THURSDAY, APRIL 19, 1906.

THE GLOSSOPTERIS FLORA.

Catalogue of the Fossil Plants of the Glossopteris Flora in the Department of Geology, British Museum (Natural History); being a Monograph of the Permo-Carboniferous Flora of India and the Southern Hemisphere. Pp. lxxiv+255. By E. A. Newell Arber. (London: The British Museum [Natural History]. Published by Order of the Trustees, 1905.) Price 12*s.* 6*d.*

IN this catalogue the author makes "an attempt towards a complete summary of what is at present known on the subject of the Glossopteris Flora," and he may be cordially congratulated on the successful completion of a task both arduous and difficult. Dr. Smith Woodward, the keeper of the department of geology, has very wisely encouraged the production of catalogues, which are in reality monographs of the greatest value to both botanical and geological students. The scattered literature dealing with the Glossopteris flora renders the work of the monographer very heavy, and the nature of much of the material on which he must base his conclusions necessitates considerable self-control and caution.

Mr. Arber's introduction treats of the Glossopteris flora under three heads:—(1) its botanical affinities; (2) its distribution in space; (3) the evidence as to its age and distribution in time. The sediments of Upper Carboniferous and Permian age have yielded a rich supply of fossil plants in both hemispheres; but in the case of India, Australia, South Africa, and South America the difficulty of drawing a satisfactory line between the Carboniferous and Permian strata has forced geologists to adopt the term Permo-Carboniferous for the plant-bearing beds of India and more southern lands. In these Permo-Carboniferous strata the genus Glossopteris is the most abundant fossil, and for this reason the southern vegetation which flourished during the epoch between the Lower Carboniferous and Triassic periods has been designated the Glossopteris flora. It has long been recognised that the Glossopteris flora differs in too many respects from the northern flora of the same geological age to justify the belief, which was formerly held, as to the world-wide distribution in the latter part of the Palæozoic era of the vegetation which is represented by the rich stores of fossils in the American and European Coal-measures. The approximate distribution of the plants of the two provinces is clearly shown in the maps published by Mr. Arber (p. xix.).

One very serious difficulty in the way of giving a satisfactory botanical account of the Glossopteris flora is the lack of petrified material, and, in the case of nearly all the genera, the absence of fertile leaves or shoots. The genus Calamites, represented by several distinct types in the northern flora, has not so far been recognised in the Glossopteris flora; in its place occur Phyllotheca and Schizoneura, two representatives of the Equisetales about which our information is still very incomplete. Both genera are adequately treated by Mr. Arber, but the botanist, however thorough the treatment, cannot help being made aware of the insufficiency of the material at his disposal. The genus Sphenophyllum affords another example of a characteristic northern type which can hardly be considered a true member of the Glossopteris flora. It is true, as Mr. Arber points out, that Prof. Zeiller has shown good reason for referring the Indian specimens, for which Royle in 1833 instituted the genus Trizygia, to Sphenophyllum. Mr. Arber figures a fragment from Natal as Sphenophyllum sp., but the specimen is too imperfect to serve as satisfactory evidence of the existence of the genus in South Africa. In the case of plants with fern-like fronds we cannot speak with any confidence as to their botanical position.

The simple tongue-shaped leaves with a distinct mid-rib and anastomosing secondary veins, which Brongniart named Glossopteris and placed among the ferns, have never been found, in spite of their extraordinary abundance, with sori or sporangia. A recent discovery by Mr. Arber affords the first satisfactory clue to the nature of the sporophylls. The fronds of Glossopteris are occasionally found in association with smaller scale-leaves, and on these groups of sporangium-like organs have been detected. These bodies are considered, on the whole, to exhibit a greater resemblance to the microspores of recent cycads than to the sporangia of ferns. The palæobotanist who describes specimens of Glossopteris is compelled to face the problem of recognising specific characters among the numerous leaf-forms, but if he knows anything of recent ferns he must admit that he has undertaken an impossible task. Mr. Arber, with the conscientious care which characterises his work, has grappled with this difficulty, and his synopsis of species supplies us with the best working scheme so far devised.

Neuropteridium is another southern genus founded on simply pinnate and sterile fronds, which, like Glossopteris and Gangamopteris, must be left as a plant of doubtful position. Among other members of the Glossopteris flora which it has been customary to place among the ferns are Tæniopteris, Sphenopteris, and Pecopteris; but the absence of fertile fronds again sets a limit to our knowledge. One interesting conclusion to be gleaned from the occurrence of certain ferns in the southern Permo-Carboniferous vegetation (*e.g.* Tæniopteris and Cladophlebis) is that the Glossopteris flora includes types which, in the northern hemisphere, are rather Mesozoic than Palæozoic.

Schizoneura, Neuropteridium, and Voltzia (a conifer) also represent other genera which apparently migrated into Europe in early Mesozoic times. Another striking fact is the absence of any members of the lycopodiales in the Glossopteris flora of Australia and India. On the other hand, Lepidodendron, Sigillaria, and some rather obscure specimens referred to Bothrodendron have been found in South Africa and South America. Mr. Arber takes the view that the occurrence of these fossils in South America and South Africa may be accounted for by

migration from the northern flora. It must, however, be borne in mind that lycopodiaceous plants existed in the far south in the Lower Carboniferous epoch.

Another characteristic member of the northern flora, which is not included in lists of plants from Gondwana Land (the name given by Suess to the southern continent which supported the Glossopteris flora), is Cordaites. It is, however, probable that the strap-like linear leaves known as Nœggerathiopsis, which are abundant in the southern Palæozoic province, are in some cases at least generically identical with Cordaites. This opinion, previously expressed by the reviewer, was strengthened by an inspection of some leaves recently discovered by Mr. Leslie which he had an opportunity of seeing last summer at Vereeniging. We have as yet no satisfactory evidence that the Cycadophyta were represented in the true Glossopteris flora. Similarly, we cannot assert with confidence that the few specimens compared by various writers with the existing *Ginkgo biloba* afford any proof of the existence of the ginkgoales. The coniferales did not play a conspicuous part in the southern vegetation; various fragments have been referred to Voltzia and other genera, but such specimens as occur appear to be indistinguishable from northern Triassic and Rhætic forms.

Although recent work has perhaps tended to bring more closely together the northern and southern Permo-Carboniferous floras, there can be no doubt as to the correctness of the view that the later Palæozoic vegetation of India, South America, South Africa, and Australia differed sufficiently from that of the northern hemisphere to justify the recognition of two botanical provinces. The southern flora lacks the richness and variety which characterise the northern; the number of genera is smaller, and in many localities the abundance of Glossopteris—almost to the exclusion of other genera—suggests a greater monotony in the vegetation. To some extent the apparently greater wealth of the northern flora may be the result of exceptionally favourable conditions for the preservation of land plants, but this does not account for the strikingly different facies. The existence of widespread Glacial deposits in India, South Africa, and Australia furnishes us with a probable means of explaining the uniformity in the vegetation of Gondwana Land and the contrast which it presents to that of the northern hemisphere. In the case of many European genera we are able to make use of anatomical characters as an index of conditions of growth, but the almost complete absence of petrified specimens in the southern province compels the admission that we cannot claim to recognise in the plants themselves any satisfactory evidence as to the nature of the climate in which they grew.

We can cordially recommend Mr. Arber's volume as the best and most comprehensive account of the Glossopteris flora which has been written; he has produced a book bearing the impress of wide knowledge and of a well balanced critical faculty, which cannot fail to be of the greatest value to both geologists and botanists. A. C. SEWARD.

A GROUP OF TEXT-BOOKS OF PHYSICS.

(1) *The Organised Science Series:* (1) *First Stage Physiography (Section I.).* Edited by Dr. R. W. Stewart. Pp. xiii+256; diagrams. (London: University Tutorial Press, Ltd., 1905.) Price 2*s.*

(2) *Science Handbooks for Laboratory and Classroom: Elementary Physics (Third Year).* By John N. Brown. Pp. 111+diagrams. (London: Blackie and Son, Ltd., 1905.) Price 2*s.*

(3) *Examples in Physics.* By C. E. Jackson. Pp. vi+172. (London: Methuen and Co., n.d.) Price 2*s.* 6*d.*

(4) *Advanced Examples in Physics.* By A. O. Allen. Pp. 60. (London: Edward Arnold, n.d.) Price 1*s.* 6*d.*

(5) *Physics.* By Charles R. Mann and George R. Twiss. Pp. x+453; illustrated. (Chicago: Scott, Foresman and Co., 1905.) Price 1.25 dollars.

THE stream of physics text-books continues to flow. The large number of institutions in which this subject is now taught probably makes inevitable a corresponding multiplicity in the text-books issued. Each teacher or group of teachers finds something lacking in the books available for his classes, and at the first opportunity a new manual is produced. But besides the stimulus of this thoroughly healthy quest of the ideal, the requirements of examination syllabuses are important factors in giving rise to publication. Each examination has its independent syllabus somewhat arbitrarily selected from the suggestions of the members of a board, meeting in committee, and the result is that every examination is thought to require a special text-book by those who wish to secure a maximum of passes for their pupils at the least expenditure of labour.

(1) Although the latter motive is distinctly present in connection with the first of the books in our list, we must at the same time readily admit that it is a most admirable volume except in name. It is a mystery why one part of chemistry added to two parts of physics should produce "physiography," but of course Dr. Stewart is not responsible for this. The book has been written to meet the requirements of the Board of Education in regard to the examination bearing its name. Dr. Stewart is no novice in the writing of text-books. He is alive to the difficulties which pupils encounter, and he removes them in advance. The outcome is a manual which rises far above the particular purpose for which it was written, and it may be confidently recommended as a very satisfactory introduction to physics and chemistry suitable for school use. It contains a large number of examples, many of which are worked out.

(2) Mr. Brown's handbook on elementary physics forms one of a series issued under the general editorship of Dr. J. G. Kerr. It is intended as a third year's school course, practical and theoretical. The matter is to some extent of the same kind as the physical part of Dr. Stewart's text-book; we cannot, however, bestow the same praise upon it. The theoretical part is very meagre, and, moreover, in

many cases is rather crude, and with the directions for the experiments which constitute the main part we are not well satisfied. Surely in a calorimeter experiment it is not well to have the water so high as 40° C., especially when a thermometer reading to fifths is used; and surely, also, it is bad science to teach a boy that he can ascertain the temperature of a Bunsen flame by heating a 32-gram mass of copper in it and transferring it to a calorimeter. If this is done, is he too young to be shown at the same time that a small bead of copper will get visibly hotter (judging from tint), and that even a very thin platinum wire will *melt* in a Bunsen burner? The temperature found in the experiment with the copper ball is less than 1000° C. The questions at the end of each chapter are the best things in the book. Many are based on phenomena with which the boy will have acquired familiarity in his sports and other amusements, and these will certainly encourage him to take an interest also in more serious pursuits; but the problem on the hanging of a man strikes one as rather too brutal for a school-book.

(3) The volumes by Mr. Jackson and Mr. Allen consist of collections of examples. Those brought together by Mr. Jackson are of an elementary character. There are about 600 classified according to the branches of physics to which they relate, and these are followed by fifty test papers of mixed problems, each paper containing about ten questions. Thus we have here about 1000 questions the order of difficulty of which reaches practically that of the intermediate examination in the University of London. This collection will certainly be welcomed by a large number of teachers under the Board of Education and in technical schools. The advanced questions have been so constructed as to lead to reasonable results. Answers are provided only to the classified questions.

(4) The collection made by Mr. Allen is of a much more advanced character, viz., that of a final pass or honours degree in physics. The problems are selected in the main from examination papers set by the London and Victoria Universities. Answers are given, and these the present reviewer proceeded to test, but he had omitted to observe an introductory note by Prof. W. Stroud:—

"Answers are appended to the problems. This is the only feature of the book I rather regret, but they are inserted in the interests of private pupils. I should be delighted if only some of the answers were *wrong*, so that students (whose notion of working examples is to juggle with the numerics in a question so as to get the numeric in the answer) might be righteously confounded, but I have no hope; for Mr. Allen's carefulness and exactitude are such that in his preface he does not even tell the users of his book that 'any corrections to the answers will be gratefully received.'"

We commend the book as an aid to the simplification of the work of a teacher, but at the same time we hope that it will not encourage him to put altogether aside the labour of compiling his own problems based on his own experiments and study. Such examples are of far greater value both to teacher and pupil.

(5) With the aim which the writers of this volume have set before themselves we have very full sympathy. It is certain that the academic method of teaching physics tends to discourage a certain class of boy from paying any attention to his subject. To remove this fault a less formal method is desirable, especially in schools. Ultimately the youth who desires a sound knowledge must be willing to learn by logical methods, for it is by these *only* that accurate ideas can be acquired. But unless he is a born student his interest must first be aroused. He must be led to see that an intelligible account can be given of the mode of action of many of the puzzling phenomena which surround him; he must learn that things with which he has been familiar are not events isolated completely one from another so that each has no bearing on the other, but that a knowledge of one contributes to his knowledge of another. In this way a desire for further knowledge is awakened.

We have also considerable sympathy with the way in which this aim is carried out. Their book is full of illustrations, largely from half-tone blocks—motor-cars and express trains in full motion, eight-oared shells, *small* engine attached to *short* train, looping the loop, charming children swinging on a gate (so different from the ordinary wood-cut children), photographs of real ripples on a pond, engines, turbines, and other machinery, the lifting-magnet with its five-ton load of iron, mining coal with compressed-air drill—these are some that meet the eye as the pages are rapidly turned over. Sometimes, indeed, the application seems rather indirect. Thus a half-tone figure of a man hard at work on the top of a hay-cart is labelled, "Haying: A man cannot work unless he consumes food." But, even in such a case, the picture is clearly intended merely to call up a series of real events, and not to portray any one with brutal accuracy. History is also called upon to contribute; knowledge has only gradually been acquired. The boy gets an idea of its growth; the "heroes" of science are introduced to him (but without portraits!).

All this is excellent, and will work well. Our only regret is that so much accuracy had to be sacrificed in the text in order to carry out the scheme completely. Is not it better, perhaps, to postpone the explanation of some things until a safe foundation for true knowledge has been obtained? The pupil will require to unlearn many of the statements made here, and this will certainly induce a period of distrust. *Some will never unlearn them.* However, the suggestion that a book of this kind might be better curtailed is the only critical one we have to offer.

MANUFACTURE OF ALUMINIUM.

The Production of Aluminium and its Industrial Use. By Adolphe Minet. Translated, with additions, by Leonard Waldo. Pp. vi+266. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 10*s.* 6*d.* net.

THIS book brings together the theory and practice of the aluminium industry in a complete and readable form. It commences with a more or less

detailed and historical survey of the chemical processes which were employed before the metal was produced upon a commercial scale by the aid of the electric current. The successful chemical processes which were all based upon the reduction of salts of aluminium with sodium and were simply modifications of the method used by Wöhler in 1827, when he discovered the metal, brought first and foremost in their train the remarkable cheapening in the manufacture of sodium; because unless sodium could be obtained at a low cost it was impossible to manufacture aluminium cheaply. However, by purely chemical processes it was never found possible to produce aluminium below about thirty shillings per kilo. In fact, in 1889 the price was 38*s*. per kilo., but at the end of 1891, soon after the advent of successful electrolytic processes, it had fallen to 5*s*., and at the present day it is rather less than 2*s*. per kilo.

Minet describes the electrical and electrolytic methods in chronological order. To the brothers Cowles, of America, belongs the honour of first producing a working furnace in which they were able to obtain alloys of aluminium with other metals, by striking an arc in a mixture of bauxite and oxide of iron or other metal. The Héroult seems to have been the first furnace in which a fused aluminium salt—cryolite—was actually electrolysed on a commercial scale, and modifications of this furnace are at the present day among the most successful which are employed, and the one worked by the British Aluminium Co. at Foyers is a Héroult. The production of aluminium is essentially one of electrolysis, but it is also electrothermic in so far as the passage of the current serves to keep the bath molten. The bath usually consists in the first place of fused cryolite, and as the electrolysis continues the loss of aluminium is replaced by additions of aluminium fluoride or of alumina. If the bath were regenerated by continual additions of cryolite, in time the quantity of sodium fluoride would become excessive, and sodium and not aluminium would be yielded up at the kathode.

Most authorities consider that in a bath which is regenerated with alumina the alumina and not the fluoride undergoes electrolysis. Minet, however, considers that it is the aluminium fluoride which undergoes electrolysis, and that the fluorine given up at the anode continuously reproduces cryolite.

Part ii. deals with "aluminium and its alloys." In this the author deals with the cost of the production of aluminium and its alloys. Aluminium is perhaps of more general use in the form of its alloys than in the pure condition. We see that Minet mentions its use in the pure state for surgical instruments—woe betide these instruments if antisepticised in mercuric chloride.

A few very interesting pages are devoted to the employment of aluminium as a reducing agent, in the production in the pure state of such metals as chromium, vanadium, manganese, &c., and also for welding purposes. Minet states that ingots of chromium weighing 100 kilos. are prepared at Essen in one charge, and the production of this quantity of metal is said to take only twenty-five minutes.

The translator contributes a short appendix upon "Aluminium in the United States." The book may be heartily recommended as a very useful contribution to the subject. F. M. P.

PETROL MOTOR-CARS.

Motor-car Mechanism and Management. In three parts. Part i. The Petrol Car. By W. Poynter Adams. Pp. x+174. (London: C. Griffin and Co., Ltd., 1906.) Price 5*s*. net.

THE author states that his object is to put into the hands of owners and drivers of motor-cars in a convenient and handy form some knowledge of the general mechanical principles which ought to be understood by those who drive them.

This idea has been carried out very fairly. The early chapters on the engine and on the various organs are treated in sufficient detail, and although there are a few blemishes and mistakes, these are not of any considerable importance.

When, however, the author deals with a matter which is extremely difficult for the average car-owner or driver to understand—namely, the understanding and care of the electrical accessories, which are now everywhere used—we can have nothing but praise for the very thorough manner in which this very difficult question has been dealt with; in fact, it is evident that the author is a trained electrical engineer, and has consequently been able to approach this subject from the standpoint of one who has had to explain the nature of electrical developments to the ordinary user of electric apparatus. We think the author's short and concise descriptions of the various sources of electrical supply which are now available, his definitions of conductors, insulators, and other electrical terms which must be used to make his explanations intelligible, are so good and so well arranged that they should be read by anyone who wishes to obtain a bird's-eye view of electrical engineering so far as it applies to ordinary users of electric light and power; at any rate, it is certain that the average user of the modern motor-car finds himself very frequently at fault when he has to puzzle out stoppages on the road due more to the failure of his electrical accessories than to any other cause, except perhaps that of the universal bugbear, the care of the pneumatic tyres.

On p. 85, when mentioning the importance of a good compression in order to get economical working of the engine, the author makes statements which are liable to mislead the user when he says that 37 per cent. of the full value of the charge is transformed into useful work, and that if the compression is increased to 100lb. this may be increased to 45 per cent. We find no note correcting this by explaining how this refers to a perfect engine, and that with such forms of internal combustion engines as are used for cars not more than 50 per cent. of such efficiencies are likely to be realised.

At the present day, when so much is being said as to the want of courtesy and consideration for other users of the road by the drivers of motor-cars, the author's remarks from p. 15 to the end ought to be read by everyone who drives a car.

OUR BOOK SHELF.

Our Stellar Universe. By Thomas Edward Heath. Pp. vi+26; with 26 star-charts and stereograms. (London: King, Sell and Olding, 1905.) Price 10*s.* net.

WHILST most students of astronomy are able to talk glibly of "stellar parallax" and "light-years," few of us are wont to form any persistent, concrete idea of the figures we employ, nor do the usual star-charts assist us in this matter. For this reason we extend a hearty welcome to Mr. Heath's latest effort to portray, as truthfully as the meagre data available will allow, the actual three-dimension character of space.

In his "Road Book to the Stars," which we reviewed in these columns on September 28, 1905, Mr. Heath explained how he had discovered a simple scale on which concrete comparisons of stellar depths could be based, and from that had been led to the construction of stereograms which would give a visual conception of the relative distances.

In the present volume he publishes twenty-six of these stereograms, including the whole of the sky, each one taking in fifty degrees square as seen from the earth. Twenty-six key-maps show these areas without distortion, and near each star disc are placed symbols denoting the magnitude, the spectral type, and the measured, or hypothetical, parallax. The hypothetical diameter of the star in miles, based on the assumption that the light-giving power of the star per unit area is equal to that of the sun, appears in an index, which also gives the data from which the key-maps were plotted and forms a handy and valuable reference table of the 1520 stars included.

In order to render their differences visible on the stereograms, all the parallaxes have been multiplied by 19,000, and where the actual values are unknown Mr. Heath has taken, as a theoretical quantity, the average parallax of the spectral type to which any one belongs.

Even if the stereoscopic appearance does not indicate the actual facts, these stereograms are of great interest and beauty, and should certainly find a place in every school or institution where astronomy is studied. They will, at least, counteract the natural assumption, made when ordinary star-charts, or even the sky itself, are consulted, that the heavens are simply studded with objects which are all in one plane.

For example, looking at No. 7—which shows the area facing xvh R.A. and 45° N. dec.—we see η Herculis standing out in the near foreground and Arcturus far removed, whilst the Northern Crown is, at first sight, hardly recognisable owing to the unfamiliar appearance produced by the separation of its stars in the third dimension. W. E. ROLSTON.

Chapters on Paper-making. Vol. ii. By Clayton Beadle. Pp. vii+174. (London, 17 The Borough, London Bridge: H. H. G. Grattan, 1906.) Price 5*s.* net.

THE object of this volume is "educational"; it is a contribution to paper-making technology, mainly as an aid to the student worker in his work of self-instruction. The author devotes himself to the task of popularising the work of the City and Guilds of London Institute by reproducing the examination papers set in the subject of paper-making in the years 1901–5, and, putting himself in the position of examinee, giving full answers to these questions.

This task is prefaced by the confession that the answers given may be in many cases open to criticism, as it is evident that certain of the subjects formulated as examination questions are in effect "leading questions" in the industry. This, however, is a tribute to the method of the institute, which, if it is to be really "educational," must keep the student mindful of difficulty, that is, of the objective realities of technical work. It is clear to us that the author has exactly appreciated the aims of the examiners in challenging the original faculties of students, and in suggesting, in the form of examination problems, some of the leading lines of progress.

In addition to this, which is the main subject-matter of the volume, the author has included a chapter dealing generally with the much controverted subjects of technical education and industrial research, and a section upon gelatine sizing embodying the results of original investigations.

The book contains a large number of special dissertations which will interest technologists and practical men, and its appeal, therefore, is to a wide circle of readers.

Anales del Museo Nacional de Buenos Aires. Ser. 3, vol. v. Pp. 574; 289 text-figures. (Buenos Aires, 1905.)

THE size of this volume is a sufficient proof of the energy with which the study of biology and the related sciences is carried on in the capital of the Argentine Republic, more especially by the professors and officials of the national museum. Two papers in the present issue by Dr. F. Ameghino, the director of the museum, both dealing with the presence of a perforation in the astragalus of certain recent and extinct mammals, have been already mentioned in these columns. The bulk of the volume is, however, occupied by an article by Dr. E. L. Holmberg on the Amyrilidaceæ indigenous to and cultivated in Argentina, and a second, by Mr. F. F. Outes, on the Stone age in Patagonia. In the latter the author describes stone implements of all descriptions, from rude flint flukes and scrapers to beautifully chipped arrow-heads and perfectly spherical "bolas." The Palæolithic, or Pleistocene, implements are all referred to a single epoch. The resemblance of these implements to those found in Europe, North Africa, and North America is very close, although, as might have been expected, the closest similarity is found in the case of the North American types. In the Neolithic epoch, on the other hand, three periods are distinguishable, each indicating a distinct step in advance of its predecessor. Throughout the Neolithic epoch Patagonia presents characteristics in the matter of flint implements distinguishing it from the rest of Argentine territory. The similarity between the Patagonian neoliths and those of the southern and south-eastern United States is surprisingly close, but between the former and those of the western United States a less marked resemblance exists. Apparently some of these stone arrow-heads were used until a very recent date by certain of the Indian tribes.

R. L.

The Natural History of Selborne. By the Rev. Gilbert White, M.A. Re-arranged and classified under subjects by Charles Mosley. (London: Elliot Stock, 1905.) Price 6*s.* net.

THE distinctive feature of this edition of the famous natural history classic is the re-arrangement of the work according to the subjects dealt with. First, there are descriptions of the locality and its physical characteristics, and these are followed by thirteen sections, respectively concerned with meteorology, geology, ethnology, mammals, birds, reptiles, fishes, insects, spiders and mites, worms, botany, superstitions, and a miscellany of subjects. This convenient arrangement will greatly assist naturalists and other students in referring to White's masterpiece.

LETTERS TO THE EDITOR.

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

The Existence of Absolute Motion.

THE article of Prof. Schuster's in your number of March 15, entitled "A Plea for Absolute Motion," is very interesting, but I think there are several conceptions contained therein which will not bear analysis. Partly in reference to his article, therefore, but also because the question is such an important one, I think it may be well to consider as definitely as may be what direct observational or experimental evidence we have for a zero point of motion belonging to space alone, and to which all motions of material bodies may be referred.

Not to be entangled in the snare which is as old as human discussion, I define my terms for present use. By space I mean vacuum in the ordinary sense, that which exists in interplanetary space, that to which we approach in our laboratories, nothing more or less. We have good reason to believe that in the visible universe no other kind of space exists. This is not, I believe, Prof. Schuster's use of the word, but I shall try to show that it is the only proper scientific use.

By absolute motion I mean motion considered with reference to this space alone.

The first evidence is furnished by the observed orbits of binary stars. If the velocity of light is dependent on the motion of the source, light which left the star when its motion was toward the earth must of necessity reach us sooner than the light emitted when this approach component of the star's velocity was smaller or negative. The observed orbit would therefore be distorted in a perfectly definite manner. The fact that this distortion is not observed proves that the velocity of light is not dependent upon the velocity of the source, and must therefore depend upon some positional property of space alone.

The conclusion is vividly represented as follows:—Imagine a hollow sphere in space with a light source at its centre. In general, a light wave leaving the centre will not reach all parts of the surface in equal times. There exists, however, *one* motion of the sphere for which this condition is fulfilled, and this state, which is absolutely independent of all existing bodies, has a fundamental claim to be called absolute rest, because it depends on space alone.

Further evidence is furnished by the laws of electrodynamics. The magnetic effect of electric convection is generally considered to be now beyond question. From it we know that the electromagnetic attraction between two like point charges moving together is a function of their velocity. Since there is no relative motion of the two and they may be considered alone in space, the motion is with respect to space alone. The state of absolute rest is found when the electromagnetic attraction is zero for all directions of the line joining the two charges.

The evidence furnished by the Kaufmann experiment on the mass of a rapidly moving electron, indicating as it does a limiting velocity in space, also implies the existence of absolute motion.

The evidence is not so good as in the other cases, because the effect is complicated by the existence of an *outside* magnetic field with reference to which the electron moves.

I foresee Prof. Schuster's objection to the above. What I have considered he will call motion relative to the ether, while his argument was based on space in a philosophical sense. I have carefully avoided the term ether. It seems to me the word has nothing to do with the discussion. The universe, out to the furthermost visible star, is of such a nature as to be traversed by light. With space in any other sense we have nothing whatever to do, because it does not exist in the visible universe. Even if such "space" did exist outside the visible universe, it is difficult to understand how our observational data could have any bearing on the matter.

Finally, if any more argument is necessary to show that the only space we can consider is that which surrounds us in the universe, it might be derived from the fundamental notion of space perception. Our perception of space is brought about through various sensations, sensations which are caused by events which do not take place in a hypothetical space, non-existent so far as we know, but in the real space which surrounds us. Our very use of the word therefore arises out of experience, and to think of another space is to form only what Mr. Spencer would have called "a symbolic conception." Indeed, I fear if this fundamental standpoint of perception were strictly adhered to, those arguing from the standpoint of another space would have great difficulty in making themselves clear. We cannot be too careful, it seems to me, in considering the origin of our fundamental conceptions.

At any rate, real space, as has been pointed out, possesses a positional, or perhaps better a motional, attribute, and so gives us a basis, founded on experience, for a conception of absolute motion.

DANIEL COMSTOCK.

Zürich, Switzerland, April 3.

The Magnetic Inertia of a Charged Conductor in a Field of Force.

I THINK there is, in Another Place, possibly some misunderstanding concerning the inertia of a moving charged conductor due to the magnetic energy set up by its motion. It depends upon the distribution of the electrification, and may vary from a minimum up to infinity. No question of distortion due to high speed is involved, so the theory is quite simple. Say a sphere of radius a has any distribution of surface charge. For simplicity, let it be symmetrical round the axis of motion, so that the surface density is representable by the sum of any number of zonal harmonic distributions. The corresponding magnetic fields follow. Their magnetic energies are all independent, so that the actual magnetic energy is the sum of the separate magnetic energies.

The really practical case, which is also very simple, is when the conductor has a charge Q and moves in a uniform electric field F. Then the surface density is

$$\sigma = Q/4\pi a^2 + 3\epsilon F \cos\theta, \qquad (1)$$

where θ is the polar angle. The magnetic force is

$$H = H_1 + H_2 = (Qu/4\pi r^2)\sin\theta + 3\epsilon F(a^3 u/r^3)\sin\theta\cos\theta. \qquad (2)$$

The magnetic energy is $\Sigma\frac{1}{2}\mu H^2$, and by integration comes to

$$T = \tfrac{1}{2}u^2[\mu Q^2/6\pi a + \tfrac{8}{5}\mu\epsilon^2 F^2\pi a^3]. \qquad (3)$$

The magnetic inertia is therefore $m = m_1(1+h)$, where m_1 is the value for the uniform charge, or $m_1 = \mu Q^2/6\pi a$, and

$$h = n^2/15\pi, \quad \text{if } n = (3F)(4\pi a^2\epsilon/Q). \qquad (4)$$

This n is the ratio of the induced electric force at the pole to the undisturbed force. If $n=1$, F is just large enough to make the surface density be zero at one pole. Then $h = 1/47$. This is the increased inertia due to the disturbance of the distribution of the charge. The "equation of motion" under F is

$$FQ = \{m + m_1(1+h)\}\dot{u}, \qquad (5)$$

where m is the mass of the body. The whole is subject to the restriction of small u/v and small acceleration, so that the electric and magnetic fields sensibly travel with the charge. Nor need F be constant in space or in time, provided it does not vary too rapidly in relation to the size of the conductor. In slow motion the magnetic energy is the fraction u^2/v^2 of that part of the electric energy that depends upon the transverse electric force.

April 3. OLIVER HEAVISIDE.

Old Customs and Festivals.

MY mother, now in her eightieth year, was led by a recent article by Sir Norman Lockyer in NATURE to relate some reminiscences of some of the festivals formerly celebrated in Newton-on-Ayr. One of these seems to point to ancient human sacrifices. In *her* mother's school-days, the pupils of Newton-on-Ayr annually elected a king and a queen on Candlemas Day. On "Pase Friday" (Good

Friday) the king and queen, decked with daffadowndillies, were led out to the Newton Moors, where they were solemnly interred in graves dug side by side in a sandy knowe. Hands were clasped through a hole bored in the sand between the graves.

The burial ceremony had disappeared by the time my mother went to school, but the selection of a king and queen still persisted, though in a degenerate form. The pupil who presented the largest sum of money to the teacher on Candlemas Day was crowned king or queen, and the royal health was drunk in toddy provided by the schoolmaster.

I append a list of some of the festivals in vogue in my mother's childhood. Some of them survived until within thirty years ago, but all, with the exception of New Year's Day, are now practically extinct.

Hogmanay (December 31).—Presents demanded.

New Year's Day.—First-footing; exchange of visits; carousal.

Hansel Monday (first Monday after January 1).—Exchange of presents.

Candlemas.—Election of school-king.

Huntygowk [Hunt the Gowk=Cuckoo] (April 1).—Fools' errands, &c.

May Day.—Washing of face in dew to keep freckles away.

St. John's Eve.—Firing of guns by sailors over captains' houses.

Midsummer Fair.—Great cattle-fair on main street of Newton. On this evening, or some other about this season, the herds in the neighbouring village commune of Prestwick built a great bonfire.

Kipper Fair (first Friday after August 13).—Procession of "whipmen" on gaily caparisoned horses. Horse races and gala on Newton Sands. Publication of lampoons. Feasting on kippered salmon and ale.

Hallowe'en (October 31).—The great saturnalia of the year. Stealing of kale-stocks; smashing of doors with same; smoking-out of house dwellers; disguises; turnip lanterns; diving for apples; eating from one common dish; burning nuts, and many other fortune-telling rites.

Martinmas.—Killing of the mairt or mart, the animal the carcase of which was salted down for winter use.

Christmas, Good Friday, and Easter were not observed.

I have not included hiring fairs, ordinary cattle and horse fairs, &c., or the fast days which were quite modern ecclesiastical institutions. I ought, perhaps, to have included the Queen's birthday (May 24), for, even in my boyhood, that day was honoured in such a boisterously loyal manner as compared with the non-observance of the anniversary in most Scottish towns, that I cannot help thinking the bonfire raisers may in part have inherited their enthusiasm from the traditions of some ancient festival. The progress of a blazing boat through the streets of Ayr and Newton was the crowning episode of the day. The boat was stolen from the Newton fishermen, and no combustible property was on that day safe from confiscation.

W. SEMPLE.

Dumfries, Scotland, March 1.

Chemistry in Rural Secondary Schools.

PROF. MELDOLA has raised an important question on Mr. Dunstan's letter. Speaking of two rural secondary schools, he says that chemistry (with physics) "has been taught with the greatest success" and is "of distinct value in after life." It would be useful to have information about the careers of the individual boys on which he bases his opinion, and the character of the science teaching in the two schools referred to. My experience with young farmers in Essex has led me to think that the chemistry taught in many rural schools has had too little bearing upon the problems of rural life to be of much practical use, and school life is too short to admit of a science being taught as a means of mental discipline unless at the same time the pupils are building up knowledge that is essential to future progress.

The county institution at Chelmsford to which Prof. Meldola alludes includes schools of horticulture and agriculture. Though not secondary schools, it may be useful to state that, while in teaching horticultural students the biologist found it quite possible to get on without the chemist, in teaching agricultural students the chemist could make little progress without the biologist. It was not that chemistry and physics were not taught to all the students, but that the biologist, *quâ* biologist, necessarily possessed both chemical and physical knowledge, while the chemist, *quâ* chemist, knew no biology. In rural secondary schools biology should be an important subject of instruction, most rural industries being more or less biological. But no progress in biology can be made without an adequate knowledge of chemistry and physics, so that it is not a question of whether these sciences should be taught—there can be no possible doubt about that—but how they are taught. The teacher needs to be essentially a biologist, or at any rate to have studied science in a biological atmosphere, *e.g.* in an agricultural college, in order to be able to teach chemistry as a natural science and build up a knowledge of its principles by the study of substances and phenomena that come within the experience of rural life.

To give a concrete case. A common subject of instruction in the chemistry of a rural school is Weldon's process for the recovery of manganese in the manufacture of chlorine. To not one boy in a thousand is the knowledge of this process likely to be useful in after life, unless as cram for an examination. The underlying principles could be just as well illustrated by a study of the process of liming land to neutralise acidity and promote oxidation, a better subject educationally because coming within the boy's own range of experience, and affording knowledge which might be useful to every boy in the school. But how many of the existing rural school science masters possess the knowledge of natural science necessary to deal with it?

T. S. DYMOND.

Savile Club, W., April 15.

Diurnal Periodicity of Ionisation of Gases.

IN the course of some experiments on the spontaneous ionisation of air and other gases in closed vessels, Mr. N. R. Campbell and I have detected a well marked periodicity in its value. It has two maxima and two minima in each twenty-four hours, the maxima occurring between 8 a.m. and 10 a.m. and between 10 p.m. and 1 a.m. at night, while the minima occur with great regularity at or near 2 p.m. and 4 a.m. The form of the curve drawn for the observations of any single day is, as a rule, sufficiently well marked for the maxima and minima to be apparent, while if the mean of the observations for several days be taken, the form of the resulting curve is unmistakable.

The cause of this periodicity has not, as yet, been determined. A continuous record of the temperature of the laboratory was taken, and it was found to have a simple daily period with a maximum during the day and a very regular minimum at 7 a.m. The temperature fell steadily from 6 p.m. until seven o'clock the following morning, and, as during this interval the ionisation rises to a maximum, falls to a minimum, and then rises to a maximum again, it does not seem possible to connect the variations with temperature.

On the other hand, the variations of atmospheric potential show some striking parallel features. This quantity has a double daily period. Its maxima, like those of the ionisation, are not very well defined, and occur about the same times. The minima in both cases are remarkably constant, and occur at exactly the same hours—2 p.m. and 4 a.m. The irregularities in the atmospheric potential curves are less marked during the night than during the day—an observation which holds also for the ionisation curves. Lastly, this diurnal variation of the atmospheric potential is most marked in February, and it was in the ionisation curves for February that the periodicity was first noticed.

This and other possible causes of the periodicity are at present being investigated, and although the research is necessarily a slow one, we hope soon to be in a position to publish a full account of the work.

ALEX. WOOD.

Cavendish Laboratory, Cambridge, April 9.

New Spot on Jupiter.

ON April 10 I observed Jupiter in sunshine and noted the red spot central at 5h. 43m., longitude=30°·0. I soon remarked that the north equatorial belt curved abruptly north in the region north of the red spot and hollow, and that at the following end of this slanting attachment there was a very conspicuous dark spot which was quite new to me. It became central at 6h. 58m., longitude=75°·3, and seemed nearly as plain as the shadow of a satellite.

On April 12 the same region of Jupiter came under review. The red spot was central at 7h. 25m., longitude=31°·6, and the new north tropical spot at 8h. 33m., longitude=72°·7. The shadow of the first satellite was projected on the disc at the following end of the dark material forming the south tropical disturbance, and it appeared very little darker than the north tropical spot.

Observations were made on April 10 with 10-inch Withreflector, power about 220, and on April 12 with 12½-inch Calver-reflector, power 315.

During the present opposition of Jupiter the north equatorial and north temperate belts have been extremely faint, but the former recently developed a much deeper tone, and particularly in that section lying north of the red spot. The late outbreak of dark material in the north tropical zone will probably lead to the further intensification of the belts in this region.

It is hardly necessary to suggest that the new marking should be followed as critically and as long as possible during the short period remaining available for such observations before Jupiter's conjunction with the sun. Its rate of motion probably differs little from that of the red spot, and it may be looked for near the planet's central meridian on April 22 at 6h. 48m., April 24 at 8h. 26m., and April 29 at 7h. 37m. W. F. DENNING.

Bristol, April 14.

Oscillation of Flame Cones.

LIKE Prof. Smithells, who endeavoured to explain the phenomena described in Mr. Temple's letter to NATURE (March 29, p. 512), I have made many experiments with gas and air mixed by mechanical means and otherwise (Proc. Roy. Soc., vol. xxiv., and elsewhere), but am unable to agree with his conclusions in this case.

Assuming the mixture ascending the tube to contain 20 per cent. of gas by volume, and the relative densities of the air and gas to be as 1 to 0·5, then the *head* which produces the current is equal to a column of air 4·8 inches (0·4 foot) high, and, disregarding friction, the velocity= $\sqrt{2g\,0{\cdot}4}=5$ feet per second.

Again, assuming the average absolute temperature of the gases above the flame, when the latter has descended to a depth of 2 feet, to be 1500° F., and the corresponding temperature of the air entering the tube from below to be 520° F., the head becomes 18 inches (1·5 foot) and the velocity= $\sqrt{2g\,1{\cdot}5}=9{\cdot}8$ feet per second.

According to Mallard and Le Chatelier ("Annales des Mines," 8me Série, Tome iv., p. 326), the maximum velocity of translation of flame in a perfectly motionless mixture of lighting gas and air, contained in a glass tube of similar dimensions to that used by Mr. Temple, is 4 feet per second, but when the mixture is moving or agitated the velocity of translation increases, and may even assume the form of an explosive wave. The maximum velocity of 4 feet per second was obtained when the mixture contained 17·5 per cent. of gas, or, according to the authors, 2·5 per cent. more than is necessary for complete combustion.

Variations in the velocity of the current on the one hand, and of the flame on the other, appear to me to account for all the phenomena observed by Mr. Temple.

62 Park Place, Cardiff. W. GALLOWAY.

Interpretation of Meteorological Records.

IN the interesting discussion of the records of Lander and Smith's instruments at Canterbury (NATURE, March 15) both Dr. Aitken (pp. 485, 512) and Mr. Omond (p. 512) appear to have overlooked the fact that *no rain fell*, but only snow to the depth of more than 1 inch. This snow was mixed with a little hail at the commencement of the storm, but no rain fell as assumed by both your correspondents. The records state that the 0·26 inch of rainfall consisted of *snow melted as it fell*. The first sign of the storm was distant thunder and a darkening of the sky in the north-west. The glycerin barometer commenced its usual sharp rise before the first hail arrived and the storm was directly overhead. It is a curious fact that the rain or snow with a thunderstorm occurs with the sharp barometric *rise*, and not with the *fall* as one might expect. I think the great fall in temperature was due to the snow, and not as described by your correspondents. The rainfall curve did not begin first as suggested by Dr. Aitken, but the barometer as explained above. It is another curious fact that, although my house is the highest here, and has my anemometer on top of 30 feet of iron tubing above roof, and wireless telegraphy aërial 80 feet above street (with which I was busy at time of storm), yet no damage was done; but within 100 yards much lower houses had chimneys and walls thrown down and roofs split, &c., and people were seriously injured. Many houses, windmills, and a church in the district were set on fire. A. LANDER.

Canterbury.

Effect of Solar Eclipse on Fish.

DURING the partial solar eclipse observed in England on August 30, 1905, I was taking a holiday, and fishing in Slapton Ley (Devonshire). All the morning the sport had been indifferent, but as the eclipse neared its maximum the fish suddenly became ravenous, and I took more in that hour than all the rest of the day. My experience was also that of all the other boats out there at the time. The explanation, I presume, would be that the fish imagined night was approaching, and therefore prepared for supper; and as every fisherman knows, the last half-hour, when dusk is gathering, is the time that fish are mostly on the feed, and will readily take any bait.

A. MOSELY.

Union Bank Buildings, Ely Place, London, E.C.,
April 10.

Sea-sickness and Equilibration of the Eyes.

IN connection with the above subject (p. 511) it may perhaps interest your readers to know that German sailors recommend as a cure for sea-sickness to take a looking-glass and look steadily at your own eyes in it. Every motion of the ship is shared by the looking-glass, and consequently by so doing your own eyes follow the motion of the ship. GEOFFREY MARTIN.

Edinburgh, April 13.

AN ETHNOLOGICAL SURVEY OF THE PHILIPPINES.[1]

WITH characteristic energy, the Americans have made a good beginning with the study of the multifarious natives of the Philippine Islands. Dr. A. E. Jenks, who is chief of the Ethnological Survey for the Philippine Islands, has recently published a substantial volume of 266 pages, and 154 plates, on the Bontoc Igorot, who live in the centre of the northern end of Luzon. Judging from the short account of their physical characters, they, like so many other peoples in the East Indian Archipelago, are a mixture of Indonesians and Proto-Malays; a few are distinctly narrow-headed, about three times as many are broad-headed, and somewhat less than two-thirds are intermediate. The average stature of the men is 5 feet 4½ inches; the women average nearly 7 inches shorter. There is no trace of Negrito blood. The

1 "The Bontoc Igorot." By Albert Ernest Jenks, Department of the Interior. Ethnological Survey Publications, vol. i. (Manila, 1905.)
"Negritos of Zamabales." By William Allan Reed. *Ibid.*, vol. ii., part i. (Manila, 1904.)
"The Nabaloi Dialect." By Otto Scheerer. *Ibid.*, vol. ii., parts ii., iii. (Manila, 1905.)
"The Bataks of Palawan." By Edward Y. Miller. (Bureau of Public Printing.)

settlement of Bontoc is divided into thirteen wards or political divisions, called *ato*; each has its separate governing council, which can declare war or make peace. Each *ato* contains three kinds of buildings:—(1) public edifices, *fawi* and *pabafunan*, for men and

FIG. 1.—Relative Heights of American, Mixed Blood, and Pure Negrito.

boys; (2) similar houses, *ola*, for girls and young women before their permanent marriage; and (3) private houses, *afong*, for families and widows. The *pabafunan* is the home of the various *ato* ceremonies, and is sacred to the male sex; it is the men's club by day and the unmarried men's dormitory; the *fawi* is the council house, and as such is frequented mainly by old men; it is also the skull-house. Dr. Jenks adds a note on the distribution of similar club-houses in Eastern Asia and in Oceania. The *olag* is the dormitory of the girls from the age of two years until they marry, and where they receive their lovers. The *afong* is the only primitive dwelling in the Philippines which is built on the ground, but it contains a small upper storey, and often an attic over this; these are used as store-rooms for cereals. The clothes, ornaments, tattooing utensils, weapons, and the like are described and figured. Of great interest are the accounts of the ordinary domestic operations, especially those connected with the cultivation of rice and the regulation of irrigation; the rules seem to be framed with common-sense, and the people appear to be sufficiently law-abiding. The hill-sides are elaborately terraced; the author doubts whether this art has been borrowed from the Chinese, and inclines to the view that it is indigenous to the East Indian Archipelago, having spread northwards to Japan. Various plants are cultivated, but rice is the most important vegetable product, and in consequence most of the religious ceremonies are in connection with this crop, and take place at stated occasions from seed-sowing to the close of the harvest. Also associated with the importance of rice in the social economy is the employment of *palay*, the unthreshed rice, as a medium of exchange, and a measure of exchange value, for articles bought and sold. *Palay* is at all times a good currency; it is always in demand, being the staple food; it keeps eight or ten years without deterioration; it is portable and infinitely divisible; it is of very stable value, and cannot be counterfeited. Certain villages have special commodities, which are made or produced in superfluity for purposes of barter, such as pots, cloths, salt, pigs. The Igorot has as clear a conception of the relative value of two things bartered as has the civilised man when he buys or sells with money; but whatever he trades, be it a five-cent block of Mayinit salt or seventy-dollar carabao (buffalo), the worth of the article is always calculated on the basis of its value in *palay*, even though the payment is in money. The standard of value of the *palay* currency is the handful—a small bunch of *palay* tied up immediately below the heads of grain; it is about 1 foot long, half head and half straw. On the whole, there is great uniformity in the size of the handful.

The forces of nature are personified in the person of the only god known to the Igorot. He instituted the club-houses and gave rules of conduct, telling people not to lie or steal, and to have but one wife; the home should be kept pure, and all men dwell as brothers.

Enough has been said to show the importance of this work, which deals in a fairly thorough manner with a people about whom nothing was previously known, and who have lived their lives uncontaminated by foreign influence. Dr. Jenks candidly admits that the time at his disposal was insufficient to exhaust the subject, and we can only hope that the work so well begun will be thoroughly completed ere long. The Igorot community seems a very favourable one for an exhaustive sociological study. It would be very desirable for an investigator to make an exhaustive census of each *ato*, recording the whole genealogies of each family, according to the method introduced by Dr. Rivers; by this means accurate information could be obtained concerning the real nature of these wards, the reason for the social and family functions of certain individuals would be made clear, and the system of kinship and the regulation of marriage would be demonstrated.

On a previous occasion we have referred to the memoir on the Negritos of Zambales, by Mr. W. A. Reed, which contains a large number of excellent plates illustrating the general appearance and some of the occupations of these very interesting and primi-

FIG. 2.—Negrito Men of Bataan making Fire with Bamboo.

tive people. The Negritos were, without doubt, the aboriginal inhabitants of the Philippines, and they and their congeners in the Malay Peninsula, and in the Andamans, are the relics of one of the most archaic of human stocks. This can only be regarded

as a preliminary study, but, so far as it goes, it has considerable value and interest. The Aeta of Zambales are of a dark chocolate-brown colour, and when pure their hair is woolly; the men have an average height of 5 feet 2 inches; they are broad-headed, the cephalic index of the men averaging 82 and that of the females 86; their noses are exceedingly broad, but they have practically no prognathism. The Negritos studied by the author are not in the most primitive condition, as they have ceased to be purely nomadic hunters, and have taken to a little agriculture. It is to be hoped that Mr. Reed, or some other competent person, will pay especial attention to the real nature of the "scattered families" that wander from one place to another; to discover this it will be necessary to learn the names and relationships of every individual of each community, and this should be done

FIG. 3.—Group of Battak Women, showing Flayed-bark Skirts and Shaved Heads.

for several communities, then we shall learn whether they are clans with mother-right or families with father-right. It is important to map out the hunting grounds, and to record whether they consist of personal property.

Despite the similarity of name, there is no reason to connect the Battak of Palawan with those of Sumatra. They are a wild, hunting folk, who cultivate one or two tuberous plants, and in a few places plant small fields of rice. They gather gums, which they carry to the coast and trade for rice, beads, &c. They wear a scanty garment of bark cloth. They are a mixed Negrito people, and appear to be analogous to the Sakai of the Malay Peninsula. The present paper is only a slight sketch; doubtless these interesting people will be carefully studied in the future. They, like the Negritos of Zambales and elsewhere, are worth special investigation, as they represent the first stage of the passage from a hunting to an agricultural mode of life. No people in this stage of culture has been at all adequately studied from the sociological point of view, and our American colleagues have here a fine opportunity for investigations that are much needed by ethnologists and sociologists.

The term Igorot (the form "Igorrote" is barbarous) is one of those names like Dyak, which has been used so loosely as to be worthless; etymologically it means mountaineer, and therefore can have no racial or even tribal significance. The grammatical study by Dr. Scheerer is concerned with that division of the Igorot who know themselves as Ibaloi and their language as Nabaloi. Contrary to popular opinion, the author can trace no Chinese influence among the people, but, on the other hand, he has found among Ibaloi personal names some that are

FIG. 4.—Ibaloi Women (Girl on Right Side).

pure Japanese words. At present it is impossible to say whether these are more than accidental similarities, or to determine in which direction the loan may have taken place. Nabaloi, like all Philippine dialects, is agglutinative, built up of roots and particles; it belongs to the great Oceanic linguistic stock.

A. C. HADDON.

THE OCEANOGRAPHY OF THE PACIFIC.

A NOTABLE addition to our knowledge of the Pacific Ocean is contained in a paper by Dr. James M. Flint, published as Bulletin No. 55 of the United States National Museum. In the early part of the year 1899 the U.S.S. *Nero*, a steam collier of nearly 5000 tons, which had been purchased for use during the Spanish-American war, was fitted out and dispatched from San Francisco with instructions to survey a route for a telegraph cable between the

United States, the Philippine Islands, and Japan. The ship was in command of Commander Belknap so far as Manila, where he was relieved on account of illness by Lieut.-Commander H. M. Hodges.

As previous surveys had established a satisfactory route so far as the Sandwich Islands, the work of the *Nero* began at Honolulu, whence the ship sailed on May 6, 1899. The instructions were to follow as nearly direct lines as practicable from Honolulu to Midway Island, thence to Guam, and from Guam to Luzon; also from Guam to Japan. Soundings were to be taken on the outward voyage at intervals of 10 miles and 2 miles alternately; temperatures of the air, and surface and bottom of the sea to be recorded; currents noted; samples of bottom to be collected and preserved. The return course was planned to cross the primary route zigzag at angles of forty-five degrees, the sides of the zigzags to be 20 miles in length, and soundings to be taken at the apices. When it is stated that this plan, modified by circumstances chiefly as regards intervals between soundings and detours from the main line in order to develop marked irregularities in the contour of the ocean bed, was effectively carried out, we may agree that the belt 14 miles wide and more than 6000 miles in length has been examined with a thoroughness,

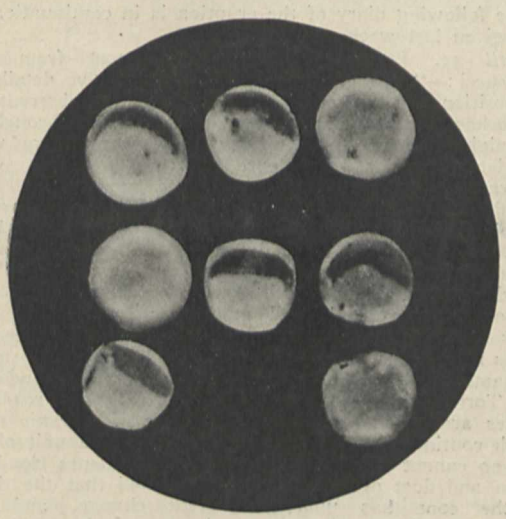

FIG. 1.—Diatom ooze obtained at a depth of 2788 fathoms in latitude 14° 24′ N., and long. 135° 31′ E. *Coscinodiscus rex*, Wallich, magnified 15 diameters.

at least in so far as soundings are concerned, which is unequalled by any survey hitherto made of an ocean tract.

The chief interest as regards depths centres about the region between Guam and Midway Islands. About half-way between the two a plain more than 3000 fathoms from the surface is interrupted by what is apparently a range of mountains, extending over three degrees of longitude, and rising in places to 720 fathoms from the surface. From the western limit of the plain, some 300 miles from this mountain range, the contour is quite irregular until Guam is reached. Extensive detours to north and south of the direct course showed a mountainous region, with peaks rising to 689 fathoms below sea-level and valleys descending to a depth of more than 5000 fathoms. Four soundings below the 5000-fathom line were made in an abyss to which the name "Nero Deep" was given, with the record of 5070, 5101, 5160, and 5269 fathoms. The last sounding is, of course, the deepest on record, being only 66 feet less than 6 statute miles. Its position was lat. 12° 43′ 15″ N., long. 145° 49′ E., or 75 miles E.S.E. of the island of Guam.

From Guam to Yokohama the soundings indicated a continuous range of mountains connecting the Ladrone Islands with the Bonin group.

Another result of importance obtained by the *Nero* is the discovery of diatom ooze as a bottom deposit in tropical waters. Many distinct patches of characteristic diatom ooze were found on the line, especially between Guam and Luzon. Along a line about 300 miles in length, lat. 14° 28′ to 14° 50′ N., and long. 136° to 130° 30′ E., diatom ooze was brought up at thirteen stations from depths between 2432 and 3547 fathoms. Again, between Guam and Midway Islands ooze of a similar kind was obtained at three stations. In all the specimens examined the diatoms belong almost exclusively to a single species, identified by Prof. Mann as *Coscinodiscus rex*, Wallich. We reproduce the figure given in the plates accompanying the paper of "diatom ooze from station 746 (lat. 14° 24′ N., long. 135° 31′ E.), 2788 fathoms. Magnified 15 diameters."

We are unable to do more than direct attention to the two most remarkable discoveries made by this expedition. It is scarcely necessary to add that the table of 2074 soundings, with details of bottom deposits, and a large number of temperature observations, forms in itself an even more valuable contribution to oceanography than the two "records" we have mentioned.

AGRICULTURAL RESEARCH IN INDIA.[1]

THE publication of the first annual report of the Imperial Department of Agriculture of India is little short of an epoch-marking event. As I have said elsewhere, agricultural research has not been wholly neglected in India in the past. Much excellent work has been done by able men working under conditions which were never encouraging. But it has been fitful and uncoordinated, and always at the mercy of uninstructed and unsympathetic officials, whose one canon of criticism has been the solvency of the annual balance-sheet.

India now possesses what it may be hoped before the century has run out will be regarded as the Rothamsted of the East; and the characteristic irony, I might almost say cynicism, of the British race is content that it should owe its foundation in great part to the large-minded munificence of an American gentleman.

The outcome will not be found to-day or to-morrow, but only after years of patient work. The Government of India must not be impatient for immediate results or querulous about current expenditure. That must needs be capital invested, and the return will be the eventual increase of the wealth and prosperity of the population of India.

It now possesses for the first time a real agricultural "headquarters staff." The various experts charged with particular features of the biological campaign are no longer scattered, but are brought together in one institution, where they can work in sympathetic partnership. A glance through the pages of this report is sufficient to reveal the enormous area of the field before them. It may be prudent at the start to make a sustained attack on a few problems rather than to nibble at many.

W. T. THISELTON-DYER.

[1] Annual Report of the Imperial Department of Agriculture for the year 1904-05. (Calcutta: Government Central Press, 1906.) Price 1*s.* 2*d.*

THE ERUPTION OF VESUVIUS.

THE eruption of Vesuvius has quieted down since last week, though scoriæ and ash continue to be ejected and there still seems to be a slow flow of lava, but in comparison with the activity of the eruption on April 8 the volcano is quiet—until next time. How soon or how long deferred this may be cannot be predicted, but the pause has enabled us to take stock of events and form some estimate of this outburst as compared with previous ones. The most important qualification of earlier reports is in regard to the reported flow of lava through the streets of Ottajano; an outburst of lava on the outer slope of Monte Somma would be remarkable indeed, but later accounts show that none such took place, the damage at Ottajano and San Giuseppe being due to a very heavy fall of ash.

The reports from the Vesuvian Observatory and the definite statement of Messrs. Thos. Cook and Son that their electric tramway has not suffered more than a temporary interruption of traffic, due to the fall of ash, show that no lava flowed in that direction. On the other hand, there seems to have been an extensive outflow into the Atrio del Cavallo and on the south side of the volcano. The lava, which stopped just short of Bosco-Trecase, seems to have reached further than the stream of 1754.

In spite of the prominence given to these lava streams in the daily papers, the eruption seems to have been less remarkable, in this respect, than that of 1895, not to mention others of earlier date, but the volume of volcanic ash produced and scattered over the surrounding country has been very great, and the aspect of the volcano has been materially changed, not only by the addition of a mantle of grey ashes, but also by the destruction of a portion of the cone. The upper part of the funicular railway has been destroyed —blown away, so far as can be made out—in the enlargement of the old crater; the volcano as a whole is noticeably lower than it was, and must have resumed very much the aspect it showed after the eruption of 1822.

The Naples correspondent of the *Times* described in Tuesday's issue the nature and results of the recent eruption. Some extracts from this narrative, dealing with points of scientific interest, are subjoined, with a diary of events abstracted from Press reports.

The most intense activity occurred on the night of Saturday, April 7, when the sides of the cone subsided and the streams of lava, already set free, gained a terrible impulse. The electric phenomena of thunder and lightning, which ordinarily attend any great volcanic convulsion, were then at their height, and the ejection of large blocks from the crater and fiery scoriæ is said to have surpassed anything within the memory of the present generation. The main courses taken by the lava flow seem to have been six in number: towards Ottajano on the north, to San Giuseppe and Terzigno on the east, past Bosco-Trecase to Torre Annunziata on the south, to Torre del Greco and past the observatory on the west. Of these, the most formidable stream was that which descended towards Torre Annunziata, those which deviated towards Torre del Greco and Terzigno being only its branches. At Torre Annunziata the lava stopped just short of the wall of the cemetery outside the town.

The actual area of ground covered by lava cannot yet be conjectured, though it is believed to exceed that covered by all recent eruptions. Next in importance comes the fall of volcanic dust and scoriæ. The direction of this fall varied each day. The worst suffering was inflicted upon Ottajano and San Giuseppe Vesuviano towards the north-east. In both places a large number of houses succumbed to the weight that fell on their roofs. Considerable damage was also done, from the same cause, at Torre del Greco.

During the first three or four days the dust plunged the towns in the immediate vicinity of the volcano into utter darkness, and materially increased the panic that had already set in. Even Naples was in a state of semi-darkness, from which it had hardly emerged on April 12. The roofs and roads seem to be inches deep in an extraordinarily fine, reddish-grey dust, which rises in dense clouds behind every carriage and foot passenger.

In some places the drift of ash seems fully a yard deep; at Ottajano and San Giuseppe in the lightest deposits it must measure three inches. The great danger in both places—and, indeed, in most of the towns on the slopes of Vesuvius—would be a heavy rainfall and the formation of mud-torrents, which will more than complete the ruin already begun by the lapilli. At the coast towns, Torre del Greco, Torre Annunziata, Resina, and others, the work of disencumbering the streets and buildings of the lapilli and ashes is already in active progress.

It is difficult to compare the extent of this latest eruption with that of those which have preceded it. Eye-witnesses of both declare it to have been more formidable than that of 1872, which practically destroyed Torre del Greco for the fourth time. The distance to which the ash was carried is so dependent on other atmospheric influences that it cannot constitute a test. In this case the ash seems to have reached Bari and towns on the Adriatic coast. One notable change has been wrought by the eruption. The cone, which has for so long been such a distinctive feature of the mountain, appears to be gone.

The following diary of the eruption is in continuation of that given last week:—

April 11. *Vesuvius Observatory.*—Report from Dr. Matteucci:—"For brevity's sake I do not give details of my position and that of the carabineers at the observatory, which has been very unpleasant and alarming. Throughout the night and up to 8 o'clock this morning we were completely enveloped in dense showers of dust. As I telegraph everything tends to reduce anxiety, and the seismic instruments show quieter records than yesterday. I shall remain here as long as possible—as long as I have food. If my words could influence the population they would be words of encouragement and sympathy in full confidence that Vesuvius will shortly become calmer."

Showers of volcanic ash and other fragmentary products continue to fall. San Giuseppe almost buried in places by mounds of ash and lapilli, and Ottajano in much the same condition. Torre Annunziata remains abandoned, and Torre del Greco is almost deserted. The roads in Naples are covered with a thick layer of volcanic dust, which continues to fall upon the city. The summit of the volcano cannot be seen on account of the dense clouds of steam and dust over it, but it is reported that the shape of the cone has undergone great change, and Dr. Matteucci estimates that the top is now nearly 250 metres lower than before the eruption.

April 12.—Seismographs quiet. Volcanic ash has ceased to fall in Naples, Portici, Torre del Greco, and Torre Annunziata, but the shower continues at Ponticelle, St. Anastasia, and Somma.

April 13.—No noticeable disturbances. The volcano still surmounted with a dense cloud, which appeared, however, to be disappearing.

April 14.—A shower of ash fell at San Giuseppe Vesuviano and Ottajano to a depth of about 1½ inches. Heavy falls of dust also recorded in the communes of Collina, Strocchia, Boscoreale, Somma, and Ottajano. Slight earthquake shock felt at Ottajano and Terzigno.

April 15.—At 2 p.m. a heavy shower of ash began falling at Ottajano, Boscoreale, Bosco-Trecase, and Torre del Greco, causing intense darkness. There was a slight fall of ashes at Portici, Resina, San Sebastiano, and San Georgio.

April 16.—No signs of activity. Seismographs quiet.

April 17.—Conditions normal except for a shower of ash falling on Ottajano and St. Anastasia. Dr. Matteucci reports from the observatory that, with the exception of a few hours, last night was calm. The activity of Vesuvius is limited to a decreased emission of dust, falling in the eastern districts.

NOTES.

We regret to announce that Prof. W. F. R. Weldon, F.R.S., Linacre professor of comparative anatomy, Oxford, died suddenly on Friday last, April 13, at the early age of forty-five.

The University of Berlin has announced the award of a prize of 50*l.* for the best physical or mathematical research presented to the philosophical faculty for the doctor's degree in 1906.

The eighty-ninth annual meeting of the Swiss Scientific Society will be held this year at St. Gall from July 29 to August 1 under the presidency of Dr. Ambühl. The programme will include an excursion to Mt. Sentis.

On behalf of the family of the late Prof. Manuelli, of Modena, Herr T. Waitzfelder has presented the Munich Museum with an interesting collection, in which are some original pieces of apparatus used by Galvani and other Italian investigators, together with some pieces of alchemistic apparatus.

The Schleswig-Holstein Board of Agriculture has elected Dr. Hans Wehnert to succeed Prof. Adolf Emmerling as director of the agricultural chemistry laboratory at Kiel. Dr. Wehnert studied at Brunswick Technical High School and Rostock University, and has had a wide experience as a manufacturer's chemist.

Mr. Edgar R. Waite has resigned his position as zoologist, Australian Museum, Sydney, consequent upon his appointment to the curatorship of the Canterbury Museum, Christchurch, New Zealand. Before he left England for Sydney in 1892 Mr. Waite was an active secretary of the Yorkshire Naturalists' Union, and also editor of the *Naturalist*.

A correspondent of the *Daily Mail*, at Entebbe (Uganda), reports on April 10 that Lieut. Forbes Tulloch, who accompanied the Royal Society's commission sent there to investigate sleeping sickness, has accidentally contracted the disease, and has left for England in charge of Lieut. Gray. The message states that the commission's laboratory has been closed, and all the inoculated monkeys shot to avert further accidents.

A message from a correspondent of the *Times* in Athens states that a telegram from Sparta announces the discovery of the famous sanctuary of Artemis Orthia, before whose altar the Spartan youths were scourged when initiated into the privileges of manhood. The site is on the bank of the Eurotas. Votive offerings of ivory and terra-cotta and quantities of small leaden figures have also been found, as well as pottery, which confirms the belief that this was one of the most ancient Spartan shrines.

The council of the Institution of Naval Architects has nominated Mr. Sidney W. Barnaby to represent that institution on the sectional committee on screw threads and limit gauges of the Engineering Standards Committee in the place of Mr. McFarlane Gray, resigned. The Secretary of State for India has nominated Mr. A. Brereton to represent the India Office on the sectional committee on locomotives in the place of Sir Frederick R. Upcott.

On Thursday next, April 26, Dr. P. Chalmers Mitchell will deliver the first of two lectures at the Royal Institution on "The Digestive Tract in Birds and Mammals." The Friday evening discourses will be resumed on April 27, when Prof. J. W. Gregory will deliver a discourse on "Ore Deposits and their Distribution in Depth." The discourse on May 4 will be given by the Hon. C. A. Parsons, on "The Steam Turbine on Land and at Sea," and on May 11 by Prof. J. H. Poynting, on "Some Astronomical Consequences of the Pressure of Light."

Hermann Schnaus, one of the most thorough and earnest German writers on photography, died on March 14 from paralysis. Beginning life as a bookseller's assistant, first in Jena and afterwards in Bonn, Frankfurt, and Zürich, Schnaus in 1881 entered the photographic publishing firm of Liesegang, at Dusseldorf. After editing *Photographische Archivs*, the first German periodical devoted to photography, Schnaus founded first *Der Amateur-photograph* (now *Photographische Welt*) and afterwards *Appollo*, and in 1905 took over the editorship of the *Photographische Industrie*, to the pages of which he had assiduously contributed from its inception.

From the *Chemiker Zeitung* we learn that the Syndicate of French Sugar Manufacturers, 42 rue du Louvre, Paris, is offering for competition a prize of 100,000 francs for a new application of sugar in the industries, other than the food industry. A condition of the award is that the suggestion shall have been tried in France, and, according to official statistics, have caused an increase in the consumption of sugar in France of at least 100,000 tons in the year. The support of the syndicate is promised in the event of a diminution or the complete abolition of the present sugar tax being necessary for the successful development of the proposed application. Foreigners are not prevented from taking part in the competition.

On March 17, at Baden-Baden, Prof. Adolf Emmerling, director of the agricultural chemistry laboratory of the Board of Agriculture of the province of Schleswig-Holstein, died in his sixty-fourth year. After graduating at Freiburg in 1865, Prof. Emmerling was for nearly four years an assistant in the chemical laboratory of Freiburg University, and for a further two years under Bunsen at Heidelberg; from thence he went to Kiel to direct the work of what was then the agricultural chemistry laboratory of the agricultural Gewerbeverein, which position he held until his death. His numerous scientific researches were published mainly in the *Berichte* of the German Chemical Society and the "Landwirtschaftlichen-Versuchs-stationen"; these included a number of new experimental methods and descriptions of new apparatus. Prof. Emmerling, who was a Knight of the Order of the Red Eagle, received the title of professor in 1882, and that of Geheimer Regierungsrat in 1900.

Sir Thomas Browne, the author of "Religio Medici," who lived at Norwich in the middle of the seventeenth century, was buried in the church of St. Peter Mancroft during the early part of the last century. It is believed that his skull was abstracted from the grave and is now preserved at the Norfolk and Norwich Hospital. We learn from the *Times* that recently there has been a considerable expression of opinion in Norwich that the skull ought to be returned to the tomb whence it was taken. The hospital governors on Saturday unanimously passed a resolution agreeing to this course, on condition that the tomb shall be opened in the presence of representatives of the hospital with the view of satisfying them that the remains therein are without a skull.

An earthquake as severe as that of March 17 occurred in South Formosa in the morning of April 14. Kagi was again the town which suffered the most damage. By the disturbance on March 17 1228 persons were killed and

2329 injured, while 5556 houses were totally, and 3383 partially, destroyed. In the present case seven persons were killed and thirty-five injured at Daigo, where 400 buildings were destroyed, while in the Ajensui district the casualties amounted to three killed and fifteen injured, 1191 houses collapsing and 749 being partially wrecked. A Reuter message states that the shock of April 14 was much more severe than that of March 17, and the low death roll, as well as the comparatively small amount of damage done, is to be explained by the fact that the people were more on the alert after their experiences of last month, and that after the havoc caused by the first disturbance there was not much left to destroy.

ARRANGEMENTS have been made to hold a joint meeting of members of the American Institute of Mining Engineers and of the Iron and Steel Institute in London during the week commencing July 23. The Lord Mayor of London has kindly consented to act as chairman of the London reception committee, and a varied programme of entertainments, visits, and excursions will be provided. Meetings for the reading and discussion of papers will be held on the mornings of July 24, 25, and 26, with visits to works in the afternoons. The Lord Mayor will give an evening reception at the Mansion House on July 24. On July 27 the annual dinner of the institute, to which the American visitors are invited, will be held at the Guildhall. Detailed particulars will be issued when the arrangements are further matured. After the meeting in London, a tour will be arranged for the American visitors to York, Middlesbrough, Newcastle-on-Tyne, Glasgow, and Edinburgh. As an alternative excursion a number of the American visitors have been invited by the local reception committee for the summer meeting of the Institution of Mechanical Engineers to take part in the Cardiff meeting of that society.

As previously announced, the annual meeting of the Iron and Steel Institute will be held on May 10–11. At the first meeting the Bessemer gold medal for 1906 will be presented to Mr. Floris Osmond (Paris), and the awards of the Andrew Carnegie gold medal and research scholarships for 1906 will be announced. Among the papers that are expected to be submitted during the meeting are the following:—Influence of silicon, phosphorus, manganese, and aluminium on chill in cast iron, E. Adamson; influence of manganese on iron, Prof. J. O. Arnold; relation between type of fracture and microstructure of steel test pieces, C. O. Bannister; use of oxygen in removing blast furnace obstructions, C. de Schwarz; volume and temperature changes occurring during the cooling of cast iron, Prof. T. Turner. The following reports on work carried out during the past year by holders of Carnegie research scholarships will be submitted:—Hardness of the constituents of iron and steel, Dr. H. C. Boynton; heat treatment of wire, J. Dixon Brunton; quaternary steels, Dr. L. Guillet; influence of carbon on cast iron, W. H. Hatfield; preparation of carbon-free ferromanganese, E. G. Ll. Roberts and E. A. Wraight; deformation and fracture in iron and steel, W. Rosenhain.

THE most important paper in No. 181 of the Proceedings of the American Philosophical Society is one by Miss M. E. Marshall on the anatomy of that aberrant nightjar *Phalaenoptilus nuttali*, the investigation taking into consideration the mutual relationships of the three families usually included in the Caprimulgi.

AMONG the contents of the *Sitzungsberichte* of the Royal Bohemian Academy of Sciences for 1905 may be mentioned an article by Dr. A. Frič on the reptiles of the Bohemian Cretaceous; Montenegro leeches, by Mr. R. Blanchard; the glands of holothurians, by Mr. K. Thon; and the third part of an account of certain fresh-water amphipod crustaceans, by Prof. F. Vejdovský.

IN a paper published in the Proceedings of the Rochester (U.S.A.) Academy of Science (iv., p. 203) Mr. C. L. Sarle concludes that the Silurian fossils described as Arthrophycus and Dædalus, the nature of which has received very various interpretations, are really burrows, Dædalus, at any rate, being probably the work of a sedentary polychætous annelid. The structures form elaborate open spirals of the "Archimedean" type.

THE concluding portion of the catalogue of the marine shells of Victoria, by Messrs. Pritchard and Gatcliff, forms the main portion of the contents of part ii. of vol. xviii. of the Proceedings of the Royal Society of Victoria. Mr. F. Chapman describes a new cephalaspid fish from the Silurian of the colony, referred to the genus Thyestes (Auchenaspis), as *T. magnificus*. The species of the genus hitherto known are all small, but the new one rivals in this respect the majority of the representatives of the typical Cephalaspis.

THE contents of Scientific Investigations (Fisheries, Ireland), No. 7, 1904 (1906), include a report by Mr. E. W. L. Holt on artificial propagation of Salmonidæ in 1904–5; notes on the spawning season of rainbow trout, by Mr. C. Arens (the translation of a paper written for the International Fish Congress at Vienna last year); records of salmon-marking experiments in Ireland from 1902 to 1905, by Mr. A. B. E. Hillas; and statistical information relating to salmon fisheries.

IN a report by Mr. E. D. Sanderson on miscellaneous cotton-insects in Texas, forming Bulletin No. 57 of the Entomological Division of the U.S. Department of Agriculture, attention is directed to the fact that, owing to the ravages of the "boll-weevil," cotton cultivation has entered on a new phase in Texas, and that noxious insects which were formerly ignored have now assumed, in consequence of early and rapid cultivation and reduced acreage, increased importance as factors in the success or otherwise of the crops. Although the investigation is still in its infancy, it is suggested that the remedy for these minor pests will be found in improved methods of cultivation rather than in recourse to poisons.

WE have received separate copies of several papers recently published in the *American Journal of Science*, among which are three by Mr. G. R. Wieland on Cretaceous turtles and tortoises, which have been already noticed in our columns. In a fourth the same author discusses the "pro-embryos" of the fossil cycads of the group Bennettiteæ. Since, with the exception of the archegonia of Cycadinocarpus, no developmental stage has hitherto been described in any fossil plant, the discovery is regarded by the author as one of the highest importance. This paper is dated 1904; while others, by Dr. J. Wortman, on remains of Eocene Primates in the Peabody Museum, were originally published during that and the preceding year. Of more recent date is a revision of the New York Helderbergian crinoids, by Miss M. Talbot, and a review of the fauna of the Palæozoic Chazy Limestone of North America, by Mr. P. E. Raymond.

NOTES on Bahama snakes, by Mr. J. L. Cole, and the description of a new Bahama sea-spider, or pycnogonid, by Mr. T. Barbour, form two of the articles in the March issue of the *American Naturalist*. Mr. W. Stone con-

tributes notes on Pennsylvanian and other reptiles and amphibians, while Prof. M. A. Wilcox commences an account of the anatomy of the limpet, *Acmaea testudinalis*, a subject to which he has for several years devoted attention. The author states that he has endeavoured to make the communication "serve as an introduction to the study of the fascinating but neglected group of Gastropoda." In the sixth article Dr. A. Hollick and Prof. E. C. Jeffrey discuss the affinities of certain Cretaceous plant remains commonly assigned to the genera Dammara and Brachyphyllum. The so-called Dammara is assigned to a new genus of araucarian under the name of Protodammara, while the shoots and branches referred to Brachyphyllum are likewise of an araucarian nature.

THE February number of *Le Bambou* contains an article on the identification of species of Phyllostachys, also cultural hints on some of the Arundinarieæ, and notes on the resistance of bamboos to frost in the south of France.

THE list of new garden plants for the year 1905, issued as appendix iii., 1906, to the Kew Bulletin, contains, as usual, a large number of orchids, especially species of Cattleya, Cypripedium, Dendrobium, and Odontoglossum. The African continent continues to furnish a considerable proportion of plants, including species of Aloe, Lissochilus, and Polystachya. Messrs. J. Veitch and Sons have introduced a number of Chinese plants, of which the Primulas have attracted attention, particularly *Primula Cockburniana* that bears large orange-scarlet flowers.

A SECOND paper on the Panama Canal, by the Hon. Theodore P. Shonts, chairman of the Isthmian Canal Commission, is published in the February number of the *National Geographic Magazine*. The experiments with foreign labour, arrangements for transportation facilities, and similar matters are fully described.

THE report on the state of the ice in the Arctic seas during 1905 has been issued by the Danish Meteorological Institute. The general conclusion drawn is that great masses of ice were disengaged from the firm ice in the north polar regions at an earlier date than usual, and the ice drifted southward faster and in greater quantities than in a normal year.

THE February number of the Bulletin of the American Geographical Society is almost entirely devoted to a report of the second annual meeting of the Association of American Geographers, which was held in New York on December 26 and 27 last, under the presidency of Prof. W. M. Davis. About thirty-three papers were communicated, and abstracts of most of these are to be found in the report.

IN an article entitled "Winning the West," in the February *National Geographic Magazine*, Mr. C. J. Blanchard gives an interesting account of the extraordinary progress made by the United States Reclamation Service during the last few years. Of the fifty millions of acres which it is estimated can be reclaimed from the desert by irrigation, ten millions have already been made productive, at a cost of some ninety millions of dollars. This area is occupied by a population of about two millions, and every year it returns a harvest valued at more than one hundred and fifty millions of dollars.

WE have received a reprint of a paper, published in the Bulletin of the American Geographical Society, by Mr. Daniel T. Macdougal, on the delta of the Rio Colorado. With the help of a map by Mr. Godfrey Sykes, which accompanies the paper, the author describes the complex hydrography of the region between the international boundary and the present head of the Gulf of California. Some useful notes on the climate and flora are added. The paper gains in interest from the fact that the Salton sink and Imperial Valley immediately to the north of the boundary are likely to be greatly modified in the near future by the work of the U.S. Reclamation Service.

THE report of the Meteorological Council for 1904–5 (the last year of the administration of the Meteorological Office by that body), which was recently presented to Parliament, contains an interesting account of the operations of the office since its establishment as a department of the Board of Trade under Admiral (then Captain) FitzRoy in 1854. The amount of up-hill work carried out by Admiral FitzRoy, with Mr. T. H. Babington as scientific assistant, and the very few clerks at his disposal was remarkable. His first care was to issue trustworthy instruments to vessels of the navy and mercantile marine, and to collect observations relating to meteorology over the oceans; but pending the receipt and collation of these observations he quickly converted Maury's numerical wind charts into seasonal charts of graphical wind-stars, and issued them in great numbers to seamen. These were soon supplemented by monthly charts, from observations obtained from British ships, combined with those from Maury's charts. Subsequently he collected and collated synchronous observations for both land and sea, from the study of which he was enabled to commence his system of storm signals and weather forecasts by which his name in this country is best known. After his death, in 1865, the management of the office was placed under a committee of the Royal Society, with an increased grant; this body established the self-recording observatories, and under the able administration of Mr. R. H. Scott, as director, the operations of the office were greatly extended. In 1877, on the recommendation of a committee of inquiry, the Meteorological Committee, the services of the members of which were honorary, was replaced by a paid council, with a further increase in the grant. After the lamented death of Prof. Henry Smith in 1883, General (now Sir Richard) Strachey became chairman; his great administrative power and ability in the direction of the constantly increasing work and usefulness of the office (with Mr. Scott, and more recently Mr. Shaw, as secretary), are too well known to require further comment here. The work of all departments, relating to marine meteorology, weather forecasts, and the discussion of the observatory and other records, attained a high degree of excellence, and compares favourably with that performed by any foreign meteorological organisation.

A NEW method of exactly standardising thermometers between 0° C. and −4°·0 C. has been devised by Prof. T. W. Richards and Mr. F. G. Jackson; it is described in the Proceedings of the American Academy (vol. xli., No. 21), and consists in observing the temperatures recorded for the freezing point of dilute hydrochloric acid solutions of known concentration. A table is given of the values for the freezing point of solutions of different strengths. The method should be of special service in standardising thermometers used for accurate physical-chemical researches, particularly in measurements of the freezing point of dilute solutions.

IN the Proceedings of the American Academy of Arts and Sciences (vol. xli., No. 20) Prof. Theodore W. Richards and Mr. R. C. Wells deal with the possibility of utilising the

temperature of transition of sodium bromide dihydrate into the anhydrous salt as a fixed point in accurate thermometry. As the result of their investigations they conclude that when the salt is quite pure the transition of the dihydrate into the anhydrous salt takes place at a temperature of 50°·674 C., but that the exact value of the transition point is slightly modified by the presence of traces of impurity. Considerable difficulty is experienced in preparing pure sodium bromide free from sodium chloride; it cannot be obtained by re-crystallising the ordinary bromide, but must be made from pure bromine and pure sodium carbonate. Details are given of the methods used in purifying these materials, the sodium bromide ultimately obtained giving a value of 23·008 for the atomic weight of sodium; this value agrees closely with that recently found for the atomic weight by the same investigators using a method based on the analysis of sodium chloride.

THE variation of the properties of the hydroxyl group of alcohols as the nature and number of the alkyl radicals attached to the carbon atom are varied forms the subject of a suggestive paper by Prof. Louis Henry in No. 12 of the Bulletin of the Royal Academy of Belgium. The observations are of interest both from practical and classificatory standpoints. It is pointed out that as the number of alkyl groups is increased in passing from a primary to a tertiary alcohol, the properties characterising the hydroxyl pass from those associated with the hydroxyl radical of water to those characteristic of the hydroxyl of bases, such as potash. In particular the different behaviour is emphasised of the three classes of alcohols towards the halogen hydrides, towards acetyl chloride, and during esterification by means of hydrogen chloride and a fatty acid. The generalities established can be utilised as a means of predicting the behaviour of the mixed alkyl ethers when subjected to the decomposing action of the halogen acids.

A WELL-ILLUSTRATED price-list of sundials and sundial pedestals has just been issued by Messrs. Newton and Co. Many forms of horizontal and vertical dials, and also pocket dials, are described in the catalogue, which should be seen by anyone who desires to possess a timekeeper of this kind as a reminder of the days when hours were marked by shadows on a dial.

A COPY of the report for 1905 of the Rugby School Natural History Society has been received. It is to be regretted that "a distinct falling off in the keenness of the sections taken as a whole" during 1905 was, according to the preface, noticed by the officers of the society. It may be hoped that the present year will, by its exceptional exhibition of vigour, retrieve the character of what has been a hard-working society.

THE Journal of the Royal Sanitary Institute (vol. xxvii., No. 3) contains the full text of the important series of papers read at the conference on smoke abatement in December, 1905. The list includes the address by Sir W. H. Preece, K.C.B., on factory and trade smoke abatement; and papers on stoking, by Commander W. F. Caborne; on the abatement of smoke from factories, by Dr. S. Rideal; on the artificial production of persistent fog, by the Hon. Rollo Russell; on the destructive effect of smoke in relation to plant life, by Mr. Arthur Rigg; on the work of the Hamburg Smoke Abatement Society, by Mr. J. B. C. Kershaw; on observations on smoke densities, by Mr. J. W. Lovibond; and on the effect of smoke on plant life, by Miss M. Agar.

OUR ASTRONOMICAL COLUMN.

THE CONTINUOUS SPECTRUM OF THE CHROMOSPHERE.—An interesting communication dealing with the question of the existence of a continuous spectrum in the radiations emitted by the chromosphere was communicated to the Paris Academy of Sciences by M. Deslandres on March 26.

M. Deslandres made special preparations for the eclipse in August last in order to determine whether the continuous spectrum (*i.e.* the radiations emitted by solid or liquid *particles*) of the chromosphere is brighter, as bright, or less bright than that of the neighbouring corona. Employing coloured screens, which absorbed the gaseous radiations, he photographed the uneclipsed ring of chromosphere and corona directly, and, in order to determine what proportion of the transmitted radiations was due to the light emitted by the metallic prominences, &c., he simultaneously employed two grating cameras which disclosed the presence and intensity of the latter.

Comparing the images photographed through screens with similar ones obtained in the usual manner by Count de la Baume Pluvinel, it was seen that the former exhibited many striking peculiarities in the large group of prominences in the north-east quadrant. On the screen photographs the prominences were much shorter than on the ordinary photographs, whilst their base and a series of nuclei towards the north were much brighter than the other portions, features not noticeable on the ordinary negatives. Spectrograms of the corona secured at Palma by Dr. W. J. S. Lockyer confirmed the results of this comparison.

M. Deslandres concludes that these prominences did emit a continuous spectrum which was more intense than that of the neighbouring parts of the corona, and were far richer in incandescent particles. A programme for the prosecution of this important research in future eclipses accompanies M. Deslandres's communication (*Comptes rendus*, No. 13).

OBJECTIVE-PRISM DETERMINATIONS OF STELLAR RADIAL VELOCITIES.—Circular No. 110 of the Harvard College Observatory contains a brief description of some results recently obtained with the objective-prism method of determining radial velocities. In this method an exposure is made in the usual way, then the prism is turned through 180° and a similar exposure made, or the telescope may be reversed and the photographic plate turned through 180°. Stars with known velocities serve as standards for the displacement of the corresponding lines in the two spectra.

A reproduction of a spectrogram of the Pleiades, taken on January 29 with the 11-inch Draper telescope, is given in the Circular. On this plate about a dozen stars could be measured, and the probable error in the resulting velocities would be about ±3·5 km. The scale is 52″·6=0·1 cm., and the exposures were thirty-seven and thirty minutes respectively. On another plate, secured on January 29 with two exposures of about twenty minutes each, about 100 stars could be measured, although a number of them, owing to distortion at the edge of the plate, could only be employed to ascertain the corrections necessary.

In No. 2, vol. xxiii., of the *Astrophysical Journal*, Mr. Geo. C. Comstock discusses a similar method for determining radial velocities, but he proposes two similar direct-vision prisms placed in front of the objective. Formulæ for calculating the velocities from the measures obtained accompany Mr. Comstock's paper.

THE OBSERVATION OF LONG-PERIOD VARIABLES.—In Circular No. 112 of the Harvard College Observatory Prof. Pickering publishes a plea for the organised observations of long-period variable stars, observations which are especially suitable for amateur observers. In order to facilitate this work various catalogues of such stars have already been published by the Harvard observers, and a new one, bringing the results up to date, is now in the printer's hands. When published, copies of this catalogue will be given to all observers who can make use of it.

A number of enlarged copies of Father Hagen's charts of the fainter variables are also being prepared, and will be supplied at cost, or given, to observers qualified to use them. Instructions as to the improved method of making these observations are included in the present Circular.

GEOLOGY IN PRACTICE.[1]

IT will be sufficient to mention such names as the Black Hills, the Bighorn Mountains, the Foxhills and Laramie Range, and the Garden of the Gods to indicate that the preliminary report on the Central Great Plains (1) includes some classical and highly interesting ground. The area covered by the report comprises the greater part of South Dakota, Nebraska, and Kansas, and the eastern part of Colorado and Wyoming—an area of no less than 1½ million square miles.

A good deal has already been written about one portion or another of this vast region; the first half of this volume gives a clear generalised account of the stratigraphy and structural geology of the whole; it is, however, by no means a mere abridgment of previously gathered information—it embodies the results of much original work.

From the time when the middle-Cambrian sea washed the Rockies and the adjacent highlands up to the latest physiographic conditions, the geological history of the region is here depicted in a broad manner. One feature of this country at once arrests attention, viz. the repetition in one epoch after another of widespread, uniform conditions of sedimentation—thus the great expanse of Dakota-Lakota sandstone in Cretaceous times, the equally widespread Arikaree sands of the Tertiary, and to-day the sandy alluvial deposits laid down by the rivers when they can no longer bear their load, and spread far and wide as the streams slowly turn from course to course. Less striking, perhaps, but equally widespread, are the argillaceous deposits like the Pierre shale of the Cretaceous. Here, as in other parts of the world, a series of "Red Beds" puzzles the geologist to place a limit to the top of the Carboniferous or the base of the Trias.

But it is not so much for the pure geology that this report will be read as for a guide—a very practical guide—to the sources of underground water. The general conditions governing the underground water system of the Great Plains are simple. A thick succession of alternating sandy and impervious sediments constitutes the rocky floor of the country. These beds are tilted up in the north and west, and dip thence gradually southward and eastward. Water-bearing beds are found in the Cambrian and in every other formation locally up to the recent hills of blown sand; but by far the most important is the Dakota sandstone, which spreads out as a great sheet 150 feet to 300 feet thick beneath the entire area of the plain. This sandstone is underlain by the Red Beds or by the Carboniferous limestone and shale, or, in East Dakota, by the Sioux quartzite; it is overlain by the great mass of clays and shales of the Benton, Niobrara, and Pierre formations. The principal zone of intake lies 4000 feet to 6000 feet above sea-level on the flanks of the Rocky Mountains and the Black Hills; as a result, high pressures are found in wells hundreds of miles from this region.

In this country we trust that the bearing of geological structure upon the amount and quality of water to be obtained in any given area is as well understood as it is across the Atlantic. Yet, although to be "like mother makes it" may express the excellence of a soup, the same can in no wise be said of geo-hydrological literature. We have a curious shyness about graphic modes of presenting information, a diffidence about making unavoidably clear, so that he who runs may read. It is in this direction that the volume under discussion excels; there are no fewer than fourteen maps, and twelve of these bear directly upon water-supply problems.

The landowner, the engineer, the manufacturer, rarely has the time or the requisite special knowledge to sift the information usually conveyed in records of well borings. He cannot afford to spend hours in the endeavour to discover whether the "ratchel" of one sinker is the "muck and rubble" of another, whether "blue bungum" can really be distinguished from "hard bind," or Kimmeridge clay from Gault. The geologist must know these things; what the landowner asks him is, How deep must I sink for water here? and How much may I expect to find? It is true that none but Providence or the "dowser" could answer these questions in terms of precise exactitude, but the report before us proves how much can be done by taking the subject seriously and by the application of graphic methods to focus the geological information in its varied forms into one or more simple images, so that even the "man in the street" can see at a glance what are the possibilities of any particular situation. The maps, in addition to giving the general geology, show also the underground areas occupied by the more important formations separately, and, by means of contours, the depth of the bed-rock beneath superficial deposits, the depth of the most important water-bearing stratum, and the altitude of the head of water, as well as other useful information.

FIG. 1.—"Toadstool Park" in badlands west of Adelia, northern Sioux county, Nebr. Sandstones overlain by Brule clays.

The volume is profusely and beautifully illustrated. Three of the plates, exhibiting forms produced by erosion, have been reproduced to accompany this notice.

Mr. Taff in his report (2) describes the structure and stratigraphy of the two groups of hills, the Arbuckle and Wichita Mountains, which rise abruptly, like islands, from the Red Rock plain in Oklahoma and Indian Territory, a region which lies south-east of that described in the previous report.

These two hill-groups have a common alignment, their axes trending north-westward and south-eastward. Their geological history appears to be identical; underlying the sedimentary rocks in each case are pre-Cambrian granites, granite-porphyries, and aporhyolites—the oldest rock is a gabbro, in the Wichita group. The succeeding Cambrian and Ordovician strata bear no evidence of folding; the period of uplift which has led to the exposure of the igneous pre-Cambrian rocks began in the middle of the Pennsylvanian (Carboniferous) epoch and culminated near its close, before the deposition of the Red Rocks (? Carboniferous or Permian) which in this region constitute the prevailing surface rock.

We are glad to see that the field staff records its appreci-

[1] Reports of the United States Geological Survey. (1) Preliminary Report on the Geology and Underground Water Resources of the Central Great Plains. By N. H. Darton. 1905. (2) Preliminary Report on the Geology of the Arbuckle and Wichita Mountains in Indian Territory and Oklahoma. By J. A. Taff. With an Appendix on Ore Deposits by H. Foster Bain. 1904. (3) The Geology of the Perry Basin in South-eastern Maine. By G. O. Smith and David White. 1905.

ation of the arrangement by which the palæontologists were enabled to accompany the party—a very proper plan, and one which in this case greatly facilitated the speed and exactness of correlation and mapping, besides accumulating material for an important monograph on the fossils.

The report contains two geological maps and several views of the scenery. An appendix on the reported ore deposits of the Wichita Mountains, by Mr. H. Foster Bain, should be of use as a warning to prospectors.

(3) Henceforth let no man say there is coal in Perry. For seventy years have the dwellers in south-eastern Maine cherished the hope that coal lay within their borders; and had they not good reason? Perry lies near the edge of a structural basin, and they had been told that the "Perry" beds were Triassic, consequently that coal might be found beneath them; the Canadian Geological Survey had coloured the beds Carboniferous on their map—in spite of Sir William Dawson's diagnosis of the plants—and mining "experts," glancing at the same obscure plant remains, had said, "Here you are, the very thing," and had gladly bidden the people to bore; and they bored, through the Perry beds into the Silurian lavas, but into no coal. Still in hope, the sum of 15,000 dollars was asked for to put down more bore-holes; it was decided, however, first to call in the aid of the U.S. Geological Survey Department, with the result that Messrs. Smith and White were sent to examine the ground. Then, hey presto! the

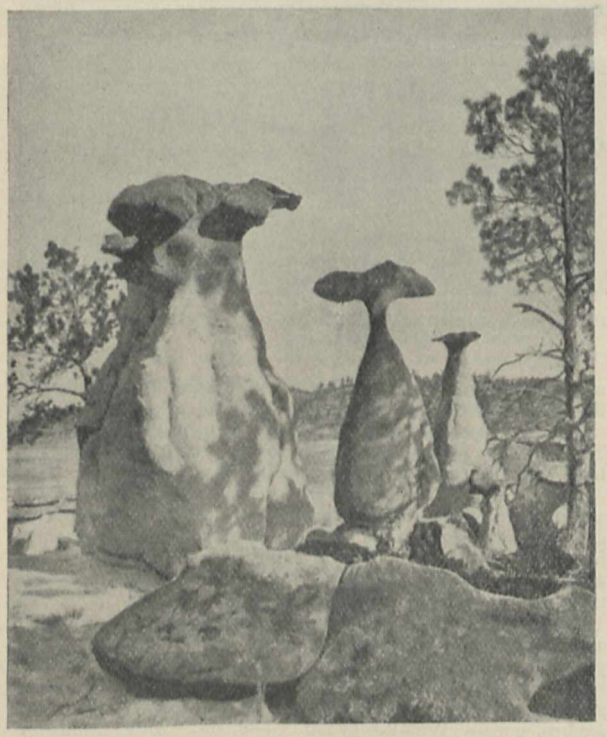

FIG. 2.—Eroded Sandstones, Monument Park, Colorado.

obscurity vanished—a ten days' reconnaissance was enough. There is no coal in the Perry beds, only conglomerate with a little sandstone and shale and interstratified basic lava. Subsequent examination of the badly preserved plants confirmed the age of the beds to be Devonian, probably Chemung, and, incidentally, produced two new generic types. The plants are figured in six plates. J. A. H.

FIG. 3.—"Jail Rock," showing castellated form of weathering of Gering sandstone and slopes of Brule clay; valley of North Platte in the distance.

STUDIES OF TEMPERATURE AND PRESSURE OBSERVATIONS.

METEOROLOGISTS will be interested in a paper recently published by Dr. van Rijckevorsel, and entitled "Konstant auftretende secundäre Maxima und Minima in dem jährlichen Verlauf der meteorologischen Erscheinungen," part ii. (Rotterdam: Van Hengel, 1905). This is really the second portion of a previous publication, only in this instance the number of stations dealt with is more numerous, and the stations themselves more generally distributed over the earth's surface.

By the method explained in the pamphlet the author has obtained for twenty-two stations the mean annual temperature variations, the resulting curve representing the mean of observations of altogether 3636 years. The author then proceeds to eliminate the annual period of twelve months, and also discusses the residuals. The main result at which he arrives is that, no matter whether he deals with all the observations collectively, with the European stations alone, or with stations collected in north or south hemispheres, there is over the whole earth's surface during twelve months a half-yearly period of temperature the epochs of which are identical. It shows maxima in the beginning of March and September, and two minima in the first days of June and December. Another oscillation which is referred to is one composed of a series of very small maxima and minima.

With regard, however, to the six-monthly oscillation of temperature, a variation which seems to be clearly marked, it is interesting to note that the epochs of maxima seem to pick out the times when the north and south poles of the sun are consecutively turned towards the earth.

As the author finds that stations representing the north and south hemispheres give practically identical results, it would be interesting if he would try an east and west system of grouping of stations, and see if the same result is obtained. In the light of recent work, it seems quite possible, but not probable, that if stations in North-West Africa, South and North America, Honolulu, and Siberia be formed into one group, and the rest of the world into another, the same variation, but of opposite or nearly opposite phase, might be the result. The attempt is well worth trying, since the author has all the material at his hand, and the more stations employed in South America to counterbalance the larger number used and more easily obtained in the European area the better. In this pamphlet curves are given showing the variations derived, and

numerous tables containing the data for stations which possess observations extending more or less continuously over fifty years or more.

In a recent number of the *Meteorologische Zeitschrift* (January) Prof. Hofrat Hann has contributed a new determination of the mean temperature of the earth's atmosphere. In the second edition of his classical "Lehrbuch der Meteorologie," recently noted in this Journal, he gave us the results of a discussion of the material then available, but the publication of more data by Prof. Mohn dealing with the air temperature in the region of the North Pole renders a slight modification of the mean values necessary.

Prof. Mohn has just completed a study of the meteorological observations made during Nansen's memorable North Polar expedition in 1893–6, and has been able to make a new determination of the mean temperatures of the air for the parallels of latitude 60° to 90° north. These new values have enabled Prof. Hann to re-calculate afresh the mean temperature of the whole northern hemisphere, using the results obtained in the investigation of Spitaler for the parallels from 0° to 55° N. The value obtained for the mean of the northern hemisphere was finally 15°·1 C. For the southern hemisphere Prof. Hann had previously determined the value to be 13°·6 C., so that the mean value for the whole earth comes out as 14°·35 C. It is interesting to remark that the northern hemisphere appears to be 1°·5 C. warmer than the southern. Spitaler in 1886 came to a similar conclusion, his figures being :—

Northern hemisphere	15°·4 C.
Southern hemisphere	14°·8 ,,
Whole earth	15°·1 ,,
Excess of N. over S.	0°·6 ,,

Prof. Hann points out that the meteorological observations made during the recent Antarctic expeditions will be of special interest in relation to this question, since a new and better determination of the value for the southern hemisphere is rendered possible.

Attention is directed to the investigation of Prof. Supan, who formed the mean air temperatures into two groups, namely, east and west hemispheres, the dividing lines being 20° W. and 160° E. In this case the eastern hemisphere appears to be the warmer, as can be judged from the following mean temperatures calculated by Prof. Hann :—

	Hemisphere	
	West	East
North Pole to equator ...	14°·6 C. ...	15°·6 C.
North Pole to 30° N. ...	5°·0 ,, ...	5°·4 ,,
30° N. to equator	24°·1 ,, ...	25°·8 ,,
Equator to 30° S.	23°·1 ,, ...	23°·6 ,,
Equator to 50° S.	19°·6 ,, ...	19°·4 ,,

It is only when more southern latitudes are included in the regions investigated that the resulting values give an excess of temperature for the western hemisphere.

In the northern hemisphere the land exceeds the water surface, while the opposite is the case in the southern hemisphere. The figures given above for these districts indicate, therefore, that the land has a capacity for raising the mean temperature of the air, the temperature of the northern in excess of the southern hemisphere being 1°·5 C.

According to General Tilto, there is a greater proportion of land to water in the eastern than in the western hemisphere, the values being

	Per cent. land	Per cent. water
Western Hemisphere (80° N. to 70° S.) ...	17 ...	83
Eastern ,, ,, ...	37 ...	63

From this, therefore, the eastern hemisphere should be warmer than the western. The above figures show that this is actually the case, thus corroborating the deductions made for the relative temperatures of the north and south hemispheres.

In an article which appeared in these columns in 1904 (vol. lxx., p. 177) entitled "A World-wide Barometric See-saw," an account was given of the results of a study by Sir Norman Lockyer and myself of barometric changes of short period, which brought to light the existence of two large regions on the earth's surface, antipodal to one another, which behaved in an inverse manner to each other. In this article a chart was given illustrating the distribution of the different types of pressure variation, and it was pointed out that the further any station was placed from the centres of the two main regions, namely, India and Cordoba, the less the barometric variations were like those of these two regions.

In a recent paper by Dr. Wilhelm Krebs, of Grossflottbek, entitled "Barometrische Ausgleichsbewegung in der Erdatmosphäre" (*Das Weltall*, Jahrgang 6, Heft 8, p. 118), the distribution of this short-period barometric change is discussed, and the author constructs an isophase chart from some of the data published in the original communication from which the above-mentioned article was an abstract.

The method adopted by Dr. Krebs is to call the Indian (Bombay) barometric change 100 per cent., and determine the percentage of the changes in relation to India at nineteen other stations distributed over the earth's surface. This procedure is really not valid, because there are two stations, namely, Bombay and Cordoba, which should both be taken as 100 per cent. each, the one positive and the other negative. Calling Bombay 100 per cent., Dr. Krebs deduces Cordoba as 31 per cent.! Since the Cordoba pressure change is the inverse of that of Bombay, it is difficult to see how the 31 per cent. is obtained. Further, the chart becomes very misleading, for the isophase lines connect up places which have a totally different short-period barometric variation. Thus, for instance, his 70 per cent. line passes through Norway and Sweden, European Russia, Arabia, the Indian Ocean, and Australia. The pressure changes in the latter three regions are closely similar, but all very different from those existing in the first three regions named.

As a matter of fact, the chart already referred to as published previously in this Journal was really an isophase map. In it each of the different signs there adopted, namely, +, +?, −, −?, &c., represented types of barometric changes, the + signs, for instance, representing all places which behaved like India, and therefore represented as 100 per cent. according to Dr. Krebs's method. A more minute differentiation than this seems at present impossible until a much larger number of stations are employed in the survey.

WILLIAM J. S. LOCKYER.

THE MINERAL WEALTH OF ALASKA.

RECENT developments have shown that Alaska as a mining field stands in the front rank among the possessions of the United States. Its annual gold production represents a value of some 1,600,000*l*. It produces silver, copper, and coal in considerable quantities, and its recently discovered tin and petroleum deposits are of great promise. During the past year the investigation of the mineral resources of Alaska has been energetically carried on by the United States Geological Survey under adverse conditions, and the Bulletins (Nos. 259, 250, and 236) recently published by Mr. A. H. Brooks, Mr. G. C. Martin, and Mr. C. W. Wright afford striking evidence of the excellent work that is being done in this direction by officers of the survey. Attention has naturally been directed chiefly to the gold placers. The placers of the Seward Peninsula, a field embracing an area of 20,000 square miles, still hold the first place in gold production in Alaska. Seven distinct types of alluvial gold deposits are met with in Alaska :—

(1) Creek placers, at the level of small streams.

(2) Hillside placers, on slopes.

(3) Bench placers, in ancient stream deposits 50 feet to 300 feet above present streams.

(4) Gravel-plain placers, in the coastal plain of Seward Peninsula.

(5) Sea-beach placers, on shore to which waves have access.

(6) Lake-bed placers, in beds of present or ancient lakes.

(7) River-bar placers, on gravel flats near the beds of large streams.

The mining of placer gold in Alaska is carried on during June, July, August, and September; and mining operations are rendered difficult not only by the short available season, but also by the lack of fall in the streams, the poor supply

of water and timber, the half-frozen condition of the gravel, and the high cost of labour and transport. In spite of these obstacles the wide and uniform distribution of alluvial gold, the healthy climate, and the proximity of the phenomenally rich goldfields of the British Yukon territory justify prospecting and mining for gold over so extensive an area. The methods of gravel and placer mining in vogue are well described by Mr. C. W. Purington. Hydraulic methods are the favourites, and the construction of the requisite ditches has gone on with great activity, about a hundred miles being under construction and a similar length in use. In the Porcupine district in south-eastern Alaska, near the international boundary, hydraulicing has proved economical. The gravel is attacked in this way, and sluice-boxes are lain on bed rock, everything being worked into them by the powerful stream from the hydraulic nozzle.

Of the gold-ore deposits in Alaska by far the most important is that of the Alaska-Treadwell mine on the eastern side of Douglas Island. The ore bodies consist of mineralised albite-diorite occurring in the form of intrusive dykes in black slates. The dykes are distributed throughout a zone about 3000 feet in width, extending along the strike for three miles. The ore consists mainly of rock impregnated with pyrites, in part filled by veins of calcite and quartz. The average value of the rock mined is 8*s*. per ton. The ore dykes have been developed along the dip for a distance of about 1000 feet. Hot ascending solutions, possibly of magmatic origin, appear to have been the cause of mineralisation, and the evidence is in favour of only one period of concentration.

None of the metals of the platinum series has yet been found in the Alaska alluvium, but stream tin discovered on the Anikovik River in 1900 has been found over an area of 450 square miles. During the season of 1904 development work on tin lodes was in progress at Lost River and Cape Mountain, and new discoveries of tin lodes were reported at Brooks Mountain, Ears Mountain, and in the Darby Mountains, all in Seward Peninsula.

The attempts to develop petroleum fields in Alaska which were begun in 1901 have been continued, but so far without any commercial production.

Promising surface indications of petroleum have, however, been found in the Controller Bay, Cook Inlet, and Cold Bay fields. Though only a few wells have been bored, Mr. Martin's studies have shown that there is ample justification for further prospecting, and that the Pacific Coast region of Alaska may prove an important source of illuminating oil. In this connection it is of interest to note that the Bering River coal is the best that has yet been found on the Pacific Coast. An average of twelve analyses showed 75·65 per cent. of fixed carbon, 15·06 per cent. of volatile matter, 7·97 per cent. of ash, 1·30 per cent. of moisture, and 1·24 per cent. of sulphur. Coal, mostly of a lignitic character, is also widely distributed in south-western Alaska, whilst the coals of the Cape Lisburne region are of two distinct classes, low-grade bituminous coal of Mesozoic age, and high-grade bituminous coal of Palæozoic age. The former covers an area of 300 square miles with 150 feet of coal in forty or fifty seams, ten of which seem to be of economic importance. The Palæozoic coals are also undeveloped. They occur in limited areas, and the beds are much crumpled and broken, so that mining will be difficult and expensive. The product will, however, probably command as good a price as the best coals shipped to Alaska.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The electors will proceed to the election of a Sibthorpian professor of rural economy on June 9. The professorship has now been made tenable for life, subject to the liability of the holder to vacate it by deprivation for sufficient cause. The present stipend of the professorship is about 700*l*. a year.

CAMBRIDGE.—Applications for the John Lucas Walker studentship, the holder of which must devote himself (or herself) to original research in pathology, are invited, and should be sent, accompanied by references—not testimonials—not later than May 8, to Prof. G. Sims Woodhead, Pathological Laboratory, New Museums, Cambridge, to whom also applications for further information regarding the studentship may be addressed. The studentship is of the annual value of 200*l*. (grants may also be made for assistance and apparatus), and is tenable, under certain conditions, for three years from July 1.

MR. EARLE has been appointed to succeed Sir A. Pedler as Director of Public Instruction in Bengal.

DR. J. MOELLER, of Gratz University, has been appointed professor of pharmacognosia in Vienna University in succession to Prof. von Vogl.

PROF. J. PRECHT has been appointed to succeed Prof. Dieterici as professor of experimental physics in the Technical High School, Hanover.

PROF. DR. E. KNOEVENAGEL has been appointed director of the Heidelberg University chemical laboratory in succession to Prof. Theodor Curtius, ex-prosector of the University; while Prof. A. Klages has been deputed to take Prof. Curtius's lectures on experimental organic chemistry.

IT has been decided to add to the University of Nancy a new physical institute, toward the cost of which the Government has promised 300,000 francs, while a further contribution of 50,000 francs has also been announced. This will mean that, apart from buildings for the medical faculty, there have been added within quite recent years new institutes for chemistry, electrotechnics, and applied mechanics, whilst the brewing school has been newly organised.

IT is announced in *Science* that Mr. Andrew Carnegie has given 400,000*l*., in addition to previous gifts, for the maintenance of the Carnegie Technical Schools, Pittsburg. From the same source we learn that by the will of the late Andrew J. Dotger, of South Orange, N.J., the Tuskegee Institute will receive 131,000*l*. on the death of his wife. It is also interesting to record that about 10,000*l*. has already been raised for the new professorship of lumbering in the Yale Forest School of the 30,000*l*. which is sought as an endowment. In fourteen western States 8800*l*. was raised from sixty contributors.

AMONG the courses of lectures to be held during May, arranged for advanced students and others in connection with the University of London, the following may be mentioned. A course of about seven lectures on the morphology of the Bryophyta will be given at the Chelsea Physic Garden by Prof. J. B. Farmer, F.R.S., beginning on May 8; a course of eight lectures on the physiology of nerve will be delivered in the physiological laboratory of the University by Dr. N. H. Alcock, commencing on May 8; and a course of four lectures on the atmospheric circulation and its relation to weather will be given on May 1, 8, 15, and 24 by Dr. W. N. Shaw, F.R.S.

IN the Journal of the Royal Sanitary Institute (vol. xxvii., No. 3) Dr. G. Reid gives drawings of a new type of elementary school now adopted by the Education Committee of Staffordshire. The central hall type of building hitherto in favour was found to present difficulties in making adequate provision for ventilation by natural means, and a plan of building was adopted in which one semi-detached hall would serve for three departments, the class-rooms being designed in pavilion form with veranda communication. The cost of erection of the new type is considerably less than that of the central hall type, the cost of schools to accommodate 1020 and 628 children respectively being 10*l*. 10*s*. and 11*l*. 1*s*. in the former case as compared with 15*l*., which was the average cost per head of the central hall type of building.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 7, 1905.—"On the Inheritance of Coat Colour in Horses." By C. C. **Hurst**. Communicated by W. Bateson, F.R.S.

Analysis of the Stud Book shows that in thoroughbred horses chestnut is a Mendelian recessive to bay and brown, which are dominants. Omitting other colours, it appears that when mated with chestnuts, bays and browns are either (*a*) pure DD, giving no chestnut foals, or (*b*) DR, giving, on an average, equality of chestnuts and of dominants.

Chestnuts mated with chestnuts (of any ancestry) breed true to chestnut, with about 1 per cent. of exceptions (9 in 1104), which may perhaps be due to errors in the records.

These observations differ from those of Prof. Pearson, who found no intrinsic difference between the inheritance of chestnut and other colours (Phil. Trans., A, vol. cxcv.), and has declared (*Biometrika*, ii., p. 214) that Mendelian principles do not apply to horse-colours.

(*Note added January* 31.)

In the paper read January 18 Prof. Weldon disputes these conclusions, while admitting that chestnuts breed true with about 1·5 per cent. of exceptions. His argument depends on the recorded exceptions. The Stud Book is very accurate, but many of the records are afterwards corrected, and there is sufficient margin of demonstrable error to make it possible that the rare exceptions which cannot be eliminated may be due rather to mistake than to physiological peculiarity in the animals. Very few of the supposed exceptions have appeared in public uncorrected. Genuine exceptions may perhaps occur, but the returns have scarcely the extreme precision necessary to establish such occurrences. Similarly the records show occasional exceptions to the purity of the pure dominants—about 1 per cent.

It is no doubt by including the families in which these exceptions occur among those from the DR dominants that Prof. Weldon has found a large excess of dominants from the mating DR × R.

Finally, the distinct properties of chestnuts must be ascribed to segregation and not to ancestry, for their behaviour in heredity is entirely different from that of bays and browns, though their ancestral composition may for several generations have been the same.

January 25.—"Observations and Photographs of Black and Grey Soap Films." By Herbert **Stansfield**. Communicated by Prof. Schuster, F.R.S.

This paper describes some work on soap films that originated with an examination of the two kinds of black films, undertaken in connection with a continuation of Reinold and Rücker's researches on soap films. The two kinds of black soap film were first described by Newton. Reinold and Rücker made electrical measurements which indicated that one black film was twice the thickness of the other, and this result has been confirmed by Johonnott's measurements with a Michelson interferometer. Johonnott found that the limiting thickness of the thicker black was 12 $\mu\mu$ (micromillimetres), after which it changed abruptly to the thinner black, 6 $\mu\mu$ thick.

Vertical plane films were examined by reflected light with a low power magnification, and it was found that the abrupt change from the thicker to the thinner black could readily be observed with films made from a solution of sodium oleate in water. It was also found that the change from one black to the other was the last and most striking of a series of similar changes that take place as a film thins. The process of thinning appears to be continuous and gradual until a thickness of about 100 $\mu\mu$ is reached, but after that it is accompanied by a series of abrupt steps. The photographs, taken with a camera and film box made for the purpose, show the two black films and three stages between the coloured part of the film and the thicker black which are called the first, second, and third greys, the numbers increasing with the thickness as in Newton's orders of colours.

The photograph reproduced in Fig. 1 shows a vertical frame, made of thin glass rod, supporting a film which is in the act of changing from the thicker to the thinner black; the small white discs that are formed on the advancing boundary of the thinner black appear to consist of material removed in the process. A narrow line of the first grey and traces of the thicker greys can still be seen between the coloured part of the film and the black.

A film shut up in an air-tight glass cell containing some of the soap solution does not thin beyond the thicker black stage if the equilibrium between the film and the water vapour is not disturbed. The thinner black is formed if

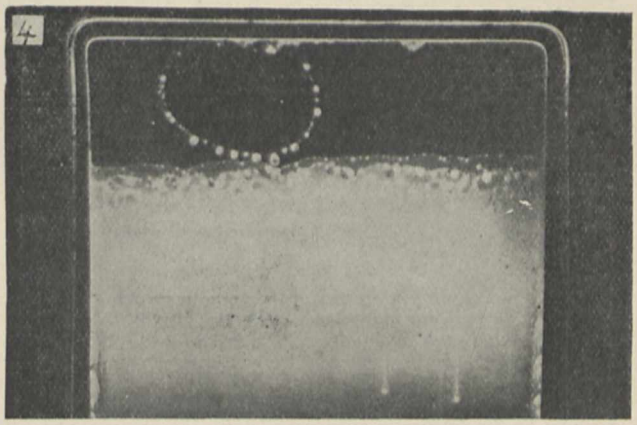

FIG. 1.—Oleate of soda film. Magnification 9. Photograph showing formation of the thinner black, and remnants of the grey stages.

evaporation takes place from the film; it may be produced by bringing a light near to the cell. Johonnott has recently shown that the same effect can be produced by a sudden increase of pressure in the cell. The change back again from the thinner to the thicker black, or to still thicker stages, can be produced by causing water vapour to condense on the film.

The paper also deals with the formation of the coloured patches which are often seen moving down through a coloured film. They have round heads and drawn out tails, and bear some resemblance to tadpoles. The head often shows concentric rings of colour, indicating that it is like a convex lens in shape. These tadpoles, or lens-

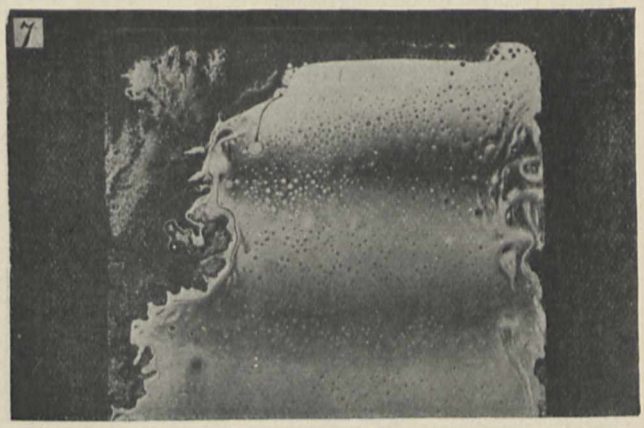

FIG. 2.—Oleate of potash film. Showing a growth of solid material on the left side, and lens-shaped thickenings falling through the coloured part of the film.

shaped bodies, often have their origin in minute grains which form in the black at the top of the film.

Fig. 2 shows the way in which solid material sometimes grows in a film. The film represented, instead of thinning in the usual way and becoming all black, only developed a few millimetres of black at the top, and then continued for hours to produce swarms of lens-shaped thickenings. When a film is behaving in this way, the grains in the

black and the lens-shaped thickenings in the coloured part of the film may be seen shooting into the tips of the dendritic growth of solid material.

The separation of solid matter in a soap film is probably connected with the formation of solid pellicles on the surfaces of aqueous solutions, which has been described by Ramsden, and it supports the theory of churning, advanced by Agnes Pockels, that the butter separates out in the bubbles formed in the churning process.

A film which is thinning rapidly owing to rapid evaporation often develops a curious "grey pattern" when a considerable amount of black has been formed. This pattern sometimes shows five or six grey stages of thickness, and seems to be produced by material spreading out into the film from thickenings which have accumulated during the thinning process.

It is suggested that the grey pattern, the grains in the black, and the lens-shaped thickenings are formed, like the solid growths in the films, by the concentration of the soap solution.

February 15.—"The Influence of Increased Barometric Pressure on Man. No. I." By Leonard **Hill**, F.R.S., and M. **Greenwood**.

The results of the present investigation show that

(1) A man can be submitted to a total pressure of seven atmospheres without untoward effects, provided decompression be effected gradually, and the capillary circulation be aided by repeated contractions of muscles, joint movements, and changes of posture.

(2) There is no sense of increased barometric pressure so long as the former is constant.

It is probable

(1) That the subjective effects of increased pressure, apart from voice changes and lip anæsthesia, depend upon psychical conditions, such as anxiety and excitement.

(2) The changes in the percentage of carbon dioxide in the alveolar air are conditioned solely by physical variations, and not by any increase or diminution in the respiratory metabolism.

In conclusion, the authors remark that they were unable to find any evidence in support of Snell's opinion ("Compressed Air Illness, or so-called Caisson Disease," London, 1896, Lewis, p. 212) that the presence of CO_2 in the respired air exercises a peculiarly unfavourable influence under increased pressure. Thus in one experiment the percentage of CO_2 in the chamber air, at +31lb., was 0·62 (equivalent to more than 1·8 per cent. at +0), and no untoward results occurred on decompression.

Society of Chemical Industry (London Section), April 2.—Mr. A. G. Salamon in the chair.—Ropiness in flour and bread, its detection and prevention: E. J. **Watkins**. Breads most frequently attacked by this disease are such as contain bran or low-grade white flours. In the present investigation it has been sought by means of culture experiments and the artificial production of ropiness in sound flour to establish the identity of an organism isolated from specimens of ropy bread and flour obtained in England. Cultures made from this bread yielded a small motile bacillus which, after repeated subculturing, was used in a series of experiments made with a known sound flour. Varying proportions of the culture were added to the water used for making dough. Such doughs when fermented showed no sign of bacterial effects, and the bread produced was of normal character when it left the oven. The bread when kept in a moist atmosphere at temperatures of 25° C. to 35° C. became ropy in about twenty-four hours. When the temperature was kept below 18° C. the disease did not appear. Dryness of the air generally prevented ropiness even when the temperature was high. Acids exercise a powerful influence in preventing the growth of the bacillus, it being found in a series of tests with varying quantities of acetic acid in the dough that the bread did not become ropy when kept long periods under conditions suitable to the bacillus. The cultural and microscopic characters prove the organism to be *Bacillus mesentericus* (Flügge).—The Röse-Herzfeld and sulphuric acid methods for the determination of the higher alcohols; a criticism: V. H. **Veley**. The two methods generally adopted for the determination of the higher alcohols are the Röse-Herzfeld (officially recognised in this country, Germany, and Switzerland) and the sulphuric acid method, adopted in France, consequently practised in this country, and officially used as a general qualitative test for the purity of all kinds of alcohol in Russia. Since these methods give very divergent results in the hands of different analysts, the author records various experiments to determine the accuracy or otherwise of the processes, and also criticises them.

Entomological Society, April 4.—Mr. C. O. Waterhouse, vice-president, in the chair.—Specimen of the very rare ant *Formicoxenus nitidulus*, a neuter, found in a nest of *Formica rufa* at Weybridge during the present month: H. St. J. **Donisthorpe**.—Specimen of *Platypsylla castoris*, Ritsema, a coleopterous parasite of the beaver, from France: G. C. **Champion**.—Specimens of a Noctua, believed to correspond to Dr. H. Guard-Knagg's original description of *Agrotis helvetina* ("Entomologist's Annual," 1872): W. S. **Sheldon**.—Examples of butterflies taken last year in Majorca showing injury to the wings, caused apparently by the attacks of lizards: A. H. **Jones**.—An account of the calcara observed on the legs of some Hymenoptera: Rev. F. D. **Morice**. The calcara were, the author said, quite constant in each species, and useful, therefore, as distinguishing characters, the only hymenopteron he had come across without them being the ordinary hive-bee. Kirby and Spence considered that they were used for climbing purposes, but this was unlikely, as the spurs occurred in species which did not climb at all. So far as he had noticed, they were used by members of this order for the purpose of cleaning their antennæ. Mr. C. O. Waterhouse said that similar spurs existed in the Trichoptera, though they did not assume beautiful forms as in the Hymenoptera; but as to their uses, he was not aware that any observations had been published or made on the subject. Mr. G. C. Champion remarked that they were also well developed on the hind-legs of some Coleoptera.

Linnean Society, April 5.—Dr. A. Smith Woodward, F.R.S., vice-president, in the chair.—Some plants new to the pre-Glacial flora of Great Britain: Clement **Reid**. Fifty photographs were exhibited derived from material procured at Pakefield, near Lowestoft. The remains were black, and therefore troublesome to photograph, but the specimens themselves could not long be preserved, as an efflorescence occurred, and they fell to pieces, but experiments were now being conducted with the view of permeating the fruits with paraffin, and so ensuring their preservation.—A second contribution to the flora of Africa: Rubiaceæ, and Compositæ part ii.: S. **Moore**. In a former memoir composite plants were alone dealt with. In the present paper are submitted descriptions of Rubiaceæ as well as of Compositæ. To the former natural order twelve new additions are proposed, referable to the following genera:—Otomeria, Oldenlandia, Heinsia, two species of Tarenna, Randia, Tricalysia, Polysphæria, and two species each of Canthium and Diodia. The Compositæ regarded as new number fifteen, of which Helichrysum claims six species; Vernonia, Inula, and Senecio two each, and Felicia, Bidens, and Dicoma one each.—The structure of the stem and leaf of *Nuytsia floribunda*, R. Br.: E. J. **Schwartz**. *Nuytsia floribunda* is a member of the Loranthaceæ and a native of West Australia, and, unlike other members of this order, it is non-parasitical and a tree attaining a height of some 30 feet.—Taiwanites, a new genus of Coniferæ from the Island of Formosa: B. **Hayata**. Dr. Masters considers the genus a valid one, judging from a small scrap which he had received from the author, who believed his new genus to be intermediate between Cryptomeria and Cunninghamia; he himself pointed out that it combined the foliage of Athrotaxis with the cone of Tsuga; in any case it is a very interesting genus.

Royal Astronomical Society, April 11.—Mr. W. H. Maw, president, in the chair.—Explanation of the apparent secular acceleration of the earth's orbital motion: P. H. **Cowell**. The author had found that certain arbitrary assumptions with regard to the sun and moon satisfied the conditions of six ancient solar eclipses. He concluded that it was wrong to assign an arbitrary secular acceleration to the moon and none to the sun, and to justify this by

supposed tidal influence. The rate at which the day increases appears to be 0·005s. per century, this being about ten times greater than previous estimates.—Planetary inversion: F. J. M. **Stratton.** The author had been led to this investigation by Prof. Pickering's suggested explanation of the cause of the retrograde motion of Phœbe, the ninth satellite of Saturn. It was assumed that at the time this satellite was thrown off from its primary the latter had a retrograde motion of rotation, which subsequently became changed to a direct motion by the inversion of the planet's axis. The author concluded that while the theory remains for the present a speculative hypothesis, it is supported by the theory of tidal friction, and gives the only explanation of certain facts that has so far been put forward.—High-level chromospheric lines and their behaviour in sun-spot spectra: Prof. A. **Fowler.** The observations showed that enhanced lines appear as high-level lines in the chromosphere, and that the corresponding Fraunhofer lines are generally enfeebled in the spectra of sun-spots.—Discussion of the Harvard observations of the eclipses of Jupiter's satellites, 1878–1901: Prof. R. A. **Sampson.** The author gave an account of this discussion, which will be published by the Harvard Observatory.

CAMBRIDGE.

Philosophical Society, March 12.—Dr. Fenton, vice-president, in the chair.—A theory of the widening of lines in the spectrum: Prof. J. J. **Thomson.** The view put forward is that the widening of the lines is due to resonance. The luminous molecules emit waves of light, and as these are also waves of electric and magnetic force, a luminous particle produces a strong electrical field in its neighbourhood; this will act on the vibrating electrified particles in a neighbouring luminous molecule, while this second molecule will exert similar forces on the first molecule. Two adjacent luminous particles thus exert forces on each other, and, if the natural periods of the two are equal, the action between them may result in a considerable change in the period. As the vibrating systems are surrounded by many systems, some at one distance and others at another, the changes produced in the periods will not be constant, but may have any value included between certain limits, the range between the limits increasing with the number of luminous molecules. This range in the value of the periods causes the original bright line to be spread out into a band.—The transmission and reflection of the radiation from radio-active substances: Prof. J. J. **Thomson.** The amounts of secondary, tertiary, and radiation of a higher order transmitted through and reflected from a plate of matter placed in the path of radiation from radio-active substances are calculated, and methods obtained for comparing the total ionisation produced by the secondary and other rays with that produced by the primary rays.—(1) The asymptotic expansion of the integral functions

$$\sum_{n=0}^{\infty} \frac{x^n \Gamma(1+an)}{\Gamma(1+n)} \text{ and } \sum_{n=0}^{\infty} \frac{x^n \Gamma(1+n\theta)}{\Gamma(1+n+n\theta)}.$$

(2) The asymptotic expansion of integral functions defined by generalised hypergeometric series: Rev. E. W. **Barnes.**—A method of following the course of certain chemical actions, and a period of induction in the action of water on monochloracetic acid: P. V. **Bevan.** The method described was to determine the resistance of the solution in which the chemical action was taking place. In dilute solutions, when an acid such as hydrochloric acid is set free as the action progresses, this method affords a very delicate way of observing the rate of decomposition. The action of water on monochloracetic acid was investigated, and was found, except just at the beginning, to follow the normal monomolecular course.—The radio-activity of metals and their salts: N. R. **Campbell.** Measurements of the activity of metals and their salts show that the radio-activity of ordinary materials is an atomic property. The identity in respect of this property of samples of the same salt prepared by different methods shows that the apparent activity cannot be due to impurity.—A relation between the velocity and the volume of the ions of certain organic acids and bases: T. H. **Laby** and G. A. **Carse.** A method of finding the relation between the velocity and linear dimensions of an ion is to calculate the latter by taking the cube root of the ionic volume found from the molecular and atomic volumes, and combine this with the ionic velocity. It is found that the product of these two quantities is approximately constant for the members of the homologous series which the authors have examined, viz. the fatty acids, amines, pyridines, and anilines, but varies from series to series.—A preliminary note on the maiotic phenomena in the eggs of the hermaphrodite *Angiostomum nigrovenosum* (*Ascaris nigrovenosa*): S. A. **McDowall.** The synapsis of the chromosomes is very clearly shown in this animal.—The reduction of the general ternary quintic to Hibbert's canonical form: H. W. **Richmond.**

DUBLIN.

Royal Dublin Society, February 20.—Dr. W. E. Adeney in the chair.—The vapour pressure of a pure liquid at constant temperature: Prof. Sydney **Young.** In order to find whether the statement contested by Battelli and others, that the vapour pressure of a pure liquid is independent of the relative volumes of liquid and vapour, is borne out by experimental observations, the author has collected together the results of his determinations of the vapour pressures of twenty-seven carefully purified liquids. He points out (1) that errors due (*a*) to the presence of dissolved air and other impurities, (*b*) to the vaporisation of mercury, and (*c*) to readings being taken too rapidly, would have the effect of making the observed pressures higher at small than at large volumes; (2) that those errors must be smaller when readings are taken during evaporation than during condensation; (3) that the errors are likely to be greater at high temperatures than at low ones. With twenty-one out of the twenty-seven pure substances, forty-five series of determinations were successfully carried out, the liquids having been almost free from air, and no signs of decomposition having been observed. There were 493 determinations of vapour pressure, each being the mean of, as a rule, four readings taken at different volumes. That the mean observed fall in pressure during evaporation for the 257 determinations at temperatures up to 180° was less than 1 in 10,000 may be regarded as a proof that the vapour pressure is really independent of the volume. At temperatures above 180° the mean fall in pressure for 236 determinations was 1 in 1450.—Views illustrating the permo-Carboniferous glaciation of South Africa: Prof. G. A. J. **Cole.**

March 20.—Prof. Sydney Young, F.R.S., in the chair.—Electromagnetic mass: Prof. A. W. **Conway.** This was a continuation, in an expanded form, of the paper read at the meeting held January 16.

PARIS.

Academy of Sciences, April 9.—M. H. Poincaré in the chair.—Some problems in mathematical physics appertaining to the equation of M. Fredholm: Émile **Picard.**—A means of controlling a system of clocks synchronised electrically: G. **Bigourdan.** In a system of clocks controlled electrically the synchronism may be disturbed owing to various causes. By the use of a galvanometer attached to each controlled clock, and the suppression of the directing current once in each minute, at the zero second, any deviation can be measured.—Concerning the presentation of a number of the "Catalogue photographique du Ciel" from the Observatory of Toulouse: M. **Lœwy.** This number is chiefly devoted to the measurements of the rectilinear coordinates of stellar images taken photographically with a view to the determination of the solar parallax by means of the planet Eros.—The transformations of systems of partial differential equations of the second order: J. **Clairin.**—The dichroism, double refraction, and conductivity of thin metal plates obtained by kathode pulverisation: Ch. **Maurain.** The effects described were shown most strongly by bismuth, but similar results were obtained with gold and nickel.—Gaseous osmosis through a colloidal membrane: Jules **Amar.** From the experiments described the author concludes that gaseous osmosis through the tissue employed is in accord neither with the experimental laws of Bunsen and Graham nor with the theories of Stefan and O. Meyer.—The variations of the absorption bands of a crystal in a magnetic field: Jean **Becquerel.** Some of

the results obtained can be most readily explained by assuming that certain bands correspond to the vibrations of positive ions.—The production of high vacua by means of liquid air: Georges **Claude** and René J. **Lévy.** The arrangement is based on the absorption of gases by charcoal at the temperature of liquid air.—The acoustic properties of certain halls for speaking: M. **Marage.** Experiments confirming the views put forward on the resonance of halls by Wallace Sabine.—The variations of some properties of quartz: H. **Buisson.** Two fine specimens of quartz were compared, measurements being made of their density, coefficient of expansion, double refraction, refractive index, and rotatory power. There were distinct differences between the two specimens, all the deviations being in the same sense. It is thus clear that quartz, even well crystallised, cannot be considered as a perfectly pure substance with absolutely defined properties, or even as a homogeneous body.—The radio-activity of springs of drinking water: F. **Dienert.**—Some pyrophosphoric compounds: J. **Cavalier.** The preparation and properties of the pyrophosphoric esters of ethyl, propyl, butyl, and amyl alcohols are described. They all proved to have molecular weights corresponding to the formula $R_4P_2O_7$, determined by the cryoscopic method.—Barium iodomercurates: A. **Duboin.**—The pure ferromolybdenums: Em. **Vigouroux.** In the direct combination of iron and molybdenum with the iron in excess, the definite compound Fe_2Mo is formed, and no other compound containing less molybdenum appears to be capable of existence.—The influence of the ketonic and acid grouping in the same molecule: L. J. **Simon.**—The condensation of the acetylenic amides with phenols. A general method for the synthesis of ethylene-oxyphenol amides: Ch. **Moureu** and J. **Lazennec.**—The genesis of an iron mineral: L. **Cayeux.**—A preliminary note on globoids and certain granulations of seeds, resembling the metachromatic corpuscles in some of their properties: J. **Beauverie** and A. **Guilliermond.**—The Khaya of Madagascar: H. **Jumelle** and H. Perrier **de la Bathie.** Reasons are shown for regarding this as a new species, *Khaya madagascariensis.*—Study of the variations of nitrogen and phosphoric acid in the juices of a grass plant: G. **André.**—The treatment of seed with copper salts: E. **Bréal.** The superficial sterilisation of seeds by copper solutions not only prevents cryptogamic diseases, but also causes a good utilisation of the reserves.—The heats of combustion and the composition of the bones of the skeleton of the guinea-pig, considered as a function of the age: J. **Tribot.**—The nucleus of the red blood corpuscles in birds: M. **Piettre** and A. **Vila.**—The Pleistocene glaciers in the valleys of Andorra and the neighbouring high Spanish valleys: Marcel **Chevalier.**—Contribution to the Tertiary flora of northern Morocco: Ed. **Bonnet.**—Observations on moving shadows at sunset and sunrise: Cl. **Rozet.** The phenomenon of moving shadows has hitherto been observed only during an eclipse of the sun. The author points out the conditions under which the same phenomenon can be seen at sunset and sunrise.—Measurements of the variations of the gravitation constant in the Simplon Tunnel: Marcel **Brillouin.**—The results of atmospheric studies in the region of the trade winds: L. **Rotch** and L. Teisserenc **de Bort.**

CAPE TOWN.

South African Philosophical Society, February 28.—Dr. J. C. Beattie, president, in the chair.—Rock specimens showing the occurrence of Glacial beds in the Griqua Town series of Hay: A. W. **Rogers.** Flattened and striated stones, the peculiarities of which can at present only be attributed to glacial agencies, occur in a hard ferruginous rock near the top of the Griqua Town series in Hay. They are of various sizes, from an inch or two up to 18 inches long. They consist of chert; a few grit pebbles are found, but as yet no granites or other igneous rocks are known from those beds; some hollows, now partly filled with specular iron, may represent limestone fragments. The boulders are scattered at wide intervals through the matrix in most cases, though gravelly grits also occur.—Under water in south-eastern Bechuanaland: A. L. **Du Toit.** The term south-eastern Bechuanaland is used as including the divisions of Mafeking and Vryburg as far westwards as Kuruman.—A set of linear equations connected with homofocal surfaces: Dr. Thos. **Muir.**

DIARY OF SOCIETIES.

MONDAY, APRIL 23.

SOCIETY OF ARTS, at 8.—Ivory: Alfred Maskell.

VICTORIA INSTITUTE, at 4.30.—Review of Sir Henry H. Howorth's "Ice or Water": Prof. Edward Hull, F.R.S.

WEDNESDAY, APRIL 25.

GEOLOGICAL SOCIETY, at 8.—Trilobites from Bolivia, collected by Dr. J. W. Evans in 1901–1902: Philip Lake.—Graptolites from Bolivia, collected by Dr. J. W. Evans in 1901–1902: Dr. E. M. R. Wood.—The Phosphatic Chalks of Winterbourne and Boxford (Berkshire): H. J. Osborne White and Llewellyn Treacher.

THURSDAY, APRIL 26.

ROYAL INSTITUTION, at 5.—The Digestive Tract in Birds and Mammals: Dr. P. Chalmers Mitchell.

SOCIETY OF ARTS, at 4.30.—Seistan, Past and Present: Colonel A. H. McMahon.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Long Flame Arc Lamps: L. Andrews.

MATHEMATICAL SOCIETY, at 5.30.—Perpetuants and Contraperpetuants: Prof. E. B. Elliott.—(1) A Question in the Theory of Aggregates; (2) The Canonical Forms of the Ternary Sextic and Quaternary Quartic: Prof. A. C. Dixon.—On the Question of the Existence of Transfinite Numbers: P. E. B. Jourdain.—Some Theorems connected with Abel's Theorem on the Continuity of Power Series: G. H. Hardy.—On a Set of Intervals about the Rational Numbers: A. R. Richardson.

FRIDAY, APRIL 27.

ROYAL INSTITUTION, at 9.—Ore Deposits and their Distribution in Depth: Prof. J. W. Gregory, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Petroleum Fuel in Locomotives on the Tehuantepec National Railroad of Mexico: Louis Greaven.

PHYSICAL SOCIETY, at 5.

AËRONAUTICAL SOCIETY, at 8.—The Use of the Balloon in the National Antarctic Expedition: Captain Robert Falcon Scott, R.N.—The Experiments of the Brothers Wright: Sir Hiram S. Maxim.

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