relating to Prime Numbers.

IT is well known that no algebraical formula can represent prime numbers only, and that primes can only be found by trials (which may be facilitated by algebraical processes). If the $m^{th}$ prime number, counting from unity, be denoted by $n$, and if $n$ is plotted in terms of $m$, it will be found that $n$ is very approximately represented by a formula of the type $Am^p$ ($A=3{\cdot}15$, $p=1{\cdot}133$, are close to the values of the constants).

The differential of this curve is given in the accompanying diagram, and the true values of $dn/dm$ are




shown by the circles. The agreement between the curve $3{\cdot}15\ m^{1{\cdot}133}$ and the true values of $n$ (taken from Barlow's tables) is too close to be shown with advantage on the scale to which the diagram is drawn. The differential curve is a good mean of the actual values of $dn/dm$.

Are there any investigations which give a reason for the tendency of $n$ to approach a definite function of $m$, or as to the ultimate value of $dn/dm$ when $m$ increases without limit? A. MALLOCK.

6 Cresswell Gardens, South Kensington, S.W.7.

## THE ATLANTIC FLIGHT.

THE honour of the first direct trans-Atlantic flight, for which the *Daily Mail* offered a prize of 10,000*l.*, has fallen to two English aviators on a British machine. The Vickers "Vimy" bomber has made the crossing, with Capt. J. Alcock as pilot, and Lt. Whitten Brown as navigator. Newfoundland was left at 4.25 p.m., G.M.T., on June 14, and a landing made at Clifden, Galway, at 8.40 a.m., G.M.T., on June 15. The machine is a standard bombing aeroplane, slightly modified for the present flight, and has a span of 67 ft. It carries two Rolls-Royce engines of 375 h.p. each, and the gross load is about 12,500 lb. The passage was made in 16 hours 15 min., giving an average speed of nearly 120 miles per hour. The wind was favourable, but the weather very bad, according to the report of the aviators. Clouds were met at all altitudes, and it was generally impossible to see either ocean or sky. At the higher altitudes the machine became covered with ice, and at one time the air-speed indicator became clogged, thus robbing the pilot of his best guide as to the attitude in which he was flying. The sense of horizontality was for the time lost, and the machine executed various evolutions until it had fallen so low that the sea became visible, and Capt. Alcock was able to recover a normal attitude.

Only four observations of position were taken during the flight, these being made with reference to the sun, the moon, the Pole star, and Vega respectively. Under these adverse conditions the precision with which the correct course was kept is very remarkable. All ships were warned that the flight was taking place, and asked to wireless their positions, but the aviators received no messages to guide them, and were entirely dependent on their own scanty observations.

Owing to the favourable wind, only two-thirds of the petrol was used during the flight, and the time of crossing was but two hours more than the minimum that had previously been calculated for the most favourable conditions possible in the North Atlantic. The average altitude was about 4000 ft., but attempts were made to find better atmospheric conditions at various altitudes up to 11,000 ft. without success.

The flight may well be regarded as one of the most wonderful feats of recent times, and the two brave aviators are to be heartily congratulated on their great achievement in the face of such enormous difficulties. It is probable that an early start was made, in spite of bad weather reports, owing to the fact that the Handley-Page machine was almost ready for flight. The circumstances of Hawker's attempt were thus repeated, but this time no engine trouble was experienced, and the passage was successfully completed in worse weather than that with which Hawker had to contend. The primary importance of engine trustworthiness has often been commented upon, and the history of the Atlantic attempt has strikingly demonstrated it.

It is of interest to note that both Messrs. Vickers and Handley Page are believers in methods of design based upon model experiments, and that both firms possess their own wind-tunnel equipment by means of which such experimental data can be obtained.

It is only ten years since the first flight across the Channel was made, and now the Atlantic has been flown under extremely adverse conditions. Such a record of rapid progress surely leaves room for the most optimistic views of the future possibilities of aviation as a rapid means of communication between distant parts of the world.

### *Weather Conditions.*

On Friday night, June 13, the Air Ministry reported "Conditions are favourable from west to east. A belt of high pressure extends across the Atlantic, just south of the course. . . ."

The wireless reports of weather issued by the Meteorological Office show that the winds during the flight all had a large amount of westing in their direction, and on the eastern side of the Atlantic the weather was cloudy, with some rain. The telegraph s.s. *Faraday*, at about 20° W. long., in close proximity to the aeroplane, at 1 a.m. June 15, had a moderate south-westerly gale with rain. Much of the excess speed throughout the flight is doubtless due to the brisk following wind, and to have achieved the journey in sixteen hours from coast to coast is an accomplishment not to be easily beaten.

At this time of year the disturbances moving generally north-eastwards across the Atlantic are usually at their most northern limit, and the strongest winds experienced on the track of steamships or aircraft have a large amount of westing. Fog, however, is at its worst in the summer season, whilst on the western side of the Atlantic sleet and snow would probably have to be encountered at the height of 2000ft. or more, at times, at any season of the year.

## BRITISH PETROLEUM.

SO long ago as 1896 the late Sir Boverton Redwood examined a sample of oil from Ashwick Court, near Shepton Mallet, and reported that it was straw-coloured, transparent, and free from fluorescence. The odour was reminiscent of refined petroleum, the specific gravity was 0·816, and the flash point (Abel) 175° F. In 1906 he wrote: "A considerable number of other districts where petroleum similarly occurs are known, and, although it has been suggested that some at least of the deposits may have been produced by a natural process of distillation from coal or bituminous shales, there is no reason to doubt that most of them are true petroleum, and are quite distinct from the oils which are obtained by known processes of distillation from either coal or shale." Later, in 1911, Sir Boverton examined and reported on an oil from a well at Kelham, and stated that the material should be regarded as a "true normal petroleum," and in 1914 he advocated that the bore hole should be deepened, believing that "more productive strata might be found at greater depth." It is a strange coincidence, not untouched by the irony of fate, that the last piece of work carried out before he died was the analysis of the Hardstoft oil.

The Hardstoft oil was struck at a depth of 3077 ft., and at the outset flowed into the bore hole at the rate of about 350 ft. per day. Sir Boverton Redwood's analysis is as follows:—

A limpid oil of dark brown colour by transmitted light, but exhibiting strongly marked green fluorescence and of characteristic odour. The oil contained only a trace of water, and possessed the specific gravity of 0·828 at 60° F.

Flash point (Abel), 73° F.

Distilling below 150° C.; 4·5 per cent. by volume.

Distilling between 150°–300° C.; 41·0 per cent. by volume; sp. gr., 0·783; and flash point, 105° F.

Mr. Hackford's percentage analysis is as follows:—

| | |
|---|---|
| Motor spirit, 7·5 | Lubricating oils, 30·5 |
| Kerosene, 39·0 | Paraffin wax, 3·0 |
| Gas oil, 20·0 | Sulphur, 0·26 |

Specific gravity, 0·823.

Chemical characteristics: Paraffin base containing naphthene.

It is clear that the oil is of high grade, and if the wells yield it in quantity the country will possess an asset of inestimable value.

During the past week the casing has been fitted with a valve and a line to a receiving tank, into which oil is flowing at about 400 gallons per day. No water at present has been found with the oil. The 8½-in. casing is now at the bottom of the hole, and drilling has been resumed. The evidence so far indicates that a true oil rock has been penetrated, and that the oil is neither a filtrate nor has it migrated. Whether or not the distribution of the oil is local and limited or extensive and in quantity time alone will show.

Active work is in progress at Brimington, where the hole is 2660 ft. deep, and at Renishaw, where 2950 ft. have been penetrated. At any time oil may be struck in these localities.

Drilling may be expected shortly near Newark, where, at Kelham, oil has previously been observed, and a licence from the Ministry of Munitions has been issued to the Oil Field of England, Ltd. The Kelham show was a somewhat heavier oil than that from Hardstoft, and on being topped it yielded 91·4 per cent. of fuel oil. Provision is being made to drill down to 4000 ft., the first strike having been made at 2440 ft. in 1911.

In the Midlothian district Messrs. S. Pearson and Sons, Ltd., are pushing on with the preliminaries for drilling down to 4000 ft. through the shale seams. Success in this project would indicate a new lease of activity for the Scottish shale industry.

## *FATHER WALTER SIDGREAVES, S.J.*

FATHER WALTER SIDGREAVES, S.J., the director of the Stonyhurst College Observatory, died, after a lingering last illness, at Stonyhurst on June 12 in his eighty-second year. He had been ailing and failing in strength for the last six months, but with indomitable courage he carried on the routine work of the observatory to within a month of his death.

Sidgreaves was born on October 4, 1837, the second son of Edward Sidgreaves, of Grimsargh, near Preston; he was educated at Stonyhurst, entered the Society of Jesus in 1855, and was ordained priest in 1871. He was for two periods director of the observatory at Stonyhurst, first during the years 1863–68, while the late Father Perry was engaged in his theological studies, and secondly, after the death of Father Perry in 1889, on the total solar eclipse expedition at Salut Isles, French Guiana. The acquisition and erection of the equipment of the observatory, astronomical, magnetic, meteorological, and seismological, is almost entirely due to his efforts. In 1863 Sidgreaves commenced the regular series of magnetic observations which has been carried on, and in the last thirty years by himself, ever since that date. His very last observation on May 3 was of the magnetic dip. In 1866 he installed all the self-recording meteorological instruments, and in the following year purchased an 8-in. equatorial refractor. This instrument supplanted the 4-in. refractor, which, however, had the distinction of having been the first telescope systematically used by the famous Father Secchi, when he was an exile at Stonyhurst during the revolutionary troubles in Italy in 1848. After the death of Father Perry the equatorial was fitted with a 15-in. object glass, the memorial subscribed for by friends of Father Perry.

Sidgreaves took part in four expeditions as companion to his successor in office—in 1868–69, when they made a magnetic survey of the west and east of France, and in 1874 and 1882, when they observed the transit of Venus across the sun's disc at Kerguelen Island and in Madagascar. His chief papers communicated to the memoirs and monthly notices of the Royal Astronomical Society dealt with the subjects of solar physics, and more particularly of stellar spectroscopy. In his memoir, "On the Connection between Sun-spots and Earth-magnetic Storms" he came to the conclusion that the effects observed were attributable to clouds of electrons circulating between the sun and the earth. A long series of observations of the H and K lines in the general light of the sun showed that the sun approximated to the class of stars which exhibit bright as well as dark lines in their spectra. But Sidgreaves's chief researches dealt with stellar spectroscopy, and with the instruments which he devised he took a whole series of remarkably fine spectra of the brighter stars. His published papers are concerned more particularly with the spectra of o Ceti, γ Cassiopeiæ, and β Lyræ, and with the Novæ of 1892 and 1901. He was as an observer most painstaking, methodical, and accurate, and sceptical of all results that could not be thoroughly substantiated. He had all the dogged grit and perseverance of the typical Lancashire character. Being afflicted with deafness, particularly so in his later years, he avoided public appearances; but his lecture

on β Lyræ before the Royal Institution in 1904 will be remembered. His photographic work in stellar spectroscopy was awarded a gold medal in the St. Louis Exposition of 1904, and a *grand prix* by the Franco-British Exhibition of 1908.

At Stonyhurst, Sidgreaves also, in his younger years, taught mathematics and chemistry, and, as a priest, physics, to the students of St. Mary's Hall for twenty-five years with great success. Everyone who came in contact with him was attracted by his kindly and amiable disposition. He effaced himself that others might have more time for research work. He was elected a Fellow of the Royal Astronomical Society in 1891, and served for many years on its council.

## NOTES.

MANY subjects of importance are to be discussed at the meeting of the International Research Council, to be held in Brussels on July 18–28. It may be remembered that the council arose out of Inter-Allied conferences held in London and Paris last year (see NATURE, December 26, 1918). Steps are to be taken at Brussels to establish the federation in its final form. The statutes of the council are to be discussed and also those of international unions of astronomy, physics, mathematics, geodesy and geophysics, and other departments of science. There will be a report of a committee on international co-operation in chemistry, and one on the foundation of the federation of societies of pure and applied chemistry. The important question of the biological exploration of the North Sea and North Atlantic Ocean will also be brought forward. The executive committee, consisting of MM. Picard (chairman), Volterra, Lecointe, Hale, and Schuster, acting upon the views expressed at the conference held in Paris in November last, has unanimously decided to recommend to the council that the following nations, which were neutral during the war, be invited to co-operate:—Denmark, Spain, Holland, Monaco, Norway, Sweden, and Switzerland. It is suggested also that Czecho-Slovakia and Finland should be considered as possible co-operating nations. The executive committee was appointed as a temporary body only, entrusted with the duty of bringing forward proposals at Brussels, and promoting the formation of national councils, the federation of which will form the International Council. It may be dissolved when the International Council is finally constituted.

IN the first issue of the *Crucible*, a magazine recently started by the science students of the University of Aberdeen, there is a characteristically trenchant article by Prof. Soddy. Under the metaphor of new wine into old bottles, Prof. Soddy points on one hand to the praiseworthy labours of the junior staffs in our universities in carrying to a high degree of efficiency the teaching of experimental science to thousands of eager students, and on the other to lack of prevision on the part of the authorities in encouraging research. It is safe to say, indeed, that the conservative instincts of the governing bodies, many members of which have not the least conception of what is meant by scientific research, tend rather to discourage than to encourage the hard-worked assistants from engaging in any form of research work. Even the Carnegie Trust for the Universities of Scotland, one of the primary objects of which was to promote scientific study and research, has expended out of its millions only some 14 per cent. on research of all kinds, including historical, linguistic, and economic subjects. According to Prof. Soddy, the *loss* on the money saved, occasioned by the depreciation of British investments during the war, would have maintained several first-class research professorships since the Trust was founded. In short, how can science as a progressive factor in civilisation get a fair chance in ancient institutions largely governed by medieval conceptions? This is virtually Prof. Soddy's complaint; and it is one calling for serious reflection and strenuous endeavour on the part of all who have the welfare of the nation at heart.

A RELIEF expedition under Capt. Godfred Hansen, of the Danish Navy, has left Copenhagen to place a depôt of stores for Capt. Roald Amundsen in Grant Land. Capt. Hansen, who in 1903–5 was second-in-command of Amundsen's expedition in the *Gjoa*, has, according to the *Morning Post*, sailed in a Danish Government vessel for Upernivik, in Greenland. In July he hopes to reach North Star Bay in lat. 76° N., where he and his party will winter. In the spring they will start north, taking Eskimo with them, and will travel *via* Cape Morton and Kennedy Channel to Fort Conger, Greeley's quarters from 1881 to 1883. The majority of the party will remain at Fort Conger and engage in hunting, while the leader and one other man will push on to Cape Columbia, a distance of about six hundred miles, in order to leave a year's rations, together with guns and ammunition and a detailed description of the route by Knud Rasmussen, the Danish explorer of North Greenland. Returning to Fort Conger, Capt. Hansen and his men will leave for Greenland in the autumn as soon as Kennedy Channel freezes. It is most improbable that Capt. Amundsen in the *Maud* will reach Grant Land next summer, since his drift across the polar basin will probably occupy at least three years, but in the event of his ship being crushed, the depôt will be invaluable. In any case, it will serve him well in the course of time, unless the *Maud* is carried east of Greenland.

ONE result of the war has been that the tendency in Germany is more and more in the direction of co-operation. From two recent translations which Sir Robert Hadfield has had prepared, to whom we are indebted for copies, we note that the technologists of Germany are convinced that technical interests can only be furthered by combination. The union of technical men was formed so long ago as last December, with the support of most of the German technical societies, for the purpose of securing for the technologist that recognition of his importance which has apparently been denied him hitherto. The new body seems to have been primarily inspired as an offset to the pernicious and undermining influence of certain groups who are trying to gain the ascendency in Germany. In the propaganda publication the Union states that a technical expert succeeded in saving some 20,000 tons of coal a month in an explosives factory without diminution of output. Another body to be formed is the German Empire Industrial League, which is a combination of existing groups, and will embrace an organisation styling itself the Joint Executive of Employers and Employed. It is hoped that all industrial interests will find expression in this new body.

WE regret to learn that official information has been received that the Cape Provincial Council, Cape Town, has decided to exterminate the herd of elephants in the Addo Bush Reserve. With the exception of a small herd in the Knysna Forest, these are the last survivors of the wild South African elephant. The animals in the Addo Bush Reserve have become a

source of danger and damage to the surrounding farms. By breaking down fences and destroying waterworks, and generally bringing about a state of terror and insecurity, they are the cause of actual damage to a serious extent. They hamper farming operations and agricultural development. Nevertheless, the drastic step that has now been decided upon cannot fail to arouse considerable dissatisfaction in the sporting and scientific world.

WE have received a copy of a proposal endorsed by many well-known scientific men for the establishment of an institute of commercial and industrial psychology and physiology. The proposal is accompanied by a summary of thirty investigations in which the scientific analysis of industrial movements resulted in a notable improvement of output, and reference is also made to the effects of shorter hours and the introduction of rest pauses. Amongst the scientific supporters of the proposals are Sir Walter Fletcher, Mr. W. B. Hardy, Lt.-Col. Myers, Prof. C. S. Sherrington, and Prof. E. H. Starling. The secretary is Mr. G. Spiller, 1 Great Tower Street, E.C.3.

MR. F. FLIPPANCE, at one time a temporary assistant in the herbarium at Kew, has been appointed assistant curator of the Botanic Gardens, Singapore.

THE Guy medal of the Royal Statistical Society for 1918–19 has been awarded to Dr. J. C. Stamp, who recently contributed papers to the society on "The Effect of Trade Fluctuations on Profits" and "The Wealth and Income of the Chief Powers."

A DIRECTOR of research is about to be appointed, at a salary of not less than 1250*l.* per annum, by the British Cotton Industry Research Association, 108 Deansgate, Manchester. Forms of application and further information are obtainable from the secretary of the association. The latest time for receiving applications for the post is July 21.

THE council of the Royal Society of Edinburgh has awarded the Makdougall-Brisbane prize for the period 1916–18 to Prof. A. Anstruther Lawson, of Sydney, for his memoirs on the prothalli of *Tmesipteris tannensis* and of *psilotum*, published in the Transactions of the society, together with previous papers on cytology and on the gametophytes of various gymnosperms.

AT the meeting of the Franklin Institute, Philadelphia, held on May 21, the Franklin medal awarded to Sir James Dewar was received by Major-Gen. J. D. McLachlan, representing the British Government, and the presentation of the Franklin medal to Major-Gen. George Owen Squier, U.S. Army, was also made. An address was given by Major-Gen. Squier on "Some Aspects of the Signal Corps in the World-War."

THE sixth lecture of the series arranged by the Industrial Reconstruction Council will be held in the Saddlers' Hall, Cheapside, E.C.2, on Wednesday, June 25. The chair will be taken at 4.30 p.m. by the Right Hon. J. H. Whitley, and a lecture will be delivered by the Right Hon. C. W. Bowerman on "Some Industrial Problems." Applications for tickets should be made to the Secretary, I.R.C., 2 and 4 Tudor Street, E.C.4.

THE annual general meeting of the Society of Chemical Industry will be held in London on July 15–18, under the presidency of Prof. Henry Louis. On Tuesday, July 15, there will be a conference at the Mansion House, when addresses will be given by representatives of the Inter-Allied Conference. Sir William J. Pope, chairman of the Federal Council for Pure and Applied Chemistry, will open the conference. The subjects of other conferences will be:—Power Plant in Chemical Works; Empire Sugar Production; Dyestuffs, Synthetic Drugs, and Associated Products; The Chrome Tanning Industry; and Recent Developments in the Fermentation Industries. A reception will be held at the British Scientific Products Exhibition, Central Hall, Westminster, on July 17.

THE New Zealand Department of Lands issued in 1918 a report on the "Waipoua Kauri Forest: Its Demarcation and Management." This forest, which has recently been demarcated by Mr. D. E. Hutchins, was made a national reserve under the State Forests Act of 1908. It covers 29,830 acres, and contains a large number of old and giant trees of Kauri, *Agathis australis*, an endemic conifer yielding a very valuable timber. The forest is in a wild state, bringing in no revenue at present. Mr. Hutchins recommends a system of management by which the old trees would be speedily felled and a young, regular growth established, which in course of time would yield an enormous revenue. The Government owns five other Kauri forests, each averaging 12,000 to 15,000 acres. As there are estimated to be about 500,000 acres of restorable Kauri forest altogether, it is desirable, perhaps, in the interests of science and of scenic beauty, that one of the five Government forests, or a portion of one, should be left in its natural state, with a fair number of the oldest trees untouched, in spite of the temptation to realise the money worth of all the finest timber.

THE North-East Coast Institution of Engineers and Shipbuilders will hold a summer meeting, which is being called the Victory Meeting, on July 9–11 in Newcastle. The meeting is the first of the kind it has held since July, 1914, when, on the eve of the war, the institution received the Institution of Naval Architects and the Institution of Engineers and Shipbuilders in Scotland at a joint meeting. Among the distinguished guests invited are Marshal Foch, Sir David Beatty, and Sir Douglas Haig, upon whom honorary fellowship of the institution will be conferred at the inaugural meeting. Papers recording the industrial work of the North-East Coast during the war will be read by Mr. A. H. J. Cochrane, Mr. M. C. James, and Mr. Launcelot E. Smith. Lady Parsons, who will receive the diploma of honorary fellowship during the proceedings, will address the meeting on "Women's Work in Engineering and Shipbuilding during the War." This will be the first occasion upon which a woman has delivered a paper before this institution. Other important papers will be read by Lord Weir of Eastwood, Lt.-Comdr. Wilkinson, Mr. Georges Constantinesco, and Prof. MacLennan. The two first-named authors deal with the subjects in which they are eminent experts: the development of aircraft during the war and thermal efficiency in Diesel and other internal-combustion engines. Comdr. Wilkinson will describe his work in the "dazzle-painting" of ships. Mr. Constantinesco will explain his new system of power transmission, and illustrate it by practical experiments. Prof. MacLennan has not yet named the subject of his lecture.

IT is well known that radiographers, if unprotected, are liable to injury by X-rays, such as "burns," intractable dermatitis which is liable to become cancerous, and sterility. Dr. Hernaman-Johnson in the Journal of the Röntgen Society (vol. xv., No. 59, p. 45) discusses the protective measures that should be taken in diagnostic work by

radiographers. He recommends that (1) the tube should be entirely enclosed in a box opaque to X-rays, and (2) *scattered* radiations should be prevented from reaching the body of the observer. The measures to be taken to fulfil these conditions are discussed. True secondary radiation is not a danger except in the case of certain metallic articles worn close to the body, and then only if the precautions named are not efficiently carried out.

BULLETIN 174 (May, 1918) of the Agricultural Experiment Station of the Rhode Island State College deals with the part played by bacteria of the paratyphoid group in the causation of disease in poultry. The authors (Philip Hadley, Marguerite Elkins, and Dorothy Caldwell) conclude that there are six principal disease types among the typhoid- and cholera-like diseases of birds:—(1) Fowl cholera, due to *B. avisepticus* of the Pasteurella group; (2) fowl typhoid, due to *B. gallinarum*, Klein, of the actual paratyphoid group; (3) paracolon infections, due to paracolon bacteria in the strict sense; (4) bacterial white diarrhœa, due to *B. pullorum* A; (5) infections in adult stock with *B. pullorum* B; and (6) infections with certain intermediate strains. The report succeeds in elucidating the bacteriology of several poultry diseases about which much confusion formerly existed.

THE World Trade Club, of San Francisco, has circulated widely copies of a letter addressed by the club to Lord Balfour of Burleigh, advocating the immediate introduction of the metric system of weights and measures in the United Kingdom. The letter points out that both Great Britain and the United States were obliged to make use of the metric system in foreign countries during the war, and urges that the adoption of the "meter-liter-gram" system is absolutely necessary in the interests of education and business, and of our foreign trade in particular. Recipients of the letter are requested to sign and dispatch the printed forms at the end, addressed to Mr. Lloyd George and President Wilson respectively, calling for legislation to bring about the exclusive use of the system in this country and in the United States.

IN the Journal of the Bihar and Orissa Research Society (vol. iv., part iii., September, 1918) Dr. W. Crooke describes a remarkable form of headdress worn by women of the Banjara tribe, wandering carriers in northern India and the Deccan. It consists of a stick or "horn" made of wood or silver, which is placed upright on the top of the head, the hair being wound round it, and over it the headcloth is draped in a graceful fashion. Numerous analogies to this form of headdress are traced in Central Asia, Assyria, among the Druses, and in ancient Indian statuary. It seems to be a mark of distinction, presumably confined to married women, and its use may ultimately depend upon the theory of the sanctity of the head. But, so far, the evidence from India does not fully corroborate this. The same is the case with the theory which would connect the Banjaras with some northern tribe, though it is possible that the Charan branch may have been priests of the Gurjaras, one of the many branches of the Hun tribes which invaded India in the fifth and sixth centuries of our era.

MESSRS. A. N. WINCHELL and E. R. Miller (Amer. Journ. Sci., vol. xlvi., p. 599, and vol. xlvii., p. 133) describe a remarkable dustfall that occurred at Madison, Wisconsin, on March 9, 1918. Microscopic examination and mechanical analysis indicate that the material is not volcanic, but merely wind-borne, and was derived from rocks physically disintegrated in a very arid climate, probably from New Mexico or Arizona. It is pointed out that a single storm may thus "transport a million tons of rock material a thousand miles or more."

MR. S. S. BUCKMAN, in a paper entitled "Jurassic Chronology: I.—Lias" (Quart. Journ. Geol. Soc. London, vol. lxxiii., p. 257, 1918), has made the most important contribution to our knowledge of Jurassic strata in the Inner Hebrides since Judd's work of forty years ago. The paper, with Mr. J. W. Tutcher's appendix on zonal sequence in the Lower Lias, covers also a wider field, and the discussion to which it gave rise shows that the gaps in the record suggested by the details of the palæontology were not immediately accepted by stratigraphers.

THE Journal of the East Africa and Uganda Natural History Society for November, 1918 (Longman, London, price 5*s.* 4*d.*) contains an account by Mr. C. W. Hobley of a volcanic eruption of Donyo L'Engai, a mountain in the trough-valley about forty miles south of the Anglo-German boundary in East Africa. This outburst occurred in January, 1917, and appears remarkable for the amount of sodium carbonate thrown out with the volcanic dust over a wide area. Mr. Hobley goes back to the old theory that metallic sodium may be a cause of volcanic eruptions; but the presence of Lake Natron a few miles to the north makes it possible that Donyo L'Engai was built up above the deposits of similar saline waters, which were blown up with the volcanic matter from below.

PROF. FILIPPO EREDIA has published an instructive paper on the climate of Gorizia in a recent issue of the *Bollettino Bimensuale* of the Meteorological Society of Italy. Gorizia is in lat. 45° 56′ N., long. 13° 37′ E., and meteorological observations have been maintained since 1870, which are discussed for the forty-five years ended 1914. The mean annual temperature is 12·7° C. (54·9° F.), the average varying from 22·8° C. (73·1° F.) in July to 2·8° C. (37° F.) in January. Pressure falls to a minimum in April, when cloud amount is highest, and is at a maximum in January. August is the sunniest month, with 63 per cent. of the total possible against 41 per cent. in April. The mean annual rainfall is 1595 mm. (62·8 in.), with extremes of 200 mm. (7·87 in.) in October and 70 mm. (2·76 in.) in January. The wettest month was October, 1889, with 497 mm. (19·57 in.), and in the Januaries of 1880 and 1888 and the Februaries of 1890 and 1891 no rain fell. Calms prevail for more than half the time, and north-east is the most frequent wind experienced in every month of the year. Snow falls on five days, hail on four days, and rain on 142 days annually. Thunderstorms are frequent, the mean annual number being twenty-eight, of which 60 per cent. occur in the three summer months. In a note entitled "Sulla Direzione delle Correnti Aeree in Sicilia," that appears in vol. xxvii. of *Rendiconti della R. Accademia del Lincei*, Prof. Eredia gives an analysis of the monthly direction of the wind for nine places in Sicily based on observations from 1891–1910, the mean direction being obtained by Lambert's formula.

ACCORDING to U.S. Commerce Report No. 85 (1919), a discovery of copper is reported from near Beaudoinville, a port at the southern end of Lake Tanganyika, Belgian Congo.

BULLETINS Nos. 9 and 10 of the Advisory Council of Science and Industry for the Australian Commonwealth are just to hand. They deal respectively with

the manufacture and uses of ferro-alloys and alloy steels from the raw materials in Australia, and with substitutes for tin-plate containers (tin cans). The latter is a specially interesting report, giving information as to the manufacture of wood and cardboard containers and of the machinery used, varnishes, the properties of the different materials, etc.

BOOKLETS have reached us from the firm of Messrs. Adam Hilger, Ltd., describing the wave-length spectrometer introduced in 1904 and various accessories which may be employed in connection with the instrument. The constant deviation prism is rotated by means of a fine steel screw, to which is fixed a drum provided with a scale of wave-lengths. In the most recent instruments this scale is on the side of the drum towards the eye, so that the wave-lengths can be read without quitting the eyepiece. In one form of the instrument provision is made for the use of a Fabry and Perot etalon, by means of which wave-lengths may be determined to a very high accuracy, or for a Michelson echelon or a Lummer-Gehrcke parallel plate for demonstrating the Zeeman effect. Another development of great importance is the improved form of polarisation photometer, based on that described by P. G. Nutting, which, when used in conjunction with the constant deviation spectrometer, provides a powerful tool for spectro-photometry. The attention of the technical chemist may usefully be directed to this method of investigation, which has already proved of service in research on dyes and on photographic plates.

IN a paper on "Electrical Phenomena occurring at High Levels in the Atmosphere," recently read before the Institution of Electrical Engineers, Dr. S. Chapman gives "a general outline of the subject, without detailed argument or references." "The account," he adds, "is not limited to what can be regarded as certain conclusions; without departing too far from the basis of observational evidence, conjectural views have also been admitted." Dr. Chapman seems finally to accept the Birkeland-Störmer theory as to the joint cause of magnetic storms and aurora being electrical ions discharged from the sun, but in opposition to Birkeland he thinks these must be $\alpha$-rays, not cathode- or $\beta$-rays. During magnetic storms he accepts a highly ionised layer coming down to about 100 km. above the earth's surface. At a lower level he supposes normally existent a second conducting layer, its ionising agent being ultra-violet light, which he identifies with $\gamma$-rays. In it are the electrical currents to which the regular (solar) diurnal variation is ultimately due. Accepting as a fact that magnetic storms are not accompanied by special changes of electrical potential gradient at the earth's surface, it is supposed that the upper atmosphere is so good a conductor that the charge from the $\alpha$-rays almost instantaneously distributes itself uniformly over a spherical surface, and so does not influence the electrical field at lower levels. The sudden rise and the subsequent slow decline of horizontal force characteristic of magnetic storms in low and mean latitudes are ascribed to vertical movements of the atmosphere, cutting the horizontal lines of the earth's magnetic field. "The general nature of the movement can be readily inferred. The mutual repulsion of the entangled charge spread over the world-wide spherical layer produces an upward, outward movement, as in a charged soap-bubble. Thus the air travels vertically upwards, except during the first few minutes of a magnetic storm. For at first the downward momentum of the injected particles depresses the air before the electricity has accumulated sufficiently to reverse the motion."

THE possibilities of exploitation of the River Dee, from its source in Wales to the city of Chester, for the development of low-fall water-power, economically utilisable for the generation of electrical energy, is the subject of a recently issued report by Mr. S. E. Britten, arising out of a conference held in June, 1917, by the Board of Agriculture and Fisheries. The *Engineer* for May 30 contains a *résumé* of the report, from which we gather that Mr. Britten's scheme provides for sixteen power-stations at various points along the river's course, with falls generally ranging from $7\frac{1}{2}$ ft. to $12\frac{1}{2}$ ft. (there is one case of a 37-ft. fall), and capable of producing in the aggregate 60,000,000 electrical units per annum. The capital cost of the scheme is estimated at 702,240*l.*, and, with an average sale of about 48,000,000 units at $1\frac{1}{2}d.$ per unit, a surplus balance of 205,468*l.* is counted upon. Included in the estimate are the sixteen hydro-electric stations at 29,700*l.* each, a tunnel at 60,000*l.*, and sixty-one miles of transmission line at 65,000*l.* The possibilities of the scheme for producing power are equivalent to a consumption of 70,000 tons of coal per annum. The valuable characteristics of the river for salmon-fishing have not been lost sight of. The quantity of fish caught annually is about 2500, with a gross weight of 13 tons, valued at 3750*l.* From six years' observation made in connection with the Chester Weir there is no evidence, according to the report, that the fish suffer in the least degree from the establishment of hydro-electric works.

THE following books are announced for early publication:—"Menders of the Maimed: The Anatomical and Physiological Principles underlying the Treatment of Injuries to Muscles, Nerves, Bones, and Joints," Prof. A. Keith; "Fractured Femurs: Their Treatment by Calliper Extension," Major M. G. Pearson and Capt. J. Drummond (*H. Frowde and Hodder and Stoughton*); "Psychology and Parenthood," H. A. Bruce (*W. Heinemann*); "Our Atlantic Flight," H. G. Hawker and Lt.-Comdr. M. Grieve, with an introduction by Major-Gen. J. E. B. Seely (*Methuen and Co., Ltd.*); "Opportunities in Chemistry; or, Chemistry in Everyday Life," E. Hendrick (*University of London Press*); and "Senior Practical Chemistry," H. W. Bausor (*University Tutorial Press, Ltd.*). The following works are in the press for publication by the *Carnegie Institution of Washington* (*Washington*):—"The Cactaceæ: Descriptions and Illustrations of Plants of the Cactus Family," N. L. Britton and J. N. Rose, 4 vols.—vol. i., "The Ecological Relation of Roots," J. E. Weaver; "The Carbohydrate Economy of Cacti," H. A. Spoehr; "Climatic Cycles and Tree-growth," A. E. Douglas; "Plant Indicators: The Relation of Plant Communities to Conditions and Practices," F. E. Clements; and "Hydration and Growth," D. T. MacDougal.

THE price of Norton's "Star Atlas," noticed in NATURE of June 12, was incorrectly given as 3*s.* 6*d.* The publishers ask us to point out that the selling price of the book is 8*s.* 6*d.*

## OUR ASTRONOMICAL COLUMN.

THE SOLAR ECLIPSE OF MAY 29.—We have received through the office of the Scientific Attaché of the American Embassy the following message from Dr. L. A. Bauer, director of the Terrestrial Magnetic Laboratory of the Carnegie Institution of Washington, referring to observations of the total solar eclipse of May 29:—"Cape Palmas.—Complete success; inner corona very bright, marked outer corona extensions S.S.E., N.N.W.; brilliant red prominence W.S.W.; several stars seen region sun; no shadow bands; magnetic effect confirmed."

THE ASTROGRAPHIC CATALOGUE.—Reference is made in the report of the Oxford University Observatory for the past year to the progress made in certain zones of this work, which were originally allotted to the observatories that have been unable to complete their undertaking without some help. The plates taken and measured at the Vatican Observatory are reduced and published under the direction of Prof. Turner, and the printing of vol. iv., which will complete nearly half this section, is in progress. The plates taken at the Santiago de Chile Observatory are sent to the University Observatory for measurement and reduction, but the supply is slow and scarcely satisfactory. The Hyderabad Observatory, which took over a zone left undone by a South American observatory, and may be considered an offshoot of Oxford, for both its directors received their training there, has made rapid progress, but this may be somewhat hindered by the death of its young and energetic director, Mr. Pocock, to whose widow the Nizam has granted a pension of 100*l.* a year.

## THE BRITISH SCIENCE GUILD.

THE thirteenth annual meeting of the British Science Guild was held (by kind permission of the Master and Wardens) at the Goldsmiths' Hall on Tuesday, June 17, the Right Hon. Lord Sydenham, president of the guild, in the chair.

The adoption of the annual report, which recorded the various activities of committees of the guild, was moved by Sir Richard Gregory. Special reference was made to the report presented by the Education Committee on "Industrial Research and the Supply of Trained Scientific Workers," which has been sent to the Prime Minister, the Minister of Education, and other authorities concerned. Shortly after its issue a deputation of representatives of British universities was received by the Chancellor of the Exchequer and the President of the Board of Education, who expressed sympathy with the plea for more generous State aid to the universities. The Civil Service Estimates for 1919–20, since published, show that 1,000,000*l.* is allotted to the maintenance of university institutions, as compared with 500,000*l.* for the year 1913–14. It is felt, however, that a full inquiry into the provision of university and higher technical education in this country is still needed.

Another subject that has received attention from a committee of the guild is the organisation of research in relation to fisheries. The report emphasises the importance to a maritime nation of investigations of the sea and development of its fishing resources. The work of existing bodies in this field deserves fuller support, and the establishment of an Advisory Council or Board of Marine Research is suggested. Especially it is urged that there should be a properly equipped institute and museum of oceanography in this country similar in scope to those existing in France, Germany, and now being planned in Denmark. A memorandum on the Decimal Coinage Bill is presented by the Metric System Committee, while the Technical Optics Committee has urged upon the President of the Board of Trade the necessity of establishing a strong optical industry in this country.

Simultaneously with the adoption of the annual report, the election of Major-Gen. the Right Hon. J. E. B. Seely, Admiral Sir David Beatty, Field-Marshal Sir Douglas Haig, and the Right Hon. the Lord Mayor of London as vice-presidents of the guild was announced. Major-Gen. Seely, in addressing the meeting, expressed his appreciation of this honour and his sympathy with the aims of the guild in regard to higher technical education and research, illustrating from his experience the important part played by the latter both in the war and in relation to industry. He referred particularly to aviation, a field in which progress was absolutely dependent on science—a fact repeatedly illustrated in the war and in the recent Atlantic flights. Of great importance was the perfecting of a system by which an aviator could at any moment ascertain his whereabouts or determine when he was flying upside down. He believed within a few years wireless telephony would go far towards the solution of the first of these problems.

An address was then delivered by the president, Lord Sydenham, on "Science and Labour Unrest." Such unrest, he remarked, was largely due to the revolution in industry brought about by the introduction of tools and machinery and the subsequent tendency, still proceeding, towards larger undertakings. In this process the intimate and friendly relation formerly prevailing between master and man had been partially lost. Moreover, the introduction of scientific methods of reproduction rendered work repetitive and monotonous, so that the personal skill of the craftsman to-day was, in general, inferior to that he possessed in the pre-machinery age. Science, however, which was responsible for these causes of unrest, could also remove them by providing for the worker better conditions of living; and among the pressing problems of this nature housing was one of the most important. Science had also shown that unduly long hours meant diminution of output, and research was now being made into the best means of eliminating industrial fatigue. Lord Sydenham also referred to various economic fallacies current among workmen, which found a congenial soil in the present unrest. Fuller education in economic subjects was necessary in order that these errors might be corrected.

Sir J. J. Thomson, who followed, referred to the many developments in applied science which had taken place during the war, and expressed the hope that the manipulative skill and aptitude for research developed in various special industries or for purposes of war would be preserved and utilised in the future in peaceful pursuits. He also emphasised the vital importance of scientific knowledge to officers in the Army and Navy, and especially to the General Staff—a matter which had been much neglected in the past. Similarly we should not make the progress we ought to make until the boards of public companies and the Government Departments included men imbued with scientific method, which he believed could be evolved only by scientific training. Sir J. J. Thomson also referred to the changes which were being made in the conditions of examination for the public service, whereby scientific subjects would be placed in a better position. He did not, however, mean to imply that the selection of men for appointments involving scientific knowledge should rest only on the results of examination. At the present time an opportunity offered itself of selecting men whose record showed ability in some field of science, and it was suggested that advantage should be taken of it.

In conclusion, a vote of thanks to the Wardens of the Goldsmiths' Hall was moved by Lord Avebury and seconded by Col. Sir John Young, who referred to the loss which the guild had sustained in the recent death of Sir Boverton Redwood, who had taken a keen interest in its work for many years, and was a past master of the Goldsmiths' Company. A vote of thanks to the chairman and speakers, moved by Major Sir Ernest H. Shackleton, was adopted by acclamation.

## IMPERIAL EDUCATION CONFERENCE.

BY invitation of the Chief of the Imperial General Staff, the universities, together with various institutions concerned with technical, commercial, and agricultural education, sent representatives to a conference held at Australia House on June 11 and 12 for the purpose of discussing problems which have presented themselves to the War Office in connection with the working of the educational schemes within the British Army and the Forces of the Dominions. Sir Henry Wilson described Lord Gorell's work as an effort to weave education into the life of soldiers, to make use of all special knowledge and skill possessed by enlisted men, and to hand back the soldiers on their return to civil life better citizens than they would have been but for their experience in the Army.

Mr. Fisher, President of the Board of Education, said that the great war from which we are just issuing has been, in a sense never before equalled, a war of science. Marvellous discoveries have been made in connection with aerial warfare, warfare against German submarines and German gas, but the most surprising invention of all was the invention of education in the Army. It was an invention scarcely second in importance to the invention of fire-arms. Referring to the calling together for the first time of young men from every Dominion overseas and the inclusion of many of them after the war in the home universities, he said that he would like every Englishman who went to the Dominions, and every member of our Dominions who settled in any other part of the Empire, to feel that his children would have the best educational opportunities that the Empire could afford. He would like to see the most promising students, whatever might be their special aptitudes, able to migrate to the university, in which they could attain to the best opportunity of development in their particular subjects.

Interchange of students and the need for a greatly strengthened Universities Bureau were two subjects which largely occupied the attention of the conference. The directors of education for the several overseas Forces emphasised the great need which they had experienced of a central office at which they could obtain information regarding the regulations, the activities, and the *personnel* of the various universities. Their demand for closer centralisation and uniformity of procedure led to a good deal of friendly banter. The diversity of the British universities, Sir Donald MacAlister pointed out, is their glory. They are able in an exceptional degree to adapt themselves to local conditions, to seize opportunity, and to make experiment. He contrasted them in this respect with the universities of France, from a visit to which, as one of the guests of the French Republic, he had just returned. All the speakers, however, agreed that co-operation amongst the universities is greatly to be desired. As Sir William Ashley put it, "the more they become dependent upon State support, the more desirable will it be that they should take counsel together."

The functions which might be undertaken by the Universities Bureau, if it were adequately staffed and endowed with funds, were defined by many speakers. President Tory would have it an office from which he could obtain information about men suitable for employment by the universities overseas. Prof. Ramsay Muir desired that it should undertake very great responsibilities in connection with the universities of India—work which no Government Department could perform to the complete satisfaction of our Indian fellow-subjects, because the Government must always be suspected of an ulterior aim, whereas the Universities Bureau would be managed by a federation, of which the Indian universities themselves would form a part.

Sir Henry Hadow, who presided over the session of Thursday morning, emphasised the importance of encouraging a free interchange of students for research work, and especially of young teachers. If migration is to be made popular and successful, the university laboratories will need to be well equipped, especially on the technological side. Technological courses should be widened and made to include as much general mental training as can be introduced into the curriculum. Mr. A. P. M. Fleming, speaking on behalf of the Federation of British Industries, urged that heads of departments are needed who are well educated in a general as well as in a technical sense. For many years to come the demand for men capable of undertaking research will greatly exceed the supply.

Lord Bledisloe at the afternoon session described agriculture as the industry most dependent upon science, and at the same time the most backward in recognising its obligation. He announced that the Board of Agriculture is prepared to participate in organising in London an Imperial Bureau of Agricultural Information. Dr. J. W. Robertson, ex-Principal of Macdonald College in the McGill University, described the successful working of "illustration" farms. The conference closed by adopting a resolution proposed by Sir Percy Fitzpatrick:—"That there is a general desire throughout the Empire that means shall be found to give practical effect to the policy, aspirations, and suggestions expressed during the four sittings of the Conference, and, in order that this may come about, the conference requests the Imperial Education Committee to submit to the Prime Minister of the United Kingdom a report of its proceedings, with a request that it be brought to the notice of all the Prime Ministers of the Empire, either at the Imperial Conference, or in such other manner as may be deemed appropriate to ensure early and practical results."

## THE ROYAL OBSERVATORY, GREENWICH.

THE report of the Astronomer Royal of the work done at the Royal Observatory during the year ended on May 10 was presented to the Board of Visitors on Saturday, June 14. Some of the details of the report are here summarised.

One of the two Chief Assistants, Mr. Jones, who had been engaged in optical work at Woolwich for nearly three years, resumed his duties at the observatory soon after the armistice Mr. Jackson, the other Chief Assistant, five members of the permanent staff, and eleven temporary computers who have been serving with the armies abroad in various capacities, returned to the observatory on different dates since February 1. With so many members of the staff absent it is not surprising that the work of the observatory has had to be curtailed in several ways, and the number of transits recorded with the transit-circle during the year was 3224, of circle observations 2818, which figures may be compared with an annual average number of 12,000 before the war. The sun, moon, planets, and fundamental stars have been observed on the meridian throughout, but other stars only to a limited extent. The observations of the moon with the transit-circle and with the altazimuth show that the increase of the error of the moon's place in the "Nautical Almanac," which has persisted since 1883, when Newcomb's empirical correction to Hansen's tables was introduced into the "Almanac," has now ceased, for the mean correction to the tabular right ascension, +0·92s., shown by the observations in 1918, is practically identical with that found in 1916 and 1917. The corresponding correction required by the "Connaissance de Temps," which depends on Delaunay's tables as revised by Radau and Andoyer, is +0·28s.

The observations with the Cookson floating zenith-telescope have been carried on throughout the war, and the result of a discussion of seven years' observations with the instrument was presented to the Royal Astronomical Society on June 13. Besides a determination of the variation of latitude at Greenwich, which may be considered trustworthy, as the discordances from a smooth curve rarely exceed a few hundredths of a second of arc, the observations also furnish a value of the aberration constant, which, deduced from the seven years' observations, is 20·442″, corresponding to a solar parallax of 8·815″. The values derived from the observations of individual years show rather a large range, and the possibility of systematic disturbing causes is being investigated.

Turning to the equatorials, the 28-in. refractor was at the disposal of M. Jonckheere until he returned to his home in Lille in January last. The observations of double-stars made by M. Jonckheere have been published in the *Astronomical Journal*. The object-glass of the 26-in. refractor, which had been dismounted in September, 1917, was replaced on October 15, 1918, and photographs of the Galilean satellites of Jupiter were taken on twenty-six nights during the apparition of last winter for Dr. de Sitter, who is making a research on the elements of their orbits. Photographs for stellar parallax have also been taken with this instrument. The 13-in. object-glass of the astrographic telescope is now in Brazil, having been used in observation of the eclipse of May 29. With this instrument a series of photographs were taken of the nova which appeared in Aquila in June, 1918, to determine its variation of magnitude in the subsequent months. The work of the Astrographic Catalogue is being supplemented by determination of the proper motions of the stars contained in it by comparison with earlier catalogues, and also by direct comparison of pairs of plates taken at an interval of about twenty years.

The record of the sun-spots has been continued, and photographs of the sun were obtained on 208 days. The measurement and reduction of the sun photographs for 1917, the series being completed by photographs taken at the Cape, is in progress. During the period covered by the report the activity of the sun has been considerable, but there has been, on the whole, a perceptible decline since the great disturbances of August, 1917.

The mean values of the magnetic elements for 1918 and three previous years are as follows:—

| | Dec. W. | Horizontal force | Vertical force | Dip |
|---|---|---|---|---|
| | ° ′ | | | ° ′ |
| 1915 ... | 14 56·5 | 0·18508 | 0·43315 | 66 51·8 |
| 1916 ... | 14 46·9 | 0·18494 | 0·43313 | 66 52·7 |
| 1917 ... | 14 37·0 | 0·18477 | 0·43305 | 66 53·6 |
| 1918 ... | 14 27·2 | 0·18462 | 0·43290 | 66 54·2 |

The annual diminution of declination increased considerably about 1910, its average value from 1900–10 being 4·9′. The horizontal force which had been increasing since measurements were begun at Greenwich in 1846 reached a maximum about 1910, and is now diminishing. The dip which had been diminishing since measurements were begun in 1843 reached a minimum about 1913, and is now increasing.

The principal meteorological features reported for the year ended April 30, 1919, are:—The mean temperature was 49·5°, or 0·1° below the average of the seventy-five years 1841–1915. The highest temperature in the shade was 89·8° on August 22, and the temperature exceeded 80° on six days. The lowest temperature was 15·5° on February 9, and on fifty-five days it fell as low as 32°.

The duration of bright sunshine registered was 1436 hours out of a possible 4456 hours. The rainfall was 31·14 in., or 6·90 in. above the average for the period 1841–1915. The number of rainy days (0·005 in. or more) was 194, the largest number for thirty-six years; 7·34 in. of rain fell in July, 1918.

The work of rating and issuing the chronometers for use of the Navy has been excessive. During the year 8631 chronometers and watches were received and 6713 issued. The number sent for repair was 2990. The corresponding figures in the report of 1914 were 2094, 2110, and 934 respectively. The wooden time-ball on the observatory is to be replaced by one of aluminium, and the work is now in progress.

The report ends with a reference to the system of time-zones for time-keeping at sea, which the Lords of the Admiralty have decided to establish in H.M. Navy; also to the substitution of a day beginning at oh. midnight for the astronomical day in all nautical publications. The Admiralty has decided that the alteration shall be made in the "Nautical Almanac" beginning in the year 1925, and in the "Admiralty "Tide-Tables" for 1920.

## THE SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

THE twenty-fourth annual congress of the South-Eastern Union of Scientific Societies was held in the Guildhall, London, on June 11–14, under the presidency of Dr. A. Smith Woodward. In his opening address the president referred especially to the pioneer work of Mantell in discovering the fossil giant reptiles in the Sussex Weald, and showed how the later finds in Belgium and North America had partly modified, partly extended, his conclusions. He mentioned that Mr. Reginald W. Hooley had recently found in the southern cliffs of the Isle of Wight a skeleton of an iguanodon which rivalled those from Bernissart, Belgium, in perfection. The specimen showed a finely granulated skin. The sudden ending of the "geological age of reptiles," as Mantell named it, still awaited explanation, for the distribution of the giant reptiles was almost world-wide at the time. The mammals found the land practically vacant for occupation, and none of them attained a larger size than a tapir until the Middle Eocene period.

Mr. L. W. Chubb described the woodlands of London, and showed the importance of the work of the Commons and Footpaths Preservation Society. The congress passed a resolution urging the London County Council to secure Castle Wood on Shooter's Hill, Woolwich, as a public resort. Dr. A. B. Rendle, in an address to the botanical section, referred to the facilities for research at the South London Botanical Institute, which was founded by the late Mr. A. O. Hume. It was important to compare the British flora in detail with that of the European continent, and much remained to be done in studying growth-stages. Mr. C. C. Fagg reported on progress with the regional survey, and showed several maps on which he had plotted records in the neighbourhood of Croydon. Mr. Reginald A. Smith exhibited a map of London on which he had marked the finds of Palæolithic implements in their relation to the river-terraces. The Rev. T. W. Oswald-Hicks showed a series of lantern-slides illustrating the life of mosquitoes, which he had prepared, to be lent to the societies of the union. In this way he hoped to spread an interest in the subject and enlist the help of more observers and collectors of mosquitoes. Mrs. Plomer Young mentioned that several thousand lantern-slides illustrating natural history were now at the disposal of the union, and could be borrowed by the constituent societies. Sir Edward W. Brabrook was elected president of next year's congress, which is to be held at Eastbourne.

## THE TEXTURE OF SANDS.

ALTHOUGH chemical analyses of sands have frequently been made for industrial purposes, and mineral analyses are now a feature of geological investigations into the petrology of sediments, comparatively little attention has been paid to the mechanical composition. This is particularly the case in the matter of the inter-relation of the mechanical composition with either the chemical or mineral constitution.

The connection between the mineral and chemical compositions of sediments is clear, the minerals representing the particular manner of grouping of the chemical elements. The relation of the mechanical composition to either the chemical or mineral constitution opens up a big field for future work, equally of considerable geological interest and immediate industrial application.

Sediments can be graded, according as they are coarse or fine, by screening or by elutriation in currents of air or water. The latter method has almost entirely replaced the older and less scientific one of subsidence. If screening is to retain any pretensions to accuracy, it cannot be carried out with sieves of less than 0·25 mm. aperture. On the other hand, elutriation of material more than 0·4 mm. in diameter is difficult to control on account of the eddies set up by the high velocities of the water-currents (47 mm. or more per second). In the mechanical analyses of sediments the two methods of procedure may be successfully combined, material more than 0·25 mm. in diameter being sifted, and that 0·25 mm. in diameter or less being separated into grades by elutriation in water. (Whilst elutriation by air-currents has been adopted commercially for grading the products of fine grinding, such as cement, silica-flour, barytes, etc., it cannot be considered sufficiently accurate for scientific work.)

It is regrettable that no general agreement exists as to the grades into which sediments should be separated. Soil analysts have adopted a series which, for certain cogent reasons, has not commended itself to those geologists who have worked at the problem. Another and different set of grades has been adopted by the potters in the separation of clays. The fact that comparatively few tables of mechanical analyses have yet been published is the strongest possible argument for agreement without delay upon a definite set of grades.

Such a division of sediments into grades is necessarily artificial. Nevertheless, the grades adopted by the geologists have as their basis the natural characteristics of the material so-named as observed "in the field." The grading system frequently adopted is:—>2 mm. diameter, gravel (G); >1 mm. and <2 mm., very coarse sand (VCS); >0·5 mm. and <1 mm., coarse sand (CS); >0·25 mm. and <0·5 mm., medium sand (MS); >0·1 mm. and <0·25 mm., fine sand (FS); >0·05 mm. and <0·1 mm., coarse silt or superfine sand (cs); >0·01 mm. and <0·05 mm., fine silt (fs); and <0·01 mm. diameter, clay or mud (c). It is a matter of controversy as to how far material of diameter less than 0·01 mm. may be accurately separated. Both elutriation and subsidence methods of separation can be arranged, but the testing of the accuracy of the process by actual measurement presents difficulties. A separation has, however, frequently been effected by subsidence methods supposedly accurate at the point 0·005 mm. diameter.

The grade sizes chosen are not of such great moment if graphical representation of the sediments by means of curves is adopted. For example, in Fig. 1, the method of plotting cumulative percentage weights against grade size is utilised. To keep the diagram within reasonable compass, the grade sizes are plotted horizontally at distances proportional to their logarithms. The ordinates at the grade size represent for each curve the percentage weight of material greater than that grade size. It is obvious that if a particular sediment be subjected to mechanical analysis upon a basis of grade sizes different from the above, the results should yield the same curve.

In the strict geological sense, the expression "sand" is a grade term, and is limited to material ranging from not less than 0·05 mm. to not more than 2 mm. in diameter. A perfectly graded sand would be one consisting of grains each with the same mean diameter. Such a sand has never been found naturally, but the ideal is closely approached by certain dune-sands which have been exposed to the transporting action of wind and water so frequently that grains smaller or greater than the average have been respectively carried ahead or left behind.

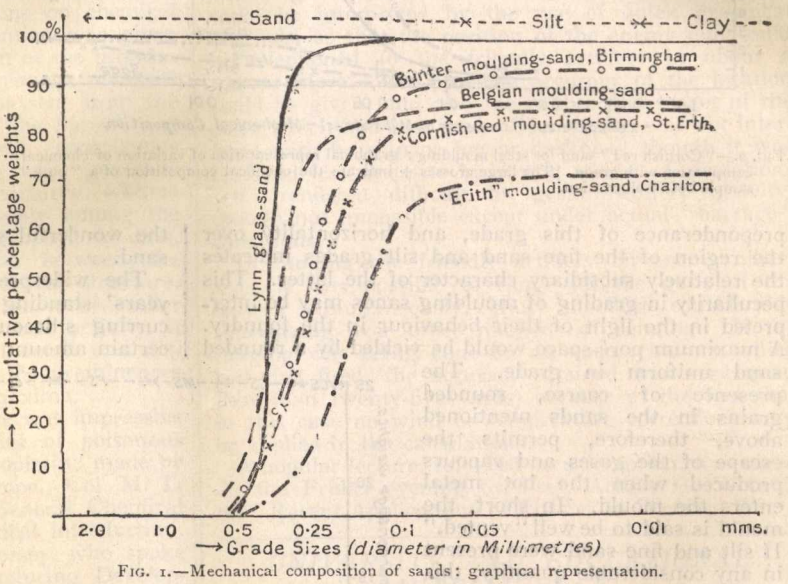



FIG. 1.—Mechanical composition of sands: graphical representation.

The term "sand" in the commercial sense, however, is used for sedimentary material of varying grades (as, for example, moulding sands), or even for the unclassified products resulting from the crushing of hard siliceous rocks, etc.

The texture of sands used in the casting of metals and alloys (particularly, perhaps, of steel, where the conditions are the most exacting) is of considerable industrial importance, as well as of scientific interest. When samples of the sands which have proved most successful for steel moulding are subjected to mechanical analysis, it is found that each consists of a high percentage by weight of the sand grade, a relatively large proportion of the clay grade, but little or no silt or superfine sand grade. Graphically expressed, the mechanical composition of such sands, of which "Belgian yellow" and "Cornish red" are

apposite examples, is shown in Fig. 1. The sand grade consists preferably of coarse or medium sand, the Belgian material being therein more suitable than that from Cornwall (St. Erth). Verticality of the graph over the region of the sand grade marks the preponderance of this grade, and horizontality over the region of the fine sand and silt grades indicates the relatively subsidiary character of the latter. This peculiarity in grading of moulding sands may be interpreted in the light of their behaviour in the foundry. A maximum pore-space would be yielded by a rounded sand uniform in grade. The presence of coarse, rounded grains in the sands mentioned above, therefore, permits the escape of the gases and vapours produced when the hot metal enters the mould. In short, the mould is said to be well "vented." If silt and fine sand were present in any considerable quantity, this natural venting would be gravely impaired. The clay grade is required to act as the "bond" uniting the sand grains together. Both the Cornish and Belgian sands mentioned have a strong bond—that is, contain a relatively high proportion of true clayey material (14 to 20 per cent.). The ideal condition in which the clayey bond exercises a maximum effect is that of a pellicle, as thin as possible, completely enveloping each quartz grain.

In contradistinction to such peculiarly graded sands (for they are abnormal geologically, and hence are of restricted occurrence) are the well-graded materials desirable for glass manufacture. A sand such as that from near King's Lynn (Fig. 1), which contains a high percentage of grains belonging to the medium sand grade and practically no silt or clay, passes freely and evenly into melt, thereby assisting to produce a homogeneous glass as rapidly as possible.

The inter-relation of chemical and mechanical constitution is well brought out in moulding sands of good quality like those from St. Erth, Cornwall, and Fontenay aux Roses, near Paris (Figs. 2 and 3). Not only must the sand be composed of suitable grades; it must also be highly refractory to heat, and capable, for example, of withstanding the effects of molten steel run from converters and electric furnaces. ("Open-hearth" steel is not so exacting upon the sand.) The refractoriness to heat is indicated by the fact that chemical analysis of the coarse, medium, or fine sand grades shows them to be high silica sands containing only small proportions of alkalis and alkaline earths.

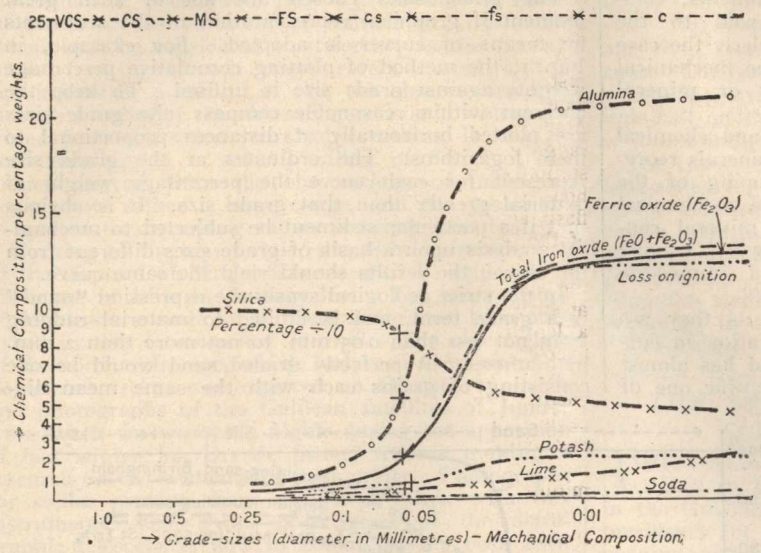



FIG. 2.—"Cornish red" sand for steel moulding: graphical representation of variation of chemical composition with grade. The large crosses + indicate the chemical composition of a "bulk" sample before elutriation.

The variation of chemical composition with grade is expressed graphically in Figs. 2 and 3, where the high silica content of the sand grades is evident. Analysis of the clay grade shows that its composition closely resembles that of many first-class British fireclays, which are also very refractory. In addition, the diagram illustrates the presence of a relatively high percentage of hydrated ferric oxide; this compound is probably present in a colloidal form, and is responsible for much of the wonderful strength of the bond of the moulding sand.

The widespread American practice, now of many years' standing, of milling together a naturally occurring siliceous sand with a good fireclay and a certain amount of an artificial bond, such as dextrin, flour, molasses, etc., is in this connection very significant. It yields an indication of the manner in which the absence of the remarkable naturally bonded sands of Western Europe has been compensated by the production of an artificial mixture of somewhat

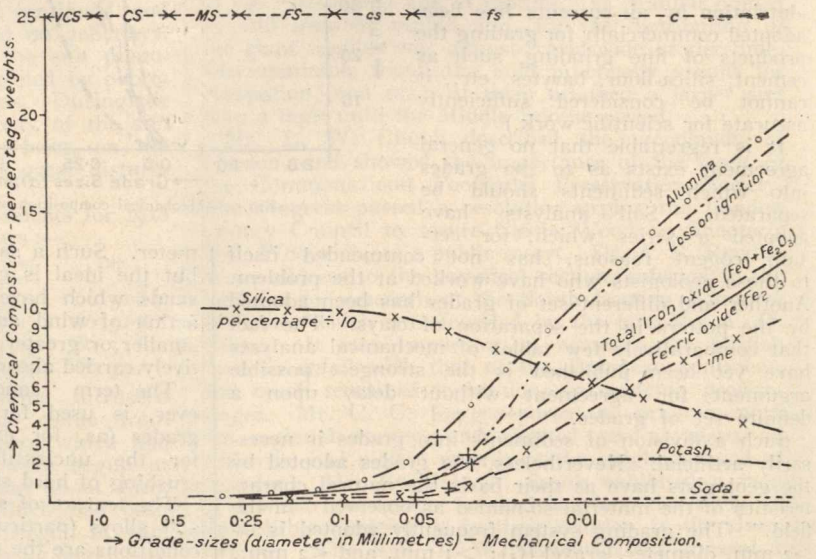



FIG. 3.—"French red" sand for steel moulding: graphical representation of variation of chemical composition with grade. The large crosses + indicate the chemical composition of a "bulk" sample before elutriation.

similar chemical and mechanical constitution, the resemblance having unwittingly been evolved.

Similarly, the study of the variation with grade in the mineral constitution of a sand presents results of great interest. The detrital minerals occurring in each grade vary in proportion, species, and physical characters. Generally speaking, the percentage weight of the heavy detrital minerals in any grade varies inversely with the grade size.

P. G. H. B.

## THE AMERICAN PHILOSOPHICAL SOCIETY.

THE annual general meeting of the American Philosophical Society was held on April 24–26, and a programme of more than fifty papers covering a wide range of subjects was presented. The sessions were presided over by the president, Prof. W. B. Scott, and by Vice-Presidents G. E. Hale, H. L. Carson, and A. A. Noyes.

Two important features were a symposium on the solar eclipse of June 8, 1918, and one on chemical warfare. In the former, special attention was given to photographs and their interpretation of the prominences and the coronal arches and streamers obtained by members of the several expeditions sent from the Lick, the Mount Wilson, the Lowell, the Sproul, and the Yerkes Observatories. Several conspicuous prominences were shown, and these were generally surrounded by complex coronal structures. These coronal arches or "hoods" are probably among the most notable and remarkable photographed to date. They point to an intimate relation between the prominences and the surrounding coronal structure. From the comparison of the observations of earlier eclipses made at different epochs of solar activity, it seems probable that complex coronal detail and disturbed regions of the corona around the prominences are more pronounced near sun-spot maxima.

The symposium on chemical warfare was impressive as indicating the enormous quantities of poisonous gases, phosgene, mustard, and chloropicrin, made by the United States and shipped to Europe. Col. M. T. Bogert, who was in charge of the General Chemical Warfare Service, gave a brief historical introduction. He was followed by Col. F. M. Dorsey, who spoke on "Chemical Warfare and Manufacturing Development"; while Col. W. H. Walker gave an address on the production of chemical warfare munitions. Col. Bradley Dewey treated in detail the American means of defence against the deadly gases used in war, and told how more than five million gas-masks were made in eight months and sent overseas with nearly three million canisters for holding the absorbing chemicals, and how these chemicals were obtained, one item being four hundred tons a day of coconut-shells and peach-stones for producing the charcoal necessary.

A paper on "Detection of Submarines" by Dr. H. C. Hayes, who was stationed at the Naval Experimental Station at New London, discussed various possible methods. The most effective one resulted from the development of a system of multiple sound-sensitive receivers mounted in such a way as to transmit to both ears of the observer a cumulative or summational impulse which becomes a maximum when the instrument is properly directed, thus showing the direction of the submarine. It is clear that such an instrument would be valuable in peace-time also in indicating the presence and direction of vessels in a fog.

Col. Augustus Trowbridge, recently attached to Gen. Pershing's staff, and in charge of the Sound-ranging Service of the A.E.F., analysed the work of this Service, the success of which was remarkable. The location of active enemy batteries and of the direction of fire of friendly guns by means of sound is new, while that by visual means—flash ranging—is an outgrowth and extension of standard artillery methods.

A sound-ranging section was in the field with the first American Division, March, 1918, while on the date of the armistice the *entire front* of the 2nd American Army was covered by both flash- and sound-ranging sections. The "central" or calculating station, situated generally in a dug-out or ruined house, was more elaborate than in the case of the flash because of the greater instrumental installation of the sound-ranging section. The "central" instrument recorded photographically the time of arrival of the sound of enemy guns at a series of instruments at surveyed positions near the front line and covering a length of about five miles. This instrument delivered automatically developed and fixed photographic records in less than a minute after the sound of the enemy gun reached the front line, and this record could be interpreted by the use of quick graphical methods, so that the position of the enemy gun could be telephoned to the friendly artillery in about a minute more. The probable accuracy of the location could be given, and also the calibre and target of the piece which had just fired. The service was not interfered with by rain or fog or darkness, though it was rendered less accurate by strong winds. Calculations were rendered difficult by great artillery activity, though not impossible except under actual "barrage" conditions.

In ranging the friendly artillery on enemy objectives it was possible to range all the guns of the battery simultaneously, thus effecting considerable time-saving over other methods of ranging. If the ranging was being done on an enemy battery which had just fired, the accuracy attained was very great (less than twenty-five yards) because of the fact that in this case no wind or temperature corrections need be applied in the calculations.

A popular lecture, followed by a reception, was given on the Friday evening by Prof. Arthur G. Webster on "Recent Applications of Physics in Warfare."

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Col. C. S. Myers and Lieut. H. W. Phear have been elected fellows of Gonville and Caius College.

MANCHESTER.—Mr. W. L Bragg has been appointed to the Langworthy chair of physics in the University of Manchester in succession to Sir Ernest Rutherford.

Prof. D. H. Macgregor has been appointed to the Stanley Jevons chair of economics in succession to Prof. S. J. Chapman, and Prof. O. T. Jones to the chair of geology in succession to Sir T. H. Holland.

OXFORD.—The statute for the reform of Responsions, which lately passed Congregation, came on June 17 before a well-attended meeting of Convocation. After speeches in favour of the statute by Mr. E. Barker, fellow of New College, and Mr. C. Norwood, Headmaster of Marlborough, and against it by Mr. E. Walker, fellow of Queen's, and the Regius professor of Greek (Prof. Gilbert Murray), a division was taken, from which there appeared 306 for the statute and 312 against it. The chief resident opponents of the statute have, however, pledged themselves not to resist a proposal by Prof. Gilbert Murray to introduce a statute on the earliest opportunity which will provide for the exemption from compulsory Greek

of men seeking honours in natural science or mathematics.

In the same Convocation the honorary degree of D.C.L. was conferred on Charles William Dyson Perrins, to whose liberality is due the fine new chemical laboratory in South Parks Road.

The gift of 25,000*l.* for the encouragement of the study of modern languages from Sir Heath Harrison, of Brasenose College, was gratefully accepted. The proceeds of this sum will be expended, partly on the provision of instruction within the University, and partly on the institution of travelling scholarships.

SHEFFIELD.—Sir Henry Hadow, Principal of Armstrong College, Newcastle-on-Tyne, has been appointed Vice-Chancellor of the University.

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SIR JAMES CAMPBELL, Lord Chancellor of Ireland, has been appointed Vice-Chancellor of Dublin University, in succession to Archbishop Bernard, who has become Provost of Trinity College.

APPLICATIONS are invited by the Senate of the University of London for the filling of the newly instituted chair of aeronautics tenable at the East London College. The latest time for receiving applications is the first post of Monday, July 7.

THE Salters' Institute of Industrial Chemistry has awarded four more fellowships for post-graduate study in the laboratories indicated:—Capt. W. H. Hoffert and Capt. A. G. Pollard (Rothamsted Experimental Station), Mr. L. A. Ravald (Municipal Technical College, Manchester), and Mr. M. L. Wilson (The University, Manchester).

WE learn from *Science* that Queen's University, Kingston, Ontario, has received an additional endowment of 200,000*l.* for the general purposes of the University. It is proposed to secure several more full-time professors and to develop the departments of physiology, bacteriology, and public health. A fund of 40,000*l.* is also available to be expended in the reconstruction of the hospital.

THE tenth British Esperanto Congress was held in Liverpool during the Whitsun week-end, and more than five hundred Esperantists were present. The congress was opened by Mr. James G. Legge, Director of Education in Liverpool, who gave the congressists a warm welcome, and expressed his sympathy with the aims of Esperanto. The annual general meeting of the British Esperanto Association was held during the congress, and many speakers commented on the recent progress made and on the suitability of the present time for a vigorous propaganda. The social functions of the congress were of a very varied nature. Two concerts were given, Esperanto being almost exclusively used for songs and recitations. The public was admitted to one of these concerts, and between the musical items demonstrations were given with the help of foreign Esperantists who were present. A visit was paid to the University of Liverpool, where the congressists were addressed by the Vice-Chancellor, Sir Alfred Dale, who afterwards showed the party some of the interesting features of the University. Parties of more than two hundred Esperantists also visited the Port Sunlight works of Lever Brothers and one of the Atlantic liners at the docks. The organising committee of the congress is to be congratulated on the excellence of their arrangements, and it was generally agreed that the congress was the most successful and enjoyable that has yet been held by British Esperantists.

A CHART prepared by Principal J. C. M. Garnett, College of Technology, Manchester, shows what the youth of the country should be receiving in the way of education between the ages of ten and twenty-five years, and indicates also their probable occupation in life. The diagram includes all grades of education, from the elementary schools (public, and private preparatory) to the universities and to post-graduate work, and includes also full-time and part-time courses, both general and special. The system is one "proposed to be brought into operation in England during the decade ending ten years hence," and it is, therefore, not very obvious why 30 per cent. of the youth should be shown as having no further school education after leaving the part-time secondary school at the age of eighteen. There is also no provision shown for general cultural education, such, for example, as that given so successfully in the Danish "People's High Schools," unless something of the kind is to be inferred from the footnote: "Junior and senior technical courses do not mean narrow vocational courses, but a general education which has a centre of interest in some group of occupations, into one of which the pupil is expected to enter." Why not, however, provide a general education for persons eighteen years of age and upwards which shall have a centre of interest in life itself rather than in any group of occupations? In Denmark, "of the 79 Government accredited schools, 48 adhere to the culture idea, pure and simple; and in this list are, perhaps, a majority of the schools which have done most to place a real stamp on the character of the nation" (H. Foght in "Rural Denmark and its Schools").

AN address on science and education recently delivered by Prof. J. Graham Kerr before the Royal Philosophical Society of Glasgow includes an earnest plea for the inclusion of science in any scheme for the complete and efficient education of the citizen. By science is meant, not merely the acquisition of book knowledge or that it be taught *ex cathedra*, but the patient, accurate, and direct investigation of phenomena in order that the pupil may attain a first-hand knowledge based upon individual experience of the processes of Nature, and with the ultimate purpose of "the training and development of the powers with which Nature has endowed him so as to give him the highest possible degree of competence for successfully tackling the problem of the life which lies beyond the school or college." The address is thoroughly democratic in its aim, and Prof. Kerr would so order our system of education as to bring its facilities within reach of the poorest of the community where ability merits aid and encouragement. In his view it is essential to enlightened popular government that the mass of the people should enjoy the advantages of a sound education, and that science in its fundamental aspects be continuously taught throughout the school and college career. He is of opinion that the subject of physics lends itself admirably in the early stages of training, since its phenomena are simple and demand, through repeated measurements, complete accuracy, and, along with mathematics, he would inseparably link with it a training in the use of the English language. Prof. Kerr further discusses the conditions under which a stable modern society can subsist and progress, and demands that biological science should find a place in the training of the future citizen, so that he may grasp the principles which underlie the problems of communal life. He further advocates the establishment of free popular lectures on science.

THE Journal of the British Science Guild for April contains a report by the Education Committee of the guild on "Industrial Research and the Supply of Trained Scientific Workers." Data are presented contrasting the facilities for research and sums expended on technical education in this country with those in the

United States and in Germany. In the United States there are 10 students at universities and technical institutions per 10,000 of population, in Germany 14, and in the United Kingdom only 6; Scotland, however, is more favourably situated, the value being 17. According to Sir J. J. Thomson's committee, the total annual output of first and second class honours men in science and engineering from all the universities in this country is little more than 500. The number of men students entering universities and colleges of England and Wales during 1913–14 was about 4400, about half this number being from public schools. Of youths leaving public schools about 25–30 per cent. pass on to universities; of boys leaving State-aided schools at ages over sixteen years, probably only 10 per cent. Whereas the income from endowments of the eighteen State-aided universities and colleges of England and Wales amounts to about 100,000*l.*, a third of the income being from Parliamentary grants, the total gifts and endowments of universities and colleges in the United States in a single year, 1913–14 (excluding grants from States, the Federal Government, or municipalities) was equivalent to an income exceeding 200,000*l.* The bequests to universities and colleges in the United Kingdom in the same year amounted to, roughly, 5 per cent. of the American endowments, *i.e.* to about the same value as the income derived. The Journal also contains the report of the organising committee of the British Scientific Products Exhibition and a list of donors. The success of the 1918 exhibition is regarded as of hopeful augury for the corresponding exhibition arranged to take place this year.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Geological Society,** June 4.—Mr. G. W. Lamplugh, president, in the chair.—Dr. A. S. **Woodward**: The dentition of the Petalodont shark, Climaxodus. The author describes the nearly complete dentition of a new species of Climaxodus from the Calciferous Sandstone of Calderside, near East Kilbride (Lanarkshire), now in the Royal Scottish Museum, Edinburgh. Climaxodus and Janassa are shown to be two distinct genera. These Petalodonts are especially noteworthy among the Elasmobranchii, because during the greater part of the life of each individual there cannot have been more than six or eight teeth in succession, a condition remarkably different from that in all ordinary sharks and skates, in which the successional teeth are always very numerous and rapidly replaced. The same limited tooth-succession is to be observed in the Carboniferous Cochliodontidæ, and perhaps also in the contemporaneous Psammodontidæ. —F. **Debenham**: A new theory of transportation by ice: the raised marine muds of South Victoria Land (Antarctica). A series of deposits of marine muds are found on the surface of floating "land-ice" in the deep bays of Ross Sea (Antarctica). Similar deposits are also found on land up to a height of 200 ft., in some cases on old ice, in other cases on moraine. The deposits are briefly described, and former theories concerning them are discussed. A new theory is put forward, prefaced by an account of the nature of the typical ice-sheet which bears them. The upper surface of the sheet is known to suffer a net annual decrease, and evidence is given to show that the lower surface has a net increase by freezing from below. The theory is that the sheet will freeze to the bottom in severe seasons, and enclose portions of the sea-floor. Owing to the method of growth of the sheet by increments from below, the enclosed portions will ultimately appear on the surface, thus being raised vertically as well as translated horizontally.

**Linnean Society,** June 5.—Dr. A. Smith Woodward, president, in the chair.—H. N. **Dixon**: Mosses from Deception Island. The mosses were collected on Deception Island, South Shetlands, by Mr. James C. Robins. Deception Island is in lat. 63° S., long. 60° 30′ W., closely adjoining the Antarctic continent (Graham Land). It has been very little visited, and until the present century only two plants—an unnamed moss and a lichen—had been observed. Two mosses were collected there in the second French Antarctic Expedition (1908–10) by MM. Gain and Gourdon. The present collection consists of eight species, one known from most of the colder regions of the world, one hitherto recorded only from the South Orkneys, three of general Antarctic distribution, two hitherto known only from the Antarctic continent, and one new species. The interior of the island is a vast crater, into which the sea has irrupted, and is about five miles across. Connected with this is a small lagoon, some 500 yards in diameter; Mr. Robins describes it as giving no bottom at 200 fathoms, and as fed by warm or hot springs from the volcano. The whole crater would seem, in the middle of extreme glacial surroundings, to afford an almost unique example of an isolated biological area, and would appear to deserve a careful survey as regards its fauna and flora, especially in so far as concerns that of the warm springs and the lagoon fed by these.—Miss Alwen M. **Evans**: The structure and occurrence of maxillulæ in the orders of insects. This paper embodies the results of the author's investigation into the structure and distribution amongst insect orders of those vestigial mouth-parts which Hansen (1903) homologised with the maxillulæ of Crustacea. In it is included, as completely as space will allow, what has hitherto been written as to the presence and form of these structures of the Insecta, since Hansen's theory was put forward.—E. E. **Unwin**: Notes upon the reproduction of *Asellus aquaticus*. The intimate relationship between the moulting of the cuticle and the reproductive processes is clearly shown, and the details of the marriage-clasp, copulation, release of the oostegites, ego-laying, and fertilisation are described. The appendages associated with these operations are also described. The aeration of the eggs in the brood-pouch is effected by a periodic movement of the oostegites and by the flapping action of the maxillipedes. The eggs are prevented from escaping at the anterior end of the pouch by the position and movement of the first pair of legs, and by a special coxal lobe carried by the maxillipedes.

### PARIS.

**Academy of Sciences,** May 26.—M. Léon Guignard in the chair.—G. **Bigourdan**: The observatory of the Hôtel de Cluny, afterwards the Nautical Observatory. —H. **Douvillé**: Concerning a memoir of J. de Lapparent on the breccias of the neighbourhood of Hendaye.—P. **Termier** and G. **Friedel**: The *débris* of strata, or "Klippes," of the Alais plain; fragments of mylonitic Urgonian limestone placed on the Oligocene.—H. **de Chardonnet**: An application of the eight-hour day. An account of the successful introduction of the eight-hour day in Hungary in the artificial silk industry. The machines are run continuously, women taking two shifts during the day, and men the shift from 10 p.m. to 6 a.m.—L. E. J. **Brouwer**: The invariant points of the topological transformations of surfaces.—F. **Vlès**: Remarks on the serial constitution of absorption spectra. Several absorption spectra can be represented by the relation

$$\lambda=\lambda_0+An+Bn^2+Cn^3,$$

where $n$ is an integer. Examples are given for the absorption spectra of potassium permanganate,

hæmoglobins, chlorophyll, and neodymium chloride.—A. **Colson**: Reduction of cryoscopy to the general laws of solubility.—A. **Noyes**: The counter e.m.f. of polarisation in sulphuric acid. The counter e.m.f. of a solution of sulphuric acid at first diminishes with the temperature, proportionally to the reciprocal of the absolute temperature. From 60° to 120° C. the fall is more rapid, and above 120° it scarcely varies at all. The change may be attributed to a difference in the mode of ionisation.—G. **Langlois**: A new synthesis of benzylidene-acetone. Cinnamene is condensed with acetyl chloride in presence of diethylaniline. The product was characterised as benzylideneacetone by its oxidation products, formation of dibromide and semicarbazone, and by elementary analysis.—J. **Guyot** and L. J. **Simon**: The action of heat on the methylsulphates of the alkalis and alkaline earths. At 220°–280° C. sodium and potassium methylsulphates give methyl ether and a pyrosulphate, some methylsulphate being formed as a by-product. With barium and calcium methylsulphates methyl sulphate is the main product of the reaction, with minimal proportions of methyl ether.—P. **Pelseneer**: Production of hybrids in molluscs.—L. **Roule**: The first phases of embryonic development in *Palemon serratus*. Criticism of a recent communication to the *Comptes rendus* by M. E. Sollaud on the development of *Leander-Palemon squilla*.—C. **Vaney** and A. **Allemand-Martin**: The action of *Hippospongia equina* of the coasts of Tunis on the Posidonia.—H. **Coutière**: The morphology of the limb of the Crustacea.—E. **Fernández-Galiano**: The conjunctive tissue of the heart of the snail.—C. **Gessard**: An achromogenic variety of the pyocyanic bacillus. This new type gives pyocyanine on glycerine gelose-peptone, but gives no pigment when cultivated in aqueous peptone. M. **Ménard** and C. **Delval**: The action of the X-rays on fibro-myomas of the uterus in woman.—A. **Robin**: The hydration, soluble residue, and insoluble residue in cancer of the liver. A new theory on the genesis of cancer.

## *BOOKS RECEIVED.*

An Introduction to the Study of Science. By W. P. Smith and E. G. Jewett. Pp. xi+620. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 7*s*. 6*d*. net.

The Foundations of Geography in the Twentieth Century. By F. Schrader. (Herbertson Memorial Lecture, 1919.) Pp. 26. (Oxford: At the Clarendon Press.) 2*s*. 6*d*. net.

The Analysis of Minerals and Ores of the Rarer Elements. By Dr. W. R. Schoeller and A. R. Powell. Pp. x+239. (London: C. Griffin and Co., Ltd.) 16*s*. net.

A Handbook of Medical Jurisprudence and Toxicology. By Dr. A. Brend. Pp. xiii+317. (London: C. Griffin and Co., Ltd.) 10*s*. 6*d*. net.

An Arithmetic for Preparatory Schools, with Answers. By T. Dennis. Second edition. Pp. xiv+376. (London: G. Bell and Sons, Ltd.) 4*s*. 6*d*.

Differential Calculus for Colleges and Secondary Schools. By Dr. C. Davison. Pp. viii+309. (London: G. Bell and Sons, Ltd.) 6*s*.

## DIARY OF SOCIETIES.

*THURSDAY*, JUNE 19.

INSTITUTION OF MINING ENGINEERS, at 11.—Lt.-Col. D. Dale Logan: (*a*) The Difficulties and Dangers of Mine-rescue Work on the Western Front, and Mining Operations carried out by Men wearing Rescue-apparatus; (*b*) Accidents due to Structural Defects of Apparatus or Injury to Apparatus, and the Future of the Proto Apparatus.—M. W. Blyth and L. T. O'Shea: The Examination of Coal in Relation to Coal-washing.—Prof. F. W. Hardwick: Reply to the Discussion on his Paper on the Training of Students in Coal-mining, with Special Reference to the Scheme of the Engineering Training Organisation.—W. Maurice: The Education of Colliery Managers for Administrative and Social Responsibilities.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture. Hon. R. J. Strutt: A Study of the Line Spectrum of Sodium as Excited by Fluorescence.

LINNEAN SOCIETY, at 5.—T. A. Dymes: Notes on the Life-history of the Yellow Flag, *Iris pseudacorus*, Linn., with Special Reference to the Seeds and Seedlings during their First Year.—Dr. G. H. Rodman: Egg-case of a Spider from the South of France—*Cyrtarachne tuberculifera*.—S. L. Moore: A Contribution to the Flora of Australia.—A. W. Waters: Observations on Certain Species of Bryozoa, chiefly belonging to the Selenariadæ, Coneschareliinidæ, etc.—Dr. E. Penard: Studies on some Flagellata.—Dr. W. M. Tattersall: Report on the Stomatopoda and Macrurous Decapoda Collected by Mr. Cyril Crossland in the Sudanese Red Sea.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—W. H. Goodchild: The Genesis of Igneous Ore Deposits.

CHEMICAL SOCIETY, at 8.

*WEDNESDAY*, JUNE 25.

GEOLOGICAL SOCIETY, at 5.30.—A. E. Kitson: Outlines of the Geology of Southern Nigeria (British West Africa), with Especial Reference to the Tertiary Deposits.—Prof. J. B. Harrison and C. B. W. Anderson: Notes on the Extraneous Minerals in the Coral-Limestones of Barbados.

*THURSDAY*, JUNE 26.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Dr. A. E. H. Tutton: Monoclinic Double Selenates of the Cobalt Group.—Bertha Ayrton: A New Method of Driving off Poisonous Gases.—Dr. F. W. Aston: Experiments with Perforated Electrodes on the Nature of the Discharge in Gases at Low Pressure.—Mary Seegar and Prof. Karl Pearson: De Saint-Venant Solution for the Flexure of Cantilevers of Cross-section in the Form of Complete and Curtate Circular Sectors; and on the Influence of the Manner of Fixing the Built-in End of the Cantilever on its Deflection.—Dr. H. Jeffreys: The Relation between Wind and the Distribution of Pressure.

*FRIDAY*, JUNE 27.

PHYSICAL SOCIETY, at 5.—Prof. C. L. Fortescue: The Current-Voltage Characteristics of High-Voltage Thermionic Rectifiers.—Prof. Ernest Wilson: The Measurement of Small Susceptibilities by a Portable Instrument.

## CONTENTS.



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