THURSDAY, JUNE 6, 1912.

TECHNICAL CHEMICAL ANALYSIS.

Technical Methods of Chemical Analysis. Edited by Prof. George Lunge. English translation from the latest German edition, adapted to English conditions of manufacture. Edited by Dr. C. A. Keane. Vol. ii. Part i., pp. xxvii+610. Part ii., pp. xii+611–1252. (London: Gurney and Jackson, 1911.) 2 parts price £3 3*s.* net.

THIS work, in its English form, is the result of a cooperation of German and English chemists, who have together sought to adapt the latest German edition to English conditions of manufacture. The entire volume extends to upwards of 1200 pages, but it is divided into two parts, presumably to suit the convenience of technical chemists who may be mainly interested in special branches of manufacture. Generally speaking, part i. is concerned with inorganic processes, and for the most part deals with the metals and their compounds, although it includes also methods of examining artificial fertilisers, feeding stuffs, explosives, matches, fireworks, and calcium carbide. Part ii. mainly deals with the products of the destructive distillation of coal, illuminating gas and ammonia, coal tar, the synthetic organic dyes, and naturally occurring organic dye-stuffs. The work, we think, might have appealed to a wider circle of readers if it had been still further subdivided. The consulting analytical chemist will no doubt find the entire volume of use, but the metallurgical works chemist is seldom, if ever, concerned with the subject of fertilisers and feeding-stuffs, and has but a very limited interest in matches and fireworks.

Part i. opens with the section devoted to iron, due to Dr. Aulich, chief instructor at the Mining School of Duisberg, the translation being revised by Mr. Wesley Lambert, of the Royal Gun Factory, Woolwich. It deals very fully with the analysis and dry assay of iron-ores, and with the determination of the various constituents of the different forms of manufactured iron.

The section on "Metals other than Iron" is written by Prof. Pufahl, of the Royal School of Mines, Berlin, and the English translation has been revised by Mr. C. O. Bannister, the head of the metallurgy department of the Sir John Cass Institute. It is, of course, almost exclusively concerned with metals of technical importance, and the established methods of assay, wet and dry, are given in sufficient detail. There is not much opportunity for novelty of treatment, and both author and editor wisely prefer to deal with methods which experience has shown to be accurate and sufficiently rapid for technical work rather than with processes which may have the merit of novelty, but which have still to stand the test of time. A commendable feature, however, is the prominence given to electrolytic methods.

The article on artificial manures is by Dr. Böttcher, a former director of the Agricultural Experiment Station, Möckern. The methods described are mostly of German origin, and some of them have only an academic interest to English chemists, who, as regards fertilisers and feeding-stuffs, are required, in pursuance of the provisions of the Fertilisers and Feeding Stuffs Act, 1906, to make the necessary determinations in accordance with the regulations prescribed by the Board of Agriculture.

The section on explosives was written by the late Dr. Guttmann, and was revised by him for the English translation in 1910. It differs in many respects from that in the last German edition, which was revised by Dr. E. Berl. The modes of carrying out the stability and heat tests are shortly described, and the possibility of these tests being modified in the case of gun-cotton preparations by the use of mercuric chloride is referred to, and methods are mentioned by which the presence of this compound may be detected, although the details are scarcely sufficient to make them of much practical use.

The section relating to matches and fireworks is from the pen of Dr. Bujard, of Stuttgart, and the English translation has been edited by Mr. E. G. Clayton. It mainly deals with the examination of the raw materials employed by the manufacturer and of the "compositions" with which the splints are tipped. Since, by the Act of 1908, which came into force at the beginning of 1910, the use of ordinary phosphorus in the manufacture of matches is prohibited in this country, and the importation of matches so made is illegal, it is of importance to have a ready method of detecting the presence of white phosphorus in the igniting composition of a lucifer match, and various methods more or less serviceable for this purpose are described.

The section on calcium carbide and acetylene is by Prof. Lunge and Dr. Berl, and the English translation has been revised by Dr. Conroy. In some respects this is the most original portion of the book, and it constitutes a striking exemplification of the mode in which German technical analysts apply scientific methods to the analytical control of a comparatively new industry.

The first section of part ii. is concerned with illuminating gas and ammonia. It is written by

Dr. Pfeiffer, of the Magdeburg gas works, and has been revised for the English edition by Dr. Harold Colman. It, of course, deals largely with German practice, but, as might be anticipated from the nature of the industry, the work of English analysts is here more in evidence than in any other section of the book, and all the standard methods, both of analysis and photometry, are described in ample detail.

The section on coal-tar is by Dr. Köhler, and the English translation has been edited by Prof. Green. Although the working up of tar is largely a British industry, the greater part of the analytical work in connection with it would appear to be based on methods devised by Continental chemists.

The section on the organic dyes necessarily occupies a considerable portion of the book. It is due to Prof. Gnehm, and has been edited for the English issue by Dr. Cain. It deals with the characters and modes of valuation of the more important raw materials of the colour industry, organic and inorganic; of the finished dyes in respect to their behaviours on fabrics, mordanted and unmordanted, and as regards their fastness to light, soap, and various reagents, and closes with an account of the more important commercial dyes, and the general procedure for the chemical examination of synthetic and of the naturally occurring dye-stuffs. The book is admirably printed and suitably illustrated, and is furnished with copious indexes, and altogether constitutes a worthy addition to the bibliography of chemical analysis.

THE ANCESTRY OF FLOWERING PLANTS.

Vorträge über botanische Stammesgeschichte, gehalten an der Reichsuniversität zu Leiden: Ein Lehrbuch der Pflanzensystematik. By J. P. Lotsy. Dritter Band. Cormophyta Siphonogamia, erster Teil. Pp. 1055. (Jena: Gustav Fischer, 1911.) Price 30 marks.

LIKE the previous volumes of this important work, the one (third) recently issued is of great value. As a storehouse of information gathered from the most varied sources, it arouses wonder at the wide field from which it has been gleaned; while it is not less marked by the clearness with which the information is conveyed to the reader and the freedom from verbiage, and by the stimulating and suggestive discussions of general questions and on subjects of special interest or difficulty. These are dispersed through the volume, where they emerge in relation to the various subjects; and they witness to the fairness with which the views expressed by other botanists are stated, and to the single aim of the author to set forth the conclusions that the evidence will warrant.

The present volume is devoted to the Coniferæ and to a part only of the Angiospermia, yet it extends to 951 pages of text and illustrations and 104 pages of index.

There is much in the volume that is unfamiliar, and the conclusions arrived at may at times arouse question or opposition rather than command assent; but the statement of each point, and of the way by which the conclusion is reached, will in every case repay careful consideration.

Pressure on our space precludes fuller notice of not a few matters of great interest, such as the division of Coniferæ into two groups—Florales and Inflorescentiales—assigned to widely different ancestors; the relationships of Gnetaceæ; the indications of primitive structures in flowers of Angiosperms, and the difficulties of tracing them to gymnospermous ancestors, and of interpreting the cells in the embryo-sac.

Monocotyledons are regarded as derived from Dicotyledonous ancestors in two distinct lines, (a) the Spadicifloræ from a series commencing in Anonales and passing through forms like Lauraceæ and Piperales to Araceæ (with Lemnaceæ as a degraded type), Palmaceæ, and Pandanaceæ, and (*b*) the remaining Monocotyledons from a series beginning with such Ranales as Ranunculaceæ, and running on through Nymphæaceæ and Ceratophyllaceæ to aquatic families of Monocotyledons (Alismataceæ, &c.). The more showy families, such as Liliifloræ, are also derived from Ranales; and from Liliifloræ are traced the Graminaceæ and Cyperaceæ as types extremely modified for wind pollination; while Orchidaceæ and certain allied families are also traced to Liliifloræ as forms adapted to insects as agents in pollination.

As these two series of Monocotyledons are intercalated among the Dicotyledons, the system of arrangement is very unlike those in general use. The only remaining series fully dealt with in this volume are Aristolochiales, Nepenthales, and Rhœadineæ, all as defined by Hallier, and all derived separately from Ranales. The first includes families so greatly adapted to parasitic life that certain of them are extremely degraded in structure. The families in Nepenthales agree in capturing animals by means of leaves modified to form pitchers. In Rhœadineæ are those families grouped round Papaveraceæ and Cruciferæ.

The indications of probable descent are suggestive and helpful in many cases in the volume under review, but of greater value are the excellent surveys of the leading features of interest, structural

and ecological, under the several families, the helpfulness of which is much increased by the profusion of admirable illustrations, by numerous bibliographical references, and by a very full index.

PHYSICAL TEXT-BOOKS.

(1) *Grundrisz der Naturlehre für Gymnasien und Realschulen.* By E. Mach. Bearbeitet von Dr. Karl Habart. Unterstufe. Siebente Auflage. Pp. 181. (Wien: F. Tempsky, 1911.) Price 2.50 marks.

(2) *An Elementary Course on Practical Applied Electricity and Magnetism.* By D. H. Ogley. With a preface by Dr. W. G. Rhodes. Pp. xi+134. (London: Longmans, Green and Co., 1911.) Price 2*s.* 6*d.* net.

(3) *An Introductory Course of Mechanics and Physics for Technical Students.* By W. M. Hooton and A. Mathias. Pp. vii+148. (London: W. B. Clive, University Tutorial Press, Ltd., 1911.) Price 1*s.* 6*d.*

(4) *The Ontario High School Physics.* By Dr. F. W. Merchant and Prof. C. A. Chant. Pp. viii+504. (Toronto: The Copp, Clark Company, Ltd., n.d.) Price 90 cents.

(5) *The Ontario High School Laboratory Manual in Physics.* By Dr. F. W. Merchant and Prof. C. A. Chant. Pp. viii+128. (Toronto: The Copp, Clark Company, Ltd., n.d.) Price 35 cents.

(6) *Lehrbuch der Physik.* Nach Vorlesungen an der Technischen Hochschule zu München, von Prof. H. Ebert. Erster Band:—Mechanik—Wärmelehre. Pp. xx+661. (Leipzig and Berlin: B. G. Teubner, 1912.) Price 14 marks. (Naturwissenschaft und Technik in Lehre und Forschung, herausgegeben von Prof. F. Doflein und Prof. K. T. Fischer.)

(7) *An Intermediate Course of Practical Physics.* By Rajanikanta De. Pp. xii+284. (Calcutta: The International Publishing Co., 1911.)

(1) THIS little book comprises introductions to the various sections of physics, including mechanics and astronomy. The treatment is almost entirely qualitative, as is to be expected in an elementary-school book. For such purposes it appears to have many good points. The statements of the fundamental principles are clear, the printing is excellent, and the diagrams with which the various experiments are profusely illustrated are very good, particularly those bearing on the movements of the heavenly bodies. Perhaps the order in which the subjects are taken is a little peculiar, the treatment of mechanics being given towards the end of the book. This would be a serious defect in a work of wider scope, in which quantitative measurements in electricity and magnetism were described; here, however, the order of the subjects is comparatively indifferent.

(2) It is probable that most teachers of practical physics have experienced the difficulties to help to remove which this book has been produced. The difficulties arise from the small amount of individual attention which it is possible for a demonstrator to give in large practical classes. As the writer of the preface points out, this is especially so in cases where the number of hours devoted by students to practical work is very small. The method which the author adopts for lessening this undoubted defect in teaching is as follows:—Not only are instructions as to procedure in a given experiment stated, but the observations are also explained theoretically. Thus a student can prepare beforehand for the experiment assigned to him, and need not work unintelligently even in the absence of the demonstrator. This book should certainly serve the purpose for which it was written. It consists of a collection of some sixty experiments in magnetism and electricity which have been carefully and clearly treated after the manner above referred to. There are, however, no experiments in electrostatics described—an omission which somewhat reduces the value of the book. Comparatively few teachers realise that many simple yet instructive experiments in that department can be performed with very inexpensive apparatus. With regard to the standard of the work, it is pointed out that it is suitable for the elementary examination in electrical engineering of the City and Guilds of London Institute.

(3) This book is similar in many respects to the one commented upon above, and most of the remarks apply to it also. The subjects treated are mechanics and heat, and all the experiments are quite simple and can be performed with very inexpensive apparatus. Sets of examples at the ends of the various chapters are given, and a table of some physical constants is to be found at the end of the book.

(4) There appears to be a tendency in recently published text-books of physics—particularly those emanating from America—to crowd too much into too small a volume. Of such this is a typical example. It is true that it is elementary in character and scarcely touches upon the exact side of the science; nevertheless the impression of "hurry" is very markedly felt in reading it. Instead of clearly dealing with and laying stress upon the essential and fundamental points, the authors, in many places, do no more than

create a vague impression. For example, in dealing with the question of acceleration, we find stated:—"Let a body move in a straight line, and measure its velocity. At one instant it is 200 cm. per second; 10 seconds later it is 350 cm. per second." Yet there is no indication of the mode of measurement, nor is an instantaneous velocity even defined. Further, a considerable amount of space is wasted in rather absurd diagrams of common objects to which the principles of physics apply, and in portrait drawings of various famous physicists, both of which features the authors regard as likely to stimulate the interest of students. Speaking generally, it may be said that this book contains too much detail for a popular exposition, and too little exact information for truly scientific study.

(5) Several curious features are to be found in the laboratory manual also. It is intended to accompany the theoretical treatment in the previous book, to which reference is always made in connection with the experiments. One cannot help thinking that some of the observations are purely imaginary, and not actually carried out by the students. Experiment 36, for instance, is on the measurement of the velocity of sound in air with a stop-watch and a gun. Two boys are required at about a mile apart. The one has a gun and the other a stop-watch. The usual procedure follows. If a breeze is blowing, the observers should *change positions*, and so on. An alternative, and equally absurd, method is also described. Most of the experimental work is quite simple, but the instructions are not always clear, and considerable individual help on the part of the teacher would be indispensable to the students. The printing, both in this book and the accompanying one, is very good.

(6) Prof. Ebert's book is a large volume comprising the theoretical treatment of mechanics and heat. In using the word "mechanics," however, it must be understood that the first section of the book is concerned with sound, and what is usually styled "properties of matter," even more than with mechanics in the sense of applied mathematics. Indeed, the somewhat disordered mixture of these subjects is the only serious objection to the book. It is difficult to understand, for instance, why the definitions of the absolute units of force and work are postponed to so late a stage (p. 216), especially in view of the fact that such subjects as elasticity and osmotic pressure have been considered previously.

The second part of the book is distinctly superior to the first. A more logical treatment renders it more easy to follow, the subject is considered in greater detail, and none of the important principles of thermo-dynamics nor their applications are omitted. Taken on the whole, the book is a good one, and has evidently been prepared with great care. One of the chief features is the large number of experiments which are described—in fact, the book is essentially an experimental treatise. These experiments are illustrated with carefully prepared diagrams, and numerous numerical examples form a useful addition to the text.

(7) This is yet another practical physics manual, compiled in this case for the students in Calcutta University and in use there for the intermediate course. It consists of instructions for the performance of a few simple experiments in each of the branches of physics, together with some information regarding general laboratory processes such as glass-blowing. There is little to distinguish the book from many of a similar kind. Fewer experiments, perhaps, are undertaken, one only—the resonance tube—constituting the whole section on sound. The instructions are clearly stated, but the printing and the diagrams leave much to be desired. The latter failing is, however, common to many books produced in India.

THE TESTING OF BUILDING STONES.

Handbuch der bautechnischen Gesteinsprüfung. By Prof. J. Hirschwald. Erster Band. Pp. xi + 387. (Berlin: Gebrüder Borntraeger, 1911.) Price 20 marks.

IN this country, and to a great extent elsewhere, the testing of building stones has fallen short of the precision attained in the testing of other materials of construction. This has been due partly to the lack of any generally recognised standard methods, and partly to the neglect of the petrological characters peculiar to stones of different kinds.

Tests of building stones are usually made for two distinct purposes, namely, to measure their comparative resistance to mechanical stresses and to find their relative capacity of resistance to weathering.

It certain quarters it has been the practice to decry the testing of building stones on the ground that it is unnecessary, since any stone worth employing at all will be strong enough for the purpose; and as to weathering, since that may be regarded as "an act of God," it is no use troubling about it. Some, while admitting that tests may be desirable, have no faith in the methods usually employed, and suggest rather an examination of the rocks in the field and in the quarries. There is something to be said for this point of view,

but the fact remains that the behaviour of cut and dressed stone in a town building is very different from that of the rock in its native habitat. Besides, occasions will continue to arise when some sort of test is required to confirm an architect in his opinion and give him peace of mind; for none is so timid as an architect with a new and untried stone.

Except for the purpose of discovering first principles, there is practically no need to test stones that have been long in use and are well known. The quality of the untried stone does require proving. To do this satisfactorily we need sound criteria founded upon knowledge of the properties of stones already used; and we should distinguish between those parts of a structure subjected to the continued influence of moisture and those which are relatively dry.

Prof. Hirschwald has been engaged for many years upon an examination of the weather-resisting properties of German stones, as exhibited in old buildings, and by the application of great ingenuity and patience he has been able to trace the influence of the individual properties of the stone upon its durability. Upon this sound basis of experience he has formulated a very thoroughgoing scheme of stone-testing which, while it aims mainly at determining the degree of weather-proofness, at the same time embraces all the tests necessary for the estimation of mechanical strength.

The method used by Prof. Hirschwald is to range a large number of stones obtained from buildings into about nine grades of quality, according to their present condition, the age of the structure being taken into account. He has then examined their petrological characters, porosity, degree of softening in water, resistance to frost, and their mechanical properties both before and after soaking and freezing. By correlating the observed results with the quality scale, and eliminating the effect first of one character and then of another, he is able to state numerically the value of any one of the structural and mineralogical peculiarities of the stone.

As the result of this laborious preliminary work we have before us a means of estimating the probable weatherproofness of a stone within closer limits and with greater certainty than has hitherto been possible.

Prof. Hirschwald's earlier book, "Die Prüfung der natürlichen Bausteine auf ihre Wetterbeständigkeit," published in 1908, was out of print in the following year. The present work is practically a new and revised edition of the earlier one. Its division into two volumes of smaller size, of which vol. i. has appeared, is a great gain to the comfort of the reader. To save expense, some of the larger plates of the earlier single volume are discarded in favour of figures in the text without any disadvantage. The work has been improved by the addition of process blocks illustrating the apparatus actually employed at the Charlottenburg laboratories, also by a fuller consideration of the tests for determining resistance to pressure, bending, shearing, and abrasion. As before, it is a storehouse of interesting numerical data concerning the properties of stone.

OUR BOOKSHELF.

A Guide to the Fossil Invertebrate Animals in the Department of Geology and Palaeontology in the British Museum (Natural History), Cromwell Road, London, S.W. Second edition. Pp. x+185+7 plates. (London: Printed by Order of the Trustees, 1911.) Price 1s.

THE second edition of Dr. F. A. Bather's guide will be even more useful than the first. It serves the student, who may never enter the British Museum galleries, as an introduction to invertebrate palæontology, since the structure and habits of each class of animals are described, before the fossil remains are dealt with. The introductions to Trilobita and Cephalopoda may be specially mentioned. The interesting discovery of the dimorphism and double mode of reproduction of many foraminifera is stated on p. 24, with particular reference to the Nummulites. Dibunophyllum is assigned "stratigraphical importance" on p. 54. A new drawing of the under surface of *Eurypterus Fischeri* appears on p. 87. We note that the class Arachnida, including the Merostomata, intervenes between the trilobites and the Crustacea. The Crustacea receive more attention than is usually given to them; the interest of the beginner in palæontology often falls off when he has mastered the structure of the trilobites. Crabs and lobsters then appear to him altogether trivial; Dr. Bather, however (p. 100), attracts us happily to the primitive Dromiacea, and thence to the evolution of the crabs that are now familiar to us.

The Brachiopoda follow the Arthropoda, and we finally pass to the Mollusca, the Cephalopoda being allowed thirty well-illustrated pages. The illustrations throughout are excellent, and cover fields of structure usually reserved for large and expensive textbooks.

The language employed is so accurate that one does not at first realise how much matter has been compressed into a single sentence. The comparison between the structure of a starfish and that of a sea-urchin (pp. 68 and 71) may be taken as an example. The term "flagellated chamber" on p. 29 seems a case where compression leads to inexactitude. On p. 74 we do not think that the author means to say that "some urchins seem to have taken to moving generally

in a single direction"; we gather that, like the regular forms, they moved in various directions, but with a selected part of the test directed forward. G. A. J. C.

The Identification of Organic Compounds. By Dr. G. B. Neave and Dr. I. M. Heilbron. Pp. viii + 103. (London: Constable and Co., Ltd., 1911.) Price 4*s.* net.

THE identification of organic substances—a matter of obvious interest and importance—stands in a somewhat different category from that of inorganic compounds, for we are not concerned here so much with the elementary constituents of the substance as with the recognition of the compound itself. Moreover, we are restricted in our method of treatment by its nature; energetic reagents or high temperatures cannot be used for fear of destroying it. This fact and the absence of any detailed method of procedure (it is impossible to compile a compact analytical table) lend to the process much of the educational value of an original investigation.

The change in the scheme of practical examinations introduced by the Board of Education and other examining bodies in recent years has fortunately directed attention to the advantages of this kind of practical organic chemistry as contrasted with the old system of "spotting," by the aid of a few hasty and generally meaningless tests, one or two out of a short list of organic compounds enumerated in the syllabus. It has also led to the appearance of a number of little laboratory guide-books for the use of students. The volume under review is one of the latest of these publications, and, it may be added, fulfils its purpose, which is to prepare candidates for the intermediate and final examinations of the Institute of Chemistry. It is divided into sections, describing in more or less detail the way in which the substance should be examined; first the tests for the elements are given, then those for ascertaining to which group the substance belongs.

The physical constants and chemical properties of a very large number of common, and also of some uncommon, substances are given, so that the student need lose no time in hunting for them in a reference book. In short, the road which leads him to his goal is so well furnished with guide-posts that with a little intelligence and care he need never lose his way. From this point of view the book is entirely satisfactory; it is clearly written, and the information is sound and explicit. J. B. C.

East London. By G. F. Bosworth. Pp. x + 256. *The Isle of Man.* By the Rev. J. Quine. Pp. x + 178. *Carnarvonshire.* By Prof. J. E. Lloyd. Pp. xi + 171. *Monmouthshire.* By H. A. Evans. Pp. x + 183. (Cambridge County Geographies.) (Cambridge: University Press, 1911.)

THESE additions to the series of County Geographies deal with four areas almost as widely unlike as could be found among British counties. East London, a somewhat artificial division of the accidentally-delimited County of London, affords little scope for real geographic treatment, and even that little has not been fully taken advantage of by Mr. Bosworth. Why the Thames has always been so important in trade, and why the nucleus of London was situated just where it is, are two questions not so fully answered as they might have been, and it is disappointing to be told in a geographical work that "it was mainly owing to them [the craft-guilds] that London became the first industrial and commercial city in the kingdom." As a topographical and historical description of the City and the county east thereof, the work is well done, and can be recommended to all interested in its area. We have not noticed any of the common errors of works on London, but the statement that London stone "was very greatly esteemed" in the Middle Ages is rather cryptic, and portions of the first paragraph in chapter 11 ought to have been placed within quotation-marks.

The only feature in common between London and the Isle of Man is the diminishing population, but how different is the meaning of the statistics in the two cases! If the latter is a county (which we doubt), it is the most natural of all counties. With a geographical unity, plain physical subdivisions, and an independent history, it has given Canon Quine the opportunity for producing a most interesting book. It is to be regretted that the account of the geology in the text refers to the Old Red Sandstone rocks that in the map are placed as Basal Carboniferous, and that Fig. 3 in the statistical diagrams is not adequately explained.

Monmouthshire, with its marked contrasts of industrial west and agricultural east, and Carnarvonshire, the county of Snowdon and slate, are both admirably dealt with by Mr. Evans and Prof. Lloyd respectively.

Moths of the Months and How to Identify Them. By the Rev. S. N. Sedgwick. Pp. 60. (London: Charles H. Kelly, 25–35 City Road, 1912.) Price 1*s.* net.

THIS little book is uniform with previous books by the same author on Birds' Eggs and Nests and Butterflies, and on Wild Flowers by Hilderic Friend. It will be very useful to young entomologists as an introduction to larger works on the subject, for the preliminary instructions relating to collecting, observing, breeding, &c., are very complete; and though the numerous figures are not all equally good, the greater part are easily recognisable. Remarks on classification are confined to brief notices of the principal groups and families; species are referred to by their English names and the Latin name of each, generic names being omitted. Under each month a selection of the most representative Sphinges, Bombyces, Noctuids, and Geometræ are enumerated, the Micro-Lepidoptera being thus excluded. One hundred and twenty-nine species are described and figured.

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.]*

Discovery of Fossils in the Chert and Black Shale Series at Aberfoyle.

THE greatest riddle in Scottish geology at the present day is that of the true stratigraphical position of the series of metamorphic rocks in the central, southern, and eastern Highlands which Sir Archibald Geikie has included under the term "Dalradian." These rocks have been mapped and to a large extent described by officers of the Geological Survey, and have been much discussed by others, but no agreement has been reached as to the structure of the area or the relations of various members of the series to each other. Even the question as to which is the top and which the bottom of the succession of deposits is still unsettled. One great difficulty met with is the lack of organic remains in the altered sediments. But fossils have recently been discovered in the group of rocks which Prof. J. W. Gregory conveniently terms the "Boundary Fault Series." This series has been traced as an interrupted belt along the southern border of the Highlands from Stonehaven on the east to the island of Arran on the west, and it is prolonged into Ireland. The best exposures in Scotland occur in Arran, in the district between Loch Lomond and Callander, and in Forfarshire and Kincardineshire. They consist of cherts or jaspers and shales, sometimes associated with limestones and with some peculiar igneous rocks.

The rocks of this belt often present a close resemblance to some of the Arenig rocks in the Southern Uplands of Scotland, and were provisionally correlated with the latter by Messrs. Peach and Horne in their volume on "The Silurian Rocks of Britain," vol. i., Scotland (Mem. Geol. Surv., 1899). Bodies recognised as remains of Radiolaria were detected by Dr. Peach in the cherts near Gualann, east of Loch Lomond.

The belt has been marked on the Geological Survey maps as doubtfully Lower Silurian. The exposures which occur along the Highland boundary in Forfarshire and Kincardineshire have been described by Mr. G. Barrow (Quart. Journ. Geol. Soc., vol. lvii., 1901), and there the "Jasper and Green-rock Series" is associated with a younger group of argillaceous and calcareous strata termed the "Margie Series."

More recently Dr. R. Campbell has recorded the discovery of fossils in the black shales, jaspers, and cherts intercalated in a series of crushed green igneous rocks north of Stonehaven, which points to the probability that the sediments are of Upper Cambrian age (*Geol. Mag.*, N.S., Decade V., vol. viii., 1911).

After spending many months in searching the black shales and cherts in the neighbourhood of Aberfoyle, I have at last been fortunate in finding a number of fossils in those beds. These have been submitted to Dr. Peach for determination. He has recognised the casts of hingeless brachiopods, some of which appear to be referable to the genus Lingulella and some to the genus Obolus; the collection also includes the jaw of an annelid. The evidence, so far as it goes, which is afforded by these fossils as to the age of the Boundary Fault Series tends to confirm the view that it is Upper Cambrian, or at any rate Lower Palæozoic.

Further search is being made for fossils in the belt between Loch Lomond and Callander, and a fuller communication will be made at the British Association meetings in Dundee in September.

THOMAS J. JEHU.

The University, St. Andrews.

The Protection of Nature in South Bavaria.

THERE appeared in NATURE of April 27, 1911 (vol. lxxxvi., p. 286), a very interesting paper by Mr. A. E. Crawley, "Germany and the Protection of Nature."

It will perhaps interest readers of NATURE to have a few particulars about this scheme of protection from one of the best centres, namely, in the health resort of Berchtesgaden, in the Bavarian Alps, the shooting residence of the Prince Regent Luitpold of Bavaria.

We find there different connected systems of protection. The Government has ordered that all wild plants of commerce, as well as rare specimens, are to be protected. Without special permission nobody may remove the following plants:—*Leontopodium alpinum*, *Rhododendron hirsutum*, *R. intermedium*, *R. ferrugineum*, *Rhodothamnus chamaecistus*, *Loiseleuria procumbens*, *Helleborus niger*, *Cypripedilum calceolus*, *Primula auricula*, *Gentiana pannonica*, *G. purpurea*, *Nigritella suaveolens*, *Orchis ustulata*, *Chamaeorchis alpina*, *Ophrys muscifera*, *Gentiana acaulis*, *Lilium martagon*, *Platanthera bifolia*, *Scolopendrium officinarum*, *Cyclamen europaeum*, *Achillea clavennae*, *Imperatoria ostruthium*, *Nymphaea alba*, *Ilex aquifolium*, *Taxus baccata*, *Pinus cembra*, &c.

When we examine the names of these plants, we see that many of them are remarkable for a limestone flora. Tables with coloured flowers show the exact form of specimen under consideration, and the waiting-rooms in railway stations, as well as the *foyers* in the big hotels, have excellently painted illustrations of the protected plants.

This system, however, is not sufficient alone; large mountain areas are also protected, and are called "Pflanzen-Schonbezirk." This applies to nearly all the great mountains which border the Königsee near Berchtesgaden, the pearl of the German lakes. No one has the right to collect here any plant, except a few men of science with special permission of the Government. Some rare butterflies, as *Parnassius Apollo*, var. *Bartholomaeus* (the only known locality for this variety is the surroundings by the old shooting residence "St. Bartholomä" on the Königsee), are also protected. Infringement of these rules involves a fine up to 7*l.* 10*s.*, or imprisonment. The protection is under the control of the Forest Department, and is left to the cooperation of the public.

In the district of Berchtesgaden is also the well-known health resort Bath Reichenhall. Here is an Alpine garden at an altitude of 400 metres for the limestone flora of the Bavarian Alps.

C. C. HOSSEUS.

A Simple Eclipse Experiment.

THE phenomena of an eclipse may be well reproduced by a simple experiment made as follows:—

Make a smooth round hole, about one-eighth of an inch in diameter, in a visiting card or thin sheet of metal, and allow the rays from the sun or other source of light to pass through the hole and fall on

a sheet of white paper held parallel to the card and at right angles to the rays. Take a pin with a round head of black glass, of a diameter very little less than the hole in the card, and, holding it about an inch from the card, pass it very slowly across the hole. The bright image of the sun will then pass through all the stages of an eclipse, commencing with the "first contact" as the head of the pin first emerges into the rays at the edge of the circular disc of light, and forming all the successive crescent phases until it lies co-axially with the hole in the card, when the appearance of an "annular eclipse" is reproduced. Further movement of the pin in the same direction will reproduce the phases which occur after totality has been reached, giving, finally, the phase of "last contact."

If the bright annular ring of light be examined carefully when the "eclipse" is at its maximum, it will be seen to be free of blurs or blemishes if the edges of the hole and the head of the pin are both clean and free from projecting particles. Now coat the head of the pin with fine dust, such as flour or the pollen of a flower—even fine tobacco ash will suffice—and repeat all the above operations. No roughness, or only a very little, will be seen on the dark image of the "moon"—the pin's head—until the annular stage is reached, when quite suddenly there will appear black spots and streaks in the bright ring of light, giving one the impression that "Baily's beads" have been produced. Whatever may be the true cause of this latter phenomenon during an annular eclipse of the sun, such as was witnessed on April 17 last at some places, the effect in the experiment above cited may be produced in one of three ways: first, by roughening the surface of the pin's head; secondly, by dust on the edges of the hole; thirdly, by both the causes stated in the first and second cases acting simultaneously.

W. G. ROYAL-DAWSON.

17 Pembridge Gardens, W., May 27.

Solar Halos on May 17.

THE set of halos described by your correspondent (NATURE, May 30) was also seen in London at the same hour. The inner one had a radius of about 22°, measured by the rough method of holding a stick at arm's length, and the outer one, of which only 60° or 70° were visible on the east, of approximately twice this angle.

Again on May 19 the inner halo was seen, and on May 27 both inner and outer, at approximately the same hour. To meteorologists it may be of interest to note that after none of these three dates did bad weather follow, as is usually expected.

The above values (22° and 46°) for the radii of the two halos are in accordance with the accepted explanation that they are due to refraction through ice-crystals, these being the angles of minimum deviation through prisms of 60° and 90° respectively, the refractive index of ice being taken as 1·31. About one point of the explanation of the text-books I should like to be allowed to ask a question. The tangent arc at the vertex of the halo, the mock-suns on the horizontal line through the sun, and the sun-pillar are said to be due to particular orientations of the ice-crystals being preponderant, that of laminate crystals with their axes horizontal and that of needles with their axes vertical. Perhaps someone that knows will be good enough to say whether these are possible positions of equilibrium of such bodies falling through air.

C. O. BARTRUM.

32 Willoughby Road, Hampstead, May 30.

Earthquake of May 23.

THE recent earthquake, reported as severe in Burmah, has left its record on our Milne seismograph by a displacement of the boom nearly as great as on January 3, 1911. On that date all the three needles of the magnetograph were shaken by the earth wave, and notably that of the horizontal force, of bifilar suspension. On the recent occasion of May 23 we find no indication of any mechanical disturbance of the needles. In the former waves the vertical movements must have been much more pronounced than on May 23.

The first tremors arrived here on May 23 at 2h. 36.6m. a.m., thirty-six minutes before the greatest swing of the boom, and this interval indicates on Milne's curve a distance of 56°—considerably short of Burmah. May it be that this was the trigger to start a stronger movement nearer to us, itself too weak to leave the mark of its first preliminaries on our films? This would be an illustration of the secondary earthquakes referred to by Milne in his Sixteenth Report of Seismological Investigations, p. 3 (from the British Association for the Advancement of Science, Portsmouth, 1911).

W. SIDGREAVES.

Stonyhurst College Observatory, May 28.

Anatomy of the Bee's Sting.

DURING a recent inquiry into the existing knowledge of the chemistry of bee poison, I examined also the anatomy of the bee's sting, a subject to which I venture to direct attention. It is stated, and the evidence seems to be undeniable, that the sting of the worker bee is the insect's ovipositor metamorphosed into an efficient weapon of attack. On the basis of the principles of evolution, it would be said that the conditions producing the specialised activities of the worker bee required also the change indicated. By inference, obviously, one must turn to the queen bee, whose existence is justified solely by her egg-laying capacities, and who may have been specialised in this direction—an opposite one to that of the worker. But here, too, is found the same metamorphosis to an almost equal extent, so that it would seem, considering that the genital opening is below the base of the sting (itself the original ovipositor), that stinging was of vastly more importance to the queen bee than egg-laying. But since the queen employs her weapon a few times only during her life, this suggestion falls to the ground. The only other explanation seems to be that at a certain stage in the evolutionary development of insects the ovipositor underwent metamorphosis before bees and their specialism came into being as such, and that it persisted in this form.

I should be glad, indeed, if those versed in this branch of knowledge would "cast out the devil" of my perplexity.

PERCY E. SPIELMANN.

21 Cadogan Gardens, London, S.W., May 14.

Clouds and Shadows.

THE shadows to which Mr. Cyril Crossland refers in his letter to NATURE of May 30 have straight, fairly well-defined edges, and are therefore certainly cast by the sun itself, which would be still visible to anyone in the high reflecting layer, whether to east or west of the observer. They are certainly not cast by light "reflected from the glowing clouds in the west," as Mr. Crossland thinks. The convergence of these rays towards the *east*, which the present writer has often seen, is purely a perspective

effect. The rays themselves are in reality practically parallel, but seem to converge to east and west just as the parallel track of a straight railway seems to converge in both directions to anyone standing between the rails. The effect in the east soon after sunset is sometimes so striking that anyone might well believe that the sun had set there, were there no other circumstances to judge by.

T. C. PORTER.

Upton, Slough, May 31.

Red Water.

IN connection with the letters on "red water" in NATURE of April 4 and 11, it may be of interest to state that a rusty-red coloration of brine and salt in evaporating pools of sea water is common on this coast.

I remember particularly such pools at Suez and near the Rawaya Salt Lake, in lat. 21° N. In the latter case the salt beds themselves, though also formed by the evaporation of sea water, remain quite pure white.

I have had no opportunity of examining the growth microscopically.

Another cause of red water is the occurrence of shoals of a large protozoan (? radiolarian) in the open sea. These are of sufficient size and density to colour large areas. CYRIL CROSSLAND.

Sudan Government, Red Sea Province, Office of the Marine Biologist, Dongonab, May 5.

Zoological Nomenclature.

THE Zoology Organisation Committee has decided to obtain the opinion of the zoologists of this country on the question of the strict application of the rule of priority as regards zoological nomenclature.

As it is not possible to draw up a complete list of those who are competent to form an opinion on this subject, I should be obliged if you would allow me to say that I shall be glad to send a copy of the voting papers to any British zoologist who will forward to me his name and address before June 30.

SYDNEY J. HICKSON.
(*Hon. Sec. of the Z.O.C.*)

The University, Manchester, June 3.

THE DUNDEE MEETING OF THE BRITISH ASSOCIATION.

AFTER a lapse of little short of fifty years, the British Association is to meet again this autumn in Dundee, on September 4–11, under the presidency of Prof. E. A. Schäfer. The former meeting in 1867 was a distinguished and memorable one, and many of the most eminent men of the time took part in it, among others Sir R. Murchison, Sir Charles Lyell, Sir David Brewster, and Sir William Thomson; Prof. Sharpey was president of anatomy, Sir Samuel Baker of geography, and Mr. Archibald Geikie of geology.

The memory of the 1867 meeting still survives in the town and district, and the citizens of Dundee are anxious, if it be at all possible, to make the forthcoming meeting no less successful. The necessary funds have been subscribed on a scale even more liberal than usual, and the offers of private hospitality from persons in and round the city are very numerous.

While Dundee is a commercial city, and by no means picturesque in itself, its situation is remarkably fine, and the views from the town over the estuary of the Tay, the Fife coast, and to the northward over the Sidlaw Hills, are exceedingly beautiful. In every direction the country affords easy and interesting excursions. Within short walking distance one has moorland and hill country, and not less attractive are the sandy wastes and dunes at the mouth of the river. A little farther one finds, for instance, the bold cliff scenery of the Forfarshire and Kincardine coasts, and all the Perthshire Highlands are within easy reach. Excursions are already arranged to such places as these, and the university town of St. Andrews and the ancient royal burghs of Arbroath and Dunfermline will each receive and entertain a party of visitors. Numerous other excursions are being planned for particular sections, and these will be more particularly described in forthcoming articles. The geologists, for instance, will find reopened for them the famous fossil fish-beds at Dura Den; they will also visit the neighbourhood of Stonehaven, the fossiliferous beds of the Lower Carboniferous in Fife, and will make, after the close of the meeting, a longer excursion to the western Highlands. The botanists will find work of unusual interest among the alpine flora of Clova and Glen Esk, celebrated by the discoveries of George Don. The agriculturists will have an opportunity of visiting some of the best farms in Scotland, and some of the best herds of polled Angus and other Scotch cattle.

The usual handbook of the meeting, now in the press, gives a complete account of the history of the town, its trade and local industries, and the topography and natural history of its neighbourhood. It is accompanied by a geological map containing much new material, and prepared, by the kind permission of the director, under the care of the staff of the Geological Survey in Edinburgh. Another and larger map depicts the flora, or "plant associations," of the adjacent parts of Forfar, Perth, and Fifeshire; it is reproduced from the work of the late Robert Smith, who was the first to introduce into this country this aspect of botanical study. The handbook is further enriched by several articles on distinguished men of science born in the district: for example, on Sir Charles Lyell, by Sir Archibald Geikie; on Robert Brown, by Colonel Prain; on George Don, the botanist, by Dr. Claridge Druce; and on Patrick Matthews, one of Darwin's most important precursors, by Dr. W. T. Calman.

The accommodation provided in the town for the meetings of the Association appears to be excellent. The reception room will be found in the Albert Institute, the principal building in the centre of the town. There, in addition to the main hall, is a suite of large galleries which will be used for conversation and writing rooms. The walls of these will be hung with a loan collection of pictures, which promises to be a very notable feature of the meeting. The great houses of the

neighbourhood are rich in artistic treasures, and the owners of these and many smaller collectors are lending their best pictures liberally. The Raeburns alone will constitute a large and important exhibit, and besides these there will be seen fine and little-known examples of Reynolds, George Jamieson, Allan Ramsay, and many others.

Garden parties or other entertainments are offered by the Earl of Moray at Kinfauns Castle, the Earl of Strathmore at Glamis, the Earl of Camperdown at Camperdown, and by Lord Kinnaird at Rossie Priory.

Lastly, it may be said that the number of distinguished foreign guests promises to be very much larger than at any recent meeting of the Association. It is, doubtless, in compliment to the president of the Association that many foreign physiologists have been invited and have accepted invitations; among others the names may be mentioned of Profs. Leon Asher, Baglioni, Botazzi, Fano, von Frey, Fürth, Fleischman, Gley, Gottlieb, Hamburger, Paul Heger, Kossel, Loewi, Lippmann, Meltzer, Hans Meyer, Gustav Mann, and Pekelharing. Among the foreign geologists, some of the principal names are those of Profs. Charles Barrois, Øyen, Reusch, Lugeon, and Baron Nopsca. But it is neither possible nor necessary to set forth here a longer list of the many eminent scientific men who have accepted the local committee's invitation.

D'ARCY W. THOMPSON.

THE CEYLON PEARL FISHERY.

PART vi. of the Ceylon Marine Biological Reports (dated January, 1912) contains the announcement that the laboratory, which has been maintained by the Ceylon Company of Pearl Fishers, has been closed, as the leasing of the pearl-banks has not proved a commercial success. Mr. T. Southwell, scientific adviser to the company, discusses the causes of this failure. He points out that the uncertain nature of the pearl-fishery has been recognised for several centuries, and that periods of barrenness have succeeded years of plenty. The banks were leased by the company in 1905, and there were successful fisheries for pearl-oysters in 1906 and 1907, since when no fisheries have been held. The banks are reported as being at the present time absolutely barren, due to the rapaciousness of man and his neglect to leave breeding stocks, and due also to the attacks of voracious fish. So thoroughly have the banks been depleted, not only of pearl-oysters but of all molluscs, that during the last two and a half years fewer than half a dozen molluscs have been obtained, in spite of the efforts of divers and the use of the trawl and dredge.

Mr. Southwell holds that, in order that the pearl-fishery may be continuous, it is essential that compact beds of breeding stocks be isolated and protected. Since this was realised, preparations have been made to afford the necessary protection to sufficient breeding stocks when they become available, but unfortunately the opportunity has not yet occurred. Mr. Southwell advocates the formation of a Government marine department, the duty of which shall be the investigation and enhancing of the marine resources of the island. He is confident that a spat-fall will take place at an early date, and, should this occur, only thorough inspection and care and foresight in preserving breeding stocks are required in order to make the banks perennially productive. It is to be hoped that, before this repopulation of the banks occurs, the Ceylon marine laboratory will have been reopened, and that naturalists will be at hand to carry out the recommendations for the fostering of the pearl-fishery which are put forward in this report.

The currents during different seasons of the year have been investigated by Mr. Southwell and Lieut. Kerkham, who have shown that when the south-west monsoon is strong the current sets nearly due east from the pearl-banks off Tuticorin almost directly across to the Ceylon banks. The larvæ of the pearl-oyster are free-swimming in the surface waters of the sea for the first five to seven days of their existence. They then develop shells, fall to the bottom, and become attached there. The writers of the report believe that the distance from the Tuticorin to the Ceylon banks—about 85 miles—can be traversed by the larvæ during the period of their pelagic life, but only when the monsoon is strong. The Tuticorin banks are important, therefore, as being the potential source of spat for the Ceylon banks.

Mr. Southwell has continued the observations on the pearl-inducing worm—a larval tape-worm (*Tetrarhynchus unionifactor*). He thinks it probable that only those larvæ which die in the tissues, and thus set up local irritation, cause the formation of pearls. He considers it practically certain that the larvæ pass directly from the pearl-oysters to the various elasmobranch fishes which devour them (that is, that there is not an intermediate host), but that certain bony fishes, *e.g.* Balistes and Serranus, are subsidiary or parallel hosts.

NOTES.

ON Wednesday, June 26, his Majesty the King will lay the foundation-stone of the National Museum of Wales in Cardiff. It will be remembered that this institution was created by Royal Charter in 1907, Sir Alfred Thomas (now Lord Pontypridd) being the first president, Lord Mostyn vice-president, and Major-General Sir Ivor Herbert treasurer. The preliminary steps of constituting the court of governors and the council took a considerable time, and it was not until the end of 1908 that a director of the museum was appointed. Dr. W. E. Hoyle, formerly head of the Manchester Museum, was selected for the post, and began his duties in March, 1909. The schedule of requirements for the proposed building was next drawn up, and three assessors, Sir Aston Webb, Mr. J. J. Burnet, and Mr. E. T. Hall were appointed,

and an open competition for designs was organised. As a result, Messrs. Smith and Brewer, of Gray's Inn, were successful, and their design was subjected to careful criticism with the aid of such experts as the late Dr. A. B. Meyer, of Dresden, and Dr. F. A. Bather. In September of last year the work of excavation was begun on the site, and the walls are now up to the level of the ground. It is expected that the ceremony will be attended by representatives of the more important museums in the northern hemisphere, including delegates from the American Museum of Natural History and the Metropolitan Museum of New York. The Treasury has promised to contribute half the cost of the building conditionally on the other half being raised by the council. It is confidently hoped that the wealthy men of the Principality will rise to the occasion.

THE death of Mr. Wilbur Wright from typhoid on May 30, at the early age of forty-five, will be deplored by all who are interested in the science or art of aviation. With his brother, Mr. Orville Wright, he shared the distinction of being the first to make successful flights with a motor-propelled aëroplane. This feat was accomplished in 1903, when a distance of 260 yards was covered by dynamic flight. Two years later the brothers Wright had improved their machine to such an extent that they were able to make a flight at Dayton, Ohio, of 24 miles at a speed of 38 miles an hour. Since then the progress of aviation with machines of various types has been very remarkable, and a flight of 462 miles has been made without alighting in about eleven hours. The Wrights commenced their experiments about the year 1900 with gliders, the first machine being a biplane with horizontal rudder in front, and having about 172 square feet of surface. Their longest glide was 622 ft., in October, 1902, at Kitty Hawk, North Carolina. The experience gained with gliders gave the knowledge and confidence required for the successful construction and manipulation of a power-driven machine. Though without technical training, Mr. Wilbur Wright and his brother attacked the problem of flight in a scientific manner, and mastered the few works available upon the subject before constructing a machine of their own. The only exact information they could find as to the resistance of the air to machines driven at different velocities was that obtained by Prof. S. P. Langley, secretary of the Smithsonian Institution. Several years before the Wrights commenced their experiments Langley had successfully flown his model power-driven biplane for a distance of half a mile, which was traversed in one and a half minutes. It is pleasant to remember that when the Langley medal was presented to Wilbur and Orville Wright in 1910, they acknowledged that Langley's belief in the possibility of human flight was "one of the influences that led us to undertake the preliminary investigations that preceded our active work."

PROF. E. RUTHERFORD, F.R.S., has been elected a corresponding member of the Imperial Academy of Sciences in Vienna.

THE annual meeting of the Société helvétique des Sciences naturelles will this year be held at Altdorf on September 9–10.

WE regret that news has just reached us of the death of Mr. J. Bernard Allen at Perth, Western Australia, on March 13. Mr. Allen was lecturer in mathematics and physics at the Technical School in that city, and his death occurred very shortly after his return from a holiday spent in England and Germany.

THE Milan correspondent of *The Daily Chronicle* reports that Prof. Lanfranchi, of the University of Parma, who has been engaged for several years in the study of sleeping sickness, has been infected by the disease in a severe form, and has been taken to the Pasteur Institute in Paris for treatment.

THE well-known phenomenon of the green flash at sunset was observed at Morecambe on May 24 by Mr. J. W. Scholes, of Grimscar, Huddersfield. About one or two seconds after the sun had set, Mr. Scholes noticed some "blue-beads" above the point where the rim had been; these remained visible for two or three seconds, and the green flash was seen when they disappeared.

MR. JAMES MEANS, writing from Boston, U.S.A., urges that methods of visual aërial signalling should not be neglected, as, in the event of war, the enemy may deliberately disturb or prevent communication by wireless telegraphy. For aërial scouting and other purposes Mr. Means suggests that puff-signalling is a simple and trustworthy method. "By this method colouring matter is intermittently injected into the exhaust pipe of the flying-machine motor. From the pipe this is ejected in large and small puffs resembling very black smoke, and these correspond to the dashes and dots of the Morse telegraphic code."

AT the anniversary meeting of the Linnean Society on May 24 the following officers were elected:—*President*, Prof. E. B. Poulton, F.R.S.; *treasurer*, Mr. Horace W. Monckton; *secretaries*, Dr. B. Daydon Jackson, Dr. Otto Stapf, F.R.S., and Prof. G. C. Bourne, F.R.S. Dr. D. H. Scott, the retiring president, delivered his address, devoting the greater part of it to a review of the palæobotanical work of the late Sir Joseph Hooker. The president then addressed Captain C. F. U. Meek, and handed to him the bronze medal of the Crisp award for microscopical science, and a cheque for the balance of the fund, this being the first presentation from the fund founded in 1910 by a donation from Sir Frank Crisp. The president handed to Prof. E. B. Poulton the Linnean medal for transmission to Dr. R. C. L. Perkins, who is abroad.

THE problem of improving the illumination of the debating chamber of the House of Commons appears to have been taken in hand, and, according to a report from the Office of Works, dated May 24, it is proposed to substitute incandescent electric lighting for the present gas lighting. Members on the back benches have been unable to read, the lighting having

been intended rather to allow the Speaker to see the members than to help the latter to read their notes. It does not by any means appear to be beyond the powers of modern illuminating engineering to secure both these ends. The present proposal is to use metallic filament lamps enclosed in holophane globes behind amber-coloured glass to cut off completely all ultra-violet rays. In view of the great opacity of ordinary glass for ultra-violet rays, the amber glass seems unnecessary.

AT the annual meeting of the Verband Deutscher Elektrotechniker in Leipzig, Prof. Gisbert Kapp, as the representative of the British Committee of the International Electrotechnical Commission, is to present to the president of the commission, Prof. Budde (who last year succeeded Elihu Thomson), a picture of Faraday as a mark of the esteem of his English colleagues. The portrait was painted for the occasion by Miss Beatrice Bright, a daughter of Sir Charles Bright, the pioneer in cable telegraphy. Nineteen States are represented in the commission, which has already done good work in settling questions of nomenclature, signs, direction of rotation of vectors, and units for electric and magnetic quantities. The next point to be dealt with is the standardisation of machinery so as to facilitate and regulate the commercial side of electrical engineering.

THE proceedings of the International Radiotelegraphic Convention, at which thirty-five States are represented, were opened on Tuesday by the Postmaster-General at the Institution of Electrical Engineers. The King will receive the delegates at Buckingham Palace on June 10. Great importance is attached to the convention, for there have been extensive developments in wireless telegraphy since the last convention was held in Berlin in 1906. The object of the convention is to consider the amendment of the existing regulations and to bring them up to date. The subjects to be discussed will deal with communication between ship and ship and ship and shore, and various questions which have arisen in connection with the loss of the *Titanic* will come before the delegates.

WE regret to see the announcement of the death, at seventy-four years of age, of M. F. Lecoq de Boisbaudran, corresponding member of the French Academy of Sciences in the section of chemistry, and distinguished by his works on spectroscopy and his discovery of gallium. The Davy medal of the Royal Society was awarded to M. Lecoq de Boisbaudran in 1879 for his discovery of gallium. The metal filled a gap which had previously been pointed out in the periodic series of known elements. Mendeléeff had shown that a metal might probably exist intermediate in its properties between aluminium and iridium before Boisbaudran's laborious spectroscopic and chemical investigation of numerous varieties of zinc blende led him to the discovery and isolation of gallium—the fifth terrestrial element which the spectroscope was instrumental in bringing to light—in 1875.

THE death is announced of Dr. H. de Struve, who from 1871 to 1903 was professor of philosophy at the University of Warsaw. A correspondent of *The Times* states that Dr. de Struve may be claimed as the founder of the present-day school of philosophy in Poland. Among his works are the "Critical Introduction to Philosophy," written in 1896, of which the third edition appeared in 1903; "History of Philosophy in Poland," written in 1900; and "Herbert Spencer and his System of Philosophy," written in 1904. In addition to his many academical distinctions, Dr. de Struve was for twelve years Dean of the Evangelical Hospital and president of the Society for the Propagation of Scientific Research. He was a member of the Grand Council of the Russian Empire, and had received the Orders of St. Anne, St. Wladimir, and St. Stanislas (First Class).

WE regret to see the announcement of the death, on June 2, at eighty-three years of age, of Mr. B. J. Austin, who was a pioneer of scientific teaching in Reading. He was the first science teacher appointed by the Reading Science and Art Committee in 1871, and upon the foundation of University College, Reading, in 1892, he became lecturer in physiology and hygiene. In 1907 the college conferred upon Mr. Austin the title of Emeritus Professor of Botany, and last year he was made an associate of the college, *honoris causâ*. Among his many pupils may be mentioned Prof. E. B. Poulton, F.R.S., who writes of him as follows:—"I well remember, when a boy attending the science and art classes at Reading forty years ago, the excellent teaching and inspiring personality of B. J. Austin, who lectured on botany and animal physiology. Even earlier than this I had gone to him for advice in starting a freshwater aquarium, and had been received with the kindest help and sympathy, going home with a piece of the Vallisneria growing in his own bell-jar. Austin's enthusiasm for nature did not show itself in any impetuous rush of thoughts too full and rapid to admit of arrangement. He stands in memory sharply contrasted with Rolleston, under whose influence I first came at about the same period of my life. The orderly sequence of Austin's clear, crisp sentences seemed one with his exquisitely formed handwriting. There was all the charm of surprise about his personality. Self-contained and perfectly balanced, it was not one which we should expect to reveal and convey, as it did, a deep and absorbing interest in natural history. He has passed away full of years, honoured in the native town where he strove so long and so successfully, happy in the twenty years of rapid development which followed the foundation of University College, Reading, a centre of intellectual life which he was among the first to welcome and to aid."

THE annual exhibition of the Society of Colour Photographers, although small, is always worth a visit by any who are interested in the subject. It is open during the present week at 24 Wellington Street, Strand. Among the screen-plate colour photographs, autochromes still hold their own, and a frame of examples contributed by Messrs. Lumière and Jougla, besides those of other exhibitors, show what excellent results they yield. The new colour

plate of the Paget Prize Plate Co., though scarcely past the experimental stage of production, is present in several examples shown by the makers. The character and method of production of this colour screen is clearly demonstrated by enlargements of it in its various stages. The colour patches are squares regularly disposed, the dyes being absorbed into a single collodion film. This gives the maximum of transparency, and the possibility of using the screen in contact with a separate plate, instead of coating the screen itself with the emulsion. Messrs. Julius and Ernest Rheinberg show their new "micro-spectra camera" and colour photographs produced by it. Here there are no dyes; the object is focussed on to a grating, and a prism of low angle gives a series of spectra which furnish the colour elements. Prints on paper by the bleaching-out method on the new "Uto" paper, and many other interesting pictures and apparatus are on view.

A LARGE and representative committee, with Lord St. Levan as president, has issued an invitation to the members of council and officers of a number of scientific and technical societies to visit Cornwall on July 16–20; the honorary secretary of the committee in London is Mr. G. T. Holloway, 9–13 Emmett Street, Limehouse, E. The number of visitors will be limited to a hundred, and it will include members of the Chemical Society, Institute of Metals, Institution of Civil Engineers, Institution of Electrical Engineers, Institution of Mechanical Engineers, Institution of Mining and Metallurgy, Iron and Steel Institute, and the Society of Chemical Industry. The Royal Society cannot be officially represented, as its 250th anniversary meeting will be held during the same week; and only a few geologists will be present, as the geological societies will be invited to a special meeting two years hence to celebrate the centenary of the Royal Cornwall Geological Society. The programme includes visits to tin mines, dressing floors, china clay, engineering and other works, and places of interest to the geologist, together with certain other functions of less scientific or technical importance, but of a more social nature. Among these may be mentioned a visit to St. Michael's Mount by invitation of Lord St. Levan, and to the Royal Institution of Cornwall at Truro and the Royal Geological Society of Cornwall at Penzance. Cornwall has reason to be proud of its societies. The Royal Cornwall Geological Society was founded in 1814, the Royal Institution of Cornwall in 1818, and the Royal Cornwall Polytechnic Society—for which the word "polytechnic" is said to have been first coined—in 1833. The work which these societies have done in the cause of education, and especially of mining and metallurgical education, and for geology and mineralogy, is well known, and the hospitality which Cornwall is now extending to representatives of other societies will be highly appreciated.

MR. R. KIRKPATRICK, who has been engaged in dredging off Porto Santo Island, mainly with the view of working out the development of *Merlia normani*, writes to say that this organism, which he had described as a siliceous sponge with a supplementary calcareous skeleton, has proved to be of a double nature, and consists of a siliceous sponge and an alga living in intimate association. The sponge has already been called *Noronha scalariformis*, Kirkp., and the name *Merlia normani*, Kirkp., represents the alga. The discovery that Astrosclera was a combination of sponge and alga rendered it probable that Merlia likewise would prove to be a double organism. The investigation of living specimens of Merlia revealed the existence of remarkable phenomena, of which Mr. Kirkpatrick hopes shortly to publish an account with illustrations.

DR. N. ANNANDALE, of the Indian Museum, Calcutta, writes to point out that, contrary to the conclusion arrived at by "H. H. H." in a letter to NATURE of April 18, he does not state in his volume in The Fauna of British India series that winter is the driest time of year all over India. The sentence to which "H. H. H." refers commences:—"In Bengal, however," and the paragraph in which the said sentence occurs includes a statement that the phenomena with which it deals have been little studied in most parts of India.

THE rainfall for May was generally below the average over the British Isles, but the month was much less dry than April. At Greenwich the total rainfall for May was 1·31 in., which is 0·61 in. less than the average, and the aggregate for the two months, April and May, was 38 per cent. of the average. The only years with a smaller rainfall in April and May at Greenwich in the last seventy years are 1844 with 0·65 in., 1870 with 0·75 in., and 1896 with 0·81 in. The mean temperature for May at Greenwich was 57·5°, which is 3·7° warmer than the average. This is the thirteenth consecutive month at Greenwich with the mean temperature in excess of the average. There were thirteen days with the shade temperature 70° or above, and on May 11 the thermometer registered 83°. There was no frost in the shade during the month. The duration of sunshine in May at Greenwich was 191 hours, which is three hours more than the average of the last thirty years. A summary of the weather for spring as comprised by the thirteen weeks ended June 1, issued by the Meteorological Office, shows that the aggregate rainfall, controlled by the heavy rains of March, was in excess of the average in the north-east and south-west of England, and in the Midland counties and the Channel Islands, whilst in both the south-east and north-west of England the deficiency was only 0·20 in. In the north of Scotland the excess for the thirteen weeks was 2·77 in., where the aggregate measurement was 12·65 in. compared with 3·93 in. in the east of England. The duration of bright sunshine for spring was nowhere very different from the average.

HAND cards, the tools used for carding or combing cotton or linen, the fibres of which, being finer than those of wool, require more delicate teeth or "staples," are still used in parts of France, and are made in Denmark for exportation to the Faroes, Iceland, and Greenland. But since about 1870 they have

been replaced by machines in northern England, and have quite gone out of use. Mr. Ling Roth, in the eleventh Bulletin of the Bankfield Museum, Halifax, has collected much curious information about this obsolete industry. The card, mounted on a handle, consisted of a piece of leather into which teeth formed of bent wire were inserted. The implements used in the manufacture were of a very rude character, and the work was done at exceedingly low rates of wages, some being sent from Halifax to Gloucestershire, where the rate of child labour employed in fixing the teeth was 1600 for a halfpenny. The machines now in use are able to set 400 "staples" in a minute.

THE tenth number of vol. iv. of Records of the Indian Museum is devoted to a supplement to Mr. E. Brunetti's catalogue of Oriental gnats and mosquitoes (Culicidæ), such an addition being rendered necessary by the amount of recent work on the subject. The author takes occasion to protest against the great splitting of genera and species—and likewise the formation of groups regarded as of supergeneric value—which forms such a marked feature in most of this work. He also objects to the practice of allowing the female to be regarded as the type of a species in cases where males and females presumed to be specifically identical have proved distinct; the obvious remedy is for describers to cite one particular specimen as the type of every new species.

IN vol. lxiii. of *Videnskabelige Meddelelser f. d. Nat. For. i Kjøbenhavn*, Dr. J. C. Nielsen gives an account of the larva of a dipterous fly infesting the nestlings, and in some cases also the adults, of South American passerine birds. The parasites, which were collected in Concepcion, Argentina, are found in large tumours situated on the abdomen of the victims, and appear to be in some cases fatal to nestlings, although it is uncertain whether the same result follows in the case of full-fledged birds. Flies have been bred from the maggots, and prove to belong to the species now known as *Mydaea anomala*, which was originally described in 1867. The eggs, or more probably the young maggots, are deposited by the fly on the bird, and the latter subsequently bore their way through the skin of their host by means of an unusually powerful biting apparatus. In Europe the larvæ of the fly *Protocalliphora azurea* are said to infest pipits, sparrows, and swallows, but the only other definitely recorded instances of such parasitism elsewhere are from South America and the West Indies, the parasite in most or all of these cases being probably identical with the one described by Dr. Nielsen.

WE have received from the U.S. Weather Bureau its useful meteorological charts of the great oceans and lakes for June (those for the South Atlantic and South Pacific include the winter season, June to August). The chart for the North Atlantic contains a special note on the safe routes to be taken by vessels trading between northern Europe and Boston or New York to escape drift ice and icebergs in various months. In the month of June shipmasters are cautioned to cross the forty-second meridian of west longitude so far south as latitude 38° 20′ north. We need scarcely mention that the mean limits of ice are also carefully laid down on the monthly charts issued by the English and German departments dealing with maritime meteorology.

OBSERVATIONS of the brightness of the sky have frequently been made for the parts of the sky at some distance from the sun, chiefly with the view of explaining the origin of their blue colour and, in later times, to test the theory which ascribes the colour to the molecular scattering of the incident sunlight. In a recent dissertation, from which he has sent an extract, Dr. H. Diercks, of the Potsdam Observatory, discusses measurements of brightness in the immediate neighbourhood of the sun, made by him at the Physikalisches Institut at Kiel. The measurements were comparative, the brightness of the sun's disc being taken as 100,000. In an example quoted, the values of the brightness in round numbers on a clear day fell from 240 at a distance of 18′ of arc from the sun to 140 at 1°, 70 at 2°, 30 at 3°, 16 at 4°, and 11 at 7°. The principal conclusions derived from the observations are:—(1) the brightness falls off regularly with increasing distance from the sun and in a symmetrical way; (2) it depends upon the altitude of the sun, an increase in altitude corresponding with a decrease in relative brightness; (3) for the same altitude the brightness diminishes as the blue of the sky increases in intensity: the smallest relative values obtained for the brightness near the sun during the course of the observations were about one-fourth of those quoted above; (4) the values of the relative brightness supply a very sensitive criterion of the purity of the atmosphere. The results suggest that the illumination is due either to ice crystals in the upper atmospheric layers or to dust in the lower atmosphere.

MR. DOW'S article on the "Luminous Efficiency of Illuminants" in the current number of *Science Progress* directs attention once more to the very low efficiencies attained, even in the best technical practice, and the vast field that is still open for further improvements. The luminous efficiency of the inverted gas-mantle is about 0·5 per cent., as against 5·4 per cent. for the tungsten filament electric lamp and 13·2 per cent. for the flame arc. But the gas-lamp has the advantage that the total radiation, on which the above percentages are calculated, is paid for at a much lower rate than in the case of electrical energy, and the existing "waste" of 99·5 per cent. leaves a large margin for future economies. It has been calculated that a "white" light covering the whole spectrum could be produced theoretically at the rate of 26 candle-power per watt, or light in the bright yellow-green region at 65 candle-power per watt, as contrasted with the 4–5 candle-power per watt of the best flame-arcs. The wave-length of maximum radiation decreases as the temperature of the source increases; in sunlight, perhaps as a sequel to many generations of natural selection, the maximum agrees with that of visual intensity, but all artificial sources give maxima in the infra-red;

unless, therefore, satisfactory non-continuous spectra can be produced, future progress, like that in the past, must depend largely on increasing the temperature of the light sources.

A SPECIMEN of a new form of pyknometer has been sent for our inspection by Messrs. C. E. Müller, Orme and Co. It consists of two parts, the pyknometer proper and a device for filling it expeditiously. The former is a spindle-shaped tube of about 0·4 cubic cm. capacity, drawn out at each end to a capillary bore. It fits into the filler, a wider tube, by means of a ground-glass joint. The other end of the filler is closed by a rubber bulb or teat. On inserting the free end of the spindle into the liquid to be tested, and pressing the bulb, air is expelled, and on releasing the pressure the liquid fills the spindle tube. Excess of liquid falls into the filler. The full tube is then withdrawn and weighed. Where a high degree of accuracy is not required, and especially when only small quantities of liquid are available, the instrument will often be useful.

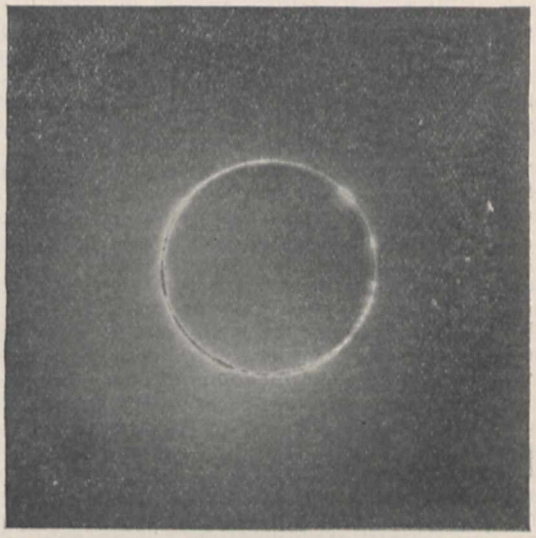
PART VI. of the *Verhandlungen* of the German Physical Society contains an abstract of a dissertation by Dr. K. Eisenmann, of Berlin University, on the distribution of potential in the kathode dark space of a vacuum tube through which an electric current is passing. The kathode used was an aluminium wire of 0·2 millimetre diameter, and the potential was measured by means of an exploring electrode of fine platinum wire projecting 0·2 millimetre out of an enclosing glass tube. The kathode was connected to earth, and the potentials at points from 3 millimetres to 10 centimetres from the kathode for different pressures of the gas and for different currents were measured. If V is the potential in volts and C the current in milliamperes, then $(V-142)^2$ is proportional to $C(C+0{\cdot}65)$, and inversely proportional to the pressure. The author's results lead to the conclusion that for a plane kathode the potential at a distance x from it would be proportional to $1-ae^{-bx}$, where a and b are constants. From this it would follow that only positive charges of electricity are present in the kathode dark space.

THE first of a series of articles on concrete-mixing appears in *The Builder* for May 31. It is generally admitted that hand mixing is less efficient than machine mixing. Under careful superintendence, good concrete can undoubtedly be produced by hand labour, but the nature of the work is monotonous, and the men engaged on it are apt to think little of efficiency. Some specialists make a practice of specifying a larger proportion of cement for all hand-mixed concrete. Careful tests made in the United States show that the strength of concrete mixed by hand may range from about 50 to 90 per cent. of the strength possessed by concrete of the same composition mixed by machine. The attempt to make amends for imperfections in the mixing process by increasing the proportion of cement cannot be successful. An excess of mortar reduces the compressive strength for the reason that mortar is less strong than stone.

OUR ASTRONOMICAL COLUMN.

THE SOLAR ECLIPSE OF APRIL 17.—A number of papers dealing with the recent eclipse of the sun have appeared in the *Comptes rendus*, and in one of them M. Salet, who was at Ovar, reports that no observer questioned by him saw the corona; all the facts considered, he concludes that nowhere along the central line in Portugal was the eclipse actually total.

At Maisons-Laffite, Mr. A. C. and Miss Allen secured several excellent photographs during the various phases. One, which we reproduce here, was taken by Mr. Allen at, or very near, the maximum phase. He used a mirror arranged and mounted to reflect the eclipsed sun into his camera at any moment, and the original image is 0·25 in. in diameter The negative shows, very plainly, a prominence group just to the left of the two smaller beads seen at the top of the disc, and the uncovered parts of the photosphere are shown by the solarised, dark arcs. These prominences are probably the two mentioned as Nos. 8 and 9 by MM. Croze and Demetresco in a paper appearing in the *Comptes rendus* (No. 20). They give the position-angles as 222° and 225·5°, counting from south through west,



north, and east, and the heights as 1/21 and 1/19 of the solar diameter respectively. Their plates also show indications of the lower corona, which they conclude can be photographed and seen even when the broadest section of the luni-solar crescent attains 1/37 of the solar diameter. The fact that the lower corona appears on their plates in the equatorial regions suggests that the corona was of a "minimum" type.

ORIGIN OF THE "EARTH LIGHT."—When from the total brightness of the moonless night sky is deducted that produced by the stars, either directly or by diffusion in the atmosphere, there still remains a quantity of light which has puzzled many observers.

In a paper published in No. 4, vol. xxxv., of the *Astrophysical Journal*, Dr. W. J. Humphreys makes some most interesting suggestions as to the origin and nature of this "earth light." He shows that it is probably due to the bombardment of the outer layers of our atmosphere by extra-terrestrial particles, such as meteor-dust. This bombardment, on reasonable assumptions, may produce enormous temperatures capable of ionising surrounding matter, and the consequent electric discharges might produce a glow analogous to a perpetual aurora. But whatever the

secondary effects, the bombardment can in several ways reasonably account for the observed phenomena connected with the earth light.

THE MINOR PLANET 1911 M.T.—When the minor planet 1911 M.T. was discovered by Dr. Palisa, its direct motion suggested proximity to the earth, which might prove useful in parallax determinations. In No. 4573 of the *Astronomische Nachrichten* Dr. Palisa now gives elements, calculated by Messrs. Haynes and Pitman under Prof. Leuschner, which give the perihelion distance as 1·1273 or 1·1643, and the aphelion distance as 2·8629 or 2·5043; both sets of elements would probably be modified by further investigations, but the former appears to fit better the observations yet compared with it.

THE ROYAL OBSERVATORY, GREENWICH.

THE annual visitation of the Royal Observatory took place on Saturday last, June 1, when the Astronomer Royal presented to the Board of Visitors his report of the work done during the year ended May 10.

Many of the instruments were opened up for inspection, with assistants in charge to explain the many wonderful devices which are an essential part of the equipment of a great observatory of the present day. Visitors were greatly attracted by a new feature, the floating zenith telescope designed by the late Mr. Bryan Cookson, and lent to the observatory by the Cambridge Observatory authorities for a period of seven years. Similar to an ordinary zenith telescope in principle, the V's which carry the vertical telescope are carried by an iron ring floated on mercury, so that, with the two axes properly adjusted, verticality is automatically secured. Observations of pairs of stars by Talcott's method are being made to determine the variation of latitude and the aberration constant, and by combining the results for several years it is hoped to secure a very satisfactory determination of the aberration. This instrument replaces the old reflex zenith tube, which is incapable of giving the accuracy now required.

The fine summer enjoyed last year allowed the meridian observations of stars between 24° and 32° north declination, begun in 1906, to make good progress, but the part of 2h. to 6h. R.A. is yet somewhat under-observed. During the twelve months nearly 14,000 transits were observed with the transit circle, besides the usual observations of nadir and level. From the 1910 observations, using the Pulkowa refractions, 38° 31′ 21·83″ was derived as the value of the colatitude, and the reduction of the observations of the sun gives a correction to the tabular value of the obliquity of the ecliptic of +0·07″. From the observations of the moon's limbs and the crater Mösting A, with the transit circle and altazimuth, the mean error of the moon's tabular place for 1910 was −0·537s. in R.A. and +0·32″ in declination.

An investigation of the large discordance between north polar distances given by altazimuth in reversed positions points to faults in the eye end of the instrument, and this is being replaced by a new part. At the same time, a travelling-wire micrometer is to be introduced for observing R.A. and a printing micrometer for the zenith distances.

More than 700 observations of double stars, mostly pairs showing relative motion, were made with the 28-in. refractor, nearly 300 of the observed pairs being separated by less than 1·0″. The 26-in. refractor, carried with the 30-in. reflector and the 6-in. Franklin-Adams lens on the Thompson equatorial, is being devoted to the determination of the parallaxes of stars in the Greenwich Astrographic Zone, photographs on the same plate being made at intervals of six months of all stars showing large proper motions. For this purpose an attempt was made to secure a better adjustment of the crown and flint components of the objective, to give greater accuracy, and it has been found necessary to order a new cell, carrying necessary adjustments, for the crown lens.

The work, with the 30-in. reflector, of securing photographic standards for the magnitudes of the stars counted on the Franklin-Adams plates, is delayed by the scarcity of nights at Greenwich on which the transparency of the sky is the same at the pole as at a similar altitude in the south. Variations of focus when the mirror was directed to different parts of the sky were also troublesome, but it is hoped to eliminate this trouble by using a subsidiary device for examining visually the focus. Among the interesting exhibits displayed on Saturday was a series of photographs taken with this instrument on October 11, 1911, to locate the new minor planet M.T., believed to be very near to the earth. At first the examination of these plates failed to reveal the object, but later, when further data were received, images believed to be of the planet were found on three plates.

The Franklin-Adams 6-in. lens is used for determining photographic magnitudes of bright stars in the Greenwich zone, all of which can be covered by eighty-four fields; of these, fifty-five have been photographed and forty-one of the plates measured. A 30° prism placed in front of this lens enabled photographs of the spectrum of Nova Geminorum (2) to be taken on several dates. Some of these exhibited on Saturday show excellent definition and great changes in the general nature of the spectrum, although the dispersion is small. The changes of magnitude of the nova were shown by photographs taken with the astrographic equatorial having a coarse wire grating placed in front of the object glass. With a grating made of 1·65 mm. wire, with spaces from centre to centre of 5 mm., the first diffraction images were sensibly round, and differed from the primary image by nearly two magnitudes.

Photographs of the sun were secured on 256 days, as against 182 days in the previous twelve months. Part of this increase was due to a greater amount of bright sunshine received and part due to an arrangement whereby work is commenced at 7 a.m. in the summer. The series of photographs for 1911 is complete except for January 1, on which date no photograph appears to have been taken at any of the four contributing observatories. All the evidence points to the present epoch as one of minimum solar activity, and advantage was taken of the lull to discuss the thirty-eight years' observations now available for determining the position of the sun's axis. The result shows that Carrington's position requires but a very small correction.

Two observers are going from Greenwich to Cruzeiro (lat. 22° 39′ S., long. 44° 58′ W.) to observe the Brazilian eclipse of the sun on October 10. Their equipment will include the Thompson 9-in. coronagraph and a quartz spectrograph especially fitted for recording the extreme ultra-violet part of the chromospheric spectrum.

Magnetic observations were carried out as usual, and showed that in 1911 there were no days of "great" magnetic disturbance. For 1911 the elements determined were:—

Mean declination	...	... 15° 33·0′ W.
,, horizontal force		.. 0·18529 (in C.G.S. units)
,, dip (with 3-in. needles)		66° 52′ 6″

In future, the Royal Observatory is to perform part of the work hitherto done by the Compass Branch of the Hydrographic Department. After 1912 the observatory will prepare the declination charts, and will also collect the data available from land stations; the observations made on board ships will be collected and reduced by the Compass Branch and forwarded to Greenwich for incorporation in the charts. Additional responsibility is placed on the Astronomer Royal in the chronometer department also, and in future permission to submit chronometers and watches for the annual trials must be addressed to him directly.

Some interesting experiments were carried out on the effect of a magnetic field on the rates of chronometers and watches, and the results are soon to be published in the Monthly Notices (R.A.S.).

The chief feature of the meteorology of the twelve months was the breaking of several records, but details regarding these have already appeared in our notes columns.

EIGHTEENTH INTERNATIONAL CONGRESS OF AMERICANISTS.

THERE have been eighteen sessions of the International Congress of Americanists, but this is the first time that a meeting has taken place in the British Isles, though six years ago an enjoyable meeting was held in Quebec. Although some very good work has been done in the past on the archæology of Central America and Peru by several Englishmen, there are at the present day very few students of American ethnology, linguistics, or archæology in this country—indeed, it may be said that the number of those who pay any attention to these subjects is also small, and it is to be hoped that the visit of the congress will do something to kindle an interest in the past and present history of the American aborigines.

The congress was invited to London by the Royal Anthropological Institute, on which body has fallen the duty of making the necessary arrangements. H.R.H. the Duke of Connaught kindly consented to be the patron, the services of our veteran Americanist, Sir Clements R. Markham, were fortunately secured as president, Dr. A. P. Maudslay was chairman of the organising committee, Sir R. Biddulph Martin and the late Mr. J. Gray were the treasurers, and Dr. F. C. A. Sarg and Miss A. C. Breton the secretaries. The chief work of organisation was undertaken by Miss Breton, and the success of the meeting was mainly due to her untiring energy and her personal knowledge of the delegates. Owing to the courtesy of the University of London the meetings were held at the Imperial Institute from May 27 to June 1.

The programme consisted of the usual business meetings, papers, and discussions; Sir Richard and Lady Martin gave a reception on May 28, the president and committee received the congress at the Natural History Museum on May 29, and a dinner was given to the delegates on May 30. A visit was paid to the American collections in the British Museum, there were excursions to Cambridge and Oxford, and arrangements were made for a visit to the Blackmore Museum at Salisbury, and to Stonehenge and other places. A valuable feature of the congress was the exhibition arranged by Dr. Maudslay; it contained a large number of beautiful photographs of monuments investigated by him at Quiriqua, Tikal, Chichen Itza, Palenque, and Copan. Miss Breton showed some of her masterly paintings of pottery and copies of frescoes, those from Acanceh, Yucatan, being of especial value, as the originals are now destroyed. Mrs. Zelia Nuttall exhibited a collection of photographs of documents and maps connected with Sir Francis Drake's last voyage. Mr. J. Cooper Clark lent a number of embroidered cloths from Mexico and Guatemala. Sir Clements Markham and others showed a number of antiquities, stone implements, pottery, and the like. Dr. A. V. Frič had a small ethnological collection from Gran Chaco. A very interesting series of paintings was exhibited by Dr. F. Heger, director of the Vienna Museum, which represent the mixture of races in Mexico; the subject of each picture is a father, mother, and child. The parents belong to different races or mixed breeds, and the progeny generally resemble one parent more than the other; each picture has an explanatory legend, and the whole series constituted a valuable demonstration in miscegenation.

The large number of the papers presented necessitated the holding of simultaneous sections, and the papers were grouped as follows:—

Palæo-anthropology.—Dr. C. Peabody directed attention to the archæological importance of the recent work of T. Volk in the gravels at Trenton, New Jersey. Dr. Ambrosetti exhibited a fossil skull and femur from Argentina; in the discussion it was pointed out that the skull was of the ordinary Indian type, with a slight amount of artificial deformation, the mineralisation was no criterion of age, and the position in which it was found did not prove a high antiquity. Dr. Hrdlička made an admirable report on ancient man in South America, in which he showed that there is no evidence of any extinct race of man that differs from recent man, and that proof is lacking of geological antiquity for man in South as well as in North America; he paid a high tribute to the zeal and honesty of the late Prof. Ameghino, but was unable to accept his conclusions. Miss Breton showed a photograph of an implement of Palæolithic type from the coast of Peru, and the question of a Palæolithic age in America was discussed by Dr. Capitan.

Physical Anthropology.—Dr. J. C. Tello demonstrated by means of lantern-slides the many methods of trephining practised by the ancient Peruvians; Dr. Hrdlička discussed the ethnic nature and probable origin of the American aborigines, in which he supported the generally recognised view of a sole Asiatic origin for them. A paper on Bolivian anthropology was contributed by Dr. Chervin.

Linguistics.—Dr. Waldemar Jochelson stated that the Aleut language is of Eskimo origin. W. Thalbitzer identified four Skræling words in Eirik the Red's saga as Eskimo, from which he inferred that the Eskimo probably peopled parts of Newfoundland in the eleventh century. Dr. F. Boas discussed the morphology and phonetics of the Mexican language. Dr. K. T. Preuss showed that the hitherto unstudied language of the Cora is structurally related to the Nahuatl. Among other contributions was one by Dr. S. A. Lafone Quevedo on the pronominal classification of certain South American Indian languages, and one by Prof. J. F. Oliveira on the language of the Cherentes of Central Brazil, a very primitive people.

A large number of papers dealt with the *Ethnology and Archaeology*, among which may be mentioned Prof. G. G. MacCurdy on shell gorgets from Missouri. Dr. Preuss indicated that thoughts and words are the intrinsically effectual part of the ceremonies and magic arts of the Cora Indians; the leaders of the ceremonies are called "thinkers"—they

practise fasting and abstaining from sleep as a means of attaining to right thoughts and promoting inspiration. Dr. Heger described a collection of objects found in ancient graves of the Diaguite culture in north-west Argentina which prove that the influence of the ancient Peruvian culture penetrated there in the time of the last emperors of the Incas. Dr. K. T. Stoepel recorded his investigations of some remarkable monuments on the Upper Magdalena River which probably antedate the Andaquies. Dr. Capitan demonstrated that the Maya architecture was a copy in stone of wooden constructions. Dr. Seler made several contributions, one of the most interesting being an account of the ruins of Uxmal, and Frau C. Seler described the painted potsherds from Cuicatlan and Teotitlan del Camino. Mr. J. Cooper Clark spoke about, and presented to members of the congress, his charming book "The Story of Eight Deer" in Codex Colombino. Dr. A. C. Simoens da Silva dealt with points of contact of the prehistoric civilisations of Brazil and Argentina with those of the Pacific coast countries.

Ethnology and Archaeology.—Prof. M. H. Saville gave an interesting lecture on archæological researches in the Andean highlands of Ecuador, Dr. Stoepel reported on an expedition to Colombia and Ecuador, and Dr. A. Posnansky discoursed on the ideographs of the Puerta monolith at Tihuanacu. Dr. W. Lehmann discussed in an able manner some Central American calendar problems, and Dr. Boas described the succession of cultures in the valley of Mexico.

General Ethnology.—Dr. Leo Sternberg filled up a gap in Lewis H. Morgan's Turanian-Ganowanian systems from tribes in the north-east of Asia. Dr. Jochelson described his researches in the Aleutian Islands. Dr. K. Sapper gave an interesting account of the daily life of the Ketchi Indians of Guatemala, and Jonkheer L. C. van Panhuys referred to the exploration of Dutch Guiana, and showed that the decrease of the Indians was due to the introduction of malaria by the bush-negroes.

Several papers were presented on *Colonial History*, the most important being Mrs. Zelia Nuttall's account of her discovery of the lost MS. of Cervantes Salazar's history of the conquest of Mexico. Enough has been said to show that a remarkable number of important papers were read which considerably advance our knowledge of the archæology and ethnology of Central and South America. The congress has happily passed beyond the time when speculative papers were offered, and it worthily fulfils its important self-imposed task of scientific research. A great many of the papers were illustrated by beautiful lantern slides, and Dr. Jochelson also showed kinematograph films. The congress was a decided success, and it was a great pleasure to English students to meet so many of their foreign colleagues.

A. C. HADDON.

THE ANNUAL CONFERENCE OF THE ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.

THE sixth annual conference of the above association was held in London during Whitsuntide, commencing Monday, May 27. The president of the association, Dr. J. Clark (the Rector of the Kilmarnock Academy and director of Higher Education for Kilmarnock), in his address discussed at some length the factors which have raised the German nation to its present position in the industrial world. After dwelling upon the extent to which Germany was indebted in the past to the teaching and example of England in commercial matters, he emphasised the important influence which the views and speculations of philosophers such as Fichte have had upon the development of the German nation. As a result of Fichte's "Addresses to the German Nation" published in 1808, "the doctrine of the submission of the individual and of self-sacrifice as a prime necessity for national development became an integral part of the German character, and established that flexibility and responsiveness to State control and official authority that have led to achievements no other nation has yet been able to imitate. . . . Education became not only the privilege of the individual, but a duty to the State in so far that it enhanced his national value. Hence originated that increased enthusiasm for education that caused the country to be described as a 'land of schools,' and prepared the way for immediate development on the technical side when the time was opportune."

Dr. Clark pointed out that we have still to create in the minds of the great majority of the inhabitants of the United Kingdom a genuine belief in the value and possibilities of technical education. Further, much work has yet to be done to convince the general public of the absolute necessity for a thoroughly sound general education as a basis for all higher education. The nation possesses one great advantage over other nations in the strong common sense and resourcefulness of the better type of British workman. "He displays a readiness, an initiative, and a responsibility that form a striking contrast to the lack of self-reliance, distrust in personal judgment, and need for constant direction that is so characteristic even of the superior type of German artisan. . . . When once the British industrial classes raise themselves educationally to the high level of the Germans, there should no longer be any doubt as to our commercial and industrial supremacy."

Papers were read by Mr. E. A. Atkins (Liverpool Technical School) on employers and the technical training of their young workmen, with special reference to a number of important recent developments in this question in the Liverpool district, and by Mr. C. B. Barber (Batley) on secondary education for technical students. Mr. Barber dealt mainly with the urgent necessity for the establishment of a number of "technical-secondary" schools, to supplement the existing "classical" or "literary" secondary schools.

Sir Alfred Keogh, Rector of the Imperial College of Science and Technology, in a paper which was read in his absence, explained the organisation of the Imperial College its aims, and the recent extensions of its work. He advocated a closer relationship between the Imperial College on the one hand, and the London and provincial technical institutions on the other. A marked feature of the discussion which followed was the belief expressed by many speakers in the necessity for the foundation of a separate technical university, consisting of the Imperial College as the central institution, with the principal London and provincial technical schools directly affiliated to it.

During the conference resolutions were passed (*a*) approving of the principles underlying Circular 776 of the Board of Education in so far as they encouraged the free development of the "grouped course" system and gave to technical institutions opportunities to conduct their own examinations; (*b*) deprecating the proposed abolition of the "external" degrees of the London University; (*c*) urging the necessity for the increased provision of scholarships (with adequate maintenance allowances) for technical students.

THE CRYSTALLISATION OF METALS.[1]

THE crystalline characters of metals have been much less completely studied than those of non-metallic minerals and artificial salts, owing in large part to the infrequency of occurrence of regular and well-defined crystals amongst metals. Masses of metal are now known to be entirely crystalline, but special means are necessary in order to reveal their structure. In a few cases, notably that of bismuth, good results are obtained by pouring off the still liquid portion of a partly solidified mass of metal, when characteristic striated crystals of bismuth, recalling the Greek "key" pattern, result. Crystals are also obtained in relief on the surface of ingots cooled in contact with the air, tin, aluminium, and silver giving good results in this way. If the solidifying metal is spread out in a thin layer, the structure in relief may be developed in quite a remarkable degree, as when sheets of steel are dipped in molten zinc in the preparation of "galvanised" iron. The crystals (Fig. 1) closely resemble those of frost figures on glass. Crystals of steel up to 15 in. in length are occasionally found in the cavity or "pipe" of large ingots, and these have a characteristic form—that of closely packed, spiky branches arranged at right angles to a main stem.

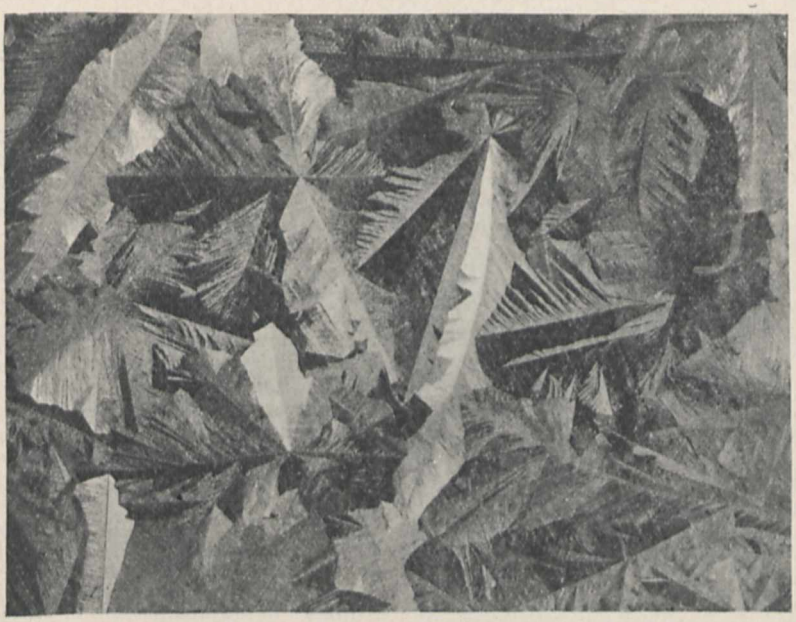


FIG. 1.—Surface of galvanised iron.

The internal dendritic structure of a solid mass of crystalline metal is most readily revealed in the case of an alloy. By suitable etching, the primary crystallites may be brought into contrast with the material subsequently deposited. The arrangement of the axes of such crystal skeletons is not readily followed by the examination of the usual plane sections, and a better representation of the arrangement of the parts in space is obtained by adopting the biological method of serial sections. A specimen is so ground as to present two accurately parallel faces, and is then placed, after etching, on the stage of the microscope in a special holder which permits the observer to bring the same area repeatedly before the objective. A suitable crystallite, having been selected, is photographed, and a thin layer is then removed from the surface by grinding and polishing. After again etching, the thickness is again measured, and a second photograph is taken. After several repetitions of this process the photographs, which represent plane parallel sections of the specimen, may be used for the reconstruction of the crystallite in plastic material. In the specimen of phosphor-copper shown to the Society, fourteen such layers were removed, the average thickness of each layer being 0·014 mm.

A marked feature of most metallic crystallites is the rounded termination of their axes. This rounding can only be attributed to the effects of surface tension at the moment of solidification. Intermetallic compounds are frequently less rounded, and less disposed to assume dendritic forms, than pure metals.

In the varied patterns of eutectic alloys it is sometimes difficult to recognise any relation to crystallisation, and it is evident that surface-tension plays an essential part. In the copper-antimony alloy shown in Fig. 2, however, it is seen that the minute antimony crystals of the eutectic are all in parallel orientation, and that the direction of their principal axes is the same as that of the neighbouring large crystallite. The violet copper antimonide forms a mere filling material, occupying the intervening spaces.

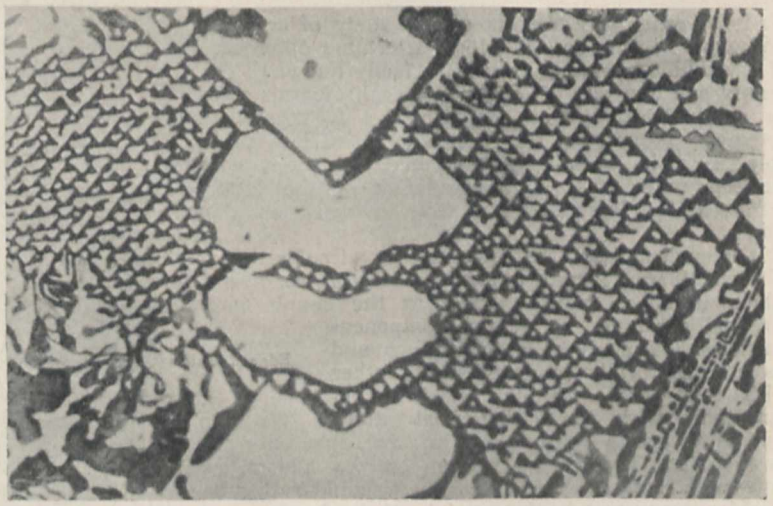


FIG. 2.—Eutectic of antimony and copper.

[1] Abstract of a paper read before the Royal Philosophical Society of Glasgow on November 29, 1911, by Dr. Cecil H. Desch.

Many eutectics take the form of masses presenting the appearance of single crystals, until found under a sufficiently high magnification to possess a duplex structure. Such masses have been termed by Benedicks "colonies," and are well seen in Swedish white pig iron. Fig. 3 represents portions of three such colonies in phosphor-copper, from which it is seen that each colony is in reality a spherulitic intergrowth of two constituents.

It may be said that the study of the formation and structure of crystallites and eutectics begins where geometrical crystallography leaves off. The labours of crystallographers have succeeded in bringing the geometrical branch of their science to a condition of remarkable perfection, but far less progress has been made in other departments of the study of crystals. For example, the causes which determine differences of crystalline habit are very imperfectly known. The beauty and diversity of form of natural minerals owes as much to differences of habit as to crystalline symmetry proper, but the former condition has, probably from its seemingly capricious character, contrasting with the severe regularity of the latter, attracted far less attention from workers on this subject.

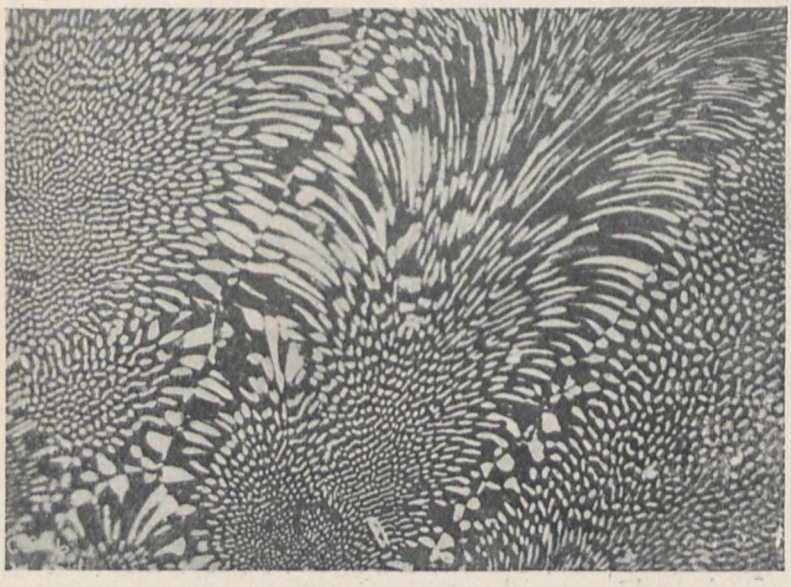


FIG. 3.—Eutectic colonies in phosphor copper.

It is evident, also, that a complete molecular theory of crystals must take into account the conditions which influence habit as well as the simple geometrical arrangement of the component particles. The study of crystallites and eutectics naturally connects itself rather with this obscure branch of the subject than with the geometrical study. Whether crystallites are to be regarded, in accordance with the views of some who have written on the subject, as embryonic crystals, or whether they should rather be considered as crystals thwarted in their development by external conditions, their relation to normal crystals is an interesting one, whilst their importance as elements in the structure of metals affords ample justification for their study. The progress of metallography shows us how greatly the purely scientific study of such questions of molecular arrangement may influence technical practice, and the increasing stringency of the demands made on technical metals and alloys calls for a minute investigation of the relations between the crystalline structure and the physical and mechanical properties. The question has therefore both a theoretical and a practical importance, in addition to the fascination possessed by all problems bearing on the form of natural objects, whether organic or inorganic, the study of which constitutes morphology in the widest sense of the word.

SINHALESE IRON AND STEEL OF ANCIENT ORIGIN.[1]

IN this paper some interesting specimens of ancient Sinhalese iron were described. These consist of a chisel from Sigiriya, dating back to the fifth century A.D., a nail from Sigiriya of about the fifth century A.D., and a native billhook, or "Ketta."

From the results of the examination of these specimens it would appear certain that more than a thousand years ago there prevailed a knowledge of the metallurgy of iron. That a knowledge of hardening the cutting edges of tools was possessed is shown by the ancient chisel, which would appear to have its edges cemented and carburised. It would also seem that the crucible process of manufacturing steel has been known in the East for a long period, and that our modern belief that this process originated in Europe is probably not correct. This Indian industry is now almost extinct, owing to the fact that steel can be imported from Europe more cheaply than it can be manufactured locally.

Reference was made to the collection of ancient specimens of iron and steel (1200 to 1800 years old) in the Colombo Museum, which is probably the most complete of its kind in the world, that is, with regard to ancient iron.

Bearing upon this subject of Indian metallurgical knowledge, two papers were mentioned on Indian steel contributed by Mr. J. M. Heath to the Royal

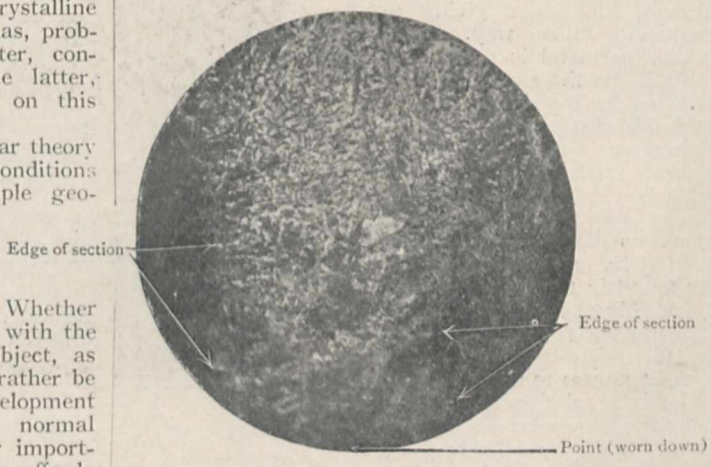


FIG. 1.—Chisel, from point. Longitudinal section. Magnified 80 diameters.

[1] Abstract of a paper read before the Iron and Steel Institute by Sir Robert Hadfield, F.R.S.

Asiatic Society in 1837 and 1839. Mr. Heath expressed the opinion that the great works in stone in Egypt were undoubtedly carried out by means of iron and steel tools, and that there was no evidence to show that any of the nations of antiquity besides the Hindoos were acquainted with the art of making steel. He also stated that the claim of India to a discovery which had exercised more influence upon the arts conducing to civilisation and the manufacturing industry than any other within the whole range of human invention was altogether unquestioned. Sir Robert entirely agreed with Mr. Heath's views, and was led to the conclusion that the methods of making steel practised in Ceylon probably reached that island from India at a very early date.

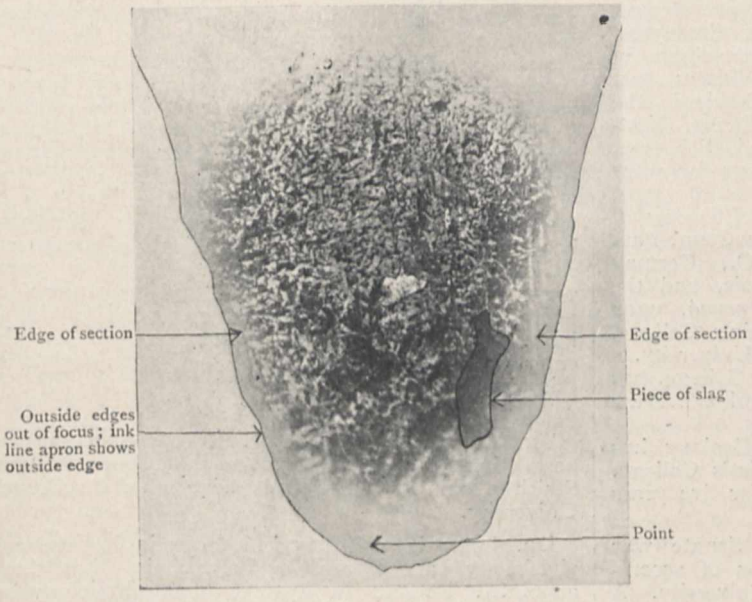


FIG. 2.—Chisel, from point. Longitudinal section. Magnified 80 diameters.

One of the most notable ancient specimens of iron is the famous Pillar of Delhi, which is not the less interesting in view of the fact that the city of Delhi itself, now the capital of our Indian Empire, owed its name to this pillar. It is a solid shaft of wrought iron welded together, the total length being 23 ft. 8 in., the total weight about six tons—a very creditable piece of work for a metallurgist of at least 1600 years ago. There are several important inscriptions on the pillar, which, notwithstanding the long exposure to wind and rain, are still quite clearly cut, showing that very little alteration has taken place in them since they were added on to the pillar. There is also a still longer iron pillar at Dhar, or Dhara, having a total length of no less than 42 ft.

The paper contains particulars of chemical and mechanical tests carried out on the specimens. The accompanying illustrations, Figs. 1 and 2, represent photomicrographs of the point of the ancient chisel. These appear to carry evidence that the chisel has been quenched, for the structure would appear to be in parts martensitic. The paper records, probably for the first time, evidence of the art of cementation having been known 1500 to 2000 years ago, as shown by this specimen. If this is the case, probably such knowledge could be traced back still further.

Figs. 3 and 4 represent the ancient chisel and nail, showing the positions from which the various test-pieces used in the research were taken.

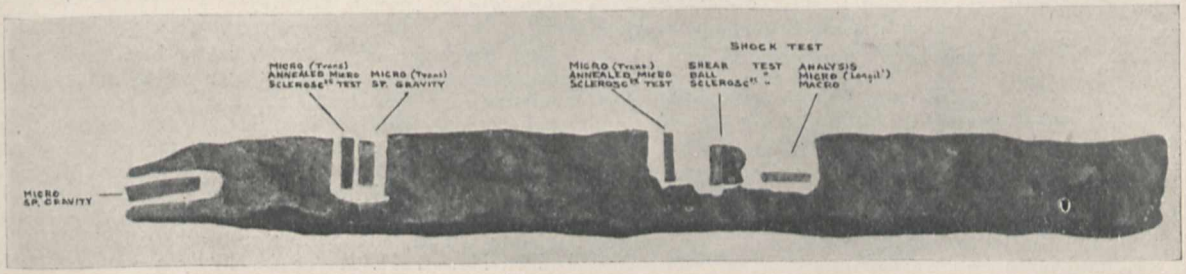


FIG. 3.—Ancient chisel from Sigiriya (5th century A.D.).

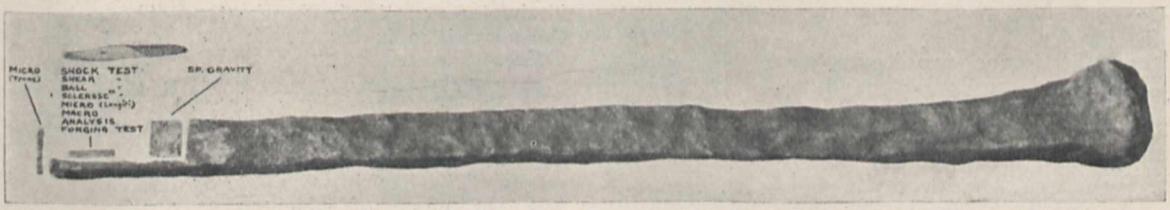


FIG. 4.—Ancient nail, 13½ in. in length, from Sigiriya (5th century A.D.).

It is probable that the evidences set forth in this paper offer a satisfactory explanation as to how the tools used in the preparation of the great works in stone, such as those seen in Egypt, were carried out in past ages.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Board of Agricultural Studies announces that an examination will be held for one "Surveyors' Institution Scholarship" on July 9 to 12. The scholarships are of the value of 80*l.* per annum, and are open only to students of the Surveyors' Institution, who have not commenced residence in the University. Names of intending candidates must be sent before June 30 to Mr. A. Goddard, the Surveyors' Institution, 12 Great George Street, Westminster, S.W., or to Prof. T. B. Wood, School of Agriculture, Cambridge, from whom forms for entry may be obtained.

It is proposed to confer the degree of Doctor of Law, *honoris causâ*, upon his Excellency Count Paul Wolff-Metternich zur Gracht, G.C.V.O., German Ambassador to the Court of St. James's, and the Degree of Doctor of Science, *honoris causâ*, upon Prof. Howard Marsh, Master of Downing College, and professor of human anatomy in the University.

Dr. Donaldson, Master of Magdalene College, has been elected to the office of Vice-Chancellor for the academical year 1912–13.

The Special Board for Biology and Geology has reappointed Dr. Shipley, Master of Christ's College, to be a manager of the Balfour Fund for five years until June 30, 1917.

LONDON.—A special meeting of the Senate was held on May 30 to consider the question of accommodation for the headquarters of the University. A resolution was adopted welcoming the efforts of Lord Haldane and other friends of university education in London to raise funds towards the present and future needs of the University; and it was decided to appoint a special committee of thirteen members, in addition to the Chancellor, Vice-Chancellor, and Chairman of Convocation, "to consider and report on an adequate site for the headquarters of the University and generally on the question of accommodation from the point of view of the University as a whole, with power to communicate with persons and bodies at their discretion." It should be noted that no approval or disapproval has been officially expressed of any particular site.

The University Gazette, dated May 29, reprints the new regulations relating to subsidiary subjects at the B.Sc. honours examinations, the syllabuses in military science which have been adopted for the intermediate and final pass examinations in arts and science for internal students, and the regulations for the Paul Philip Reitlinger prize, which is of the value of 30*l.*, and is to be awarded annually, alternatively for an essay and for medical research work. The annual reports of the Physiological Laboratory and the Brown Institution are also given, together with the agenda paper for the Congress of the Universities of the Empire.

The D.Sc. (economics) degree has been granted to J. F. Unstead, an internal student, for a thesis on wheat cultivation.

The principal, Sir Henry Miers, has been nominated as a member of the Teachers Registration Council.

New regulations have been approved defining the conditions under which the Oxford senior local examination will be accepted as exempting from the matriculation examination. Honours in the first or second class will be required in and after 1913.

OXFORD.—An acceptable gift has just been offered to the University by Mr. Walter Morrison, of Balliol College, in the shape of the sum of 10,000*l.*, to serve as the nucleus of a pension fund for professors. The need for such a fund has long been recognised, and it is hoped that, so good a start having been made, it will not be long before an adequate provision exists for members of the professorial staff who have earned their retirement by long service.

On June 3 the honorary degree of D.Sc. was conferred on Dr. Franz Boas, professor of anthropology in Columbia University, New York, and Mr. A. P. Maudslay, president of the Royal Anthropological Institute of Great Britain and Ireland. Dr. Boas is well known as a scientific explorer in various parts of the Arctic regions and of the North Pacific, and as director of the International School of American Archæology and Ethnology in the city of Mexico. His work on "The Mind of Primitive Man" is of first-rate interest to anthropologists. Mr. Maudslay has earned the gratitude of all students of prehistoric civilisation by his researches, conducted at great personal risk, among the wonderful monuments of primitive culture in Central America, and to him is largely due the success of the arrangements for the entertainment of the Congress of Americanists in this country.

THE Central News New York correspondent reports that by the will of the late Prof. Goldwin Smith a sum of 160,000*l.* is bequeathed to Cornell University.

DR. JANET LANE-CLAYPON, lecturer in hygiene and physiology at Battersea Polytechnic, has been appointed lecturer in hygiene and physiology at King's College for Women (Home Science Department).

A COURSE of three lectures on "The Comparative Anatomy and Functions of the Gas Bladder of Fishes" will be given at University College, Gower Street, W.C., by Dr. W. N. F. Woodland, on Tuesdays, June 11, 18, and 25. The lectures are addressed to advanced students of the University, especially those of zoology, anatomy, and of physiology, and to others interested in the subject dealt with. Admission is free, without ticket.

THE Secretary of State for India has appointed a committee to inquire and report as to the facilities available for Indian students for industrial and technological training in this country, with special reference to the system of State technical scholarships established by the Government of India in 1904. The committee is constituted as follows:—Sir Theodore Morison, K.C.I.E. (chairman), and Sir Krishna Gupta, K.C.S.I., members of the Council of India; Mr. J. H. Reynolds, lately principal of the Municipal School of Technology at Manchester; and Prof. W. E. Dalby, professor of civil and mechanical engineering at the Imperial College of Science and Technology at South Kensington. The secretary to the committee is Mr. P. H. Dumbell, of the India Office.

IN *La Géographie* for April M. P. Glangeaud outlines a scheme of no little interest for the geographical education of the public through the medium of "tables d'orientation" erected on favourite viewpoints. The Touring-Club de France, an organisation the name of which most travellers through France have daily cause to bless, has placed on such points indicators directing the visitor to the names of salient natural features visible from where he stands; thereto bare facts, such as the heights of mountains, are added. These M. Glangeaud proposes to amplify with inscriptions of some twenty lines indicating in a manner readily intelligible the natural forces which have been at work in shaping the landscape. Such

an inscription has already been set up on the Banne d'Ordenche, a viewpoint above the valley of the Dordogne; it explains briefly that the Banne itself is a volcanic neck, and indicates its relation to the volcanic system of the Auvergne generally, most of the members of which are visible from it. The inscription is stated greatly to interest those who ascend the Banne. "Tables d'orientation" are rare in our own country; there is no organisation specially concerned to provide them, but if such as exist were equipped with explanations of the scenery on M. Glangeaud's lines, they would probably become objects of pilgrimage not only for tourists, but for students and school classes.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 23.—Sir Archibald Geikie, K.C.B., president, in the chair.—H. S. **Hele-Shaw**: Theory of a new form of the chamber crank chain. The paper commences by showing in what way the mechanism is derived from the ordinary type of crank mechanism, its various phases being indicated diagrammatically. One feature of the mechanism, which is of practical importance, is that the crank is fixed, and so a variable stroke can be obtained by very simple means. The new feature of the mechanism, which results in somewhat remarkable properties, is the employment of what is called "a floating guide ring." This device largely reduces the friction of the contrivance when working under high pressures.—Prof. R. A. **Sampson**: A new treatment of optical aberration. A method is developed by which Gauss's method of relating original and emergent rays in a coaxial optical system

$$\left.\begin{aligned} y &= \beta x + b, \\ z &= \gamma x + c, \end{aligned}\right\} \qquad \left.\begin{aligned} y' &= \beta' x' + b', \\ z' &= \gamma' x' + c', \end{aligned}\right\}$$

by means of a transformation,

$$b' = Gb + H\beta, \quad \beta' = Kb + L\beta, \quad c' = Gc + H\gamma, \quad \gamma' = Kc + L\gamma,$$

where $GL - HK = \mu/\mu' = N$, may be applied so as to include the aberrations of the third order. The method is adequate for the numerical calculation of telescopic objectives, and offers a remarkable economy in the work hitherto necessary.—Sir W. de W. **Abney**: The extinction of light by an illuminated retina. In this communication the author describes an apparatus adapted for illuminating the retina with known amounts of light, coloured or white, and for extinguishing the sensation of the light in the different colours of the spectrum. Confining himself to the stimulation of the retina by white light only, he shows the movement in the spectrum of the rays requiring the maximum amount of diminution to extinguish their light according as the retina is more or less illuminated.—Dr. W. **Wahl**: Optical determinations at high pressures. *Diagram of state of carbon tetrabromide.*—The melting point of CBr_4 is raised 1° by a pressure of 16 kg. cm.^{2} The transition point from monoclinic to regular crystal form is raised 1° by 32 kg. cm.^{2} The melting-point curve and the transition-point curve do not, therefore, intersect at high pressures to form a "triple point." In consequence, the monoclinic form of carbon tetrabromide cannot be caused to melt at any temperature or pressure whatever. *Diagram of state of α-β-dibrompropionic acid.*—Two modifications of the acid are known, a stable one melting at 64° and an unstable melting at 51°. The unstable modification is not spontaneously transformed into the stable one so readily as in most other cases of "monotropy," and as only very small quantities are employed for these optical determinations, it has been possible to determine the melting-point curve of the unstable modification also. During *isothermal melting* of the unstable modification the pressure may be reduced as much as about 150 kg. cm.^{2} below the true melting-point pressure before melting takes place rapidly. This pressure difference corresponds to a superheating of 2·5°. The melting point of the stable modification is raised 1° by a pressure of 51·3 kg. cm.^{2} The difference between the absolute melting points of the two polymorphic modifications is at any pressure similar to the difference between the absolute melting points at ordinary pressure.—T. R. **Merton**: The changes in certain absorption spectra in different solvents. (1) The absorption spectra of uranous chloride in a number of organic solvents have been measured quantitatively, the results indicating that the differences cannot be considered as a shift of the bands, since the entire character and intensity of the absorption varies in different solvents. (2) The apparent gradual shifts observed when one acid radicle is replaced by another can be simply explained by the superposition of absorption curves, and evidence has been found in support of this explanation. (3) A marked change in the character of the absorption has been found in the presence of free acid, more especially in solvents containing a ketone group. The addition of another solvent to these solutions causes a slow disappearance of the lines without shift, in accordance with the results of Jones and Strong. (4) The influence of pressures up to 750 atmospheres on the absorption spectra of solutions has been investigated with negative results.—W. C. **Ball**: Changes in the absorption spectra of "didymium" salts. The absorption spectra given by aqueous solutions of "didymium" salts, such as the nitrate, chloride, &c., were observed to be considerably altered by sodium hyposulphate, $Na_2S_2O_4$, the lines and bands being altered in position, width, and intensity. These alterations were found to be independent of any reducing action of the very strongly reducing hyposulphite, but to be connected with changes in the ionisation of the didymium; for similar effects on the spectra of the didymium salt of strong acids were produced under conditions likely to diminish such ionisation.—Dr. P. **Phillips**: The viscosity of carbon dioxide. In this experiment the method of determining the viscosity is that described before the society by A. O. Rankine in January, 1910. The viscosity of carbon dioxide is determined for temperatures of 20°, 30°, 32°, 35°, and 40° C., and for a range of pressures from 1 to 120 atmospheres. When the viscosity is plotted against the pressure, the form of the isothermals is very similar to the form of the density-pressure isothermals, but the former cross, whereas the latter do not. When the kinematic viscosity is plotted against the pressure, it is noticed that at the saturation pressure the kinematic viscosity of the gas is the same as that of the liquid. The minimum value of the kinematic viscosity being approximately 0·00069 at 30°, 32°, and at 35° C., this is taken as the critical value of the kinematic viscosity, and therefore multiplying it by the critical density, 0·464, the critical value of the coefficient of viscosity is found to be 0·000320. When the viscosity is plotted against the square of the density it is found that, for a considerable range of density near to the critical point, the viscosity is a linear function of the square of the density. This would seem to show that the viscosity is proportional to the molecular attraction between two adjacent layers of the fluid, that is, to the a/γ^2 term in Van der Waals's equation.

Zoological Society, May 21.—Sir Edmund G. Loder, Bt., vice-president, in the chair.—Major J. Stevenson **Hamilton**: The local races of Burchell's zebra. The author pointed out that it was possible to shoot in one herd individuals presenting the characters of various subspecies as described by systematists. In the Transvaal, for example, he obtained skins exhibiting features claimed to be distinctive of such races as *E. burchelli wahlbergi*, *E. b. transvaalensis*, and *E. b. chapmanni*; and from his experience he expressed the opinion that these subspecies had been based upon inadequate museum material.—Dr. William **Nicoll**: Two new trematode larvæ found encysted in enormous numbers in the mesentery of several striped snakes (*Tropidonotus ordinatus sirtalis*).—Dr. W. T. **Calman**: A new genus and species of the crustacean order Branchiura.—G. A. **Boulenger**: Second contribution to our knowledge of the varieties of the wall-lizard. This paper was a continuation of one published in the society's Transactions in 1905, and dealt chiefly with the variations of *Lacerta muralis* in south-eastern Europe and south-western Asia. It also contained a supplement to the first part, thus completing an account of the varieties, of which about thirty were regarded as more or less definable, the author endeavouring to show the inconstancy of the characters adduced by some herpetologists in assigning specific rank to a number of these forms, connected by many gradations.—Sir Charles **Eliot**: The rare British nudibranch *Hancockia eudactylota*, Gosse.

EDINBURGH.

Royal Society, May 6.—Sir William Turner, K.C.B., president, in the chair.—Dr. J. G. **Gray**: Walking and climbing gyrostats and novel illustrations of gyrostatic action; and, in conjunction with George **Burnside**: Motor-spun gyrostats and accessories for demonstration of the properties and practical applications of the gyrostat. New models of gyrostats were described, and a number of curious experiments shown in illustration of their behaviour.—G. H. **Gulliver**: The effect of vibration upon the structure of alloys. The paper gave an account of the microscopic changes produced in certain alloys by the application of a few millions of light blows. The changes were in the direction of an increased size of crystal, and to a less marked degree in the direction of chemical homogeneity, resembling the alterations due to annealing.—H. **Levy**: The singular solutions of partial differential equations of the first order.

May 13.—Dr. Horne, F.R.S., vice-president, in the chair.—Dr. B. N. **Peach**: Report on rock specimens dredged by the *Michael Sars* in 1910, by H.M.S. *Triton* in 1882, and by H.M.S. *Knight Errant* in 1880. The stones, which were obtained from various places in the North Atlantic, were for the most part glaciated. Those which were found in the globigerina ooze were probably deposited from floating ice, and came originally from the west of Scotland and the north and west of Ireland. Those found in stony clay were probably deposited by land ice. They probably came from the north of Scotland and from Orkney and Shetland.—Dr. A. A. **Lawson**: Chromosome reductions in plants: a study of the changes which occurred in cells which ultimately became pollen cells.—Dr. F. A. **Bather**: Caradocian Cystidea from Girvan. The specimens were the property of Mrs. Robert Gray. Eight species were described, and these fell into two limited groups. In both groups there was evidence of a similar gradual modification to accord with the same mode of life. This modification consisted in a change from the erect habit of a typical pelmatozoan attached to the sea floor by its stem to a free-moving habit, accompanied by a superinduced bilateral symmetry. This mode of life appeared suited to a littoral environment; and the Girvan fossil bed seems to have been part of a highway skirting the Atlantic basin, along which forms were slowly migrating in each direction from east to west and from west to east, meeting on the way, and becoming modified as they passed.

PARIS.

Academy of Sciences, May 28.—M. Lippmann in the chair.—Paul **Sabatier** and M. **Murat**: The preparation of phenylcyclohexane and dicyclohexyl: the direct hydrogenation of diphenyl. Starting with 1:1-phenylcyclohexanol, this is converted by means of phenylmagnesium bromide into 1:1-phenylcyclohexene; the latter can be reduced to phenylcyclohexane without difficulty by hydrogen in the presence of reduced nickel. Dicyclohexyl is prepared by a similar method starting with 1:1-cyclohexylcyclohexanol, and can also be obtained by the direct reduction of diphenyl by the Sabatier and Senderens method.—Ch. **Gallissot**: Photometric and colorimetric observations of the new star in the Twins made at the Observatory of Lyons.—The secretary announced the death of Eduard Strasburger, correspondant for the section of botany.—M. **Luizet**: The variations in brilliancy and colour of the new star in the Twins proved at the Observatory of Lyons. There is a general resemblance between the new star in the Twins and that in the constellation of Perseus; the changes in brilliancy and colour are less regular in the former than in the latter.—Costa **Lobo**: The kinematographic registration of the eclipse of April 17. These results tend to show that the eclipse was total at the point of observation in the direction of motion of the moon, but annular in a perpendicular direction. The figures can be explained by assuming a flattening of 12 kilometres on the moon's diameter.—G. **Demetresco**: A new variable star. During the examination of a negative (taken by P. Henry in 1900) for statistical purposes it was noticed that there was a star of which the three images were unequal. Further negatives of the same region have proved that this star is variable.—M. **Rouyer**: Surfaces of constant curvature.—Patrick **Browne**: Some functional equations.—Paul **Lévy**: Green's function relative to the cylinder of revolution.—M. **Duchêne**: Concerning an apparatus, called *Tourne-Sol*, designed to facilitate the observation of the ground from an aëroplane.—F. **Croze**: Contribution to the study of the Zeeman phenomenon in the spectra of hydrogen and nitrogen.—L. **Riéty**: The difference of contact potential of glass and an electrolyte.—H. **Pélabon**: Selenide batteries. The battery is made up consisting of metal, a saturated solution of a salt of this metal, and a bar of an alloy of the metal and selenium. The electromotive forces of such cells were studied for the cases of silver, lead, copper, and tin. The resulting data confirm the conclusions drawn from a study of the fusibility of the same series of alloys.—A. **Blondel**: The oscillations of alternators.—H. **Pecheux**: An attempt at the determination of some atomic weights. A comparison of the amounts of silver, lead, copper, and zinc deposited electrolytically by the same current.—Albert **Colson**: The necessity of revising the law of mass action and of homogeneous equilibria.—Ph. A. **Guye, G. Kovacs,** and E. **Wourtzel**: The weight of a normal litre of atmospheric air at Geneva. Slight variations of density from day to day were observed, and corresponding with this the proportion of oxygen was also found to vary, 20·93 and 21·04 per cent. being the limiting values found.—Jacques **Duclaux**: The mechanism of coagulation. The coagulation of

colloidal solutions is explained by the author as due to osmotic phenomena.—Jean **Bielecki** and René **Wurmser**: The action of the ultra-violet rays on starch. Exposure of solutions of highly purified starch to the light from a Cooper Hewitt lamp caused a reduction of the rotatory power. Dextrins, reducing sugars, pentoses, formaldehyde, and some acids were detected in the solution.—Mme. Paul **Lemoine**: Calcareous algæ collected during the Charcot Expedition, 1908–10.—Mme. **Phisalix**: The natural immunity of the hedgehog towards the poison of *Heloderma suspectum*. The immunity of the hedgehog against the poison of the lizard is due to the resistance of its cells; it is a cytological immunity.—Ch. **Gravier**: The Pterobranchs described by the second French Antarctic Expedition, and a parasitic crustacean on one of them.—E. **Bataillon**: New analytical researches on the experimental parthenogenesis of amphibians.—A. **Trillat** and M. **Fouassier**: Study of the properties of a distillate from a culture of *B. proteus* upon the vitality of micro-organisms.—L. **Lematte**: The estimation of mono- and bi-metallic phosphates in the presence of organic compounds of acid nature. Evaluation of the total urinary acidity.—R. **Fosse**: Syntheses of urea by oxidation of ammonia and the carbohydrates, of glycerol, and of formaldehyde.—Gabriel **Bertrand** and F. **Medigreceanu**: The presence and the distribution of manganese in the organs of animals. With the exception of white of egg of birds, manganese has been found in all the organs and in all the animal products examined.—J. **Deprat**: The discovery of the Ordovician with Trinucleus and the Dinantian in North Annan, and on the general geology of this region.—E. **Rothé**: The possible influence of solar radiations on the propagation of Hertzian waves. A study of the intensity of wireless signals during the recent eclipse of the sun.—Albert **Turpain**: The influence of the eclipse of the sun of April 17, 1912, on the propagation of electric waves.—M. de Montessus **de Ballore**: The non-existence of isoseistic curves.

CALCUTTA.

Asiatic Society of Bengal, May 1.—Dr. **Annandale**: Frogs and snakes from the Abor foot-hills. The collection exhibited forms a very interesting addition to our knowledge of the fauna of the Himalayas, illustrating a district (the eastern extremity of the great range) hitherto almost unknown. Specimens of at least twenty species of frogs, mostly arboreal in habits, were obtained, and of these more than a third are new to science, while several (notably species of the two peculiar Burmese genera Chirixalus and Phrynoderma) are of considerable interest from a geographical point of view. No fewer than twenty-three kinds of snakes were obtained, including three apparently new to science, one of which represents a hitherto undescribed genus.—S. W. **Kemp**: Specimens of Peripatus from the lower Abor hills. Peripatus is a very primitive arthropod which shows relationships with both worms and insects. It had not previously been found within the limits of the Indian Empire nor, in the eastern hemisphere, in any locality north of the Malaya Peninsula. The specimens from the Abor country show some affinity with those from the latter region, but they evidently represent a species hitherto undescribed.—W. **Kirkpatrick**: A comparative vocabulary of the language of European Gypsies or Romnichal and colloquial Hindustani. Although the linguistic test is not an infallible test of pedigree, it seems possible to account for the similarity of Romnichal or the language of European Gypsies and colloquial Hindustani by the fact that the Gypsy folk of Europe came originally from India. The Gypsy words given in the vocabulary show in most cases an obvious identity with Hindustani. The Gypsy terminal or affix *Engro* or *Mengro* corresponds to the Hindustani *Walláh*.—D. N. **Mallik**: Note on the secular cooling of the earth and a problem in conduction of heat.

BOOKS RECEIVED.

A Handbook of Nursing. By M. N. Oxford. Sixth edition. Pp. viii+319. (London: Methuen and Co., Ltd.) 3*s*. 6*d*. net.

Les Nomogrammes de l'Ingénieur. By R. S. de la Garza. Pp. xii+195+lxxxv plates. (Paris: Gauthier-Villars.) 12 francs.

Tierpsychologisches Praktikum in Dialogform. By Prof. K. C. Schneider. Pp. iii+719. (Leipzig: Veit & Co.) 16 marks.

Mémoires Scientifiques: I. Sciences Exactes dans l'Antiquité, 1876–1884. By P. Tannery, J. L. Heiberg, and H. G. Zeuthen. Pp. xix+466. (Toulouse: É. Privat; Paris: Gauthier-Villars.) 15 francs.

Fossilrekonstruktionen. By Dr. F. König. Pp. 70+10 plates. (München: E. Dultz & Co.)

Smithsonian Institution, U.S. National Museum. Report on the Progress and Condition of the U.S. National Museum for the Year ending June 30, 1911. Pp. 147. (Washington: Government Printing Office.)

Report of the Commissioner of Education for the Year ended June 30, 1911. Vol. i. Pp. xviii+675. (Washington: Government Printing Office.)

Diary of Birds' Nests and Eggs. Pp. iii+22 pp. of ruled paper. (London: Hugh Rees, Ltd.)

Concrete Costs. By Dr. F. W. Taylor and S. E. Thompson. Pp. xxii+709. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 21*s*. net.

Chemical Research in its Bearings on National Welfare (incorporating a lecture delivered by Prof. Emil Fischer in Berlin, January 11, 1910). Pp. 80. (London: S.P.C.K.) 1*s*. 6*d*.

The Dynamics of Particles, and of Rigid, Elastic, and Fluid Bodies: being Lectures on Mathematical Physics. By Prof. A. G. Webster. Second edition. Pp. xii+588. (Leipzig: B. G. Teubner; New York: G. E. Stechert and Co.; London: Williams and Norgate.) 14*s*. net.

Memoirs of the Connecticut Academy of Arts and Sciences. Vol. iii. March, 1911: A Study of Chiriquian Antiquities. By Dr. G. G. MacCurdy. Pp. xx+249+xlix. (New Haven, Conn.: Yale University Press.)

Problems in Practical Chemistry for Advanced Students. By G. F. Hood. Pp. vi+265. (London: Mills and Boon, Ltd.) 5*s*.

University of London. Francis Galton Laboratory for National Eugenics. Eugenics Laboratory Memoirs, XVI.:—Treasury of Human Inheritance. Name and Subject Indices to Vol. i. By J. Bell. Pp. xiv+575–591. (London: Dulau and Co., Ltd.) 3*s*. net.

The Cinematograph and Natural Science. By L. Donaldson. Pp. 88. (London: Ganes, Ltd.) 2*s*. 6*d*. net.

Advanced Calculus. By Prof. E. B. Wilson. Pp. ix+566. (Boston, New York, Chicago, and London: Ginn and Co.) 20*s*. net.

Elements of the Differential and Integral Calculus. By Dr. W. A. Granville. Revised edition with the

editorial cooperation of Prof. P. F. Smith. Pp. xv+463. (Boston, New York, Chicago, and London: Ginn and Co.) 10*s.* 6*d.*

Lectures on the Theory of Functions of Real Variables. By Prof. J. Pierpont. Vol. ii. Pp. xiii+645. (Boston, New York, Chicago, and London: Ginn and Co.) 20*s.* net.

Hortus Mortolensis Enumeratio Plantarum in Horto Mortolensi Cultarum. Alphabetical Catalogue of Plants Growing in the Garden of the late Sir Thomas Hanbury, K.C.V.O., F.L.S., at La Mortola, Ventimiglia, Italy. By A. Berger. Pp. xxiv+468+vi plates. (London: West, Newman and Co.) 4*s.* and 5*s.*

Smithsonian Miscellaneous Collections. Vol. 59, No. 1:—The Natives of Kharga Oasis, Egypt. By Dr. A. Hrdlička. Pp. vi+118+38 plates. (Washington: Smithsonian Institution.)

The Vulgate Version of the Arthurian Romances. Edited from the Manuscripts in the British Museum by H. O. Sommer. Vol. v. Le Livre de Lancelot del lac. Part iii. Pp. 474. (Washington: Carnegie Institution.)

Guide to the Manuscript Materials relating to American History in the German State Archives. By Prof. M. D. Learned. Pp. vii+352. (Washington: Carnegie Institution.)

A Physical Study of the Firefly. By W. W. Coblentz. Pp. 46+plate. (Washington: Carnegie Institution.)

Verhandlungen der Schweizerischen Naturforschenden Gesellschaft. 94 Jahresversammlung vom 30 Juli bis 2 August 1911 in Solothurn. Band i. Pp. viii+297. Band ii. Pp. viii+263+164. (Aarau: H. R. Sauerländer & Cie.) 7 francs and 3 francs.

Agricultural Education in the Public Schools. By Prof. B. M. Davis. Pp. vii+163. (Chicago: University of Chicago Press; Cambridge: University Press.) 4*s.* net.

Bibliography of the Mineral Wealth and Geology of China. By Chung Yu Wang. Pp. 63. (London: C. Griffin and Co., Ltd.) 3*s.* net.

Anthropologie Anatomique. Crane-Face-Tête sur le Vivant. By Dr. G. Paul-Boncour. Pp. xix+396. (Paris: O. Doin et Fils.) 5 francs.

Commercial Guide to the Forest Economic Products of India. By R. S. Pearson. Pp. ix+155+xiii. (Calcutta: Superintendent Government Printing.) 1*s.* 6*d.*

DIARY OF SOCIETIES.

THURSDAY, JUNE 6.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Process of Excitation in Nerve and Muscle: Keith Lucas.

ROYAL INSTITUTION, at 3.—On X-Rays and Matter: Prof. C. G. Barkla.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—Address by President: W. E. Garforth.—Why Leave Shaft-pillars? W. H. and B. H. Pickering.—Safety-devices in Connection with Electrical Machinery and Appliances for Coal-mines: D. Bowen and W. E. French.—A Rope-driven Coal-cutter: W. L. Spence.

LINNEAN SOCIETY, at 8.—The Development of the Cod, *Gadus morrhua*, Linn.: Prof. A. Meek.—Lantern-slides of Orchids recently observed in Sussex: E. J. Bedford.—Palæontographical relations of Antarctica: C. Hedley.—Lantern-slides illustrating the Fauna and Flora of the Falkland Islands: R. Vallentin.

FRIDAY, JUNE 7.

ROYAL INSTITUTION, at 9.—Lord Lister: Sir William Macewen.

SATURDAY, JUNE 8.

ROYAL INSTITUTION, at 3.—The Weather and the Utilities of Forecasts: Willis L. Moore.

MONDAY, JUNE 10.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Garden of Eden: Sir William Willcocks, K.C.M.G.

TUESDAY, JUNE 11.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Excavations in the Coldoun. Ancient Stone Monuments and Description of Human Remains: F. J. Bennett and Dr. A. Keith.

WEDNESDAY, JUNE 12.

AERONAUTICAL SOCIETY, at 8.30.—Hydro-aëroplanes: G. Holt Thomas.

THURSDAY, JUNE 13.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* A Chemically Active Modification of Nitrogen, produced by the Electric Discharge, IV.: Hon. R. J. Strutt, F.R.S.—(1) On the Series Lines in the Arc Spectrum of Mercury. (2) On the Constitution of the Mercury Green Line $\lambda=5461$ AU and on the Magnetic Resolution of its Satellites by an Echelon Grating: Prof. J. C. McLennan.—(1) On the Convergence of certain Series involving the Fourier Constants of a Function. (2) On Classes of Summable Functions and their Fourier Series: Prof. W. H. Young, F.R.S.—The Number of β Particles emitted in the Transformation of Radium: H. G. Y. Moseley.—Portland Experiments on the Flow of Oil: S. D. Carothers.—On a Form of the Solution of Laplace's Equation suitable for Problems relating to two Spheres: G. B. Jeffery.—On the Emission Velocities of Photo-Electrons: A. Ll. Hughes.

FRIDAY, JUNE 14.

ROYAL INSTITUTION, at 9.—Unknown Parts of South America: A. H. Savage Landor.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of West Mayo and Sligo, with special reference to the August Long Excursion: Prof. A. J. Cole.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 8.—Demonstration of a Method of Determining very small Differences of Density: T. H. Blakesley.—The Maximum Sensibility of a Duddell Vibration Galvanometer: Dr. F. H. Haworth.—An Accurate Examination of the Steinmetz Index for Transformer Iron, Stalloy and Cast Iron: F. Stroude.

MALACOLOGICAL SOCIETY, at 8.—On a collection of Molluscs collected by Mr. E. Jacobson in Java: M. M. Schepman.—Description of Thirty-three New Species of Gastropoda from the Persian Gulf, Gulf of Oman, and Arabian Sea: J. Cosmo Melvill.—Note on the Generic Name Pectunculus: Wm. H. Dall.—Note on Ianthina species: Tom Iredale.—Egyptian Non-marine Molluscs: Maxwell Smith.

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