THURSDAY, APRIL 11, 1912.

## KRÜMMEL'S HANDBOOK OF OCEANOGRAPHY.

*Handbuch der Ozeanographie.* By Prof. Dr. O. Krümmel. Band ii., Die Bewegungsformen des Meeres (Wellen, Gezeiten, Strömungen). Zweite Auflage. Pp. xvi+766. (Stuttgart: J. Engelhorns Nachf., 1911.) Price 32 marks.

METEOROLOGISTS and oceanographers are blessed beyond most scientific students in having at their disposal standard works which not only give an exhaustive list of important books and papers relating to their subjects, and a trustworthy statement of their contents, but an ordered survey of the present state of those sciences and a just, critical estimate of current progress. What Hann is to meteorology, Krümmel is to oceanography. The "Handbuch der Meteorologie" of the former, and the "Handbuch der Ozeanographie" of the latter, with their hundreds of pages of expensive printing—formulæ and footnotes—would surely be the despair of most British publishers, and yet they are somehow kept fairly up to date by new editions.

We are concerned here with the second volume of the new issue of Krümmel's great book, which follows the first after the interval of four years. It deals with dynamical oceanography, and falls into three major divisions—waves, tides, and currents; the first two occupying about half the book, with two hundred pages each, and the last the other half with some four hundred pages.

In the first division we find accounts of the theory of surface waves in deep and shallow water, and of observations of the size of waves. The relation of surface waves to the winds is next considered, and then comes an extremely interesting chapter on modifications of waves in shallow water and along coasts. A chapter on waves produced by earthquakes and similar disturbances is followed by one on stationary waves and *seiches*, with a summary of the late Prof. Chrystal's researches. The final chapter of this section discusses the phenomena of internal waves and "dead water." In all there is so much that is recent that this division of the work may not unfairly be said to constitute the first general treatise on a new subject.

Prof. Krümmel treats the tides in a novel and extremely suggestive manner. After general descriptions of the phenomena of the tides and of methods of observation, the equilibrium, dynamical, "canal," and stationary-wave theories are stated and discussed. Harmonic analyses of tidal observations, tidal currents, *bores*, and allied phenomena are each given a chapter, and the section concludes with a full and masterly description of the tidal characteristics of the great divisions of the ocean.

The last division, on oceanic currents, has practically only two chapters; after a short introduction on methods of observation, a chapter of 100 pages deals with the surviving theories of the causes producing and modifying translational movements, and the work concludes with a monumental chapter of 180 pages on the currents of each of the great oceans and the enclosed and fringing seas. Here the great feature is the treatment of horizontal and vertical movements together, giving a complete view of the circulation in each case and not merely of one of its components at a time.

It is, of course, impossible to "review" a work of this kind in detail. The features which are most impressive in this case are three, and they concern only the broader aspects. First, we note the immense value of the geographical point of view which is adopted and persisted in throughout. The results of recondite research in many branches of pure and applied science are laid under contribution almost all through the book, but there is never any doubt left that the essential problems are those of distribution—the work belongs in more than name to a series of "geographical handbooks." Secondly, we appreciate the conspicuous fairness of the author in reviewing the work of different observers. No one disputes the importance of the improved methods of observation which have come into use in recent years in, for example, the measurement of temperature in the depths; but Prof. Krümmel fully admits the value of the earlier work, and of work done by sailors and other observers to whom the new methods were, or are, not accessible; and he makes profitable use of the old data as well as of the new. Lastly, we are profoundly impressed by the extraordinary completeness of the work. There are few fields in which the recent output has been greater and more widely scattered in all sorts of unlikely places than in oceanography, but we have failed to discover the omission of any important contribution.

## THE INSURANCE ACT, 1911.

*National Insurance.* By A. S. Comyns Carr, W. H. Stuart Garnett, and J. H. Taylor. With a preface by the Right Hon. D. Lloyd George, M.P. Pp. xxxi+504. (London: Macmillan and Co., Ltd., 1912.) Price 6*s.* net.

IN the brief preface with which the Chancellor of the Exchequer introduces this book to the public, he repeats the statement that "we have swept into the National Insurance scheme some

10,000,000 workers hitherto unprovided for," in other words, that one-fourth of the population of the United Kingdom are workers (not of the lowest class) who have not hitherto "provided for" themselves in sickness. He ignores the multitude of members of unregistered friendly societies, and of other persons who have hitherto provided for themselves in sickness to their own satisfaction. The authors of the book have fallen into the same error (see p. 98).

The Bill, which is now an Act, was introduced without that patient and systematic inquiry into facts which ought to have preceded a measure so comprehensive; its defects were hastily patched up from day to day as they were brought to light, vital alterations were made in its very last stages, and it is being over-hastily brought into operation. As an almost necessary consequence of this haste, the Act is probably one of the most complicated and perplexing statutes ever passed.

Mr. Lloyd George is therefore right in commending this book to all who wish to bear their share in working out the scheme of the Act, and it will also be useful to those who are compelled to work out that scheme, whether they wish to do so or not. He says truly that the authors have collected a mass of information, which cannot fail to be of value. When it is remembered that the Act only became law on December 16, 1911, immense credit is due to them for their industry and insight. They have cited nearly three hundred law cases, and have shrewdly and acutely commented upon each section of the Act. The preliminary chapters are clearly written and full of interest. In one of them the financial side of the Act is discussed and vindicated. A scientific journal cannot but take note of the manner in which science has been misused in support of the Act. Eminent actuaries have made calculations based upon the unverified hypothesis that the probable experience under compulsory insurance may be deduced from that under voluntary insurance; and have held that by the manipulation of reserves you can remedy the inherent error of charging a uniform contribution for a varying risk.

Unforeseen and dangerous consequences may follow if certain sections of the Act become operative. For example, Section 63 (4) directs that the "average expectation of sickness" is to be "calculated in accordance with the tables prepared by the Insurance Commissioners for the purpose of valuations," and that if in any place the actual amount of sickness is 10 per cent. more than that assumed average, the local authorities, the water companies, and the owners of land are to be mulcted in that excess. If the tables to be prepared by the commissioners should be based upon the same unverified hypothesis as those upon which the Act has been framed, this section may result in great mischief and wrong.

The disregard shown in the Act to the just claims of the medical profession is another grave defect in it from the scientific point of view.

Some slight errors in the book are to be noted. At p. 163 "periods" should be "persons." At page 186, "Registrar-General" should be "chief registrar." The index is not sufficiently copious.

## *JAEKEL'S CLASSIFICATION OF VERTEBRATES.*

*Die Wirbeltiere. Eine Uebersicht über die fossilen und lebenden Formen.* By Prof. Otto Jaekel. Pp. viii + 252. (Berlin: Gebrüder Borntraeger, 1911.) Price 10 mk. 60 pfg.

IN this volume, which is apparently intended to be a text-book for students, the author further exemplifies his distinctly original views—some of which have been previously mentioned in NATURE—with regard to the taxonomy and phylogeny of vertebrates. In the preface he tells us that particular attention has been directed to the illustrations, as a good figure, in his opinion, is worth half-a-score pages of descriptive text. On the selection and execution of these text-figures, Dr. Jaekel may be cordially congratulated, as they are a long way above the average of those to be found in the great majority of text-books, and thus serve in great degree to justify the aforesaid assertion, and likewise render his work highly useful to students and teachers, whether his views on classification be accepted in their entirety or no.

The first sixteen pages of the volume are devoted to a general discussion of the classification of vertebrates—a term which Dr. Jaekel uses in the same sense as the chordates of other writers—with special reference to the taxonomic position of the tunicates; this introductory section concluding with a table of geological horizons. The rest of the book is devoted to a systematic survey of the various groups. Dr. Jaekel divides the Vetebrata into three "Unterstamme," or sub-kingdoms; namely, Protetrapoda, Eotetrapoda, and Tetrapoda. The first includes tunicates alone; the second comprises fishes, in the widest sense of that term; while in the third are grouped the whole of the remaining vertebrates. As regards the Eotetrapoda, it must suffice to mention that this is divided into three classes: (1) Malacostomata, which includes as sub-classes the extinct pterichthyds and cephalaspids, and the existing lampreys and lancelets; (2) Hypostomata, embracing the Palæozoic placoderms, and the living sturgeons, chimæroids, and selachians; and (3) Teleostomata, with all the more typical fishes.

As regards the Tetrapoda, the most striking innovation is the interpolation of the class "Paratheria" between Aves and Mammalia, as originally proposed by the author in the *Zoologischer Anzeiger* for 1910 (vol. xxxvi., pp. 113–124). At the risk of repeating what has been already mentioned in this journal, it is advisable to remind our readers that this group is taken to include therapsidans (as represented by the African Triassic Lycosaurus and its relatives), chelonians, typical anomodonts (Dicynodon, etc.), theriodonts, and monotremes. Such, it should be mentioned, is the classification given in the table of contents, although in the text we find some departure from this, the Therapsidi there forming a "Hauptordnung," with the Testudinata and Anomodontii as "Nebenordnungen," while the Theriodonti constitute a second Hauptordnung, with the Monotremati as a Nebenordnung.

To recapitulate the characters on which the author relies as a reason for including such diverse types as chelonians and monotremes in a single class would occupy too much space; but it may be questioned whether any of these are really sufficiently important to justify such a sweeping change. Clearly neither the production of young by means of eggs nor the formation of secondary noses by means of an under-roofing of the palate comes under this category; while such features as a depressed and small-brained skull, large and lateral eyes, certain points connected with the dentition, and the structure of the occipital condyle or condyles are of little or no importance. Similarly, the constancy of the phalangeal formula (except when it has been specially modified, as in turtles) throughout the group can scarcely be regarded as more than an inheritance of a common archaic feature. On the other hand, the author allows no value to the possession by monotremes of hair and certain other mammalian features (exclusive of warm blood, which may be regarded as a secondary character). Accordingly, while giving full credit to Dr. Jaekel for his careful and painstaking investigations, we are not yet prepared to accept his views of the classification of the higher vertebrates in their entirety. R. L.

## THE PRODUCTION OF WHEAT.

*Wheat-growing in Canada, the United States, and the Argentine: including comparisons with other areas.* By W. P. Rutter. Pp. x+315. (London: A. and C. Black, 1911.) Price 3*s.* 6*d.* net.

THIS book represents an inaugural dissertation submitted by the degree of Master of Commerce of the University of Manchester, and constitutes a general examination of the conditions under which our present wheat supply is grown and marketed.

It opens with a discussion of the nutrition of the wheat plant, the effect of climate, and the limits within which wheat can be commercially grown, the varieties and their appropriate regions and soils. While it is easy to perceive certain relationships between environment (including therein latitude, soil, and such meteorological factors as temperature and rainfall), it proves as yet impossible to give these factors any quantitative expression; we can only say generally that wheat is most suited by what climatologists call "steppe" conditions, and that the hard, strong wheats are generally spring sown and grown in areas with a dry, cold winter and a summer of progressive heat and desiccation. Some discussion then follows of the character of western farming, the systems of land tenure, and the labour conditions that prevail, following which come tables setting out the yield per acre and the total production in the countries under consideration.

An account of the methods of transporting wheat in America will be of particular interest to the English reader; here are described the great railroad systems, the ports, and waterways, the freights, both local and overseas, so that one can get an idea of the charges which the foreign grain has to bear before it is marketed in competition with our home-grown produce.

Later chapters explain the system of elevators, the storage charges, the inspection and grading which enable dealings to be made without the purchaser seeing samples or even knowing where may be the parcel of wheat that he is buying. The great grain markets are described, and the dealing in futures and the effect of such speculations on the consuming farmer and the public are discussed.

Finally, Mr. Rutter examines the prospects of the future, and considers to what extent the export is likely to be maintained at its present magnitude. To do this it is necessary to consider how far the conditions of farming in America are changing, to what degree the soil is becoming exhausted and what new land is available, also what increase is probable in the consumption in America. Upon these questions to a large extent depends the future profitableness of British farming; the rise of prices that has been slowly gathering headway during the last dozen years represents to some extent the depreciation of gold, but also the manner in which the consuming population has been increasing faster than the wheat areas available. Englishmen are perhaps not much in the habit of paying attention to these general surveys, and certainly Mr. Rutter's dis-

sertation is the first of its kind in this country, but no serious student of agriculture, and particularly of its relation to the trend of commercial and social development, will fail to derive profit from Mr. Rutter's book. It represents an immense amount of painstaking work, such as can only be appreciated by one who has himself tried to reduce to some common denominator the scattered statistics and information about various countries, and it should find an interested public now that agriculture is being systematically studied and taught in the United Kingdom. A. D. H.

## ACTUAL ELECTROCHEMISTRY.

*Applied Electrochemistry.* By Prof. M. de Kay Thompson. Pp. xii+329. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1911.) Price 9*s*. net.

THERE have been many books written on this subject, and they are apt to come under two heads, the purely scientific, in which the principles of modern electrolytic theory are discussed very fully, without much information as to their practical application; and the purely commercial, in which the various industries are described, with views of the various kinds of plants. A third variety might be included which discusses all sorts of processes, most of them never having had any real existence, the information and illustrations being taken entirely from the rather imaginative patent literature of the subject.

Dr. Thompson does not begin with an elaborate treatise on what is known as "theory"—he assumes that the reader is well acquainted with the first principles; he merely refers to them, and utilises them and their formulæ as he needs them. He discusses first such subjects as electrochemical analysis. This chapter is a mere sketch, but a good sketch of the subject, which is now far too large to be treated so shortly. A reader would get a good idea of this sort of analysis from the book, but in order to utilise it he would have to study a special treatise. Electro-plating is treated very shortly, but in a refreshingly common-sense way. This common sense runs through the whole book. It is not necessary to give a list of the contents; it may be taken that the book gives a concise account in clear and scientifically accurate language of all the important electrolytic and allied processes in commercial use, and that it does not discuss all sorts of inventions that have been failures in practice. It is a great pity that such failures are not discussed as failures, the reasons of their non-success being given. These would be very valuable, but most difficult to give. In science, both applied and unapplied, people are far too reticent about failures, yet there is much to be learned from them. Dr. Thompson deals very fully with the electrolysis of salt in the wet way, and one of the most interesting chapters is that on ozone. Though there are books on ozone there is not much trustworthy information, and this chapter is very welcome.

The book is American, with heavy American paper but no aggressive American spelling. It has involved a great deal of literary work, and references are always given. There can be little doubt that the amount of matter read and rejected was greater than that utilised. The work is, in short, an admirable, intelligent account of the electrochemical industry as it exists.

J. SWINBURNE.

## A TREATISE ON CHOLERA.

*Cholera and its Treatment.* By Prof. L. Rogers. pp. xiv+236. (London: Henry Frowde and Hodder and Stoughton, 1911.) Price 10*s*. 6*d*. net.

THIS book is a complete treatise on cholera, containing all the essentials of the subject without being over-burdened with details which are of little practical importance. The first and second chapters deal with the history of cholera epidemics and their lessons, and the epidemiology of the disease. In chapter iii. the etiology and prophylaxis of the disease are discussed, and it commences with a description of the specific organism of the disease, the comma bacillus of Koch, which the author fully accepts as the cause of cholera. In this section we should have been glad to see a somewhat fuller discussion of the significance of the various cholera-like comma bacilli which have been isolated during the last few years. The hypothesis of Emmerich that cholera is a condition of nitrite poisoning is not accepted by the author. Prophylactic vaccination by means of cholera vaccine is regarded as being of considerable value, and the measures to be taken for the disinfection of infected wells are described.

Chapter iv. deals with the clinical aspects of cholera and its diagnosis, chapter v. with the morbid anatomy and pathology. In the final chapter the treatment is discussed at some length, and to many this will be considered the most important part of the book, for the author himself has contributed in no small measure to the rational treatment of this terrible malady. Dr. Rogers is entirely opposed to the purgation method except at the very early stage and before the onset of the typical watery evacuations, the "rice-water stools." Opium also has to be used with extreme caution. Injections of saline fluid, either per rectum, subcutaneously, intraperitoneally, or

intravenously, according to circumstances, are regarded as potent remedial measures, but still better is the similar use of a hypertonic salt solution, introduced by Dr. Rogers, and minute details are given for its proper administration.

Dr. Rogers also advocates the administration of permanganates, either in solution or in pill form, their action being to oxidise and destroy the toxin. By the adoption of the hypertonic salt injections plus permanganates the mortality in the Calcutta Hospital was about 23 per cent. in 1909–1910, a reduction of more than half the rate obtaining among cases treated with physiological saline solution given intravenously (mortality 51·9 per cent. in 1907). This is a splendid record, and we can only hope that Dr. Rogers's interesting book will be widely read and his methods adopted by all those who have to deal with cholera.

R. T. H.

## OUR BOOKSHELF.

*A Monograph of the Mycetozoa: a Descriptive Catalogue of the Species in the Herbarium of the British Museum.* By Arthur Lister, F.R.S. Second edition, revised by Gulielma Lister. Pp. v+302+201 plates (120 coloured). (London: printed by order of the Trustees of the British Museum, and sold by Longmans and Co., B. Quaritch, and Dulau and Co., Ltd., and at the British Museum (Natural History), 1911.) Price 30*s.*

THE Mycetozoa are miscroscopical organisms possessing some of the attributes of both animal and vegetable life, as commonly understood, but they are now generally referred to the vegetable kingdom. They differ from the lower fungi inasmuch as the spores give birth to swarm-cells or moving cells, instead of a mycelium. The swarm-cells coalesce to form a wandering plasmodium, which ultimately develops sporangia, bearing spores inside, or sporophores, bearing spores on the outside. Further, the Mycetozoa feed on bacteria. The first edition of the late A. Lister's monograph was published in 1894, and the second edition, now before us, is a revision and augmentation by his daughter, Gulielma Lister.

This work is an official publication of the Botanical Department of the British Museum, and Dr. A. B. Rendle, the keeper, says, in his preface: "A special feature of this edition is the replacement of the collotype plates by a new and more complete series. A large proportion has been reproduced by the three-colour process, and greater justice has thus been done to the original drawings by Mr. and Miss Lister. . . . That so large a proportion are reproduced in colour is due to Miss Lister's generosity. A bibliography has been added, and also a short glossary." The most important alteration is in the nomenclature: the earliest specific name, under whatever genus it may have been published, has now been adopted, and the starting-point for those names, as well as those for the genera, is the "Species Plantarum" of Linnæus, published in 1753. This has necessitated very numerous changes.

Miss Lister deserves the congratulations and thanks of students for the admirable and authoritative work she has completed. Letterpress and illustrations alike are good, and it should give an impulse to the study of some of the most elegant organisms in nature, open to everyone who can afford a microscope—organisms that abound wherever there is other vegetation, and a collection of which might be contained in a match-box.

W. B. H.

*Evolution in the Past.* By Henry R. Knipe. Pp. xv+242. (London: Herbert and Daniel, 1912.) Price 12*s.* 6*d.* net.

JUST as the researches of Arthur Evans in Greece, and Flinders Petrie in Egypt, have added whole chapters to the history of those countries, so the labours of Cope, Marsh, Osborn, and others in America, Dollo in Belgium, Andrews in the Fayûm, and elsewhere, have contributed so largely to the past records of our earth that we are now almost as well acquainted with its ancient denizens as if they formed a part of its living fauna.

In this happy condition of time and circumstance Mr. H. R. Knipe has brought out his new book, "Evolution in the Past," and having gathered together, from every available source, the latest information on the life history of our planet—from the earliest traces of living things up to the coming of man—and being furthermore aided by the spirited restorations of animals by Alice B. Woodward, and of plant life by E. Bucknall, he has produced one of the most fascinating and readable books of the year.

As a guarantee for the accuracy of the restorations made, the author and the artist have both received valuable help from Dr. Arthur Smith Woodward, Dr. Andrews, Drs. Calman and Bather, and other eminent authorities in the Natural History Museum, who have given them the benefit of their up-to-date knowledge, and carefully criticised the work throughout.

Fifty full-sized plates of animals and six of landscapes in the past render the book attractive to the veriest tyro, whilst the avoidance of technical terms makes the text more agreeable to the general reader, and an excellent holiday companion.

*Leisure Hours with Nature.* By E. P. Larken. Pp. xv+263. (London: T. Fisher Unwin, n.d.) Price 2*s.*

MR. LARKEN here provides interesting reading-matter and a profusion of well-reproduced photographs relating to various objects and scenes in nature. The rapid increase in the number of books dealing with nature-study indicates, it may be hoped, not only a growing interest in animate nature, but the development of keener observation of plants and animals among young people.

## 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.*]

### Skull of a Neanderthal Type in the Cambridge Fens.

THE manner in which Prof. McKenny Hughes applies the term "Neanderthal" to a human skull recently discovered in the peat of the Cambridge fens (NATURE, April 4, p. 114) will certainly mislead anthropologists abroad and also at home as regards the true nature of his discovery. From the excellent figures which he appends to his article there cannot be the slightest doubt that the skull he describes is a fairly typical specimen of the round-headed race which came into England during the Bronze period.

Far from being of the Neanderthal type, the specimen he describes is as opposite to that type as has ever been produced in the evolution of the human race. It is apparently a short skull, 180 mm. long; the length of the typical Neanderthal skulls is 200 mm. or more. While the proportion of the width to the length is 84 : 100, in the Neanderthal crania the proportion is about 75 : 100 or less. The mastoid processes, the inion, the lambda, the joint for the lower jaw, and the lower jaw itself are all of the form we are familiar with in people of the Bronze age, and are totally unlike these parts in Neanderthal man. Even the pronounced supraorbital ridges are of the form and size we frequently see in skulls of the Bronze period, and not at all of the Neanderthal form. The correct designation in my opinion is the discovery of a brachycephalic skull with pronounced supraorbital ridges.

There is one point in which Prof. McKenny Hughes could greatly assist those who are at present studying the remains of ancient man in England. I believe he has in his keeping a human molar tooth which Prof. Boyd Dawkins discovered with remains of the hippopotamus and other extinct animals representative of the early Pleistocene fauna while carrying out excavations in a cave at Pont Newydd, near St. Asaph. That molar is probably the most ancient part of man yet discovered in England, and it would be of the greatest interest to know something of its characters —whether or not it showed those features which we know to occur in the teeth of Neanderthal man. I presume that these characters are absent, otherwise they would certainly have attracted the sharp eye of Prof. Boyd Dawkins. A. KEITH.

Royal College of Surgeons, April 4.

### Are Eyes Autophanous?

SEEING the interest which Colonel Herschel's letter (NATURE, January 18) has attracted; and the various animals he has himself observed, it may be useful to record as many animals as possible which exhibit the phenomenon. Going into the aquarium one evening with a reading lamp, I found the eyes of the crayfish (*Jasus lalandii*, M. Edw.) shining like rubies out of the darkness. I soon discovered the correct position in which the source of light should be. Even more brilliant and beautiful are the eyes of the prawn (*Leander squilla*, Linn.), but the colour is more an orange tint.

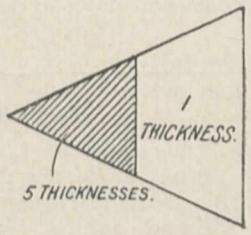
Amongst fishes the eyes of the barbel (*Galeichthys feliceps*, C. and V.) appear salmon, while those of the two dogfish (*Scyllium africanum*, Gm., and *Mustelus laevis*, Risso) shine silvery. So far these five animals are the only ones in which I have noticed the phenomenon, though doubtless it has been observed in other marine animals, if only the records were forthcoming.

A very simple arrangement would enable the sight to be seen by visitors to public aquaria, and would well repay for the extra trouble of opening for an hour or so on some nights. K. H. BARNARD.

South African Museum, Cape Town,
Cape of Good Hope, March 20.

### Centre of Pressure on Triangular Plane Gliders at Small Angles of Incidence.

MAY I direct the attention of those interested in aërodynamics to the fact that the centre of pressure on a triangular plane glider (apex forward) at a small angle of incidence (angle of attack), say 5° to 10°, lies almost exactly at the centre of the length? The good gliding qualities of the ordinary paper arrow (folded from a square or rectangular piece of paper with its c.g. necessarily central) point to this conclusion, which may be further tested by the following form of glider.




Cut out two equal isosceles triangles in thin card or thick paper. Cut one of these into four equal triangles similar to the whole. Paste these four successively on the apex of the other large piece (see figure). When the paste has dried so as not to affect the weight, it will be found that the glider runs quite well with the usual gliding angle for planes of about 1 in 5.

A knowledge of this fact will probably be useful in estimating the righting torques of triangular tails, &c. HERBERT CHATLEY.

The College, T'ang Shan, N. China.
March 17.

### Red Water.

As regards the "red water" from a crater lake in Uganda, referred to in NATURE of April 4, p. 113, I would direct attention to a similar phenomenon which occurs at the great salt lake of Sambhar, in Rajputana. The lake brine contains sodium chloride, sulphate, and carbonate, and when it is quite saturated during the very hottest dry weather a red coloration appears of organic origin. It varies from a delicate roseate hue to a deep claret red, and there is a demand for salt which contains it, because the consumers are accustomed to the colour. H. WARTH.

## *SIAM.*[1]

SIAM has a double interest, for not only is it a rich and fertile country, inhabited by a pleasant people who have an undoubted part to play in the world, but it lies between two great Powers, and owes its safety to that fact. *Consule Planco* it nearly caused a war. Now it is a "buffer" State, and it is to the interest of both England and France that it should be strong and progress. It is the only country inhabited by an Indo-Chinese people which is under independent government, and it will be an interesting

[1] "Siam: a Handbook of Practical, Commercial, and Political Information." By A. W. Graham. Pp. xvi+637+plates+map. (London: Alexander Moring, Ltd., 1912.) Price 10*s.* 6*d.* net.

study for the future to compare its progress in various ways with that of the kindred races on each side, one under French and one under English rule.

Mr. Graham's book is not one to read through. It is a handbook to consult when any particular subject connected with Siam arises, because it gives a summary of essential facts on almost all points connected with that country. Its geography, science, races, history, local organisation, education, government, industries, commerce, communications art, archæology, architecture, religion, language, and literature are all touched on. There are five appendices, a bibliography, and an index. The whole 637 pages are crammed with facts, and the author has spared no pains to be full and accurate. A great deal of hard and honest work must have gone to the making of this book. What it lacks are ideas. The facts are lifeless, and have no general coherence; perhaps this cannot be helped in a book of this nature.

If Mr. Graham wants really to interest us, he should select one of these many subjects which he has touched and tell us all about it—the art, for instance. Could he not tell us the ideas that underlie the carving and silver work, their relation to other national ideas, their comparison with those of kindred art, their limitation by material and method? That would make a fascinating book.

The illustrations (one of which is here reproduced by the courtesy of the publishers) are from photographs; they are excellent in their way, but they suffer from the defect of many such illustrations, that they are not always directly connected with the text. Finally, we take exception to the Gaudama on the binding. This is a sacred emblem to many millions of people, and is out of place on a handbook.

Typical scene in Central Siam. From "Siam: a Handbook of Practical, Commercial, and Political Information."

## THE SMOKE PROBLEM.[1]

THE first twelve years of the twentieth century will be memorable for many advances, but few will bear more important fruit in the future both as regards our health and welfare than the strenuous attempts that have been made continuously during that period to arouse the public to a sense of the criminality of wasting the fuel supplies of the country by the methods employed in the generation of heat and power from bituminous fuel, which have resulted in a pollution of the atmosphere that towards the end of the last century had become a national scandal.

In view of the widespread interest which is being taken at the present time in smoke abatement, Prof. Julius B. Cohen and Mr. Arthur G. Ruston, of the University of Leeds, have collected the records of experiments and observations made by them during the past twenty years, and have embodied with them the results of other observers, thus making a most welcome addition to the literature of the subject.

[1] "Smoke: a Study of Town Air." By Prof. J. B. Cohen, F.R.S., and Arthur G. Ruston. Pp. vi+88. (London: Edward Arnold, 1912.) Price 5s. net.

The portions of the book devoted to the effects of soot on vegetation and the influence of deposits from smoke on the assimilation of carbon dioxide by the growing plant are specially well done, as is also the influence of smoke on the intensity of light, and the effects of sulphuric acid on vegetation. In these portions of the book the effect of smoke deposits in dwarfing and finally killing

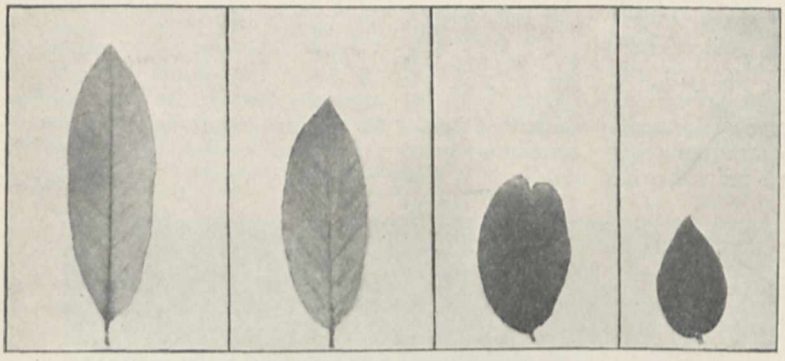



FIG. 1.—Laurel leaves and their respective assimilations.

town vegetation is shown clearly to be due to at least three well-defined actions—(1) the blocking up of the stomata by soot; (2) the reduction of the intensity of sunlight by the coating formed on the leaf, which reduces the assimilation of carbon dioxide; and (3) by the action of sulphuric acid partly condensed in the soot and partly in the rain water.

The photograph (Fig. 1) reproduced here from the book shows in a striking way the effect of locality on the development and power of assimilation possessed by the leaf. The laurel leaf grown at Weetwood Lane on the outskirts of Leeds shows in marked contrast to the one from the City Square, which may be taken as the centre of the town, the assimilative power of the latter being only 11·6 per cent. of the former.

The disappointing part of the book is that which deals with the nature of smoke and the soot which it contains, and from the commencement of the first division on page 4 it is marked by loose expressions. For instance, we read that "soot is a product of incomplete combustion, and is formed partly by the mechanical removal of dust by the chimney draught, and partly by the decomposition of the fuel, such as occurs in the process of destructive distillation." Dust is not, as a rule, a product of incomplete combustion, nor is the tar and free carbon formed in the destructive distillation of coal.

Again, on page 5, analyses of soot from various sources are given, and also analyses of the coal that gave rise to them, from which the reader learns that these "original" coals contained 0·88, 0·92, and 1·64 per cent. of tar respectively. Surely the authors do not believe that a ton of these coals contains about a couple of gallons of ready-made tar.

In describing the experiments by which they sought to ascertain the amount of soot carried up the chimney, they say, "The chimney gases were drawn off at the rate of about a litre a minute, which would approach the speed of the gases passing up the flue," and they add that a good fire was maintained all the time. They probably mean that the rate of flow through the aspirator tube was about that of the rate of flow in the flue, but they do not say so, and if the flue draught was a litre a minute, it is no wonder their figures are abnormal.

The method of taking the carbon in the carbon dioxide of the flue gas as representing the amount of carbon burnt on the fire cannot give anything but incorrect results: if soot is formed, there is incomplete combustion, and carbon monoxide and hydrocarbon gases are also produced, and the percentage of soot found will be far too high. In any case, the percentage of soot to carbon

FIG. 2.—Black fringe of soot on Coniston Lake, Lake District.

burnt is of no practical importance. It is the percentage of loss on fuel used that is the important factor, and the soot is only a small proportion of this, unburnt hydrogen and hydrocarbon vapours and gases being by far the most important items.

The authors evidently believe in broad generalisations, and on page 61, in discussing

town fog, they state that "without dust there is no mist, rain, or dew." No one will deny the important part played by dust, but few will accept the statement that without it there would be no rain or dew.

Most of us have probably seen such soot deposits as is illustrated by the photograph (Fig. 2) of a soot fringe on Coniston Water, but only when a rain cloud formed over one of the large manufacturing towns has drifted and burst, depositing its sooty cargo directly on the surface of the lake.

The condition of the water in a rain gauge in the north of Scotland would soon convince the authors that it is not every drop that has a dust core, whilst as dew is formed by the deposition of condensing moisture on the rapidly cooling smaller forms of vegetation, which are playing the same part in condensation as the dust particles, it seems unjust to put all the onus on the latter. It is an ungrateful task to have to point out these weaknesses in what is otherwise so excellent a work.

## THE BRITISH ANTARCTIC EXPEDITION.

THE arrival of the *Terra Nova* at Akaroa in New Zealand with the reports from Captain Scott's south polar expedition brings the last Antarctic news that can be expected this season. The despatches published by the Central News and referred to last week summarise the progress of the south polar party until January 3, the work of the two expeditions in South Victoria Land of the geological party under Mr. Griffith Taylor, and of Lieut. Campbell's party at Cape Adare.

Captain Scott's two despatches describe the work of the expedition during the first winter in the establishment of depôts for the main journey to the south pole, and his advance to a point only 150 miles from the pole. The preliminary work on the Great Ice Barrier was greatly hampered by unfavourable weather. For two months there was a succession of heavy storms, and the wind is described as having been more than a gale during nineteen per cent. of that time. Three of the ponies were lost by the breaking away of an ice floe, and the main start for the south pole was begun somewhat later than was intended in order to avoid exposing the others to the severe cold. Captain Scott with his party left the winter quarters on November 2. They were preceded by the motor sledges, which broke down, owing, inappropriately, to the overheating of the engines, after a journey of sixty miles, and were abandoned. Captain Scott appears confident that with the experience gained from this experiment, motor transport can be successfully adopted in the Antarctic. The weather during the march appears to have been very unfavourable; there were "prodigious" snow-falls and fierce gales of wind. The ponies were killed at successive stages and used to feed the dogs. No longitudes are given, so that the southward route cannot be followed in detail, but from the localities mentioned it was apparently in the main the same as that used by Sir Ernest Shackleton. On January 3 the party was 150 miles from the pole, and as it had attained the plateau at the height of 9,800 feet, and had a month's provisions, there can be little doubt that it soon attained its goal.

The cables announce but little new geographical information, for Captain Scott at the time of the despatches had not reached "Shackleton's Farthest," the geological party had been working mainly in an area already explored, Lieut. Campbell's journey from Cape Adare was limited by unfavourable ice conditions to the known coast, and there is no news of his results from Terra Nova Bay. The last-mentioned expedition may secure results of great interest, for Lieut. Campbell started near the point whence David, Mawson, and Mackay reached the south magnetic pole, but he was to use a more northerly route, between Mount Melbourne and Mount Nansen, and would thus explore new country which may yield especially instructive geological results.

The western party under Mr. Griffith Taylor made two expeditions on the mainland to the west of McMurdo Sound. The first expedition, from January 27 to March 14, 1911, landed at Butter Point, ascended the Ferrar Glacier, and returned across the Barrier to the south of McMurdo Sound. The second expedition continued the exploration of this district to the north. The sledge party crossed to Granite Harbour, ascended the Mackay Glacier, and continued northward the survey of the district geologically mapped by Ferrar. Some coal was discovered which is believed to be interbedded in the Beacon Sandstone, a conclusion consistent with Shackleton's discovery of coal and a fossil plant in the same formation on the Beardmore Glacier. Still more important was the discovery of "numerous well-preserved fossils," apparently in the Beacon Sandstone. The determination of the age of that formation would be a most important contribution to the geology of South Victoria Land; but as so competent a geologist as Mr. Griffith Taylor describes the fossils as "probably crustacea," they are perhaps not sufficiently well preserved to give conclusive evidence as to their age. The fossils had to be left at Granite Harbour, and it is to be hoped that they will be recovered by the *Terra Nova* next season.

Mr. Griffith Taylor's report upon the glacial features of this area will no doubt prove very instructive.

Lieut. Campbell's party from its station at Cape Adare sledged westward in order to explore part of the eastern coast of Wilkes Land; but owing to the breaking away of the ice from Robertson Bay the survey was not carried further west than Cape Barrow. Its field was limited in the main to the area explored by the members of the Southern Cross Expedition. Lieut. Campbell's party maintained continuous observations at their station from February, 1911, till January, 1912. These records will doubtless add greatly to the value of the simultaneous observa-

tions which were being made, apparently by Dr. Simpson, at McMurdo Sound. It is, indeed, probable that the systematic meteorological, magnetic, and physical work may yield the most important results of the expedition; for records were made at two stations, and the weather conditions appear to have been very different from those of the previous seasons during which expeditions have wintered beside the Ross Sea.

The biological collections should also prove very valuable. The material obtained by the seven hauls of the deep-sea trawl will probably contain many new species and interesting additions to the Antarctic fauna. The line of soundings made by the *Terra Nova* to the south of New Zealand is also an important contribution to the ocean contours of that area.

Apart from the oceanographic work, perhaps the most interesting geographical information in the despatches is that dealing with the meteorology. Unlike the calms and fine weather experienced by Amundsen in his more easterly route, Captain Scott was harassed by a succession of southern gales similar to those met by Shackleton, although the weather on the plateau appears to have been milder. It has been suggested that the low temperature of these southern winds indicated their anticyclonic origin, but as Captain Scott reports for one of them a temperature of only 35°, they do not support the existence of the hypothetical south polar anticyclone. The *Discovery* expedition reported a very slight snowfall in the area around the Ross Sea, and the recent diminution of the glaciers was thus explained. The evidence collected by that expedition was recognised at the time as inconsistent with that conclusion, and the heavy snowfalls now reported show that there is no difficulty in explaining the formation of the barrier ice by the accumulation of snow.

The reports show that the expedition has made most important contributions to Antarctic knowledge. Subjoined is a summary of the scientific results published by the Central News (Ltd.) Agency.

*Summary of Scientific Results.*

The general plan arranged for the scientific work of the expedition has been carried out so far almost in its entirety. The self-registering meteorological instruments have given a continuous record of pressure and temperature and of wind velocity and direction. These have been checked by the eye every four hours. The upper atmosphere has been investigated by means of small balloons, which have shown the direction of the upper currents of the air to a height of six miles and have recorded temperatures to a height of five miles. Absolute magnetic observations have been made every week. Self-registering magnetic instruments were installed in a room excavated in the side of a small glacier, this eliminating the changes of temperature which are a serious cause of error in this class of work. All through the winter the aurora was observed every hour, but very few brilliant displays occurred. Atmospheric electricity has also been studied, and ice work and physiography have afforded much fieldwork.

Vexed problems regarding the origin of Alpine topography when Europe and other temperate regions were undergoing an ice age are being studied in the examples offered by the retreating glaciers of Victoria Land, where the ice age still obtains. The mainland offers a rich field for petrology, with an abundance of mineral-bearing quartz veins, but none of any economic value.

Specimens of coal of economic value and well-preserved fossils have been found near Granite Harbour. An excellent field exists at winter quarters for ice work in miles of glacier, while in front of the hut stands a cape formed largely of massive moraine with lava flows from Erebus. Pendulum observations for the value of gravity have been carried out; a tide gauge has given a continuous record, and marine biological work has been done throughout the winter at a hole kept open in the sea ice for nets, water samples, and sea temperatures.

The quantitative and qualitative observations of minute organisms at various seasons are giving interesting results. The parisitology of all seals, penguins, and others birds and fish available has already given good results. Some new protozoa have been found.

The above has fully occupied the time of the scientific staff and indicates that there is an ample field for further research in every direction.

Successful biological work has been carried out on board the ship. With seven trawls a large collection of the deep-sea fauna of the Antarctic has been obtained. A number of catches with the tow net have been secured which show a vertical distribution in the transparent floating organisms of the sea. Continuous meteorological observations have been taken in the ship, linking up Australasia with Antarctica.

Natural history research has been greatly assisted by the use of the kinematograph. Many thousands of feet of film have been used in securing permanent animated records of the interesting bird and animal life of these regions, and every phase of seal, penguin, and skua-gull life has been thus illustrated. Some remarkable kinematograph films have been secured showing for the first time the "Killer" whale, the wolf of the seas, in its native element.

## NOTES.

We notice with regret the announcement of the death on March 8, in his seventy-fifth year, of Dr. Edward Divers, F.R.S., the distinguished chemist, and Emeritus professor of chemistry in the Imperial University, Japan.

At a meeting of the committee of the Lawes Agricultural Trust held on March 30, Mr. A. D. Hall, F.R.S., director of the Rothamsted Experimental Station, tendered his resignation. Mr. Hall's resignation takes effect in September, after which he will give his whole time to the work of the Development Commission. The committee of the Lawes Agricultural Trust will proceed to the election of a new director in June.

The Philosophical Institute of Canterbury, New Zealand, which came into existence on August 30, 1862, will celebrate its jubilee this year. It is proposed to mark the occasion by holding a gathering in Christchurch.

The council of the New Zealand Institute, at its annual meeting, held in Christchurch at the end of

January this year, decided to award the Sir James Hector memorial medal and prize to Dr. L. Cockayne as the investigator, working in New Zealand, who has done most to advance botanical science.

A SEISMOLOGICAL Observatory has been added to the Geological Department of the Georgetown University, Washington, D.C., U.S.A. The equipment consists of two Bosch-Omori tromometers of 25 kilos. mass, a Wiechert horizontal pendulum of 200 kilos. mass, two Mainka conical pendulums of 130 kilos. mass each, and a vertical pendulum of 80 kilos. mass, after Wiechert. A separate cave, fitted with a Bosch photographic recording horizontal pendulum, is under construction.

THE sixty-fourth annual meeting of the Cotteswold Naturalists' Field Club was held at Gloucester on April 2. Dr. C. Callaway and the Rev. Canon Razeley were elected honorary members. The retiring president, Mr. William Crooke, after reviewing the work of the club during the past year, dealt with the evidence for the antiquity of man that had been obtained of recent years. The Rev. Walter Butt, J.P., was elected president for the coming year, and Mr. L. Richardson hon. secretary.

ON Thursday next, April 18, Prof. A. W. Crossley will deliver the first of two lectures at the Royal Institution on "Synthetic Ammonia and Nitric Acid from the Atmosphere." The Friday evening discourse on April 19 will be delivered by Mr. Alan A. Campbell Swinton on "Electricity Supply: Past, Present, and Future," and on April 26 by Sir George H. Darwin on "Sir William Herschel." In addition to the Friday evening arrangements already announced, the discourse on May 24 will be delivered by Mr. A. D. Hall on "Recent Advances in Scientific Agriculture: the Fertility of the Soil," and on June 14 by Mr. A. H. Savage Landor on his recent journey through unknown parts of South America.

BY the will of Lord Lister, the sum of 20,000*l.* is bequeathed to the Lister Institute of Preventive Medicine, and 10,000*l.* each to the Royal Society, King Edward's Hospital Fund, King's College Hospital, and the North London and University College Hospital. In the will Lord Lister requests his nephews, Mr. Rickman John Godlee and Mr. Arthur Hugh Lister, to arrange his scientific MSS. and sketches, destroying or disposing of such as are of no permanent scientific interest, and to present the remainder to the Royal College of Surgeons, England. Lord Lister's orders and medals are bequeathed to the Edinburgh University, and the will states:—"I expressly declare that it is my intention that the University authorities for the time being shall be perfectly at liberty to dispose of all or any part of the gift—for example, by having the medals melted down or the diplomas or other writings destroyed—at any time and in any manner that may seem to them desirable."

THE Essex Field Club has recently appointed a committee for the purpose of raising a small fund to put in order the tombs of John Ray and Benjamin Allen (which stand adjacent to one another in the churchyard at Black Notley, but have been allowed to fall into disrepair), and to erect at Braintree a memorial to Samuel Dale, of that town, to whom no memorial exists. These three naturalists were friends and contemporaries, living at Braintree or in its immediate vicinity in the closing years of the seventeenth century and the opening years of the eighteenth. John Ray (1627–1705) was by far the most eminent British naturalist of his day, and has been rightly described as "the Father of Modern Natural Science." Samuel Dale (1659–1738), though a younger man and of less eminence, was widely known in his day as a naturalist, especially as a botanist. Dr. Benjamin Allen (1663–1738), the youngest and least eminent of the trio, was an excellent naturalist and a skilled physician. For carrying out the work of restoring the two tombs, and erecting a memorial to Dale, the sum of about 50*l.* is required, and subscriptions are invited to make up this amount. Such subscriptions may be sent to Mr. Miller Christy (115 Farringdon Road, E.C.), or the Rev. J. W. Kenworthy (26 Inglis Road, Colchester).

THE one hundredth anniversary of the foundation of the Academy of Natural Sciences of Philadelphia was celebrated on March 19–21. The actual date of the anniversary was March 21, but the celebration began on the evening of March 19, when delegates to the number of 133, who had been appointed by corresponding societies to represent them, were welcomed by the Hon. Rudolph Blankenburg, mayor of Philadelphia. After the delegates had presented their letters of credential and congratulation, the president delivered an historical address setting forth the early struggles of the society for existence, alluding briefly to the distinguished men whose work had prepared the way for the celebration, directing attention to the special features of the museum, and insisting on the importance of natural history studies in their utilitarian aspect, more especially in connection with the parasitic origin of disease. In conclusion, he handed over to the society on behalf of the building committee the enlarged hall of the Academy, which, through the liberality of the Legislature of the State, had received important additions and had been made thoroughly fireproof during the past year. The works to be issued in connection with the centenary celebration consist of a quarto volume of illustrated scientific memoirs, the commemorative volume, an index to the entire series of Proceedings and Journal, and a detailed history of the Academy by the recording secretary, Dr. E. J. Nolan. At the sessions on March 20 and 21, summaries were given of communications presented for publication in the commemorative volume, and of other papers on scientific subjects. The scientific sessions concluded with a lecture by Mr. Witmer Stone, one of the curators of the Academy. On the evening of March 21, 163 members and guests sat down to a banquet in the new geological hall, formerly occupied by the library. The banquet, in common with all the other details of the programme, was a brilliant success, and the entire celebration will be long remembered as one of the most interesting events in the history of American science.

THE alleged traces of primitive man in Argentina, the *tierras cocidas* of Monte Hermoso, have been often referred to in these pages. The views of the late Florentino Ameghino have found a supporter in Colonel A. A. Romero (*Anales del Mus. Nac. de Buenos Aires*, vol. xxii., 1911, p. 11). It is argued that we know little of man's precursors, that they may go back to a high antiquity, and that the grouping of the "scoriæ" sometimes suggests a united camp-fire. The petrographic arguments now adduced, and the very defective photographs of thin slices, do not add much to the discussion. The scoriaceous earths containing vegetable remains, as shown in plate viii., are much more to the point, as opposing a volcanic origin.

IN the Journal of the College of Agriculture, Imperial University of Tokyo, vol. ii., No. 7, Mr. Kamakichi Kishinouye describes an interesting collection illustrating prehistoric fishing in Japan. This collection was made from a large series of shell-mounds of the Neolithic period, associated with numerous flint implements, pottery, the hard parts of molluscs, fish, turtle, birds, marine, and land mammals. The fishing implements are of the most varied description, including stone arrow and harpoon heads, others of bone or horn, sinkers, &c. In their form they closely resemble implements of the same period found in these islands. The fishing-hooks have usually barbs on the outer side of the stem. One fine landing-hook or gaff, the only example found, is made of horn, about 130 mm. in length, and bent in the middle at an angle of about 90°. This prehistoric race seems to have possessed little of the artistic capacity of their successors, but some clay dishes bear representations of *haliotis* or *anodonta* shells, and on another appears a design which may represent the head of a shark. This valuable paper is accompanied by excellent illustrations of typical specimens.

PARTS iii. and iv. of vol. viii. of *Biometrika* have been issued together as a double number. Of the principal articles three—on Egyptian, negro, and pygmy crania respectively—deal with craniology; the two former are from the pen of Miss H. Dorothy Smith, the latter edited by Prof. Pearson from the work of the late Dr. Crewdson-Benington. Mr. Carr Saunders discusses the relation between pigmentation and disease on the basis of data derived from the medical survey of school children at Birmingham, but, unlike earlier workers in the same field, such as Shrubsall and Macdonald, fails to find any appreciable relation. Of the remaining articles we may specially direct attention to three, by Dr. Maynard and Prof. Pearson, bearing on the interpretation of data relating to the appearance of multiple cases of disease in the same house. The supplementary tables calculated by Mr. Everitt for facilitating the determination of Prof. Pearson's coefficient for a fourfold table should also be mentioned.

A NEW "quarterly review of scientific thought," with the somewhat imposing title of *Bedrock*, has been launched on its career this month by Messrs. Constable. Of the articles included in the first number, several are distinctly noteworthy. Prof. Welton discusses the value, to the teacher and to the scientific worker, of a logic of method, and his comments on teaching should prove useful and stimulating. The good teacher, says Prof. Welton, shows his pupil how to go along the high road; the old-fashioned bad teacher plumped him down at his destination, as if he had been transported there on a magic carpet; the bad new-fashioned teacher turns him adrift, giving him no indication of the way. Dr. Archdall Reid contributes a characteristic discussion of recent researches in alcoholism, and the reader will find it interesting to follow this by a perusal of Dr. Gossage's article on "Human Evidence of Evolution." Prof. Poulton's examination of the facts of mimicry as a crucial test between the theories of Darwin and of Bergson is both admirable and timely, but would have been more easy to follow if the publishers could have seen their way to give the illustrative plates in colour instead of in black and white. The articles on "Interaction between Passing Ships," by Prof. Gibson, and on "The Stars in their Courses" (substantially the Halley lecture) by Prof. Turner, take the reader into different fields of thought, and are both written in a simple and attractive style. Altogether the new quarterly opens well.

THE report of the Rugby School Natural History Society for 1911 records the retirement of its late president, Mr. Henderson, one of whose last official acts was the inauguration of the successful exhibition held in March of the year under review. The astronomical section, which lapsed a few years ago, has been revived, and is doing well, but in the zoological section (which appears to be restricted to ornithology, entomology forming a section by itself) the secretary deplores the lack of enthusiasm displayed by the members.

TWO unusually interesting new mammals from Tonkin were described at the meeting of the Zoological Society on March 19. The first was a civet resembling the banded *Hemigale hardwickei* of the Malay countries in colouring, but distinguished by the spatulate crowns of its milk-incisor teeth—a difference which its describer, Mr. Thomas, regards as of generic value. The second, described by Mr. Dollman, was a snub-nosed monkey of the genus Rhinopithecus, of which three species, from western and central China and the Mekon valley, were previously known.

THE insects causing damage to the chir pine (*Pinus longifolia*) in the north-west Himalaya form the subject of vol ii., part 2, of the Indian Forest Memoirs. The timber of the chir is much used for a variety of purposes in India, owing to the ease with which it is worked, and the tree is also tapped for resin, as a source of turpentine. The long list of insect pests by which this tree is attacked given by E. P. Stebbing shows how sorely it stands in need of protection, one of the worst of these being the beetle *Platypus wilmoti*, the larvæ of which bore into the very heart of the timber. Special attention is directed to the insects parasitic on, or preying upon, the mischievous species.

IN the *Journal of Genetics*, vol. ii., No. 1 (February), Mr. A. W. Hill deals with the history of *Primula obconica* under cultivation, and concludes that the amelioration and development in form and colour of the flowers, &c., which have taken place during the past thirty years, must be attributed to selective processes, also that there is not sufficient evidence in favour of the view that hybridisation with other species has taken place. It is of the greatest importance that the history of other species which are made the object of extensive breeding experiments should be thoroughly cleared up, as in this paper, which is illustrated by two beautiful coloured plates.

THE difficult problem of the morphological nature of the endosperm of angiospermic plants forms the subject of a paper by Prof. Coulter in the *Botanical Gazette*, vol. lii., No. 5. From a critical review of the literature, the author concludes that endosperm formation is not dependent upon the presence of a male nucleus, nor even upon fusion of the two polar nuclei of the embryo-sac, hence these fusions may be regarded as supplementary rather than determinative. Further, the formation of endosperm does not even depend upon having been preceded by a reduction division. The author is therefore led to the view that the fusions associated with endosperm formation do not represent a definite process, but are miscellaneous in number and order; and that the product of such fusions as do occur is merely an undifferentiated tissue, which practically continues the tissue of the gametophyte, that is, it is simply *growth* and not *organisation*.

THE concentric growths of chalcedonic silica known as beekite appear as disease-spots in fossil shells, and have spread in some cases until the organic remains are replaced by lumpy masses of silica. Mr. James Strachan brings his considerable experience as a chemist to bear on the origin of beekite in a paper read before the Belfast Naturalists' Field Club on March 27. He concludes that the chalcedony is precipitated by osmotic action in the colloid matter of the shells, where it replaces calcium carbonate. The rings around the central disc of chalcedony represent the periodic movement of the chemical action. Mr. Strachan points out that this mode of origin has been suggested by Prof. Sollas for banded flints. It will be noticed that, if animal matter is requisite for the precipitation, the formation of beekite is referred to an early stage in the history of the rocks in which it occurs.

THE views of Lugeon and others as to Alpine mountain-structure have been so widely accepted that Mr. Bailey Willis probably does good service by a criticism based on personal observations. In a "Report on an investigation of the geological structure of the Alps" (Smithsonian Miscell. Coll., vol. lvi., No. 31, 1912), he urges the efficacy of thrust-planes as against recumbent overfolds, and shows how the exotic masses of strata known as *klippen* may be explained by the intersection of two thrust-planes of opposite slope. He believes that the earlier thrusting in the Alps came from the north-west, and was followed by erosion carried on until a mature type of surface had been produced. The far more recent thrusting from the south-east is regarded as Pliocene, since the scarp weathered out in the Bernese Oberland on the Alpine mass that was moved forward remains still fresh and young. This short paper clearly gives matter for large discussion. The spelling of some of the place-names seems to want revision.

AN important memoir on the climate of the Italian capital has been issued by the Italian Meteorological Office. Rome is one of the few places for which meteorological observations extending over more than 100 years are available. In this volume Dr. F. Eredia has gathered together and summarised the available data. For all the principal elements monthly means or totals are given for each year from the commencement of the record up to the end of 1910, the whole forming a historical record of great importance. The observations of precipitation go back to the year 1782 in unbroken sequence. The temperature record also begins in 1782, but there is a gap in the series from 1792 to 1811. Monthly normal values have been computed for all elements, and for pressure temperature, humidity, and wind velocity the diurnal variation has been determined from the records of autographic instruments. The observations are not strictly homogeneous throughout. There have been changes of site, instruments, and methods of observing, but in preparing the results for publication every effort has been made to minimise the effects of such disturbing causes.

THE Danish Meteorological Institute has distributed (as in previous years) an excerpt from its nautical meteorological year-book, containing useful information relating to the state of the ice in the Arctic seas in 1911; the monthly summaries for April–August are illustrated by maps. The details seem to us to show that the conditions were, on the whole, somewhat more severe than usual. At the entrance to the White Sea there was much pack-ice in April and May, and Archangel was closed until near the end of the latter month. Novaia Zemlia was not ice-free until comparatively late, and in Barents Sea the ice was more closely packed than usual; the west coast of Spitsbergen became clear in August, but round the north-east coast navigation was impracticable during the year. On the east coast of Greenland there was more ice than usual during the summer, but at Angmagsalik the sea was open unusually early. In Baffin Bay it was difficult to penetrate the ice throughout the summer. So few reports were received from Bering and Beaufort Seas that it was difficult to form a general opinion; in May and June, however, the conditions seem to have been normal.

IN the *Zeitschrift des Vereines deutscher Ingenieure* Dr. Th. von Kármán, of Göttingen, shows that the ordinary theory of the flexure of beams cannot be applied to cylindrical tubes of small thickness owing to the considerable changes which take place in the form of the cross section when the tubes are bent. The author gives formulæ which take this effect into

account, and it is found, both from theory and from experiment, that in certain cases the deflection may be from three to five times as great as that given by the usual $EI/\rho$ formula.

IN the case of sudden explosions or volcanic eruptions anomalous sound phenomena frequently occur, the noise of the explosion being sometimes heard at abnormal distances, while it is inaudible at other places nearer the source. These phenomena were discussed in 1910 by Dr. G. v. d. Borne. In the Proceedings of the Tokyo Mathematico-Physical Society, vi., 9, Mr. S. Fujiwhara gives an analytical investigation based on a formula for the velocity potential subject to the assumptions that the atmospheric density follows the adiabatic law, and that the wind velocity varies very slowly with the height, the velocity of sound thus varying with the altitude.

IN Blatt 4, 1911, of the Royal Observatory of Wilhelmshaven, in continuation of similar previous work, Prof. Bidlingmaier gives a graphical representation of the hourly magnetic character of the last half of 1911, based on a scale "0," "1," "2," of disturbance. As an extension, he develops a scale of magnetic "activity," ultimately dependent on the range of the magnetic elements in each hour. If this lies between $50(n-1)\gamma$ and $50n\gamma$, the measure of the activity is $n^3-(n-1)^3$. This idea is applied to the ten years 1890 to 1899, and conclusions are drawn as to the activity of the earth's horizontal magnetic field in the several years.

IN his Nobel lecture to the Academy of Sciences at Stockholm in December last, now issued by Messrs. Barth, Leipzig, Prof. W. Wien gave a valuable survey of the recent advances made by the theory of radiation and of the difficulties which still beset it. Lord Rayleigh's form of the law of radiation of a black body, based on the equal distribution of the energy amongst the degrees of freedom of the vibrating system, agrees with observation over the longer wave-lengths only. Prof. Wien's formula, based on his "law of displacement" or compression of radiation, agrees, on the other hand, with measurements over the shorter wave-lengths only. Prof. Planck's form of the law agrees with observation over the whole of the range of wave-lengths at present available, but rests on the conception of energy as atomic in structure. The difficulties which such a conception raises are very grave, and Prof. Planck himself has substituted continuous for discontinuous absorption of radiation (see these "Notes" for March 16, p. 90, and June 15, p. 528, 1911), while Sir Joseph Larmor devoted his Bakerian lecture in 1909 to a possible alternative. Prof. Einstein's attempt to bring Dulong and Petit's law of atomic heats under Planck's theory has met with partial success only, and Prof. Wien thinks the processes going on in the atoms themselves must be taken into account before the theory of radiation can be placed on a satisfactory footing. A commencement has already been made by Prof. Sommerfeld, who gives the constant $h$ of Planck's theory an atomic significance.

AN interesting series of papers on the chemical effects of light on organic compounds appears in the *Gazzetta chimica Italiana* (vol. xlii., p. 65 *et seq.*). In the first paper, by Prof. Paternò and C. Maselli, the synthesis is described of a substance having alkaloidal properties, by exposing acetophenone dissolved in alcoholic ammonia to bright sunlight during several months. The alkaloid $C_{18}H_{18}N_2$ forms well-defined measurable crystals, and appears to owe its origin to a complex change in which two molecules of acetone, two of ammonia, and one of alcohol are involved. In the absence of light the alkaloid is not formed. In the later papers, by L. Mascarelli, a striking change brought about in aromatic aldehydes by traces of iodine under the influence of sunlight is dealt with. It has been known for some years that benzaldehyde polymerises to trimeric and tetrameric forms under the influence of the sun's rays; it is now shown that in the presence of traces of iodine a dimeric form is produced which has the structure of benzyl benzoate. There has, in fact, been reduction of a portion of the benzaldehyde at the expense of the remainder, a result similar to that well known to be induced by the action of alkalies, such as potassium hydroxide.

IN the January number of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, M. H. Gault gives a summary of the additions which have been made during the last few years to our knowledge of natural perfumes and other essential oils. Among the principal oils dealt with are those of cloves, eucalyptus, fennel, juniper, geranium, jasmine, lavender, lemon grass, and peppermint. The article is a continuation of one on the same subject published in 1908. Various sources have been drawn upon for the information, Schimmel's "bulletins" figuring frequently in the references, which include also a fair number of English and American periodicals. A short account of the origin of each oil is given, with particulars of its physical and chemical characters, including its density, boiling point, refractive index, rotatory power, saponification value, and so on; usually also the chief chemical components are indicated. Special points in the chemistry of individual oils are discussed incidentally, but the author reserves for a future article the more general consideration of the chemical constituents of essential oils, as well as a fuller discussion of certain researches. To those interested in the subject the contribution will be useful as a convenient *résumé* of investigations, the accounts of which have been disseminated hitherto over a number of publications.

BULLETIN No. 52 of the University of Illinois contains an account of investigations of the strength of rolled zinc carried out by Mr. Herbert F. Moore. From the results it appears that zinc, either rolled or cast, has no well-defined yield point, and its elastic limit is very low. Zinc possesses a relatively high degree of plasticity. The ultimate strength of thin rolled zinc plate (not more than 0·05 inch thick) is about 24,000 lb. per sq. in. The modulus of elasticity of zinc in tension is about 11,500,000 lb. per sq. in. The stress per square inch of area sheared developed in punching or shearing rolled zinc plates is about 40 per cent. of the stress developed in punching or shearing mild steel plates; the energy required in

punching or shearing rolled zinc plates is about 30 per cent. of the energy required to punch or shear mild steel plates. The ductility of rolled zinc is much less than that of mild steel, and the ductility of zinc plate with the grain is greater than the ductility across the grain.

IN the new Liverpool Adelphi Hotel of the Midland Railway Company, which was opened a few days ago, uniform and accurate time is secured throughout by an installation of upwards of 200 electrical impulse dials on the "Synchronome" system, all operated by one controlling pendulum. It is necessary that electric clocks in bedrooms should be silent in action, and this condition is fulfilled by those on the "Synchronome" system.

PROF. KAMERLINGH ONNES directs our attention to an error in our note of March 14 (p. 41) on his measurements of the resistance of mercury at low temperatures. The values there given are not resistivities, but the resistances of a wire of solid mercury.

## *OUR ASTRONOMICAL COLUMN.*

THE ECLIPSE OF APRIL 17.—Anyone intending to see the eclipse of the sun from a station on the central line as it crosses France will find several points of interest in M. Fayet's article in the *Revue Scientifique* for March 30.

After explaining eclipses in general, M. Fayet describes the conditions of the coming eclipse, and illustrates his description with several maps and diagrams; he also gives numerous tables of position angles, times, &c., for many stations in France. It would appear that a total eclipse is not likely to be seen in France, and in any case spectrographic and any long-exposure work are out of the question; but M. Fayet shows that from the point of view of geometrical astronomy the eclipse is a most important one, giving exceptional facilities for delicate determinations of the moon's place, the apparent size of the moon, and the figure of the earth. There are, then, plenty of possibilities of a large number of amateurs making observations of great value, even if the eclipse is only an annular one; no expensive instruments will be necessary, and the value of the observations will be greatly enhanced as they are multiplied in number. In France the observers are being officially organised, and preparations are being made for the distribution of the exact time and the coordination of the results. St. Germain-en-Laye, a few miles west of Paris, would appear to be one of the most readily accessible points near to the central line.

In the *Comptes rendus* (No. 14) for April 1 M. Bigourdan discusses very clearly, and explains in detail, the observations which may be made for the better determination of the moon's apparent diameter and position, and the reasons for making them during this particular eclipse.

THE EL NAKHLA EL BAHARIA METEORITE.—The meteoritic fragments which fell in Lower Egypt on June 28, 1911, are described in detail by Dr. John Ball in Survey Department Paper No. 25. Altogether some forty stones, weighing nearly 10 kgms., have been collected, but, as the explosions producing the fragments are supposed to have taken place at a considerable altitude, scattering the pieces over an area about 4·5 kms. in diameter, this probably does not represent the total mass as it entered the earth's atmosphere. The weight of the heaviest fragment is 1,813 grams, and of the smallest about 20 grams; some small fragments have a fused skin all over their surfaces while others are only partially covered, thus indicating a succession of explosions. A portion of the stone was submitted to Sir Norman Lockyer for spectroscopic analysis, and his report places the spectroscopic prominence of the various elements in the order Cr, Na, Ca, Al, Mg, Si, Mn, Fe, V, Ti, and K; the last is very weak. A chemical analysis by Mr. W. B. Pollard gives $SiO_2$, 50; FeO, 20; CaO, 15; MgO, 12; and $Al_2O_3$, 1·65 per cent.; $Cr_2O_3$ appears as 0·23 per cent., and traces of the other elements were found. Although this is the first "find" in Egypt, Dr. Ball believes that a large meteorite fell in a direction 32° W. of true N. from Philæ on April 5, 1902; such phenomena as attend these falls were then observed, but no stone was found.

A DAYLIGHT METEOR.—The director of the Meteorological Office informs us that at Brocklesby, Lincs, on March 28, Mr. F. J. Gibbons observed a vivid meteor at 2.50 p.m. in broad daylight on a bright afternoon. The meteor appeared to move from south to east in a downward course. It would be interesting to know if the meteor was observed elsewhere. Observations of meteors in daylight appear to be uncommon, although particulars of a certain number are given in the annual reports of the British Association Committee on luminous meteors.

THE STONYHURST OBSERVATORY.—Father Sidgreaves's report of the meteorological and magnetical observations made at Stonyhurst during 1911 contains the usual tabular summaries with a few notes on the more important points. The observations of sun-spots and of magnetic declination point to 1911 being a minimum epoch for each, but later observations must be awaited to fix this point with certainty.

PHOTOGRAPHS OF HALLEY'S COMET.—The first fascicule of vol. v. of the *Annales de l'Observatoire astronomique de Tokyo* is devoted to Halley's comet as observed at Dairen, Manchuria, during the months April–June, 1910, by MM. Sotome and Hoasi; photographs taken at Tokyo by M. Toda are also included. The form, changes, and length of the tail and the acceleration of its particles are discussed at length, and there are nineteen plates of excellent reproductions of photographs, 131 in all, at the end of the work.

## *CYCLES OF THE SUN AND WEATHER.*

SINCE Sir William Herschel suggested that variations in the visible changes of the sun's surface might be sensibly reflected in the meteorology of our planet, many investigators of high authority have endeavoured to determine the precise nature of the relationship between solar and terrestrial phenomena. In the seventies of last century it was decisively shown that the variation of certain meteorological elements coincided with that of photospheric activity as revealed by observations of sun-spots. The conclusions arrived at were expressed very definitely by Prof. A. Schuster in a paper presented to the meeting of the British Association in 1884. "There can," he said, "be no longer any doubt that during about four sun-spot periods (1810 to 1860) a most remarkable similarity existed between the curves representing sun-spot frequency and the curves of nearly every meteorological element which is related to temperature. This is not, in my opinion, a matter open to discussion: it is a fact."

But though a connection was established, further studies of its character seemed to lead to contradictory conclusions. High air temperatures were

associated with lowest sun-spot conditions, while the frequency of tropical cyclones and abundance of rainfall, which should *prima facie* show the same relationship, suggested that there was increased movement and evaporation about the maximum epoch of the sun-spot period. As the results obtained from the different groups of facts could not be reconciled, the discussion of the subject was for some years in abeyance. Broader views are, however, now being taken; and it is realised that many sun-spots may mean increased rainfall in one part of the world and decreased in another, or the like inversion of any other meteorological element. Also, the development of means of obtaining more complete records of changes upon the sun's surface, in addition to those manifested by sun-spots, has encouraged further inquiry into the subject of solar influence.

Full knowledge can only be secured when the new methods have been used for many years, but, so far as the discussion has proceeded, it indicates that there is no real inconsistency in the earlier conclusions, and that studies of the sun offer the most promising prospects of success in long-range weather prediction. Meteorological analysis of observations made at a solar physics observatory has become even more important than consideration of the results from an astronomical point of view. As was remarked in a report of the U.S. Weather Bureau a few years ago:—"Advances in the period and accuracy of weather forecasts depend upon the exact study and understanding of atmospheric pressure over large areas, and a determination of the influences, probably solar, that are responsible for ordinary and extraordinary distributions of atmospheric pressure upon the earth's surface."

We may take it for granted that the weather of any region is determined mainly by the barometric pressure and the interchange of areas of high and low barometer. The most important variations to consider are, therefore, those of atmospheric pressure, and the conclusions arrived at may then be used for comparison with variations of solar phenomena independently determined. The unit of inquiry should, however, be the world, and not one particular region; and there should be no assumption, as was formerly common, that solar changes indicated by sun-spots or other phenomena would affect the whole of our globe simultaneously and in the same direction at any particular epoch. Investigations carried on in recent years in this spirit have led to results which are both stimulating and valuable. For convenience we will refer first to the meteorological conclusions, then to solar changes, and finally to the relationships found between sun and earth.

Periodic plus and minus "pulses" of rainfall in India were described by Sir Norman and Dr. W. J. S. Lockyer in a paper read before the Royal Society in November, 1900, and were shown to be related (sometimes inversely) to similar variations at Mauritius, Cordoba (South America), the Cape of Good Hope, and other places. Attention was then devoted to an examination of the variations of pressure over the Indian and other areas, and a period of about 3·5 years (always referred to later as the 3·8-year periodicity) was found in the mean variation of pressure over the whole of India and at individual stations, and also in other large areas. An inverse variation was found in the pressures at Cordoba, and, referring to it, the authors remarked:—"The cause, therefore, which raises the mean value for the low-pressure months over the Indian area would appear to lower the mean value of high-pressure months at Cordoba simultaneously. In fact, we have a see-saw" (Proc. Roy. Soc., lxx., June 19, 1902). The area affected by this barometric see-saw was extended in a later paper (Proc. Roy. Soc., lxxi., December 4, 1902) to Ceylon, Java, Mauritius, and Australia, and further results were described in 1904.

H. F. Blanford and Hildebrandsson had previously found similar evidence of reciprocal barometric variations in widely separated regions, but the extension of the investigation to about a hundred stations in various parts of the earth led to the important result that there exists a world-wide barometric see-saw between two nearly antipodal parts of the earth, one region about India and its neighbourhood showing exactly opposite effects as regards atmospheric pressure in any year to those felt in a region which includes South America and the southern parts of the United States.

The pressure variations in the British Isles year by year do not go up or down with either side of this see-saw, but appear to be a mixture of both types. During some years the British area is enveloped in the pressure system that extends over the large region of which India is about the centre, while for another series it is dominated by the conditions of atmospheric pressure experienced in the region of which South America is the middle portion. On this account the cycle of 3·8 years distinctly exhibited in the meteorological records of two great regions of the world appears in British meteorology at a period of about three years, in the course of which variations are sometimes very noticeable. An examination of the records of annual rainfall at Greenwich for sixty years shows this three-year cycle very clearly. Taking a series of years, it is found that two wet years are followed by a dry year; but after eight years a reversal takes place, two dry years being followed by a wet one. This peculiar result is due to the combination, in the British Isles, of the Indian and South American pressure systems, which have a definite period of change—one going up while the other goes down—in a period of about 3·8 years.

Passing now to solar conditions, we have, first of all, the well-known sun-spot period of about eleven years. This is the mean length of the period; and it must be remembered that epochs of maximum activity, as indicated by frequency and magnitude of sun-spots, do not follow those of minimum activity at constant intervals, but vary from about three to five years. Moreover, when a critical examination is made of solar phenomena, it is found that successive cycles differ from one another in certain respects. Dr. Lockyer discovered that underlying the ordinary sun-spot period there is another of greater length, namely, about thirty-five years. In other words, the sun has to pass through about three cycles of activity before it reaches the same state as it was before. Sun-spots must not, of course, be taken as the sole criteria of the sun's condition; and it was pointed out by the Lockyers in 1900 that "there seems little doubt that in the future the measure of the change in the amount of solar energy will be determined by the amount and locus of the prominence area" (Proc. Roy. Soc., lxvii.). The solar latitudes in which sun-spots most frequently appear vary with the epoch of the sun-spot period, and the eruptive prominences have their maxima in the same latitude as the spots. A detailed examination of the records connected with solar spots and prominences revealed subsidiary maxima and minima of about 3·8 years (*ibid.*, lxx., 503), so that three waves of solar activity have to be considered having approximate periods of four, eleven, and thirty-five years. The condition of the sun at any time represents the algebraic sum of these coefficients of activity.

The correlation of the factors of terrestrial weather now becomes possible. In the first place, the old view that the sun's influence upon weather must be general

has been abandoned—as it should have been long ago. As the earth's atmosphere is a constant quantity, the crest of a wave in one part must be compensated by a trough in another. Solar action must thus have a double effect of opposite nature upon the atmosphere. High pressure in one region must be counterbalanced by low pressure elsewhere, and maximum rainfall in one region will coincide with minimum rainfall in another part of the globe. This is the explanation of the apparent inconsistent conclusions arrived at in earlier investigations of relationships between solar and terrestrial weather. There is now no room for doubt that the earth's meteorological conditions vibrate in sympathetic response to solar periods of about four, eleven, and thirty-five years. There may be other periods of oscillation, but in any case these three exist upon the sun and earth, and can be traced in the records of many phenomena. The shortest wave has been established by the Lockyers for solar and terrestrial variations, and the longest, represented by Brückner's cycle on the earth, was discovered by Dr. Lockyer to have its counterpart on the sun.

It is not surprising that other investigators have arrived at much the same conclusions independently. In a paper published in *The American Journal of Science* of December, 1894, on "Inversion of Temperature in the 26·8-day Solar Magnetic Period," Prof. F. H. Bigelow showed that the northern low-pressure and the southern high-pressure belts of North America vary in latitude directly with what he described as "solar magnetic intensity." He referred in the paper to a period of about three years, but his curves (reproduced in *The U.S. Monthly Weather Review* of November, 1903) only relate to meteorology and magnetism, and not to solar activity, the connection between magnetism and prominences not being described by him, so far as we know, until 1902. In the following year Prof. Bigelow published a paper on "Synchronism of the Variations of Solar Prominences with the Terrestrial Barometric Pressures and the Temperatures," and showed direct and indirect changes of both pressure and temperature. In an article in NATURE of January 8, 1903, Dr. Lockyer gave full credit to Prof. Bigelow, and stated that the two investigations were in agreement as regards three main points, namely:—(1) close connection between solar activity and barometric pressure; (2) great extent of areas over which very similar pressure variations exist; (3) presence of two large areas over which the pressure variations are reciprocal to each other.

Quite recently a paper has reached this country (Bulletin No. 1 of the Argentine Meteorological Office) in which Prof. Bigelow deals with "The Synchronism between the Variations of Solar Phenomena and the Meteorological Elements in Argentina and the United States." It is not clear whether the Bulletin is intended to be a semi-popular statement of the position of the subject or a contribution to scientific literature, but the almost complete absence of reference to the work of others suggests the former conclusion. Anyone not familiar with the points of progress would be led to believe that Prof. Bigelow is personally responsible for practically all that is known of solar and terrestrial relationships. *L'Etat, c'est moi*, said Louis XIV. on one occasion, and this spirit prevails in the paper before us. The only reference to South Kensington relates to photographs with a spectroheliograph, and no mention whatever is made of the investigations of solar and terrestrial meteorology, which, as may be judged from the foregoing account, form a substantial part of the work of the Solar Physics Observatory.

R. A. GREGORY.

## THE ETNEAN ERUPTION OF SEPTEMBER, 1911.

PROF. A. RICCÒ, director of the Observatory of Catania, has issued a preliminary report on the eruption of Etna which took place last September (*Boll. Sismol. Soc. Ital.*, vol. xv., pp. 273–280). The eruption may be said to have begun on the preceding May 27, when a new vent appeared on the north-east flank of the central crater less than a hundred metres below the rim, from which there issued hot white smoke, but no solid matter. In August, rumblings were heard in the central crater and in the new vent, and, from both, smoke and lapilli were discharged. This continued until the night of September 9–10, when a series of very strong earthquakes occurred, and a great radial fracture, eight kilometres in length, was formed, running in a N.N.E. direction from the new vent. Some of the earthquakes were felt as far as Mineo, 60 km. from the volcano. In the Observatory of Catania, 30 km. distant, the Vicentini microseismograph was almost continuously agitated from midnight to 6 a.m. on September 10. The strongest shock occurred at 2.14 a.m., and at the same moment a new vent was opened, about 4 km. from the central crater, from which smoke, ashes, lapilli, and stones were ejected. Later in the day, three new vents were opened, and by the next day there were sixteen in action, of which two emitted lava.

On September 12, the number of new vents was greatly increased. They seem to have followed the line of the great fracture. The highest group consisted of six vents in a N.N.E. line, from which a great quantity of fragmentary material had been ejected, but which on September 12 had become almost inactive. A little lower down, in the same direction, was a row of four vents; and, still farther, a line of six others, very active, which discharged incessantly great masses of smoke and large stones. Lower still was a fourth group, of four vents, arranged in a line bending towards the N.E., of which the two lower emitted small streams of lava. Continuing in the same direction is a tract of land to the south-east of Monte Nero, much fissured, and containing a long string of about thirty vents, from the lowest and largest of which issued an important stream of lava. To the north-east of Monte Nero, there started another line of craters (the sixth), about a score in number, from the lowest of which issued a second and larger stream of lava. This stream followed the course taken by the lava in 1646, and, travelling with great rapidity, crossed the Circumetnean railway on the evening of September 12. Between the two craters emitting lava was a seventh group of cones, throwing out incandescent matter.

On September 15 and 16, great masses of smoke were still emitted from the central crater and the vent of May 27. The two upper groups of vents were almost spent, the third continued very active; the fifth group of thirty or more vents emitted dense smoke and incandescent materials; in four days they had piled up cones some tens of metres in height; from the lowest lava still issued. The sixth group was also surrounded by lofty cones, from the lowest of which lava continued to flow at the rate of three metres a second.

The eruption ended tranquilly on September 23.[1] On October 1 the vents were again examined, and several changes were noticed. Those of the third group were united in four large craters; the fourth group consisted of twenty-seven vents, the fifth of

[1] The date is given as the 13th inst., but this is clearly a printer's error. On October 1 the eruption had been ended about a week.

forty-two cones, the sixth of twenty-eight high cones, while the seventh group had disappeared, probably beneath the lava-streams. The Circumetnean railway was occupied by the lava-streams for a length of 800 metres, the lava being piled up over it to a height of 30 metres. The front of the lava reached the Vallone Crasso, about 2 km. beyond the railway. Great quantities of sand and ashes were erupted continuously from the central crater, especially between September 11 and 16. On the days on which the dust fell over Catania, the air was thick, the sun and moon near the horizon were redder than usual; sometimes also the sun, when high up, was reddish and surrounded by a reddish-yellow aureole; but there was no sign whatever of a Bishop's-ring.

C. D.

## *WATER RESOURCES OF THE UNITED STATES.*[1]

CONFRONTED with eight water supply papers, varying in size from 78 to 370 pp., embracing an area of country which is half the United States, and exhibiting a comprehensiveness of treatment which covers river-gauging, well-sinking, water analysis, irrigation, topography, physiography, geology, and meteorology, one is constrained to admit that any attempt to do justice to such a mass of material within the brief compass of a short notice is an impracticable proceeding, foredoomed to failure. It will only be possible, in fact, to turn over the numerous pages of carefully recorded data and valuable information, and pick therefrom, almost at random, one or two of the more interesting and salient facts.

At the outset one is arrested by a photograph exhibiting in a marked degree that wonderful illimitability and fascinating monotony of the desert which is only to be likened to the corresponding spaciousness of "old ocean's grey and melancholy waste," and one learns that there is good evidence to show that the central portion of the Estancia Valley, in New Mexico, with its area of 2000 square miles, was once the bed of a lake, at the margin of which are still to be seen beach ridges and other features of littoral formation. Debouching into this central plateau are a number of broad avenues, or arroyos, of gradually increasing depth, which extend backward to the cliff-edged cañons in the mountainous borderland. These arroyos, generally speaking, hold no permanent stream, but form avenues for the escape of storm waters, which disappear even before they reach the lowest level, leaving behind them the sediment and detritus which they carried.

This vanished lake of New Mexico has a counterpart of vaster dimensions in western Utah, where, in the Pleistocene epoch, it is affirmed, there existed a lake some 20,000 square miles in area. Its surface was about 5200 feet above the present sea-level, or about 1000 feet above the present level of the Great Salt Lake. More or less distinct shore lines can be traced as the lake gradually sank and dwindled through the later stages of its history; two, particularly, can generally be recognised, one marking the time of its maximum development, and the other an intermediate condition.

In Texas there is the problem of the mounds. Scattered over the north-eastern portion are innumerable small mounds, varying from 20 feet to 100 feet in diameter, and from 2 to 5 feet in height. In general they are circular in outline, but in some localities they show a tendency towards elongation in a north-east to south-west direction. Various suggestions have been put forward to account for their origin: human or animal agency, water erosion, glacial action, wind. No definite evidence in favour of any one is forthcoming, and the question remains an open one.

Other points might be noticed, but these few will suffice to show that, apart from the columns of figures, there are many items of interest and much wealth of general information contained in these water supply papers of the United States Geological Survey.

## *THE PORT ERIN BIOLOGICAL STATION.*

THE twenty-fifth annual report of this station shows that it continues to be an active instrument in advancing biological teaching and research, sixty students and research workers having occupied the tables during the year. Among the several researches in progress may be mentioned a biometrical investigation of the variation in the shells of the common limpet, which shows that specimens collected near low-water mark are flatter than those taken near high-water mark, and that, contrary to expectation, there was no difference in height between shells obtained from exposed and from more sheltered positions, if taken at the same water-level. *Biddulphia sinensis*, a diatom from the Far East, which made its appearance in European seas eight years ago, and was recorded from Port Erin in the last report, was found again in quantity and in vigorous condition, in September and October, 1911.

Prof. Herdman gives an account of the occurrence of the Peridinian *Amphidinium operculatum* at Port Erin. This flagellate organism was first observed there on April 7, and from this date to May 1 it occurred in such profusion as to form brown deposits in the ripple-marks on the sand at about half-tide level. On the same patch of sand there were, from June 3 to July 22, deposits similar in appearance to those already noticed, but on microscopic examination they were found to be composed of diatoms, chiefly Navicula (probably *N. amphisbaena*), and careful search failed to reveal the presence of any specimens of Amphidinium. On September 9 and 10, however, dense swarms of the latter organism were again present, but diatoms were absent, and this condition was maintained for a few days. On September 16 the naviculoid diatoms returned in force, and remained abundant during the two following days. By October 2 the diatoms had again vanished, but Amphidinium had reappeared, and it continued to be more or less in evidence until the 27th. Between October 28 and November 1 no specimens of Amphidinium were found, but on November 2 three small patches composed of this flagellate made their appearance in the usual positions on the beach, and then died away. From this date to the time of writing neither the flagellate nor the diatoms had been observed. Prof. Herdman suggests that the alternate occurrence, in the same area, of these two organisms is probably due to a physiological cause, and that each organism in turn exhausts or alters some essential constituent of the environment, so as to prevent its own continued existence in quantity, but leaves the ground suitable, or even favourable, to the physiological needs of the other set of competing organisms.

[1] United States Geological Survey. Water Supply Papers:—No. 263, Surface Water Supply of Ohio River Basin, 1909; No 266, Surface Water Supply of Missouri River Basin, 1909; No. 267, Surface Water Supply of Lower Mississippi Basin, 1909; No. 268, Surface Water Supply of Western Gulf of Mexico; No. 273, Quality of Water Supplies of Kansas; No. 275, Geology and Water Resources of Estancia Valley, New Mexico; No. 277, Geology and Underground Waters of North-Eastern Texas; No. 279, Ground Water in Juab, Millard, and Iron Counties, Utah. (Washington, 1911.)

## *HEAT-WAVES IN ASIA: SUNSHINE AT TRIESTE.*

DR. H. VON FICKER contributes to the *Sitzungsberichte d. K. Akad. der Wiss.*, of Vienna (vol. cxx., part vi., June, 1911), a comprehensive discussion of "heat-waves" travelling across northern Europe and Asia during the years 1898–1902. He deals with eleven cases in which the mean daily temperature increased by at least 10° C. in twenty-four hours, and the course of the change could be traced over a large area. The majority of the "heat-waves" occurred in winter, and three of these and the single summer-"wave" are discussed in detail. The mean values for the eleven cases are treated very fully, the synchronous conditions of wind, pressure, change of pressure, humidity, and cloud each receiving as full a consideration as the available data permitted.

In a previous investigation of cold waves in the same region, Dr. Ficker found that the wind in the cold area was roughly perpendicular to the wave-front, indicating that the change of temperature was produced by the horizontal transference of a mass of cold air. The result may be compared with the deductions of Lempfert and Corless from a detailed investigation of line squalls in this country. With heat-waves, however, the wave-front travels towards the east or south-east, while the wind is from south-west. The author concludes that there is a continuous south-west current which is lifted temporarily by the mass of cold air in the cold waves, and that in the general circulation of the atmosphere this warm south-west current is the medium through which air is carried polewards. He does not attempt to determine the motive power which pushes the cold air equatorwards. It may be the unexpended momentum of a south-west current which has crossed the polar regions, or it may be due to the effect of the earth's rotation on the south-west current in the rear of the cold wave.

In the northward progress of the warm current, the cooling is less than the warming which the cold wave experiences as it moves towards the equator, and this is attributed to the lifting of the warm current, which is thereby removed from the cooling effect of the earth. The latent heat of the vapour carried by the current ought also to be an important factor.

The maximum temperatures at different places in the "heat-wave" differ much less from one another than in the cold wave, and the increase of temperature is greatest in the coldest places. There are exceptional cases in Central Asia which are explained by the dynamic warming of descending air (Föhn).

The velocity of the wave-front is about 33 km. per hour, which agrees fairly well with the corresponding velocity found for cold waves. The latter would naturally expand laterally as they progressed, so that the actual velocity of the wave-front ought to be less in the case of heat-waves, for which no such lateral expansion is possible.

The relative humidity frequently increases with the advent of the "heat-wave," and the absolute humidity invariably does so. The amount of cloud also increases in general. The conclusion is drawn that the "heat-wave" cannot be attributed to descending air, but must be due to the horizontal flow of warmer and more humid air. It is difficult to reconcile this with the conclusions based upon the observations of wind, and it is possible that the surface wind does not provide a satisfactory basis for the theory developed by Dr. Ficker. It is now established that the upper wind, at moderate altitudes, deviates considerably from the wind at the surface, and has approximately the same direction as the surface isobars. Above the south-west winds found by Dr. Ficker, there would probably be a general current from west to east, or approximately in the direction of motion of the wave-front, and the general progress of the wave may be governed by this upper current.

The paper will contribute to the solution of the problem of scientific forecasting in its wider aspects, and the author is to be congratulated on the excellent use which he has made of the data contained in the publications of the Russian Central Observatory.

The same number contains a discussion by Dr. E. A. Kielhauser of nineteen years' records of the duration of sunshine at Trieste.

In the daily variation the maximum occurs at 1 p.m. in winter and at 2 p.m. in the other three seasons, but in summer there is a secondary maximum at 11 a.m. with nearly the same value as the principal maximum. At Kew the principal maximum in summer occurs at or before 11 a.m., and is considerably in excess of the secondary afternoon maximum.

The most interesting table is one giving the number of occasions in each month on which series of 1, 2, 3 . . . consecutive days without sunshine occurred. October had the greatest number of single days, and December of series of 2, 3, 4 days, but January had the greatest total number, and stands out as the month in which the longest sunless periods occur. No period, however, exceeded eleven days, so that Trieste is more favourably treated than London in this respect. At Westminster in January of the present year there were thirteen consecutive sunless days, at Kew fourteen. The difference in favour of Trieste is not sufficient, however, to justify its inclusion in the "sunny south."

In winter the chances are in favour of a sunless day being followed by a second sunless day, but the case is reversed in summer, and on no occasion did two consecutive sunless days occur in August, which had only ten such days in the nineteen years. July is the month with the greatest total duration, but August had the smallest number of sunless days.

E. GOLD.

## *THE TOTAL ECLIPSE OF THE SUN, APRIL, 1911, AS OBSERVED AT VAVAU, TONGA ISLANDS.*[1]

OWING to very unfavourable weather, the eclipse of last year was observed in the presence of a large amount of cloud. The lecturer, while only being able to refer to the few results that were secured, took the opportunity of explaining why expeditions were sent out to observe eclipses, and how a large expedition is organised when it is known that the assistance of one of his Majesty's ships is available. Introducing the subject with a few words as to the conditions which cause total solar eclipses, their occurrence in families, &c., he then pointed out that the sum total of time spent in useful observation at all the eclipses which have been observed up to date is very short, and amounts probably to less than three hours, for an eclipse cannot last longer than eight minutes, and does not, as a rule, exceed three minutes.

The line of totality of last year's eclipse extended across the Pacific Ocean, commencing at New South Wales, Australia, and terminating in the ocean just to the west of Central America. The central portion of the track passed near the islands of Tofua, Vavau, Tau, Nassau, and Danger Islands. Tofua being an active volcano, and Tau, Nassau, and Danger Islands difficult of access, most of the expeditions located themselves on Vavau, where there was a very safe anchorage for ships and where stores were obtainable. All the parties settled close to Neiafu, the chief village

[1] Abstract of a discourse delivered at the Royal Institution on Friday March 1, by Dr. William J. S. Lockyer.

of Vavau, and there the duration of totality was computed to be three minutes thirty-seven seconds, or 217 seconds.

In the earlier days of eclipse expeditions those who took part in them had to be content with eye observations alone. The discovery of and rapid advance made in the sensitive photographic plate, and its successful application in 1860 to eclipse work, revolutionised eclipse programmes altogether, so that an abundance of facts may now be photographed in a brief interval of time, and these be examined at leisure at a less exciting moment.

It is well to remember that many inquiries, which in the earlier days formed part of eclipse programmes, need attention no longer. Thus, for example, the corona was first thought to be the illuminated lunar atmosphere until observations proved it to be a solar appendage. Further, during eclipses the corona was supposed to be either quickly rotating or pulsating

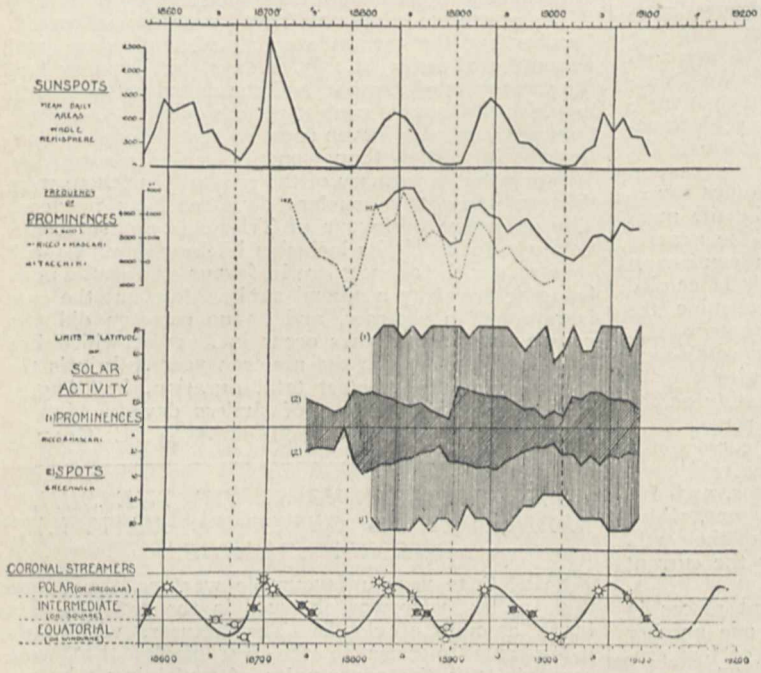



FIG. 1.—Curves to show that while the different forms of the corona exhibit a regular variation, corresponding in time to those of sun-spot areas and prominence frequency, it is the prominences (which, unlike the spots, are not limited to any latitude) that are responsible for the varying systematic changes of form of the corona.

visibly, but subsequent observations have shown that during those times it is apparently as rigid and stationary as an Indian order suspended in the sky.

The prominences, those ruddy, brilliant tree-like forms which appear during totality at the edge of the moon's limb, were also considered as belonging to our satellite, until observations in 1860 demonstrated them as belonging to the sun. While we know that they are solar, there is even now no necessity to waste time during eclipses on either the study of their forms, positions, or chemistry. The reasons for this are that in 1868 a method was devised by which they can be individually studied *visually* any day when the sun shines, and in 1891 a means was afforded of *photographing* in a few minutes, on one plate, all the prominences situated on the sun's limb.

The solution of these and other problems which might be mentioned are gradually reducing the importance of observing eclipses, and it is well within the bounds of possibility that in the near future all the main solar inquiries will be able to be conducted without waiting for their occurrence.

In recent years, among the most important work of eclipse expeditions, that of the study of the form and chemistry of the chromosphere and corona has taken first place.

Even now the research on the chemistry of the chromosphere is in process of being divorced from eclipse work. This is due to the magnificent work that is being carried on at the Mount Wilson Solar Observatory with large-scale instruments. At that observatory the chromospheric spectrum has been photographed in full sunlight. The method employed, while surpassing in accuracy of wave-length measures those made from eclipse spectra, may in time equal, or even possibly exceed, them in detail.

Thus the chemistry and form of the corona are practically the only large inquiries which are restricted to eclipses, and probably we may not have long to wait before even these form part of the daily routine of solar physics observatories situated in good observing localities.

Time will not permit me to tell you even briefly how the special results obtained during eclipses help the advancement of solar and celestial physics.

When it is remembered, however, that our sun has a temperature of about 7000° at its surface, and perhaps several hundreds of thousands of degrees at its centre—that the very sun-spots which appear to us as black spots on its surface are brighter than the brightest arc lamp—then the importance of the study of every attainable part of this very effective group of furnaces in and out of eclipse is imperative for the advancement of knowledge.

If one be permitted to refer briefly to the progress of our knowledge of the form, origin, and chemistry of the corona, you are well aware that its shape is not the same at every eclipse, but that there seems to be a systematic change going on, extending over several years (Fig. 1). A study of these forms has shown that the changes repeat themselves about every eleven years, and since the mean daily areas of sun-spots are known to have a periodicity of this length of time, their close association is generally conceded. It happens, however, that when the coronal streamers are most prominent in highest solar latitudes, and when at the same epochs the mean daily spotted area is at a maximum, the mean latitude of the spotted area is very low, being only about 15°. Thus there seems reason to question the conclusion that sun-spots at such a low latitude can originate coronal streamers so distant as the solar poles.

It must not be forgotten that a study of the frequency of solar prominences has disclosed the fact that not only have these phenomena a periodicity of about eleven years, synchronising exactly with the spotted area, but that when their frequency is at a maximum they are conspicuous at the highest solar latitudes. Thus there occur at the same time prominences and coronal streamers near the solar poles, a very possible and probable condition for cause and effect.

In the eclipses of 1901 and 1905 several striking

photographs were secured illustrating intimate association between prominence and the overlying coronal material, thus affording further evidence of their close connection.

While, therefore, prominence activity is most likely responsible for providing and raising the material from the body of the sun in the various latitudes according to the different epochs of prominence activity, what action is it that organises and arranges the streamers which extend sometimes five or six millions of miles into space?

The close association between the occurrences of terrestrial magnetic storms and solar disturbances, and the results of the researches which were described in this institution in 1909, namely, the discovery of solar vortices and the presence of powerful magnetic fields which result from the revolution of the negatively charged particles, termed corpuscles, in them —these suggest strongly a cause, namely, electromagnetic action, to explain the effect.

being of the "slit" type, employing a 10-ft. concave grating, while the other was of the "slitless" or prismatic camera type, in which the dispersion was secured by four 6-in. prisms of 45° angle.

The lecturer then referred to the various eclipse parties, namely, the two British official parties under himself and Father Cortie, a private party under Mr. Worthington, an Australian party under Prof. Baracchi, and two other observers who went out separately. The great assistance which the officers and men rendered to the lecturer's party can be gathered from the fact that 14 officers and 107 men took part in the observations.

Vavau was reached on April 2, and a camp was set up about a mile and a half up the harbour.

Work was commenced at once to clear the ground for the eclipse and living camps, to cut paths, and to erect landing-stages and steps. The various groups of volunteers confined themselves to their several duties, and general working parties were formed for

FIG. 2.—A view of the eclipse camp (Solar Physics Observatory expedition).

So long, then, as the corona can only be observed during eclipses, the study of its general form and its structure in close proximity to prominences should be minutely recorded and discussed.

About the chemistry of the corona nothing is known. The spectroscope on many occasions has permitted observers to photograph the many radiations that it emits, and while numerous determinations of the wave-lengths of these radiations have been made, no terrestrial equivalents have yet been discovered. Thus its composition is still a mystery.

For the occasion of last year's eclipse the main work intended to be accomplished by the expedition of which I was in charge was a study on a large scale of the spectra of the chromosphere and corona, together with the form of the corona.

For the spectroscopic work, two instruments giving large dispersion were constructed, adjusted, and taken out, and several coronagraphs of different focal lengths were utilised for recording the form of the corona.

The large spectroscopes were of two kinds, one

fetching dead coral, sand, and water for the concrete pillars, for building the pillars, and putting together and covering the instrument-huts and dark-room.

The weather experienced for the first week was all that could be desired in the way of absence of rain, but the high humidity, coupled with a high temperature and the presence of millions of flies and thousands of mosquitoes, rendered the work of the camp formation extremely arduous. In the water we had other enemies in the form of sharks and sea-snakes.

At a later stage a rainy type of weather set in, and it was the exception to have a day free from it. Tropical downpours were very frequent, and special precautions had to be taken to have efficient coverings for every instrument and to trench the small compounds in which each instrument was enclosed.

By April 20 arrangements were sufficiently advanced to warrant the commencement of rehearsals, and on six days before the eclipse these rehearsals took place (Fig. 2).

During the period occupied in preparing the instru-

ments for the eclipse, transit observations were being conducted for time and position, meteorological observations were being made at fixed times, and continuous records were being secured by a barograph, thermograph, and hygrograph.

In order to eliminate any doubt as to the possible inaccuracy of the computed times of the contacts of the limbs of the sun and moon, and also to give certain prescribed signals to those observers whose programmes necessitated them, a special telescope was set up (in conjunction with the siderostat of the 6-in. prismatic camera) to throw an image of the sun on a previously marked disc. The face of this disc was so graduated as to enable the observer to estimate the angle subtended at the centre of the dark moon by the remaining bright crescent of the uneclipsed portion of the sun; previous calculations had shown that when the crescent subtended angles of 90°, 45°, and 30°, there remained 42, 9, and 4 seconds respectively before totality began. This method only holds good when clouds do not obstruct the view of the sun.

In order to allow for the contingency of second contact not being seen on account of clouds, the observer was furnished with a deck-watch to give all the necessary signals at their computed times. The actual code of signals was as follows:—

| | | |
|---|---|---|
| 10 minutes before totality (wind clocks, caps off, lamps lit)... | Bugle | "Rouse up" |
| 5 minutes before totality ... | ,, | "Alert" |
| 42 seconds ,, ,, ... | 3 blasts (whistle) | |
| 9 ,, ,, ,, ... | 2 ,, ,, | |
| 4 ,, ,, ,, ... | 1 ,, ,, | |
| Totality begins, "217" on eclipse clock ... ... .. | Voice | "Go" |
| Totality ends, "0" on eclipse clock ... ... ... ... ... | ,, | "Stop" |

Eclipse day, April 28, or, as we had not altered our date since we crossed the "date line," April 29, dawned. It was a cloudy morning, and too cloudy to make one believe that it would clear up for the eclipse.

The lecturer here referred in the main to the account of eclipse day which he gave previously in these columns (vol. lxxxvi., p. 567, June 22, 1911).

The following table shows the observed and calculated times, and it will be seen that second contact occurred about 23 seconds before the expected time, and the duration of totality was nearly five seconds shorter than was anticipated:—

| — | Contacts | | Duration |
|---|---|---|---|
| | Second | Third | |
| | h. m. s. | h. m. s. | m. s. |
| Calculated (Downing) ... | 9 37 1·7 | 9 40 38·5 | 3 36·8 |
| Observed (Lockyer)... ... | 9 36 38·6 | 9 40 10·7 | 3 32·1 |
| Difference ... ... ... | 23·1 | 27·8 | 4·7 |

Large differences of time were experienced also by the Australian observers, whose time arrangements were quite independent of those of my party.

With the spectroscopic cameras of my party practically no results of any value were secured, while in the case of the coronagraphs nearly all the negatives displayed strong images of the clouds which marred the coronal streamers. Only two of the large number of plates exposed are of value, and these are restricted to the structure of the lower corona.

There is little doubt that the gradual fall of temperature during the eclipse, which was found to be 5° F., favoured the conditions of cloud formation in such a humid atmosphere, and thus prevented us from making satisfactory observations.

The work of all the other groups, such as those for sketching the corona, for the observation of the shadow bands, shadow phenomena, &c., was all for the main part spoilt by the presence of the clouds, in spite of the care taken in widely distributing the parties. Some interesting observations were, however, made by those who watched the behaviour of animals, &c.

While my party, together with that of Father Cortie, fared very badly, the Australian observers were more fortunate, and Mr. Worthington and his staff more fortunate still. With regard to the results secured by these parties, I can only show you in the

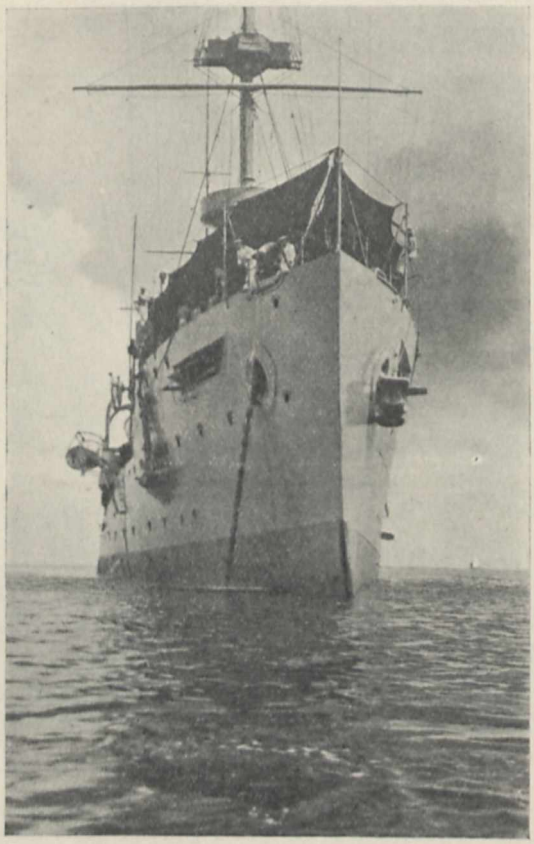


FIG. 3.—H.M.S. *Encounter* weighing anchor at Suva, Fiji, after landing the S.P.O. observing party.

case of the Australian observers a combined sketch carefully made from Mr. Dodwell's negatives and visual observations. This shows clearly the extensive equatorial streamers and the open spaces at the solar poles filled with the beautiful forms of the polar plumes. This corona is undoubtedly one of the "minimum" type, representing the wind-vane form. When this was compared with the sketch I made at the time of the eclipse, it was seen that both were in fair agreement in most of the main features.

Through the kindness of Mr. Worthington, I have been allowed to show you some of the beautiful results which he secured. Unfortunately, like us, he did not obtain any spectra, although he was equipped with a very fine instrument specially adapted for the ultra-violet region of the spectrum, but, unlike us, he was compensated by success on other lines. Both the long

and short exposures with his coronagraphs met with success. Beautiful structure is displayed in the regions of the solar poles, and the equatorial streamers are extensive and full of detail. These photographs also exhibit a "minimum" type of corona, corroborating the observations of the other parties; they are of considerable value as records and for future study, and form the main contribution to solar physics which this eclipse has afforded.

Although the astronomical results of my party were chiefly negative, we managed to get together at odd moments a collection of specimens for the Natural History Museum at South Kensington, the Botanical Gardens at Kew, and the Physic Garden at Chelsea.

In concluding this account, I should like to place on record in this institution the fine way in which the volunteer observers of my party worked in sometimes very trying circumstances; the magnificent assistance rendered by the captain, officers, and men of H.M.S. *Encounter*; the great liberality of the Orient Steam Navigation Company in again transporting out and home all our instruments, baggage, &c., free of charge; and lastly, the assistance of many individuals who at various stages of our journey made matters as easy as possible for us.

## *THE RELATIONSHIP OF NEANDERTHAL MAN AND PITHECANTHROPUS TO MODERN MAN.*[1]

THE more the remains of Neanderthal man are studied, the more it becomes apparent that Prof. Schwalbe is right in regarding this Pleistocene race as being totally distinct from all existing races of mankind. It is true that Neanderthal man in some characters, for instance, the teeth, shows a certain degree of specialisation, but in the vast majority he is infinitely more simian than any race now living. He serves in some degree to carry human history towards an ape stage. Those who believe that modern man has been evolved in a comparatively brief and recent geological period are inclined to accept the Neanderthal type as representative of mankind of a late stage of the Pleistocene epoch, and to suppose that modern man has been evolved from the more primitive type since that date.

Two lines of research have rendered such beliefs untenable. All the remains of Neanderthal man so far discovered in France and Belgium are referable to a limited and late part of the Pleistocene epoch. The flint implements and accessory evidence show that Neanderthal man flourished in Central Europe during the Mousterian and earlier part of the Aurignacian periods. All trace of this type then disappears; the races which immediately succeed it are of the modern type; the evidence points to an extermination of the ancient or Neanderthal type early in the Aurignacian period.

In those long stretches of the Pleistocene epoch—the Acheulean and Chellean—which precede the Mousterian period, and are characterised by flints of great beauty of workmanship, no trace of Neanderthal man has been found in Europe. The remains which have been discovered show that the Europeans of the Chellean and Acheulean periods were of the modern type. Lately, M. Rutot, of Brussels, has tabulated a list of the human remains which he regards as referable to pre-Mousterian periods, and in every case these belong to mankind of the modern type.

Prof. Keith reviewed the evidence relating to the human mandible found by Boucher de Perthes at Moulin Quinon in 1863, and came to the conclusion that it was an authentic document. Boucher de Perthes found it in a stratum containing implements of the Acheulean period. The mandible is peculiar in form, but is clearly of the non-Neanderthal type. No trace of Neanderthal man has been found in Italy, but human remains of the modern type have been found in Lombardy and Tuscany in strata which in point of formation long preceded the Mousterian period.

The most convincing evidence of the early existence of the modern type of man is to be found in England. The Galley Hill remains from the 100-ft. terrace of the Thames Valley are at least Chellean in date; according to M. Rutot they are much earlier. The fragmentary Bury St. Edmunds skull, of which Prof. Keith has lately made a minute examination, is of the modern type, and in point of date belongs to the Acheulean period. The human skeleton lately discovered by Mr. J. Reid Moir beneath a stratum of weathered chalky Boulder-clay near Ipswich is much older than the Galley Hill remains, yet in all its characters the Ipswich skeleton represents the modern type of man.

The only remains of man so far discovered in Europe which certainly antedate the Ipswich skeleton is the Heidelberg mandible, which must be assigned to the oldest part of the Pleistocene epoch. The Heidelberg jaw clearly formed part of the skeleton of a primitive form of Neanderthal man. On the evidence at present available, it must be inferred that two types of man were in existence in Europe during the Pleistocene epoch: (1) the Neanderthal type, represented by the Heidelberg mandible, near the beginning of that epoch, and by the various skeletons found in Belgium and France near its end; and (2) the modern type, represented by remains of many races belonging to the inferior, middle, and superior formations of the Pleistocene epoch. It is evident, too, that the point at which these two types of mankind emerged from a common stock must be assigned to an earlier date than most anthropologists are inclined to admit at present—probably to the older part of the Pliocene period.

That the modern type of man must be of great antiquity is evident from the degree of divergence which is to be seen amongst existing races of mankind. All the evidence at present at our disposal indicates that human races change very slowly in their physique; to produce the negro of Africa and the fair-haired European from a common stock clearly demands a very long period of time. Of all the races now existing in the world, the native Australian most nearly approaches the type which might serve as a common ancestor for African and European. He combines the characters of each, and at the same time has certain features which link him to the Neanderthal type. At least such a surmise serves as a convenient working hypothesis.

The structural differences between the Neanderthal and modern types of man are similar in nature, although somewhat less in degree, than those which separate the gorilla from the chimpanzee. Those two anthropoids are more nearly related structurally than is usually supposed. There is a similar differentiation among the modern gibbons of the Far East and among the extinct Miocene gibbons of Europe. The siamang and Paidopithex represent the gorilla or Neanderthal form; the gibbon and Pliopithecus correspond to the type represented by the chimpanzee and modern man. In all these groups of higher Primates the same process of evolution seems to be at work.

Although the results of more recent inquiries place

[1] From Hunterian Lectures delivered at the Royal College of Surgeons, England, on February 26 and 28, March 1, 4, 6, and 8, by Prof. Arthur Keith.

Pithecanthropus at the beginning of the Pleistocene period, the Pliocene date originally assigned by Prof. Dubois seems the more probable one. There can be no doubt that the Javan fossil form is human in every point of structure save that of size of brain. Pithecanthropus, like Neanderthal man, was evidently a primitive form which had survived long after much higher types of mankind had been evolved. If we look upon Pithecanthropus as representative of mankind at the close of the Pliocene epoch, then we must suppose that the human brain was doubled in size during the earlier part of the Pleistocene period. Such a rapid degree of evolution is unknown in the whole history of palæontological discovery. It will probably be found that Pithecanthropus is representative rather of a Miocene than of a Pliocene stage in the evolution of man.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

CAMBRIDGE.—An exhibition of 50*l.* a year, tenable for two years, is offered each year by the governing body of Emmanuel College to an advanced student commencing residence at Cambridge as a member of Emmanuel College in October. The governing body may award additional exhibitions of smaller value should properly qualified applicants present themselves. The exhibitions will be awarded at the beginning of October. Applications, accompanied by two certificates of good character, should be sent to the master of Emmanuel not later than September 24.

THE sixth annual report of the president and treasurer of the Carnegie Foundation, covering the year ending September 30, 1911, has just been received, and is here summarised. The endowments now amount to 2,424,600*l.*, comprising Mr. Carnegie's original gift of 2,000,000*l.* in 1905, an accumulation from income of 224,600*l.*, and 200,000*l.* received in 1911 as the first instalment of Mr. Carnegie's additional gift of 1,000,000*l.* in 1908. Of the income of 118,000*l.* for the year 1910–11, 105,200*l.* was expended in retiring allowances and pensions, 7200*l.* in general administration, and 3200*l.* in educational publication. Thirty-one retiring allowances and seventeen widows' pensions were granted during the year, increasing the number in force to 373, the average annual payment being 326*l.*, and the total distribution to date 349,200*l.* The exchange of teachers conducted through the Foundation sent nine American teachers to Prussia during the year and received seven Prussian teachers in the United States, in both instances with gratifying results.

THE second part of the report referred to above is a comprehensive survey by the president of educational progress and tendencies from a national point of view. Private and local educational initiative without guidance and federal and State grants without supervision are so wasteful financially and so hurtful educationally that agreement and cooperation must inevitably increase. The great variation in educational efficiency that now exists is shown to be unnecessary and wasteful. It is neither necessary nor desirable that some States should spend only one-eighth as much as others *per capita* for education, have only half as long a school year, enroll only half as large a proportion of their school children, and spend only one-fifth as much in educating each teacher. A better adjustment is developing between the colleges and the high schools. Many universities and colleges have advanced within ten years from competing with high schools, while other institutions, like Harvard, have broadened their entrance requirements so that they can be met by the average good high school. The increase in the number and size of post-graduate schools—50 per cent. in the last decade and tenfold in the last thirty years—has been much greater than the natural need. Poor and pretentious graduate schools, conducted with the funds of undergraduate colleges and attended chiefly by subsidised students, often merely impair the appreciation of good undergraduate teaching and hamper real research, through the multiplication of mechanical seminars, dissertations, and the like. Professional education, also, is hampered by an enormous duplication of facilities, resulting in great financial waste, and often in a competition in low entrance requirements and poor instruction. Some States have four, five, seven, and nine schools of engineering each; New York city alone has six, and Pennsylvania has thirteen, five of these having fewer than forty students each. The report will be sent to any address upon request to the Carnegie Foundation, 576 Fifth Avenue, New York City.

## *SOCIETIES AND ACADEMIES.*

### LONDON.

**Geological Society**, March 27.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—Bernard **Smith**: The glaciation of the Black Combe District (Cumberland). After a brief discussion of previous work and literature, a short sketch is given of the geological structure of the district. With the exception of the western coastal plain the main topographical features are pre-Glacial, but they have been either subdued or accentuated by glaciation. The chief pre-Glacial drainage-lines determined those of the present day.—J. F. N. **Green**: The older Palæozoic succession of the Duddon Estuary.

### DUBLIN.

**Royal Dublin Society**, February 27.—Mr. R. Ll. Praeger in the chair.—Prof. T. **Johnson**: *Heterangium hibernicum*, sp. nov., a seed-bearing Heterangium from Co. Cork. This is a fossil plant from the Carboniferous slate, near Bandon, and is contained in the National Museum. The specimens were described in 1864 by W. H. Baily, of the Geological Survey, as "linear plants" under the name of *Filicites lineatus*. They represent the recently discovered group of seed-bearing ferns which connect the ferns with the lowest group of flowering plants. The Bandon specimens are of special interest in that one of them bears a small "seed" in direct continuity with the parent plant.—Prof. Henry H. **Dixon** and W. R. G. **Atkins**: (*a*) Changes in the osmotic pressure of the sap of the developing leaves of *Syringa vulgaris*. The osmotic pressures were calculated from the depression of freezing point of the sap, determined by a thermo-electric method, before described. Measurements were made from February to October, and it was found that the osmotic pressures ranged from 11 to 13 atm. in the buds, from 10 to 15 atm. in the leaves, increasing with age. Mean molecular weight determinations of the sap solutes usually lay between 160 and 180. (*b*) Variations in the osmotic pressures of some evergreens. The leaves of deciduous plants showed an increase of pressure with age. Ilex and Hedera were found to behave similarly. The highest pressures were observed in March and April, and also from October to December, as the leaves are then at their maximum average age just before the growth of young leaves and elongation of the shoots. No

correlation was found between the pressures and the rainfall or sunshine. Specimens of Hedera from a north and south aspect were examined, and the former were found to have a slightly lower pressure than the latter.—Miss Genevieve V. **Morrow**: The ultimate lines of the vacuum tube spectra of manganese, lead, copper, and lithium. The author described the methods adopted for obtaining the quantitative spectra of metals by means of the vacuum tube, and pointed out the importance of obtaining such data in order to make spectrographic analysis complete. It was proved that the presence of an extremely minute trace of a substance could be detected by means of these tubes; one-tenth of a milligram of a metal gave almost a complete spectrum in some cases, and a much smaller quantity gave the ultimate lines.

March 26.—Mr. R. Ll. Praeger in the chair.—Dr. Jean **Timmermans**: Experimental researches on the density of liquids below 0° C. The author has devised a method by which the density of a liquid below 0° can be accurately determined, and has established a series of fixed points between 0° and −160°. He has determined the boiling points and the densities from 0° to the freezing points of twenty-five carefully purified organic liquids. The law of Cailletet and Mathias is not found to hold absolutely even in the case of normal pentane. None of the liquids examined show a point of maximum density. The law of corresponding states, as modified by Mme. K. Meyer, is found to hold even at the lowest temperatures. The ratio of the maximum density (calculated at −273°) to the critical density is found to be approximately equal to the ratio of the actual to the theoretical density in the cases examined.—Dr. A. F. G. **Kerr**: Notes on *Dischidia rafflesiana* and *D. nummularia*. This is an account of the external morphology of the vegetative organs, and of the structure of the flowers of these two plants, worked out on fresh material gathered in the neighbourhood of Chiengmai, Siam. There are also observations on the relationship of the plants to the ants which they harbour, and to the part played by the latter in the dispersal of the seeds. The disposition and the contents of a large series of pitchers of *D. rafflesiana* were examined *in situ*, and it was found that out of 227 pitchers 88 were so situated that the retention of water in the pitcher was a possibility, while of these only fourteen actually contained water. In a discussion of the theories as to the functions of the pitchers, the author concludes that they are organs for economising water. The water vapour given off by the stomata on the inside of the pitchers is absorbed by the nest material of the ants, which is plastered over the contained roots and is transmitted through them into the plant.

## PARIS.

**Academy of Sciences**, April 1.—M. H. Poincaré in the chair.—G. **Bigourdan**: Some observations of position which may be made during the solar eclipse of April 17, 1912. An outline of observations requiring special attention during the coming eclipse.—M. **Bertin**: The relation between the increase of displacement of a vessel and increase of load.—W. **Kilian** and Ch. **Jacob**: The non-parallelism of the isopic zones and tectonic folds in the Franco-Italian Alps and in the Valais.—E. **Waelsch**: Bipedal functions, triple orthogonal systems, and isostatic efforts.—Arnaud **Denjoy**: An extension of the integral of Lebesgue.—L. E. J. **Brouwer**: The invariance of the closed curve.—A. **Friedmann**: Isodynamic surfaces.—J. **Pionchon**: The solution of copper in water. An element formed of two plates of copper with water as liquid shows a momentary current when one of the plates is tapped. If the water has been in contact with metallic copper for some time, this effect is not observed, and this is supposed by the author to be due to the solution of minute traces of copper by the water. The amount dissolved is too small to be detected by chemical means.—P. **Vaillant**: The influence of temperature and of light on the conductivity of a phosphorescent body (calcium sulphide). The electrical conductivity of a film of calcium sulphide increases under the action of light to a maximum and then diminishes. For a given apparatus, the relative variations of conductivity are independent of the initial conductivity.—R. **Fortrat**: The telluric bands due to oxygen. It is shown that each band may be regarded as being composed of two equal series obeying very nearly the law of Deslandres.—G. A. **Hemsalech**: The relative velocities of the luminous vapours of various elements in the electric spark. Applying the experimental method developed in previous papers, it is shown that the elements studied can be divided into groups, in each of which there is a relation between the velocities of the vapours in the spark and the atomic weights.—A. **Aubertin**: The appearances of the discharge of a condenser.—Louis **Hackspill**: The vapour pressure of the alkaline metals between 250° C. and 400° C. The metal was sealed in a U tube, one limb of which was maintained just above the melting point of the metal and the other at the temperature at which the vapour pressure was required. The vapour pressures were determined from the observed change of level in the two arms of the tube. The results obtained are shown graphically for cæsium, rubidium, potassium, and sodium.—Alfred **Henry**: The determination in absolute value of the mass of the molecules of liquids, and more especially that of the mercury molecule.—Marcel **Boll** and Paul **Job**: The photochemical kinetics of the chloroplatinic acids in very dilute solutions. The decomposition of the chloroplatinic acids, $H_2PtCl_6$, $H_2Pt(OH)Cl_5$, $H_2Pt(OH)_2Cl_4$, and $H_2Pt(OH)_4Cl_2$, by the light from a mercury arc was studied in tenth-millinormal solutions; in each case the reaction was found to be bimolecular.—P. **Pascal**: Thermal analysis of hexachloroethane and its binary mixtures. The cooling curve of solid hexachloroethane showed that three forms exist with transition points at 125° and 71·6°. The melting points of mixtures of hexachloroethane with naphthalene and with phenanthrene were also studied, and the results shown graphically.—M. **Lespieau**: The dimethyl ether of 1 : 5 pentinediol and its hydrogenation.—A. **Guilliermond**: The mitochondria of the sexual organs of plants.—Raoul **Combes**: A method for the culture of the higher plants in sterile media. An apparatus is figured and described in which the roots of a growing plant remain in a medium rigorously sterile whilst the stem and leaves are in the open air.—F. **Jadin** and A. **Astrug**: The presence of arsenic in some plants used as food. The researches of Gautier and G. Bertrand have definitely demonstrated that arsenic exists normally in man and animals. The examination of a number of edible plants and fruits shows that some of this arsenic may be taken as vegetables. Arsenic was found in all the thirty-nine substances examined in quantities between 0·03 part per million in the leek and 0·25 part per million in almonds and beans.—H. **Arsandaux**: The presence of rocks belonging to the charnockite series at Gabon.—R. **Tronquoy**: Modification of the tin-bearing lodes of Villeder (Morbihan).—M. **Laquerrière**: First results of the application to gynecology of the electrolysis of radium salts (Haret's method).—E. **Doumer**: The treatment of tubercular osteitis by the high-frequency discharge. Eleven cases were treated, and in all these a cure was effected, the time taken varying from

one month to two years. In four cases the clinical diagnosis was confirmed bacteriologically, and in these the course of the treatment and its results are described in detail.—J. **Vallot**: The existence of dust in the air on the upper glaciers of Mt. Blanc and its effects.

## BOOKS RECEIVED.

Die Zelle der Bakterien. By Prof. A. Meyer. Pp. vi+285+plate. (Jena: G. Fischer.) 12 marks.

Das Ostseegebiet. By Dr. G. Braun. Pp. iii+108+map. (Leipzig: B. G. Teubner.) 1.25 marks.

Beitrage zur Naturdenkmalpflege. Edited by H. Conwentz. Dritter Band. Pp. xvi+688. (Berlin: Gebrüder Borntraeger.) 18.75 marks.

The Children's World. By S. Shenessey. Pp. 64. (London: A. and C. Black.) 1*s*. 6*d*.

Black's School Geography. Geographical Pictures, Series III.—Sculpture of the Earth's Crust. Packets Nos. 1 and 2. (London: A. and C. Black.) Each 6*d*.

Studies in Terrestrial Magnetism. By Dr. C. Chree. Pp. xii+206. (London: Macmillan and Co., Ltd.) 5*s*. net.

Gardening for the Ignorant. By Mrs. C. W. Earle and E. Case. Pp. xxiii+232. (London: Macmillan and Co., Ltd.) 1*s*. net.

Wissenschaft und Wirklichkeit. By M. Frischeisen-Köhler. Pp. viii+478. (Leipzig and Berlin: B. G. Teubner.) 8 marks.

Moths of the Months, and How to Identify Them. By Rev. S. N. Sedgwick. Pp. 60. (London: C. H. Kelly.) 1*s*. net.

Grunlinien der anorganischen Chemie. By W. Ostwald. Dritte Auflage. Pp. xxii+860. (Leipzig: W. Engelmann.) 18 marks.

Quain's Elements of Anatomy. Eleventh edition. Edited by Profs. Schäfer, Symington, and Bryce. In four volumes. Vol. ii., part i. Microscopic Anatomy. By E. A. Schäfer. Pp. xi+739. (London: Longmans and Co.) 25*s*. net.

How to Make an Orchard in British Columbia. By J. T. Bealby. Pp. viii+86. (London: A. and C. Black.) 1*s*. 6*d*.

## DIARY OF SOCIETIES.

*THURSDAY*, APRIL 11.

MATHEMATICAL SOCIETY, at 5.30.—An Application of the Theory of Integral Equations to the Equation $\nabla^2 u+k^2 u=0$: H. S. Carslaw.—On Mersenne's Numbers: A. Cunningham.

CONCRETE INSTITUTE, at 8.—The True Bending Moments of Beams with various degrees of Fixity: Maurice Béhar.

*FRIDAY*, APRIL 12.

ROYAL ASTRONOMICAL SOCIETY, at 5.—(1) Recent Observations of Nova Cygni (1876); (2) Micrometrical Measures and Focal Peculiarities of Nova Lacertæ (Espin): E. E. Barnard.—The Planet Jupiter in 1889: A. Stanley Williams.—The Spectrum of the New Star in Gemini, 1912, March: W. E. Curtis.—Definiton of Correlation Coefficients: J. C. Kapteyn.—*Probable Papers*: (1) A Proposal for the Comparison of the Stellar Magnitude Scales of the Different Observatories taking part in the Astrographic Catalogue. Second Note: The Bordeaux Magnitudes. (2) A Tentative Explanation of the "Two Star Streams" in Terms of Gravitation. Second Note: The Position of the Centre of our System: H. H. Turner.—Nova Geminorum, Positions for 1900·0 of Ninety-five Stars surrounding it: F. A. Bellamy.—Photographs of the Spectrum of Nova Geminorum No. 2: Cambridge Observatory.

MALACOLOGICAL SOCIETY, at 8.—The Genus Dosinia and its Subdivisions: A. J. Jukes-Browne, F.R.S.—On the Generic Name to be applied to the *Venus islandica*, Linn.: E. A. Smith.—Note on *Lapparia Parki*: H. Suter.—Characters of Three New Species of Fresh-water Shells from Uruguay; New Species of Limicolaria from British East Africa: H. B. Preston.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Exminster Sewage-disposal Works: H. G. Hoskings.

*MONDAY*, APRIL 15.

VICTORIA INSTITUTE, at 4.30.—Directivity of Life as seen in the Structure of Plants and Animals: Prof. G. Henslow.

*TUESDAY*, APRIL 16.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Remodelling and Equipment of Madras Harbour: Sir Francis J. E. Spring, K.C.I.E.—The Alteration in the Form of Madras Harbour: H. H. G. Mitchell.

ILLUMINATING ENGINEERING SOCIETY, at 8.—Lighting of Private Houses by Gas and Electricity: W. H. Y. Webber and W. R. Rawlings.

*WEDNESDAY*, APRIL 17.

ROYAL SOCIETY OF ARTS, at 8.—Municipal Chemistry: J. H. Coste.

GEOLOGICAL SOCIETY, at 8.—The Pre-Cambrian and Cambrian Rocks of Brawdy, Hayscastle, and Brimaston (Pembrokeshire): H. H. Thomas and Prof. O. T. Jones.—The Geological Structure of Central Wales and the Adjoining Region: Prof. O. T. Jones.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Report on the Phenological Observations for 1911: J. E. Clark and R. H. Hooker.—A Method of Summarising Anemograms: R. G. K. Lempfert and W. Braby.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Note on the Life-history of a Marine Diatom from Bournemouth: J. D. Siddall.—A modified form of the Lever Fine-Adjustment, and a Simple Turn-out Device for the Substage Condenser: E. B. Stringer.

*THURSDAY*, APRIL 18.

ROYAL INSTITUTION, at 3.—Synthetic Ammonia and Nitric Acid from the Atmosphere: Prof. A. W. Crossley, F.R.S.

LINNEAN SOCIETY, at 8.—*Botrychioxylon paradoxum*, a Palæozoic fern with secondary wood: Dr. D. H. Scott, F.R.S.—On *Psygmophyllum majus*, sp. nova, from the Lower Carboniferous rocks of Newfoundland, together with a revision of the genus, and remarks on its affinities: Dr. E. A. Newell Arber.—The Alpine Flora of the Canadian Rocky Mountains: Mrs. Henshaw.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—*Adjourned Discussion*: The Causes Preventing the More General Use of Electricity for Domestic Purposes.

INSTITUTION OF MINING AND METALLURGY, at 8.

*FRIDAY*, APRIL 19.

ROYAL INSTITUTION, at 9.—Electricity Supply: Past, Present, and Future: A. A. Campbell Swinton.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Tenth Report to the Alloys Research Committee on the Alloys of Aluminium and Zinc: Dr. W. Rosenhain and S. L. Archbutt.

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