THURSDAY, JUNE 8, 1911.

THE "PERSONAL FACTOR" IN THE WAR AGAINST CONSUMPTION.

(1) *Pulmonary Tuberculosis and Sanatorium Treatment.* By Dr. C. Muthu. Pp. vi+201. (London: Baillière, Tindall and Cox, 1910.) Price 3*s.* 6*d.* net.

(2) *Conquering Consumption.* By Dr. Woods Hutchinson. Pp. 138. (London: Constable and Co., Ltd. · Boston and New York: Houghton Mifflin Company, 1910.) Price 4*s.* 6*d.* net.

(1) SOME twenty years ago the sanatorium treatment of consumptive patients was but in its infancy, and, with the exception of Dr. Walther's disciples who had studied at Nordrach, there were few who understood the real inwardness of this method of treatment. The result was, necessarily perhaps, a somewhat hide-bound method, and although a certain proportion of patients did well, others, even those in the earlier stages of the disease, seemed to be unaffected, favourably, at any rate, by prolonged treatment. Indiscriminate over-feeding, irrational exercise, inattention to details, and imperfect understanding of the general principles upon which the sanatorium treatment is based were accountable for many of the failures.

During the last ten years a number of physicians, especially young men, have devoted themselves very thoroughly to the study of sanatorium and after sanatorium treatment, and we are now reaping, as the results of the observations and experience of these observers, an extensive literature, some of which has been embodied in what may be called the consumptives' liturgy. Amongst those who have written such text-books is Dr. C. Muthu, late physician to the Inglewood Sanatorium, Isle of Wight, and at present physician to the Mendip Hills Sanatorium, Wells, Somerset. Dr. Muthu, who is not only a physician but a philosopher, gives a record of ten years' observations and work in open-air sanatoria.

As regards the pathology and etiology of tuberculosis, he has here written many things with which certain, probably the majority of, pathologists and physicians will disagree. This, no doubt, arises from the fact that Dr. Muthu looks at the question from the point of view of his patient, and we may accept it that from the point of view of treatment what is lost thereby is perhaps more than gained in another direction. One gathers from a perusal of this work that Dr. Muthu looks upon the successful treatment of pulmonary tuberculosis as being possible only when an intimate partnership and cooperative movement between physician and patient can be agreed upon and carried out. If the will of the patient be strong the firmness of the doctor is not so important a factor, but in the case of the inexperienced and vacillating patient the personality of the physician and his power of dominating his patient come to be of prime importance. The patient must be lifted out of his diseased condition, not only as regards body, but as regards mind. He must not dwell upon its course but upon its cure.

The keynote as to Dr. Muthu's ideas on the pathology of the disease is given in a statement put in opposition to von Ziemssen's dictum, "no tubercle bacilli, no tuberculosis," Dr. Muthu contending that it will be nearer the truth to say, "no soil, no tuberculosis," which one supposes should really read, "no suitable soil, no tuberculosis." Dr. Muthu's own statement is perhaps considerably stronger than he really wishes those who read his book to accept, for it is only fair to him to state that he still appears to have some belief in von Ziemssen's dictum. It is, however, the function and the appropriate function, of the sanatorium physician to preach the doctrine that the soil much more than the seed controls the disease, for, after all, it is the cure of the patient that he has to effect. One cannot help feeling, however, that it is a dangerous doctrine to preach that pulmonary tuberculosis is not a contagious disease. That the infective material takes long to manifest its presence all will accept, that it is not so infective as the ordinary zymotic diseases may also be taken for granted; but that it is infective, and, under certain conditions, highly infective, should never be ignored. However, those who read the chapters on the predisposing factors, on early diagnosis, and on the prognosis of tuberculosis will be interested whether they agree with the author or not.

When we come to the principles of open-air treatment we are in hearty accordance with almost every word Dr. Muthu writes. His experience is wide, he has entered into his work with enthusiasm, and apparently has recorded his results accurately. The special chapters on treatment are of interest rather to the medical profession than to the general public, and their value can only be fully appreciated by the medical man, as their complete understanding involves a knowledge not usually acquired by a layman. Dr. Muthu deals with the social aspect of tuberculosis in the third part of his work, and we can thoroughly recommend this portion to the consideration of all who take an interest in the welfare of their fellows. Dr. Muthu evidently feels deeply, and he certainly expresses himself strongly and clearly. Some may not agree with him on all that he writes, but here again, whether they agree with him or not, they will be interested and often enlightened. The book is well printed and the illustrations are excellent.

(2) In Dr. Woods Hutchinson's work we have an original and hopeful statement of what the Americans call "a difficult proposition." Dr. Hutchinson starts out on the assumption that man is "the toughest, the most resourceful, the most ferocious and dangerous animal that walks upon the face of the globe," and he thinks that we have not yet added bacteria to our conquests simply because we did not know of their existence until about half a century ago. Now he considers that this conquest is only a question of time, especially as the harmful bacteria form such a relatively small proportion of the known microbial organisms. Dr. Woods Hutchinson is a great believer in the tubercle bacillus as the cause of tuberculosis, and he considers that as a cause of

the disease it may be taken into the human system in various ways—in the food we take, the air we breathe, in the dust of the room, of the street, by flies, dirty fingers, filthy garments, and in a dozen other ways in which excreta and dirt may be spread. He considers that eight-tenths of all civilised people have had tuberculosis and have recovered from it without knowing anything at all about it.

In spite of all this, after describing in very popular language tuberculosis of various types, he states his belief that if we could put a stop to the dissemination of the tubercle bacillus we could put an end not only to pulmonary consumption, but could diminish our cripples by two-thirds, cases of scrofula by three-fourths, the fatal convulsions of childhood by a half, and eliminate a very large proportion of the fatal bowel diseases that occur in childhood. His optimism again comes forward when he considers Osler's statement that "we to-day run rather less than half the risk of dying of consumption that our grandfathers did and barely three-fourths of the risk that our parents did."

Dr. Hutchinson now and again drifts into what may be called Dooleyisms, which have a distinctly original flavour about them, and certainly tend to amuse, and, at the same time, to give us "furiously to think." As in the following:—

"If the rich had more sense and the poor more money, and both more public spirit, consumption would soon be a thing of the past. And it would be only one of many evils which would disappear in the process."

Again, when speaking of fresh air, he says:—

"Like other necessities of existence, it goes with the land, somebody else is going to get too little air, not to mention food and other incidentals. This isn't socialism—it's sanitary science. . . . It costs money to have plenty of fresh air to eat, even though the air is free . . . the one thing which no intelligent, civilised community can afford under any circumstances, is to allow any section, or class of it, to grow up without sufficient food to eat, air to breathe, and fuel to burn. . . . Wipe out the conditions which create consumption, and you will at the same stroke abolish half our crime and two-thirds of our pauperism!"

Dr. Hutchinson, after giving his message of hope describing the bacillus as the enemy, the weapons of the war to be waged against him, gives chapters on "Fresh air and how to get it," "Sunlight: the real golden touch," "Food, the greatest foe of consumption," "Work and rest: intelligent idleness," "The camp and the country," "Cash and consumption," "Climate and health," and "Specifications for the open-air treatment at home."

Speaking of the open-air treatment of consumption and camp-life, he says:—

"The cure of consumption is not a drug, or an operation, or a magic method of any sort. It is a *life* that must be lived twenty-three hours and sixty minutes out of the twenty-four, and seventy years out of your threescore and ten. You cannot learn it properly by being told about it, or lectured about it, or advised about it ever so wisely—you must live it."

Referring to the economic aspect of the question, under the heading "Cash and Consumption," the author believes that the community should provide the means for the worker to recover from his tuberculosis, and he contends that it can very well afford to do so, as thereby it escapes supporting his widow and educating his orphan children. It is on this basis that he speaks of poverty as the most expensive thing in the world for any community when quoting the tables of Korosi, which show that of each 10,000 well-to-do persons only forty die annually of consumption; of the same number of moderately well-to-do, 62·7; of poor, 77; and of paupers, 97. He maintains that there is a sound biological basis for our desire to be rich, for he points out that by becoming so "we reduce our chances of dying from tuberculosis fifty per cent."

There is good, sound, common-sense in the chapter on climate and health, which contains the following statement:—

"If anvone goes South to avoid the trouble of ventilating his bedroom properly, or taking sufficiently vigorous exercise in the open air to get up a glow and defy the frost, he is doing himself harm rather than good."

Wherever you go, the author says, go to a place where you can be comfortable, where you can get plenty of good and cheap food, where you can live in the open air without discomfort, where you will not be overworked, and where you can carry out to the full all the lessons learnt in the sanatorium. We have enjoyed reading Dr. Woods Hutchinson's book, and we can recommend it to all who like common-sense and can appreciate the writing of a man who knows his own mind concerning the subject with which he is dealing.

PROGRESS IN GIRLS' EDUCATION.

Public Schools for Girls: a Series of Papers on their History, Aims, and Schemes of Study, by Members of the Association of Headmistresses. Edited by Sara A. Burstall and M. A. Douglas. Pp. xv+302. (London: Longmans, Green, and Co., 1911.) Price 4*s.* 6*d.*

THIS is a book calculated to rejoice the heart of an educational worker, not so much for the wisdom it contains as for the evidence it affords of the spirit animating the educational policy of our leading English schools for girls. Here we have twenty-four essays relating to the subjects of girls' education, written by experienced headmistresses, who one and all seem to have a real zeal for their work, and a humble-minded desire to find the best way of doing it. There is a sense of sincerity, earnestness, and warmth in the essays that is highly pleasing, and a willingness to look at new proposals and plans that contrasts most favourably with the self-confidence, and subacid raillery sometimes affected by the high-placed pedagogue.

The essays are the outcome of a suggestion made by Mrs. Woodhouse, when president of the Association of Head Mistresses for 1907–9, and they are edited by her successor, Miss Burstall, and Miss Douglas, chairman of the curricula subcommittee.

They comprise a chapter dealing with the history of the development of public secondary schools for girls, a series of papers describing the present manner of dealing with the various school subjects, a paper on examinations, and papers on the general aims and ideals in education and suggestions as to possible reforms. The subject of discipline is deliberately omitted.

It will be understood from the foregoing that the amount of material presented affords abundant opportunities for comment and criticism, but the present notice must be restricted to one or two topics.

In the first place, it is noteworthy that in this presentation of views we find distinct evidence of an increasing differentiation between the education of girls and the education of boys. This, in a sense, is nothing new. Long ago there was a differentiation, inasmuch as whilst boys were being substantially taught, girls were being scarcely taught at all. But the first onset of the girls' high-school movement tended to an equalisation, both in quality and quantity, and doubtless there are still a good many people who do not admit that there is good reason for much difference.

The question involved is really one of great importance, both as regards girls and boys. Is a secondary school to be regarded chiefly as preparatory to a university or as a place where formal education is for most people ended? If the destiny of the pupils is assumed to be the university, where, up to now, the professional studies of men and women have been undifferentiated, there does not seem to be much reason for difference between girls' schools and boys' schools, and in both cases the teaching will be on purely academic lines. But surely if we think of the vast majority of pupils, we must realise that this assumption is wholly unwarranted, and we are thrown back on the inquiry—should not our main object in girls' schools be to frame a curriculum which at the end will equip girls, in the fullest degree possible within a school, for the unprofessional life that follows?

If this question is answered in the affirmative, it can scarcely be denied that there is room for distinctive features in the curricula of girls' schools. Whatever happens in connection with what is called the feminist movement, it can scarcely be doubted that for a long time to come the vast majority of women will be concerned with the administration of the home, and it would seem natural that this should be in the minds of those who have to consider the curricula. That this is now much more the case than it was twenty years ago is one of the most gratifying inferences to be drawn from the volume before us, and it is to be hoped that, notwithstanding the deep-seated belief which we profess in what are called disciplinary and humanising studies, our headmistresses may have the courage to specialise studies and equip their girls for women's work so far as it can be properly done in school.

The teaching of science to girls is at present receiving a good deal of attention. The subject is dealt with in the present volume by the able and experienced hand of Mrs. Bryant, and incidentally in home science by Miss Faithfull, and in home arts by Miss Gilliland.

"The prime condition to be fulfilled in a school scheme of natural science study is," according to Mrs. Bryant, "that it shall lend itself with certainty and ease to develop in the immature but plastic mind of average ability this *scientific attitude* of alert *individual inquiry*." For this "the subject-matter should be at each stage as attractive as possible, in the sense of stimulus to inquiry. . . the problems raised by the subject under discussion should not be too difficult for the learner's own powers of intellectual inquiry. . . . So far as possible the natural practical interests of the learners should be enlisted as a powerful additional stimulus to scientific motive."

No one will be likely to find fault with this clear and reasonable doctrine.

I may perhaps be permitted here to fall into the first person and to state that for a long time past I have been endeavouring to assist in making school science for girls comply a little more fully than has been the case with Mrs. Bryant's third requirement, viz., that it shall appeal to the natural practical interest of the learners. In doing this I have been brought into conflict with those who are alarmed for the "purity" of science teaching, and I have been suspected of a desire to introduce a sort of soft and effeminate subject which lacks all the elements of logic and discipline, so dear to the stern educationist. As a matter of fact, my aim has been nothing more or less than to imbue the science teaching in girls' schools with as much illustration from everyday topics, and especially topics of the household, as will give it a living interest and make it a more human, more useful, and more abiding possession. I state it, not as an opinion, but as a fact of experience, that the average science graduate, male or female, coming from an ordinary university course, is extraordinarily ignorant of some of the very simplest applications of science in relation to daily life, and that there is a considerable region of facts, both in physics and chemistry, lying outside the conventional "subject" as understood by degree artists in universities, which it behoves every reasonable school science-teacher to explore. I am not fond of the term domestic science, which rather curiously has been often used as synonymous with the arts of the cook and launderer, but that the principles and discipline of elementary physical science can be inculcated with a large accompaniment of topics and examples relating to the household arts I am perfectly satisfied, and I shall not readily be deterred from advocating this at some sacrifice of Atwood's machine and the oxides of nitrogen.

The question of the teaching of practical household arts in relation to girls' schools is admirably dealt with by Miss Gilliland, but a discussion of this subject and many others must be forgone for lack of space. The essay on examinations by Miss Gadesden deserves a special word of praise. We can, in conclusion, warmly congratulate Miss Burstall and Miss Douglas upon having brought to publication a collection of essays which does great honour to those who are directing the momentous work of educating our future rulers.

A. SMITHELLS.

MODERN GAS MANUFACTURE.

A Text-Book of Gas Manufacture for Students. By J. Hornby. Sixth edition, revised and enlarged. Pp. xi+423. (London: G. Bell and Sons, Ltd., 1911.) Price 7*s.* 6*d.* net.

THE fact that a sixth edition of Mr. Hornby's text-book was needed is the most convincing proof of its excellence, more especially as the readers to whom it appeals are necessarily limited in number, and other text-books on the subject exist.

The many alterations and advances which have taken place in gas manufacture during the past ten years have rendered it imperative to remodel the book so as to deal with the various types of vertical retort which are being introduced, and the use of increased charges for horizontals, which are found to give substantial improvement in the quantity and quality of both gas and tar.

The author disclaims any intention of making the book an exhaustive treatise on the subject, but in point of fact he so nearly attains this level that it is a pity he has not gone a little more fully into the theoretical aspect of carbonisation as gleaned from his own experience, rather than to rely on quotations from the work of others, which, although in most part excellent, sometimes give a wrong impression.

For instance, in speaking of the effect of distillation at low temperature, he quotes a paragraph from Dr. Lunge's work on "Coal Tar and Ammonia," to the effect that amongst the liquid, watery products "acetic acid is paramount," which, although true to a certain extent of the products obtained from lignite and peat, gives a wrong impression of the liquor obtained at low temperature from an ordinary gas coal.

After a brief general sketch of the usual procedure in a gas works, the author deals in the first chapter with the formation and general characteristics of the various classes of coal, and in discussing the conversion of vegetable deposits into coal, represents the complete reaction of fermentation and decay on cellulose by the beautifully simple equation,

$$2(C_6H_{10}O_5)=5CO_2+5CH_4+C_2,$$

which certainly does not take into account the feelings of the supporters of any dehydration theories. In discussing the caking coals, it would be worth while in a future edition to mention at any rate the influence of the percentage of oxygen on the gas yield and coking properties of various coals.

In the second chapter the wide subject of carbonisation is attacked, and here the description of the gaseous products of distillation due to primary and secondary actions are not quite in accord with the more modern views on the subject, but the remainder of this and the next chapter are very well done, and the reader is given next a section on labour-saving appliances, amongst which inclined and vertical retort settings are dealt with.

The diagrams of the Dessau, Woodall-Duckham, and Glover-West retorts are excellent, and it is a pity that the author has not dealt more fully with the relative advantages and drawbacks of these systems. There is but little doubt that the continuous systems of carbonisation as represented by the two latter retorts gives the nearest approach to a uniform treatment of coal that is to be found, and that when the general arrangements have been perfected by experience they will show themselves to be far superior to their Continental forerunner, the intermittent Dessau retort.

The author's treatment of the modern practice of filling the retorts with the charge so as to leave no space at the top of the retort, and extending the period of carbonisation is insufficient, and the two reasons which he gives for the improved results obtained are not nearly so important as that the mass of coal provides a cool and easy escape for the hydrocarbon and other gases distilling from the portions in contact with the hot walls, and so prevents the destruction of valuable illuminants.

In this part of the work also some notice ought to be taken of Mr. Glover's Norwich chamber retorts, which for the same reason give excellent results.

It would have been of great advantage to the work if the author had compiled with care a table contrasting the results obtained by the various methods of carbonisation from the horizontal retort with small charges and high heats to the latest types of sloper chamber ovens.

In the appendix on the "Distillation of Tar," the author gives the specific gravity of ordinary tar as ranging from 1·12 to 1·16. Is this a relic of the days when the gas manager was content with 10,000 cubic feet of gas per ton of coal, or is it an up-to-date figure from the vertical retorts and modern processes? Has the author never come across that tar, which a large proportion of our gasworks are making, in which, owing to the degree to which the temperature has been pushed to obtain a large yield of gas, the specific gravity has been raised to 1·2 and above, and the value reduced almost to nil?

Perhaps the most serious fault that can be found with this text-book is that little or no attention is paid to the subject of the thermal value of gas. The day is rapidly approaching when illuminating value will be superseded by calorific value as the test for the quality of gas, when the calorie and thermal unit will be as important to the gas manager as the candle standard is now, and a text-book for the rising generation of gas engineers should certainly deal in full with the subject of how best to transfer the greatest heat value from the coal to the gas.

THE DELINEATION OF THE EARTH'S SURFACE.

Maps and Map-making. By E. A. Reeves. Pp. xiii+145. (London: Royal Geographical Society, 1910.) Price 6*s.* net.

THE course of instruction in surveying and map-making offered to students and travellers by the Royal Geographical Society is justly esteemed for its useful and practical character. A book on this subject by Mr. Reeves, the map curator of the society, who has for many years carried out the instruction, and under whose direction the system of teaching has

undergone continuous and marked improvement, is certain of a cordial welcome.

We may at once state that the book is no other than it purports to be—a reprint of three lectures, the first on instruments, the second on survey methods, and the third on maps and map-making. It is in no sense a text-book on the science of surveying. It is, for example, not the sort of book that the practical surveyor would take into the field, nor would it be of much value to the student who has passed the elementary stage.

Its true function, we take it, is identical with that of a lecture, not to instruct, but rather to stimulate curiosity, not so much to teach as to show that there are things worth learning. A book of this class has a tendency to fall into a difficult category, being too technical for the ordinary reader and too simple for the expert. At the same time, we may frankly recognise that as regards this particular subject there are a large number of persons—travellers, officers, and officials, whose duties take them into the uncharted regions of the world—to whom a little knowledge of survey methods is a valuable acquisition but who have no desire or capacity to prosecute their studies further.

To these and to all others who desire a general acquaintance with a science which must always remain of great practical importance and of considerable human interest, we can cordially recommend Mr. Reeves's book.

The first chapter, dealing with the history and development of surveying instruments, profusely furnished with illustrations, as indeed is the whole book, will be found full of curious information. The treatment of modern instruments is perhaps too compressed to be thoroughly satisfactory and has a tendency to degenerate into a mere catalogue, wherein the various instruments are briefly described, but no adequate attempt is made to estimate their relative merits or defects. Thus the prismatic sextant is mentioned as an "improvement" on the ordinary form without a hint that, as a matter of fact, it was found to be no improvement, and has passed entirely out of use.

The book is well printed and misprints are not common. We scarcely know whether the spelling *geodecist* (p. 24) is intentional; if so, we must enter a protest against it.

The specimen maps are reproduced with the uniform excellence of style that we are accustomed to in the R.G.S. publications.

In conclusion we may direct attention to the map on p. 131, showing relief by "stereoscopic" colouring, *i.e.* a system wherein the varying altitudes are shown by an ordered sequence of spectrum colours, the high ground red and thence descending through greens and yellows to a blue sea. The effect of relief on such a map is very good. The eye naturally adjusts itself as in viewing near and far objects so that the tops of the hills appear nearest and the bottoms of the valleys farthest from the observer. A neglect of this principle of spectrum colours is a marked defect of the recently published half-inch Ordnance Survey map of England.

E. H. H.

MATHEMATICAL TEXT-BOOKS.

(1) *Elements of Plane and Spherical Trigonometry.* By Prof. D. A. Rothrock. Pp. xi+147+xiv+99. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 6*s.* net.

(2) *Homogeneous Coordinates for Use in Colleges and Schools.* By Dr. W. P. Milne. Pp. xii+164. (London: E. Arnold, 1910.) Price 5*s.* net.

(3) *A Geometry for Schools.* By F. W. Sanderson and G. W. Brewster. Pp. x+336. (Cambridge: University Press, 1910). Price 3*s.*

(4) *Analytic Geometry.* By Prof. N. C. Riggs. Pp. xi+294. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1910.) Price 7*s.* net.

(1) THIS volume contains a fairly through treatment of the numerical aspects of plane and spherical trigonometry. In addition to this, a certain amount of attention is directed to elementary identity work, and some indication is given of the higher analytical developments of the subject, based on Demoivre's theorem, in the concluding chapter of the first part of the book. It is unfortunate that the symbol $e^{i\theta}$ is regarded as equivalent to $\exp(i\theta)$. This is the source of much error in the minds of students, and from the earliest stage it is most desirable to emphasise the distinction between the two forms. With this exception, the mode of presentation is excellent. There are numerous exercises and problems, but at present no answers are given. This is a serious omission, and it should be rectified in a new edition. Five-figure tables of logarithms and trigonometric functions are appended to the book.

(2) The utility of homogeneous coordinates when carefully employed, is undeniable. It so often happens that their properties are sketched in a brief chapter at the end of treatises on Cartesian methods, thus leading the reader to believe that the subject is one of small value and importance. It is, of course, a misuse of this instrument to apply it to metrical results, except in very special circumstances; but its application to properties of a descriptive character is particularly instructive and illuminating. The present volume contains, in a remarkably small compass, a comprehensive account of the subject, treated in exactly the right way. Its wealth of detail will be invaluable to the teacher, who will probably prefer to make selections for his pupils. The correspondence between point and line coordinates is worked out in a thorough fashion, and the part played by ideal and imaginary elements is clearly indicated. Such work as this is well within the range of the scholarship class in secondary schools, and it arouses keen interest, mainly because analysis is very properly subservient to principle. There is an admirable collection of examples. We wish the book all the success it unquestionably deserves.

(3) The plan of this book agrees to a large extent with the recommendations made in the Board of Education circular on the teaching of geometry. The proofs of the fundamental congruence and parallel theorems occupy a subordinate position, thus making it possible for the student to pass rapidly over the

initial stages and advance quickly to simple rider work. There are four main sections in the book; each of these starts with an experimental investigation and ends with the theoretical treatment of the corresponding theorems. There are abundant numerical examples, but some teachers will consider that the supply of riders is inadequate. An excellent innovation is the insertion of circle properties before areas are dealt with. This provides such an excellent field of simple and interesting riders that it is surprising that the Euclidean order has been followed so long. The last section contains as many of the theorems on ratios as are usually given in elementary text-books, the numerical examples, illustrating the use of proportion, are particularly good.

(4) The analytical geometry of the conic is treated in this volume in less detail than is usual in most text-books. For practical purposes, it is far more important for the student to acquire a correct appreciation of the principles which obtain for curves of any degree, and to master the use of infinitesimal methods. The author has therefore employed the calculus freely and applied it both to plane and skew curves and simple surfaces. The examples have been chosen rather to elucidate principles than to test analytical dexterity. The book may be used with confidence by engineering students, with whose needs it is primarily concerned.

SCIENCE AND SPECULATION.

The World of Life: a Manifestation of Creative Power, Directive Mind, and Ultimate Purpose. By Dr. A. R. Wallace, F.R.S. Pp. xvi+408. (London: Chapman and Hall, Ltd., 1910.) Price 12*s.* 6*d.* net.

THE appearance of a new book written by the veteran naturalist in his eighty-eighth year cannot fail to arouse the interest of a wide circle of readers. The work may indeed be regarded as a recapitulation of the opinions on a great variety of topics which, during a long and active literary career, extending over more than fifty years, Dr. Alfred Russel Wallace has put forth in a number of memoirs, books, and magazine articles. But to regard the work as a mere summary of the results of former labours would be to do a great injustice to its author; for there is scarcely a subject referred to in it, in which fresh facts, novel lines of reasoning, or suggestive conclusions are not presented for our consideration.

The book naturally divides itself into two portions, which are of very diverse character and unequal value and importance. As regards the first part, we must state at once that the space at our disposal is altogether insufficient to enumerate—much less to discuss—the numerous interesting problems suggested in it.

After a first chapter, devoted to a somewhat academical discussion of the nature and origin of life, we have five chapters treating on the subject with which Dr. Wallace's name will always be so honourably associated—the distribution of plants and animals. Readers familiar with the author's great work on this subject, and with his "Island Life," will be surprised and delighted to find how many novel facts and lines of treatment have suggested themselves to the author since the publication of his earlier works. Among many interesting discussions in this part of the book we may specially instance the contrasts pointed out between the more uniform floras of temperate climes and the richly diversified floras of tropical lands. These latter are shown in many cases to be in great danger of extinction through human agencies, and the interesting suggestion is made that the British Government might follow the example of the Dutch in Java, by establishing small forest reserves in our tropical colonies; such reserves, Dr. Wallace points out, need not be of anything like the extent of the animal reservations of North America and Africa, for, owing to the crowded and diversified nature of all parts of a tropical forest, small areas of even a square mile would be sufficient for the purpose.

Later chapters devoted to illustrations, extensions, and new applications of the theory of natural selection cannot fail to arrest the attention of all naturalists; we may especially refer to the discussion of "recognition marks," and those on bird life, bird migration and extinction, and the relations of bird to insect life. We may note that even when the author feels compelled to express dissent from the views of Darwin—as in his ideas concerning the origin of man's intellectual and moral faculties—we find his loyalty and devotion to his old friend and fellow-worker displayed as conspicuously as ever.

The three chapters on the geological record, well illustrated as they are by wood-cuts drawn from various sources, abound with interesting observations. We may instance his development of the ideas put forward by Dr. Smith Woodward, in an address to the British Association, concerning the tendency of groups of animals in the periods before their final extinction to run into extravagant and sometimes *bizarre* forms. This is illustrated in the case of the trilobites and ammonites.

Later chapters on the relations of the chemical elements to vital agencies, on the "mystery of the cell," on the parts played by plants, animals, and man respectively in the economy of nature, are eloquent and illuminating; but it is unfortunate that the author is never able to avoid the pitfalls of teleological speculation. This tendency is still more strikingly manifested when the author proceeds to discuss such questions as the existence of pain in the lower animals, of the non-justifiability of vivisection, of the remedies for the overcrowding of cities, and similar problems of the day. On all these and similar questions Dr. Wallace writes very confidently, sometimes intruding his speculative opinions in the midst of the treatment of purely scientific questions.

Most of the author's scientific friends—and they are very numerous—will feel regret that these and similar discussions were not reserved for a separate volume. We are all familiar, from reading his "Man's Place in the Universe," and his autobiographical work—"My Life"—with the author's peculiar views on extra-scientific, social, and political questions. Some of these tendencies to unbridled speculation seem to have reached an extreme limit in the twilight of a noble life, as when it is gravely suggested to sub-

stitute for the idea of a single Creator, orders of angelic beings, each charged with the task of originating and exercising supervision and control over special evolutionary processes! Everyone must feel how incongruous are such incursions into the realms of the unknown and the unknowable with the really valuable and suggestive discussions of the first part of the book. But however much we may regret the intrusion by the author of these wild speculations, and greatly as we may dissent from his social and political panaceas, as hopelessly impracticable, we all recognise that they are inspired by the author's love of humanity and all living things, by a desire to ameliorate the sorrows and sufferings he sees around him, and by a hope—ill-founded though it may be—that such teachings may be of service to his fellow-men.

NATIVES OF THE ARGENTINE REPUBLIC.

Los Aborigenes de la República Argentina. Manual adaptado á los programas de las Escuelas Primarias, Colegios Nacionales y Escuelas Normales. By Prof. F. F. Outes and Prof. C. Bruch. Pp. 149. (Buenos Aires: Angel Estrada y Cia., 1910.)

THIS neat little book, well printed and illustrated, far surpasses its modest subtitle: a manual adapted to the teaching in primary and secondary schools. It is really a condensed account of what is known of the natives of the Argentine Republic, of those who are quite prehistoric, those who were found at the time of the conquest by the Spaniards, and those who "still survive precariously in some far-off districts."

A rapid survey of the earth's history as told by the sedimentary strata and their leading fossils is made the occasion for explaining the meaning of the many indispensable technical terms. Since much of the evidence of the existence of prehistoric man rests upon his primitive implements, the theory of artificially chipped stones is explained and illustrated, and how, at least in Europe, the evolution through polished and carved implements of stone to those of metal can be traced. A roll-call of scientific work in Argentina, from Pigafetta, Magellan's companion in 1520, to the Princeton University expedition, concludes this introduction of twenty-eight pages.

The palæontological account is greatly helped by a coloured diagram. Besides the mystical Tetraprothomo, the pliocene Monte hermoso level has yielded pieces of rock which enthusiasts have taken for examples of intentionally fire-baked clay, whilst others refer their condition to volcanic action. In short, the earliest undoubted human remains and traces date from the Enseñada Loess, lowest pleistocene. The *Homo pampeanus*, of the early American type, seems to have used the carapace of the contemporary Glyptodons for shelter. Post-pampean man was clearly neolithic, and he continued in this state until his discovery by the Spaniards, with the sole exception of the Diaquita in the north-western mountains, which had advanced to the use of bronze. These interesting people are described in the second chapter.

To facilitate the account of the various tribes, each chapter has a little map, and stress is laid upon the prevailing climate, as influencing man through the fauna and flora. Each chapter begins with a description of the physical aspect of the respective district, whether forest, mountain, or plain, with frequent photographs; the tribes are grouped as much as possible according to their relationship. Each group, or tribe, or race, is tersely characterised physically; as a linguistic point the personal pronouns have been selected. Sociologically: the kind of food and how it is prepared, especial attention being paid to the mode of kindling of fire. Then follow the kind of shelter, dress, ornamentation, dances, creeds, and superstitions, family and funeral rites, weapons, and wars. To each chapter is attached a carefully selected and apparently well-nigh exhaustive bibliography, and 146 illustrations, comprising maps, scenery, implements, pictographs, and portraits enhance the text, which in a small compass manages to impart an astonishing amount of information.

OUR BOOK SHELF.

Solectrics: a Theory Explaining the Causes of Tempests, Seismic and Volcanic Disturbances, and how to Calculate their Time and Place. By Alfred J. Cooper. Pp. iv+100; illustrated by over 100 diagrams. (London: J. D. Potter, 1910.) Price 10s.

THE "solectric theory" postulates a force which in some sense corresponds to the sun's radiant energy, giving rise to light, heat, chemical action, and magnetism, but the author also inserts gravity and vital force. Having introduced such a force, the author is able to explain the rotation of the earth, the obliquity of the ecliptic, and many other things. This solectric energy penetrates the whole solar system, and there is a constant adjustment of this force according to the configuration of the planets and moon. The sum is constant, the whole passing continually from and to the sun; only local disturbances have to be considered. At intervals the earth becomes charged with solectric energy, both directly from the sun and indirectly from the planets and moon. According to the length of time that the earth is submitted to this force, so its manifestation will vary. If the accumulated energy is spread over a large flat country or an ocean, a storm occurs; if the energy has been gathering for ten or twelve days, and is concentrated in a mountainous district, an earthquake takes place; if the earth has been surcharged for a month or more, volcanic eruptions follow. But whatever the form of the disturbance, it is necessary that the sun or moon should be $57\frac{1}{2}^\circ$ or 88° from the position affected at the critical moment.

If we have correctly interpreted the author, this expression means that the place must lie on a circle $57\frac{1}{2}^\circ$ or 88° from the position in which the sun or moon is vertical. We have not been able to follow the process by which the position on either of these circles is definitely located, but evidently the operation is not a simple one, for the author intimates that a body of expert calculators will be required in order to apply the theory. But if the instructions are pursued rigorously, it will be possible to issue warnings to any state threatened by an earthquake, or to ships likely to be overtaken by a tempest.

Differing from many theories, the aim here is eminently practical, but if the author entertains any hope that it will be tested, we are afraid he is doomed to disappointment. Though we cannot agree with his conclusions, we should wish to treat Capt. Cooper

with great respect. He has witnessed many storms and startling phenomena in all parts of the world, and has sought to ascertain the causes according to his lights. Not being sufficiently acquainted with phenomena outside his own experience, and perhaps misled by the "long arm of coincidence," he has gone wrong, but the spirit of inquiry exhibited is very creditable, and much to be preferred to the display of indifference so often manifested by seamen and others.

Die Cnidosporidien (Myxosporidien, Actinomyxidien, Microsporidien). Eine monographische Studie. By Dr. M. Auerbach. Pp. viii+261. (Leipzig: Verlag von Dr. Werner Klinkhardt, 1910.) Price 18 marks.

THIS memoir deals with an important group of parasitic Protozoa, associated with disease in cold-blooded vertebrates, especially fishes, and in invertebrates, for instance, pébrine in silkworms. The spores of these Sporozoa are enclosed in a valvate shell (the valves of which are shown to arise from two or three special cells in the sporoblast), which contains, besides one or more masses of spore-plasm, one to four polar capsules, each with a spirally-wound filament. The assertions of some workers that the polar filaments can be extruded and subsequently retracted are not borne out by the author's experience. The morphology of the vegetative forms and spores and the multiplicative and propagative reproduction are fully described; some form of sexual reproduction is now known to occur in members of each of the three subdivisions of the Cnidosporidia.

In the biological portion of the work the occurrence of the parasites is discussed, and an excellent host-index is given showing the Cnidosporidia recorded from each, with references to the records; the situation of the parasite and its pathological effects are described. In the systematic section an account is given of the genera and species described subsequent to 1897, which thus serves as a supplement to Labbé's account in "Das Tierreich" (1899). There are useful hints on technique, a list of 530 memoirs dealing with this group of parasites up to August, 1909, and an appendix giving a summary of the literature issued between that date and the time of printing. A comprehensive index completes this admirably arranged and useful monograph, which is illustrated with eighty-three half-tone figures.

Lehrbuch der Botanik für höhere Lehranstalten und die Hand des Lehrers, sowie für alle Freunde der Natur. By Prof. O. Schmeil. (Sechsundzwanzigste Auflage.) Pp. xvi+534. (Leipzig: Quelle and Meyer, 1910.) Price 5.40 marks.

THE author of a book that passes through twenty-five editions in seven years has reason to be satisfied. Such is the record of Dr. Schmeil's "Text-book of Botany," which is intended for use in high schools and similar institutions, as well as for teachers and home students. It is largely a systematic compilation treating of phanerogams, with a shorter review of cryptogamic types; to this is added an account of general morphology and physiology, and a brief appendix on plant systems and geographical distribution. The success of the book may be attributed to the training value of systematic botany in a general course of education. The information proceeds by families, for which one or more of the important members is taken for tolerably full description, especially with regard to features of biological interest, while others, particularly those of economic interest, are mentioned, and in many cases figured. Among the numerous illustrations those portraying general habit and appearance are a notable feature. Most of the coloured plates refer to an individual species, but one is a representation of a wood in the carboniferous epoch. It would be useful if general characters were given for each family mentioned; as it is, they are omitted in those cases where they are not readily obtainable.

Four-Figure Logarithms on a New Graphic System, dispensing with Interpolations. By Dr. R. C. Farmer and M. M. Farmer. Pp. 8. (London: Longmans and Co., 1910.) Price 6*d*. net.

THE authors of these tables have attempted to avoid the necessity of employing difference columns. With this end in view, numbers are printed on one side of a graduated line, drawn down the page, and the corresponding logarithms are placed opposite to them. The difference between successive printed numbers is 10 and the intermediate spaces are divided into ten parts. The logarithms are also printed at intervals of ten, and the correct subdivisions are indicated. It is claimed that more accurate readings will be made in this way than from the ordinary tables where a slight error in the fourth place occasionally occurs. But we must confess that we have found this new method a considerable strain on the eyesight, and there is the additional inconvenience of having three pages to consult instead of one. For practical purposes, ordinary tables give a sufficient degree of accuracy; we therefore doubt whether this new graphic system, in itself distinctly ingenious, will receive much support.

Die Abstammungslehre. By Dr. P. G. Buekers. Pp. xi+354. (Leipzig: Quelle and Meyer, 1909.) Price 4.40 marks.

THIS is a very good little book. It presents the main facts bearing on the theory of descent, which have been ascertained of recent years, within a convenient compass. The account of variability is very useful, but what will probably be found of greatest use to German readers will be the author's epitome of the mutation theory and his account of elementary species in Draba and Viola, of which there are some very useful figures. His chapter on the natural system of classification is very interestingly written; he deals at length and is evidently very much interested in the question of the minute discrimination rendered possible by a long training of the observation, and he mentions a bulb dealer who knows more than a thousand varieties of hyacinths from the dry bulbs alone. His concluding chapter embodies an attempt to hold the scales between the mutation theory and the theory of the selection of continuous variations. The author makes an unequivocal declaration in favour of the theory of mutation; his thoughtful analysis of the evidence on this question should ensure the book a wide circulation. It is to be hoped that it may be translated into English.

The Cornish Riviera. Described by Sidney Heath. Pp. 64. *The Peak District.* Described by R. M. Gilchrist. Pp. 64. *Dickens Land.* Described by J. A. Nicklin. Pp. 64. All pictured by Ernest Haslehust. (London: Blackie and Son, Ltd., 1911.) Price 2*s*. net.

THESE additions to the "Beautiful England" series which Messrs. Blackie are publishing contain all the attractive features to which attention has been directed in noticing previous volumes. Mr. Haslehust's beautiful pictures in colour, supplemented as they are by bright, entertaining letterpress, should assure the popularity of the volumes.

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.]*

A House divided against itself.

MOST of your readers have doubtless heard of a question relating to the site of the Natural History Museum at South Kensington, and to a site for a new Science Museum. For the latter it is proposed to utilise the waste land behind the Natural History Museum, together with a portion of the site assigned to the Natural History Museum. The supporters of this scheme state that there is plenty of land for both museums, and have presented a memorial to the Government to this effect. Biologists learnt of this memorial largely owing to a Question and Answer in the House of Commons. They considered that such a proposal seriously imperils the future of the Natural History Museum. A second equally influentially signed memorial expressing these views is sent to the Prime Minister.

The spectacle is an edifying one. The scientific men of the country are roughly divided into two camps opposed to one another, while, as Sir Norman Lockyer says in a letter to *The Times*, May 30, "there should be no contention between these persons—their aims are the same; they desire to afford the best facilities for the increase and coordination of knowledge in all its branches." Is there no machinery which can make such contention only possible as a last resort? The records of the Royal Society and the British Association afford a hundred instances of the cooperation of all sections of scientific men, while the search for instances of the pitting of the different sciences against one another is almost vain. In questions which affect several sciences, surely it is possible for representatives to come together privately and discuss them freely. Probably in 90 per cent. of the cases an agreement would be reached, and both sides would cooperate for the good of science as a whole. For the due progress of human knowledge the cooperation of the different sections of science is more needed to-day than it has ever been in the past. All branches are becoming more and more woven together, and public contention between sections can only weaken the influence of science as a whole.

J. STANLEY GARDINER.

Cambridge, May 31.

Fishes and Medusæ of the Intermediate Depths. A note on the work of the *Michael Sars*.

DR. HJORT'S account of the work of the *Michael Sars* during last summer's cruise[1] is of the very greatest importance to the marine geographer: it is the most illuminating article of its kind which has appeared within recent years.

Among the many interesting questions which are raised, I wish to direct attention here to one only, which is of particular interest to me because of my studies on the Medusæ of the intermediate waters, or the mesoplankton, if that term be preferred. This is the observations on the vertical range of the "black fishes," "shining silvery fishes," and "red prawns" of the intermediate depths.

Briefly stated, the result of Dr. Hjort's observations is that the adult black fishes and red prawns form an important community, the upper limit of which everywhere corresponds with the same intensity of light, *i.e.* practically with the lower limit to which sunlight penetrates with strength demonstrable by the photographic plate. This limit is deeper in low latitudes, nearer the surface in high, that is, about 500 metres between Newfoundland and Ireland; 700–800 metres at 33° N.; and when black fishes were taken from lesser depths, such captures were made at night.

The silvery fishes dwell at a higher level, where the light of the violet end of the spectrum penetrates with considerable strength.

These generalisations rest on such a mass of observation, and the methods of investigation were so well chosen, that they seem to me altogether deserving of acceptance; indeed, they form one of the most important of recent additions to our knowledge of oceanic biology.

Now, among the "intermediate" or "mesoplanktonic" Medusæ there are two similar colour groups, one unpigmented, or faintly pigmented, but often highly iridescent, as, for example, *Colobonema sericeum*, *Rhopalonema funerarium*, *Halicreas papillosum*; the second, characterised by very dense entodermic pigmentation, of a deep red, reddish-brown, or chocolate colour. Conspicuous genera among the latter are Atolla, Periphylla, Crossota, and Æginura.

Dr. Hjort's paper raises the question, Do the intermediate Medusæ, like the intermediate fishes, fall into two classes in their vertical distribution as well as in colour, and, if so, do the depth limits of the two correspond with those of the fishes and crustaceans?

Unfortunately, our knowledge of the bathymetric range of all the Medusæ in question is still extremely scanty. We know that they do not normally come to the surface except in very high latitudes, as, for example, Periphylla from the surface off Cape Adare in December, 1899, and January, 1900, the ice then being broken up, and in McMurdo Sound. On the other hand, the evidence which I have collated[1] shows that they are by no means exclusively abyssal. During the *Albatross* Eastern Pacific Expedition they were taken abundantly between 300 fathoms and the surface, and I have recently received an extensive collection from the north-western Pacific from the same depth zone.

Closing-net records are too few in number to be conclusive, but it is at least suggestive that in the eastern Pacific the *Albatross* took three genera of red Medusæ in a Tanner-net haul at 400 fathoms, one of which was also taken in the open net from 300 fathoms, but none of the transparent group, while at the same station two genera of the iridescent-transparent group were taken in a Tanner-net haul at 300 fathoms, and three specimens of a third transparent form, *Halicreas papillosum*, and one of a fourth, *Homoeonema alba*, were taken in the open-net haul from 300 fathoms to the surface.

These records certainly suggest that at this locality the red forms occurred, as a whole, below the transparent-iridescent ones, but that the two groups overlapped at, say, 250–300 fathoms.

In my discussion of the bathymetric range of the eastern Pacific Medusæ, I concluded that the upper limit of the intermediate forms probably corresponded, roughly at least, with the depth to which sunlight penetrates with appreciable strength. But the facts with regard to fishes brought out by Dr. Hjort suggests that my generalisation may not hold for the intermediate Medusæ as a whole, but only for the "red" genera.

This question can be settled only by further records; such, we hope, will be afforded by the *Michael Sars* Medusæ when they are worked up. But I direct attention to it here because, if it proves that red prawns, red or brown Medusæ, and black fish form a rather definite faunal group dwelling below the limits of light, as now seems likely, to which, too, the pelagic holothurian Pelagothuria probably belongs, the similarly excessive development of pigment in such divergent groups, in an environment of practical darkness, is a phenomena of great interest.

Such cases as this only emphasise the gaps in our knowledge of the life of the deep seas, and how rich a harvest of discovery still awaits the student who will explore the intermediate waters with a well-matured plan of operations.

HENRY B. BIGELOW.

Museum of Comparative Zoology, Cambridge, Mass.

Musical Sand.

WORKING with sand obtained from the beach at Barmouth, North Wales, I have been able to confirm most of the conclusions arrived at by Mr. Carus Wilson (NATURE, vol. xliv., p. 322) and by Mr. Skinner (NATURE, vol.

[1] *The Geographical Journal*, vol. xxxviii., pp. 349–377, 500–523, and NATURE, January 19, 1911.

[1] Reports on the scientific results of the expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, by the U.S.F.C. steamer *Albatross*, ... XVI. The Medusæ, by Henry B. Bigelow. Memoirs Museum Comp. Zoology, vol. xxxvii.

lxxvii., p. 188), while the following additional observations have been made.

Distribution.—I found musical sand at intervals along the shore for more than ten miles north of Barmouth, at Whitesands Bay, Pembrokeshire, and at the North and South Sands, Tenby. This suggests that it is much more widely distributed along the shores of the British Isles than has hitherto been supposed.

Conditions affecting Pitch of Note.—I obtained the note by plunging a flattish pestle into an evaporating basin containing some of the sand, and there appears to be a definite relation between the curvature of the vessel and the pitch of the note produced. The following typical numbers were obtained with vessels of different material, which were approximately hemispherical in shape, the same pestle being used in each case :—

Vessels	A	B	C	D	E
Radius of curvature in cm....	5·4	5·1	4·7	4·4	4·2
Frequency of note (about) ...	1280	1440	1700	2180	2300
Inverse ratios of squares of radii	1·12	1·32	1·18	1·25	1·06
Ratios of frequencies	1·13	1·33	1·18	1·35	1·10
Vessels	A & B	A & C	B & C	C & E	D & E

When round-bottomed glass flasks are plunged into a milk-bowl containing sand, the pitch appears to depend on the curvature of the flask; *e.g.* flask

$$R = 3{\cdot}5 \text{ cm gives note } n = 2050$$
$$R' = 4{\cdot}2 \text{ cm gives note } n' = 1370$$
$$\frac{R'^2}{R^2} = 1{\cdot}44 \qquad \frac{n}{n'} = 1{\cdot}49$$

Within certain limits, a change in the temperature, the quantity of sand moved, or the gas present between the sand particles, appears to have no appreciable effect upon the pitch.

E. R. THOMAS.

University College of Wales, Aberystwyth.

The Protective Value of the Sticky Hairs on Young Leaves and Shoots.

IT is often difficult to imagine, and still more so to discover, the particular foes against which the hairs of young plants are a defence. In the course of the last two days I have noticed two instances in which the same foes have been successfully vanquished by a similar device on two widely different plants. The first instance was afforded by plants of *Salvia patens*, which had been removed from a cool frame to the shelter of a wall prior to being planted out in the borders; the second by the young leaves and shoots of several species of Rhododendron growing in my garden. The hairs of both these plants were abundantly laden with dead and dying hymenopterous gall-flies of several different species (? of the genus Andricus). I examined several individuals, and found them invariably to be females. They were caught by the legs, wings, or indeed almost any portion of the body. I failed to discover any insects other than the gall-flies captured by these hairs; and yet there were a few dipterous flies walking unconcernedly over the leaves, and in no way inconvenienced by the sticky hairs. The evidence would seem to point to these hairs being a special protection against gall-causing insects at a stage when the tender leaves and shoots would otherwise be very vulnerable by these tiny creatures.

OSWALD H. LATTER.

Charterhouse, Godalming, May 21.

The Teaching of Science in Secondary Schools.

THE report of the Board of Education on the above subject (see NATURE, May 4) contains many expressions of opinion with which I heartily agree. But I must beg respectfully to differ from the authors as regards the limitations they propose to put upon the use of everyday phenomena in science teaching. The report says :—"They should, of course, be introduced as *illustrations*, that is to say, when, and only when, they may happen to be wanted to give point to the teaching." This dogmatic statement ignores the fact that many well-known teachers strongly prefer the opposite mode of procedure. Upon their view a practical problem should be made the *starting point*, so that the development of the scientific method should follow instead of precede; *e.g.* from a study of the crane the class should discover the triangle of forces. The main argument for this procedure is that the boys actually want to know how a crane works, whereas interest in abstract principles does not, as a rule, outcrop until the age of sixteen or seventeen years. My own experience is distinctly in favour of the appeal to the utilitarian rather than to the scientific motive, except in the case of exceptional boys or of those above the age of seventeen.

G. F. DANIELL.

Oakleigh Park, N.

June Meteors.

THOUGH the long days and twilight nights prevent much attention being given to observations of shooting stars in June, still, important meteoric events are liable to occur in this month. The following are computed details of the four most important meteor showers that take place during the period June 9–30 in the present year :—

Epoch June 8, 17h. (G.M.T.), twenty-sixth order of magnitude. Principal maximum June 9, 9h.; secondary maximum June 9, 19h. 40m.

Epoch June 9, 6h., twenty-second order of magnitude. Principal maximum June 10, 9h. 35m.; secondary maximum June 10, 19h. 40m.

Epoch June 13, 12h. 20m., seventh order of magnitude. Principal maxima June 12, 5h., and June 12, 12h. 15m.; secondary maxima June 10, 23h. 10m., and June 12, 18h. 35m.

Epoch June 14, 4h., eighth order of magnitude. Principal maxima June 12, 23h. 20m., and June 13, 0h. 5m.

June 5. JOHN R. HENRY.

Daylight and Darkness.

I AGREE with Mr. W. T. Lynn that the article in NATURE of May 11 (p. 349) leaves "little to be said with regard to the so-called Daylight Saving Bill"; but there is one remark in it to which exception may be taken. This is the statement (p. 350) that it is "easy" to alter one's watch when travelling into a zone where different time is kept, if by "easy" is meant "not inconvenient." All travellers must have found the inconvenience of the change of time, even when reduced to a minimum through the change being an exact hour. Some inconvenience is unavoidable in travelling, but it is, of course, absurd to cause this inconvenience unnecessarily as the "Daylight Saving Bill" proposes. The inconvenience is such that in a journey to India I found it best never to alter my watch at all, it being simplest to keep to Greenwich time, and mentally make the allowance for local time.

T. W. BACKHOUSE.

West Hendon House, Sunderland, June 1.

HEREDITY AND DESTITUTION.

DURING the past week a conference has been sitting to consider possible means for the prevention of destitution. A general inaugural meeting took place on May 30, at the Albert Hall, and sectional meetings were held on several days at Caxton Hall.

Mr. A. J. Balfour, who delivered the opening address at the general meeting, struck a note of which echoes were heard throughout the congress. He devoted much attention to the bearing of heredity on destitution, and to the influence of the present selective fall in the birth-rate on the average economic efficiency of the nation.

Although Mr. Balfour held that some supposed

deductions from the principle of natural selection among mankind were not supported by facts, those who believe that the importance of heredity and selection in racial qualities has been too much neglected cannot but be grateful to him for raising boldly a question which our statesmen and politicians are only too prone to ignore. Almost anything which directs public attention to the subject is to be welcome.

While according a generous recognition to the importance of racial studies, Mr. Balfour asked the selectionist to face the question why he could perceive no "segregation of efficiency in the past between those who are better off and those who are worse off." Mr. Balfour implied that, unless a satisfactory answer could be given, the theory of natural selection as applied to mankind should be regarded with hesitation if not with suspicion.

Not everyone will share Mr. Balfour's inability to perceive a higher level of ability among the upper half of the nation as compared with the lower. Distinct evidence of segregation of special types of ability might be adduced. But the question why the process has not gone farther, why the upper classes do not show preponderant ability more markedly than they do, is worthy of consideration.

The whole problem of selective action in mankind, and especially civilised mankind, is fraught with difficulty, and tentative considerations alone can at present be put forward. One could imagine a society in which ability possessed full selective value, and a cumulative segregation of mental qualities gave to the best part of the race at all events, a much higher average efficiency than we can now show. But that society would in some respects be unlike our own. It would be more ready to accord all advantages to ability without envy or hesitation; it would be much firmer in visiting weakness of mind or body with appropriate disabilities. It would secure in some way that able men and women should be encouraged to have a full complement of offspring, and should be placed in a position where a hunt for heiresses by themselves or their sons would not be necessary to support the position won by their own ability, for, as Galton pointed out, heiresses usually come of infertile stock, and too often extinguish the family which captures them.

These considerations may serve to give us the clue to Mr. Balfour's problem: Why are not our upper classes more markedly superior in ability to the lower?

First, ability, even ability which leads to achievement, does not necessarily secure a more able partner. A man rising rapidly too often either marries unwisely before he has risen, or, engaged in the struggle to advance, marries not at all, or too late, to leave many offspring. One or two children are not enough to give the hereditary ability a full chance of appearing. Thus the favourable variation is destroyed in the first generation.

Secondly, if he marries appropriately and rears a large family, that family has still many dangers to run. Unless the ability be of the type which wins great wealth, and unless the opportunity for winning that wealth occurs, a search for well-dowered partners will probably extinguish some lines of offspring. Or again, if wealth renders this search unnecessary, some of the children may fall a prey to the needy adventurer with undesirable mental qualities.

Thirdly, when a family becomes firmly established among the upper classes, the pressure of selection becomes less acute. Places are found for the sons, whether their abilities deserve them or not; some of the daughters make good marriages, regardless of whether they possess their share of the family ability. Selection ceases to a great extent, and reversion to a lower level inevitably occurs.

These reasons apply to all the ages during which modern society has been developing. But, during the last forty years, the voluntary and deliberate restriction of the birth-rate among the more successful stocks of the nation has introduced a new cause which affects chiefly those among whom its results are most disastrous from the point of view of the nation and the race.

An able man and an able wife—a pair nearly sure to produce a high proportion of able offspring—too often regard the interests and duties, which their ability thrusts on them from all sides, as a reason or an excuse for restricting severely the number of their children, or for refusing the burden of parenthood altogether. For the last forty years the power of doing so has been changing slowly but surely the whole aspect of racial problems.

But, while we may give reasons to explain the comparative want of segregation of ability, it should be recognised that signs of partial segregation of ability are not totally wanting. At present, it is probable that selection is keenest and most effective in the professional class, and competent observers are to be found who believe that the average ability among the sons of professional men is higher than in any other class in the community.

During the eighteenth and early nineteenth centuries, there were frequent intermarriages between the leading political, administrative, and military families, and a statistical analysis of the entries in the "Dictionary of National Biography" gives us evidence of distinct accumulation of those special types of ability in the governing class during that period. The rarity of such accumulation in other cases may well be due largely to the want, in other sections of the nation, of distinct classes, corresponding to the different types of ability. If mates were naturally sought from within the limits of a definite class, access to which was more and more jealously guarded as its efficiency and ability increased, a similar and more marked segregation of ability might appear in other directions.

But Mr. Balfour saw another difficulty in the path of a selectionistic interpretation of social phenomena. As Dr. Archdall Reid has shown, disease is now one of the most effective selective agencies at work among mankind. By the early elimination of those specially susceptible to a given disease, the race is gradually becoming more and more immune to that special scourge. If we diminish the infection of the disease by improved sanitation and knowledge of hygiene, this process of immunisation will cease, and the race will revert to a more susceptible state. Hence, Mr. Balfour argued, no convinced selectionist should advocate improvement in our sanitary environment.

Doubtless, improvement in the environment has its dangers. It may keep alive to reproductive age many of weak physical or mental constitution, who would, for the sake of the race, be better out of the way. We shall guard against those particular dangers all the better for facing them with open eyes. But immunity from certain special and preventable diseases is not the highest quality of the ideal man. If we can guard against infection in other ways, it may well be that greater aggregate advance will be made when we can prevent the waste now incurred by nature in protecting the race against that particular disease. As our knowledge of inheritance, Mendelian or other, is increased, we may be able to point the

way to combining immunity from the disease with other valuable qualities. Meanwhile, it is unwise to lose the chance of preserving those other qualities, which may now be linked with susceptibility to the disease, for want of the sanitary precautions which advancing knowledge puts in our power. Thus the selectionist escapes from Mr. Balfour's dilemma, and may support with a clear conscience all efforts towards improvement in the environment, provided that it is fully realised that improvements in the environment alone will not necessarily improve the innate qualities of the race, any more than better cow-stalls will of themselves improve without limit our breeds of cattle, and, provided that all efforts are also made deliberately to encourage reproduction among the best stocks, and to discourage it among the worst.

But consideration of these general problems, interesting though they are, is not necessarily essential to the application of the principles of heredity to the treatment of destitution—the immediate object of the conference opened by Mr. Balfour's speech. Whether or no there is a general segregation of ability broadly between the upper and the lower classes in this country, it is undeniable that the ranks of the paupers contain a certain proportion of those who, mentally or physically, are hereditarily unsound. It is the fact that the differential birth-rate is telling in favour of the unsound as against the sound that is so sinister, even more so than its effect on the relative rates of reproduction of different social classes.

No one denies that many fall into reach of the Poor Law through no fault of their own. By seasonal unemployment, by movements of trade, by the pressure of temporary illness or economic misfortune, relief becomes necessary. To meet these cases, every attempt should be made to improve the organisation of the labour market, to obtain more effective education, to prevent blind-alley occupations for boys and girls. Such subjects met with their full share of consideration at the conference, and will always appeal with greater force to the philanthropist, who wishes to relieve immediate distress, and to the politician who wishes to capture votes by doing so.

But, as all those who administer the Poor Law with their eyes open know, these cases are but part of the problem. A large number of the occupants of our workhouses and prisons are congenitally defective in mind or body. Often, for the feeble-minded or unsound themselves, there is no hope of improvement, and, even in cases where, at great expense to the community, they can be taught a trade in special schools, as Mr. Balfour pointed out, their acquired characters will not be inherited, and their offspring will tend to reproduce their infirmities. The feeble-minded are specially prolific, and, in this time of a general fall in the birth-rate, are increasing relatively to the other sections of the community. Several years ago, a Royal Commission reported in favour of the compulsory and permanent care and detention of the mentally defective. That nothing has been done to carry out the recommendations of the Commission, in spite of the urgency of the case, is a standing disgrace to the Government and to the Parliament of this country. Were these unfortunates shielded from the degradation which follows their so-called freedom, and prevented from handing on their defects to future generations, this part of the problem of destitution would be solved, and a heavy burden of incompetence and pauperism removed once for all from the shoulders of the competent, who, there is now reason to fear, often restrict the number of their offspring to meet the increasing load of taxation required to support the inefficient members of the community.

Several of the special papers read to the sections of the conference dealt with the problem of mental defect as a cause of pauperism. On May 30 Dr. F. W. Mott and Dr. A. F. Treadgold dealt with the insane and the feeble-minded in their hereditary aspects. Dr. Mott pointed out the significance of the fact that a considerable proportion of the inmates of the London County Asylums were related to other inmates, while Dr. Treadgold gave evidence that feebleness of mind was more prevalent in the rural districts. It should be noted that rural districts which have specially been depleted by immigration to the towns seem particularly affected in this way. The worst strains get left, and the inbreeding of defective stocks intensifies the evil. Dr. Treadgold said that the real cause of the existence of a certain class of parasitic pauper was germinal defect, and emphasised the folly of allowing such a class to propagate freely. On Wednesday Sir William Chance pointed out that, whatever the cost of segregation, it would be repaid in a generation many times over by the saving in workhouses and prisons. Other papers on mental defect in its bearing on pauperism and crime were read by Mr. T. Holmes, Dr. C. H. Melland, Miss Mary Dendy, and Dr. F. Needham, while Dr. C. W. Saleeby spoke on the eugenic summary and demand.

Whatever be the effect of the conference on legislation or administration, it is impossible to follow its proceedings without perceiving that the thinking world is at last waking up to the fact that biological knowledge has an intimate bearing on sociology. The last few years have seen a great change in this respect, and, though much more is yet to be done, the future is full of hope. W. C. D. W.

PLAGUE.

THE recent epidemic of plague in northern China with its 60,000 deaths, is remarkable in two respects. First it was the most extensive manifestation of pneumonic plague in this pandemic; and, secondly, it was characterised by a more or less sudden cessation. It affords a warning as to the capabilities of the disease, and as to one of its possible developments, and although the outbreak has come to an end for the time being without any great efforts in the direction of prevention, yet it has demonstrated that the plague of the present day is as powerful for mischief and as capricious in action as that of any period in the past centuries. Arising in or close to eastern Mongolia, where the ordinary annual epidemics of plague have for many years shown a tendency to a comparatively high percentage of the pneumonic type, this influenzal form, shorn of the bubonic variety which has hitherto accompanied it and has been its predominant partner, appears to have been conveyed as early as October, 1910, to some of the more recent settlements on the Manchurian portion of the Trans-Siberian Railway.

The increasing mortality in these settlements did not attract any particular attention until December, when, in consequence of panic following an appreciation of the situation, there ensued a great exodus of the Chinese, both by rail and by road, to their homes in the more southern provinces of Shinking, Chili, and Shantung. To the infection thus carried far and wide the rapid and extensive dissemination of the disease and the formation of new centres may be traced. But the virulence and great mortality which characterised the epidemic in some places and its comparative harmlessness in others are not so readily explained. The cause or causes of these variations have always been, and still remain, a per-

plexing problem, and our knowledge regarding the vehicles of infection and the part played by animals, insects, and man in the spread of plague do not at present assist us in its solution.

From the information available it would seem that the early infected centres suffered severely, while those that were infected later suffered but little. Possibly their immunity was because they were infected later in the season, for the disease towards the end of February and beginning of March began everywhere to lose its strength and power of diffusion which could not be attributed to preventive measures. This is no new phenomenon with pneumonic plague, and it is one which is well worthy of close investigation. This occasional self-limitation of pneumonic plague independent of active measures in no sense justifies the conclusion that preventive measures are unnecessary and useless in this form of plague. On the contrary, measures taken earlier would have further curtailed the outbreak. Prompt and early action is important and urgent, because no one can tell when a pneumonic plague is self-limiting and may confine itself to a few villages, or when it may have the force of a pandemic and spread if unchecked from country to country.

While much attention has been directed to the mortality in Manchuria from the pneumonic variety of plague, the ravages of the bubonic form in India have not been noticed, and yet the mortality of the latter far exceeds that of the former. Since 1896, when the disease was imported into Bombay, there have occurred in India seven million deaths from plague. The mortality varies in different years. Some years it is greater and in others less, but never since the disease appeared in the country has any year been free of mortality. Two provinces have been affected more than the others. One is the Punjab, with a population of only twenty millions, the other the United Provinces of Agra and Oudh, with a population of forty-seven millions.

The plague deaths in these two provinces during the past twelve years have been as follows (statistical abstract relating to British India from 1899 to 1909):—

	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Punjab	255	572	14,959	171,302	205,462	396,357	334,891	91,712	608,685	30,708	35,655	152,387
United provinces of Agra and Oudh ...	7	135	9,778	40,223	84,499	179,082	383,802	69,660	328,862	22,878	39,394	139,328

In the Punjab the plague mortality increased from 255 in the year 1899 to 396,357 in 1904; then it declined for two years. In 1907 it rose to the enormous number of 608,685, and in 1908 and 1909 fell to a comparatively low figure. In the United Provinces of Agra and Oudh the mortality increased from 7 in the year 1899 to 383,802 in 1905; there was then a decline for one year, a rise to 328,862 in 1907, and a further decline in 1908 and 1909. Both in the Punjab and the United Provinces the deaths in 1910 have again risen, and the upward tendency is being continued in 1911, particularly in the United Provinces, as is shown by the following statement of the plague mortality in January, February, and to the week ending March 25th:—

Months	United Provinces	India
January	35,000	65,000
February	41,000	85,000
March	72,000	131,000
Total ...	148,000	281,000

In the first three months of 1911 the deaths from plague in India were 281,000, and in the United Provinces 148,000, which are respectively nearly five times and more than twice the mortality from the disease in China from October to March inclusive.

With this mortality in China and India it is difficult to realise that only twenty years ago plague was considered to be practically an extinct disease. True, it lingered in some of its old homes, but to such a small extent that it was hoped that even in these it would finally disappear. Now the whole position has changed. The slow but wide dissemination of the disease since it first attacked Canton in 1893 and Hong Kong the following year, and which has been followed by the infection of many countries in different parts of the world is one of the most remarkable and sinister events of the age. Its importance hitherto has not been connected with its mortality, for with the exception of China and India the deaths from the disease have been few, but it lies in the fact that every year the sowing of infection among susceptible and subterranean animals becomes more extensive, and that countries which have for hundreds of years been free of plague infection are no longer in that position.

The danger lies in the disease among animals being permitted to acquire a firm foothold wherever it may be, for the infection in such circumstances is difficult to eradicate. The insidious manner in which the infection gets imported into a country, the ease with which human cases have been hitherto dealt with, and the apparent difficulty the disease has in spreading, or even maintaining its hold, are apt to lull the suspicions of even the most wary. Thus with no immediate results forthcoming it is not surprising for it to be assumed that the twentieth-century civilisation has, so far as the West is concerned, deprived plague of its powers. It was to advancing civilisation the disappearance of plague from Europe was attributed, regardless of the fact that a similar disappearance had taken place in the East, and that recessions and long periods of rest from plague are matters of history. Plague, when it broke out in Bombay, had not been there for 184 years. Until then Bombay had prided itself on its sanitation, with its immense waterworks and drainage; and its external appearance was that of a fine and thriving city. But plague was the most informing sanitary inspector it ever had, and revealed the actual housing condition of the people, and it is just as likely, in due time and under favourable conditions, to visit the crowded and verminous slums of the cities of the West, where the "awakening of the insects" in the houses is as regular in season as that in China.

The disease is one which essentially affects the very poor, whose condition still make the cities of Europe vulnerable. It has always been called the poor man's plague. The one great advantage the West possesses over the East, which it did not possess in former times, is the power of trained organisation. It is on intelligent organisation based on scientific knowledge rather than on any great advance in the housing of the very poor in Europe that reliance will have to be placed to combat the disease and to secure safety from any great epidemic. In the meantime, in addition to systematic and continuous measures against infected animals in places where the disease has been imported, special attention requires to be directed everywhere against verminous houses and verminous people.

W. J. SIMPSON.

ON THE BLUE AND WHITE NILES.[1]

THE reorganisation of the regions of the Upper Nile after the destruction of the Dervish power and the steady growth of prosperity in every district has profoundly impressed all who have travelled in the Sudan. The history of these last twelve years' work has yet to be written, for the account of Mahdiism, by Sir Reginald Wingate, the present Governor-General, only dealt with the events which led up to the re-conquest of the country to the south of Wadi Halfa. Yacoub Pasha Artin, for many years Under-Secretary of State of the Ministry of Public Instruction in Egypt, does not attempt to provide such a survey, for which perhaps the time has not yet arrived, but has given us instead a series of delightful sketches of these lands, which are being more and more visited each year. Written in form of letters setting forth his daily experiences, his conversations with those he met, Europeans, Egyptians, or Sudanese, first impressions noted on the spot when all was fresh and vivid, this account of the regions of the Blue and White Niles is not only of interest but has a special value on account of the author's intimate knowledge of Oriental life and history.

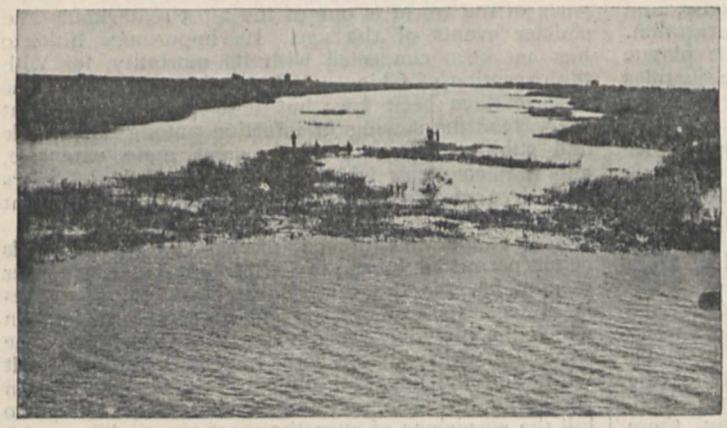

FIG. 1.—A "Sadd" on the River. From "England in the Sudan."

Starting early in November, Artin Pasha, accompanied by Prof. Sayce, was able to take advantage of the favourable flood of 1908 and reach Roseires, on the Blue Nile, by steamer; thence, returning to Khartoum, he traversed the White Nile as far as Gondokoro, on the northern frontier of Uganda, thus visiting the two main lines of communication and many of the stations on their banks. All attempt at a scientific account of the country is disclaimed, but indications appear frequently that the systematic study of the country and its resources is everywhere being carried on so far as means are available. Mention of the Department of Woods and Forests bears witness to this, for the demand made upon the trees on the banks of both Blue and White Niles for the steamer traffic can only be prudently met by careful conservation of the present supply. Inspectors have been appointed, and though difficulty was experienced at first in obtaining local labour, this has been overcome, and now funds alone put a limit to the conservation possible. Both here and on the White Nile forest fires constitute the greatest danger to the young growth, but even these are being to some extent controlled.

The efficiency of the present administration is dwelt upon, though mention is made of cases where the Oriental foot finds the Western shoe to pinch inconveniently. In the area occupied by Arab tribes the question of slavery outweighs all others. An Arab sheikh discussed it frankly with the author, laying down that Arab landowners were incapable by habit and custom of working their land themselves, that they have always had negro slaves as cultivators, and that losing the slaves ruin will stare them in the face. Such changes can but be made slowly, but with the present increasing prosperity of the country and the suppression of inter-tribal warfare, even the Arab tribes will shortly accommodate themselves to new conditions. The author is especially qualified to present the local opinion, but he rarely states his own view of the merits of the questions raised.

On the White Nile a short stay was made at Kodok (formerly Fashoda), where the pastoral tribe of Shilluks has its head-quarters, and descriptions of these interesting people are given. Under their own chief, the Mek, they have readily fallen in with the new *régime*, by which their tribal customs are respected, but retain the deepest hatred of those whom they call Turks, the slave merchants and slave-hunters of former days. Between this point and Gondokoro the Nile flows through a narrow valley plain, mainly occupied by marshes and lagoons, which provide the drift marsh vegetation, which at times is carried by wind and current into narrow channels or acute bends of the river, there to form a dense obstruction, the "sadd" proper. Loose application of this term to the region generally, to marsh vegetation, and to drifting vegetable matter, is to be deprecated, and even in the present account it is employed with some latitude. These obstructions have often been described, and Marno gave a very full account of them in 1880 and 1881. Though more understood to-day, the conditions which determine their formation are not controlable, so that during the late summer and autumn months, when rain and stormy weather prevail, constant care has to be exercised by the steamers passing up and down to remove any block that may be forming before it grows too solid. Among the illustra-

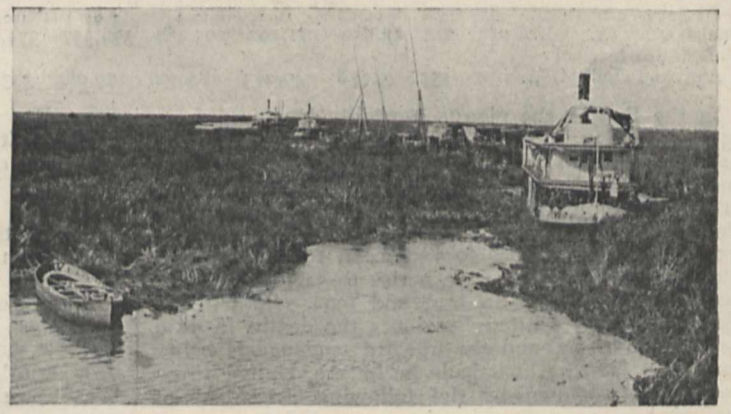

FIG. 2.—Stuck in the "Sadd." From "England in the Sudan."

[1] "England in the Sudan." By Yacoub Pasha Artin. Translated from the French of the author by G. Robb. Pp. xvi+251+map. (London: Macmillan and Co., Ltd., 1911.) Price 10s. net.

tions are two which are here reproduced by permission of the publishers. One shows a "sadd" sufficiently solid to check the flow of the river and form a lagoon; in the other both steamers and sailing boats have been brought up by a more compacted barrier of the same kind.

Khartoum is fully described, and the scientific work carried on at the Wellcome Laboratories is referred to. So many points of scientific interest are alluded to, having a bearing on various branches of knowledge, that we can only regret that the results have not a wider circulation and greater accessibility than is afforded by the annual official reports. The founder of the Wellcome Laboratory renders the results of its staff available, but in forestry, hydrography, and also in all that concerns the native races of the Sudan those who are working there are gaining data which have a value and importance beyond their own region. The illustrations greatly assist in forming an idea of the country described, but the map is not so satisfactory; it would be of more use if the modern place-names were correctly given and a consistent orthography employed.

H. G. L.

THE STRUCTURE OF HAUSALAND AND ITS NEIGHBOURHOOD.[1]

IF there is one point more than another which calls for the attention of the geologist in West Africa it is the position and age of the older sedimentary series, *i.e.* the beds between the presumably Archæan gneiss and the Cretaceous strata.

Such information as is available about these rocks, quartzites and argillites, grits and phyllites, is fragmentary, and obtained from a variety of sources throughout West Africa, often from localities where no recognised survey has taken place, and where the relations of the component rock groups are unknown.

On the western side of northern Nigeria we have such a sedimentary series frequently exposed, and with this Dr. Falconer, in his book, "The Geology and Geography of Northern Nigeria," has dealt at length. He regards these rocks as the scarcely altered representatives of a group of schists and sedimentary gneisses, termed the "softer" gneisses, because of their relatively low capacity for resisting erosion, and believes that they were deposited upon a surface of Archæan gneiss—the "hard" gneiss—and affected thereafter (*a*) by regional metamorphism, and (*b*) by folding.

It can scarcely be doubted that the quartz-schists and quartz-muscovite-schists of Kabba and Ilorin are the same as those of the Central Province of southern Nigeria, a correlation which can probably be extended to the rocks of the Eastern Province, and possibly—for the general character of these schists is exceedingly constant—to other parts of West Africa.

Dr. Falconer, who states his case with great fairness, has accordingly advanced an hypothesis of considerable importance, but it would have greatly aided the reader and enhanced the value of the work as a book of reference if some plates had been included showing the minute structure of the rocks.

The book is technical and solely for the geologist, and, though one would be loth to lose any of the excellent photographs with which the author has embellished his work, one ventures to think that in some instances microscopy might have taken precedence.

The granite intrusions (see Fig. 1) are pre-Cretaceous in age, and fall into two subdivisions: an older foliated, and a younger non-foliated group, which includes soda-granites. The pneumatolytic modification of some of these granites, as at Bukuru, has as a distinguishing feature cassiterite and sulphides of copper, zinc, and lead.

The Cretaceous beds, confined to parts of the valleys of the Benue and its tributary, the Gongola, fall into an upper and a lower series of grits and sandstones, divided by a limestone-shale series of Turonian age. It is interesting to note the presence of salt in the lower grit series, and of veins of galena and blende at Arofu, doubtless connected with a small inlier of granite near the town.

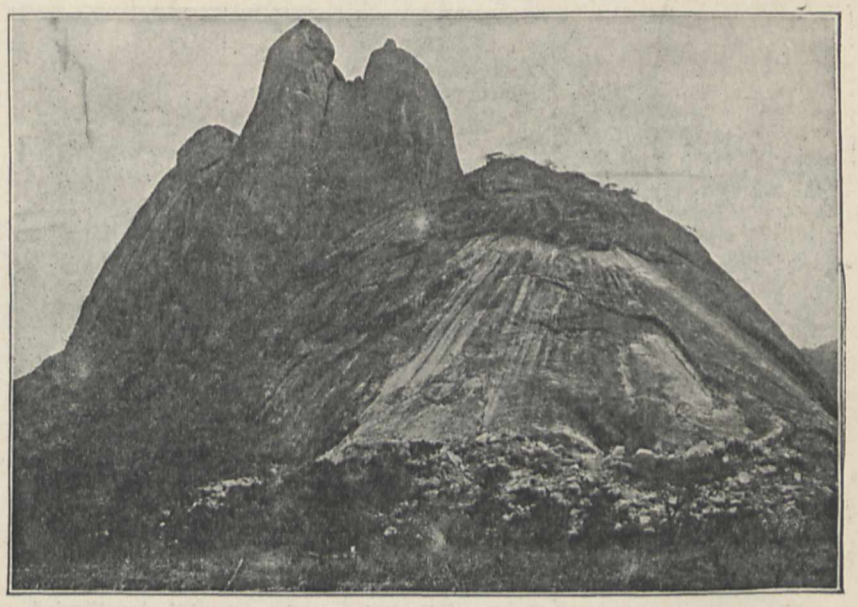

FIG. 1.—Exfoliation in the Kilba Hills. From "The Geology and Geography of Northern Nigeria."

Salt occurs in the north-eastern part of southern Nigeria, as do also galena and blende, which facts, together with the probable existence of Turonian beds in the same neighbourhood, suggest a general similarity in history.

In both Protectorates the Cretaceous beds are pierced by dykes and sills of dolerite.

Dr. Falconer lays some stress on the unconformity which he believes to exist between the Cretaceous and Eocene beds; and is worthy of note, in view of Mr. Kitson's opinion that a passage exists in southern Nigeria between the Mesozoic and Cainozoic.

There are three groups of Eocene beds in northern Nigeria, of which the western only has yielded fossils; the others are correlated with them on petrographical grounds, and on their position as regards the known Cretaceous.

Of these beds the first, especially around Sokoto, where limestones and calcareous clays and shales occur with efflorescences of alum and gypsum, is the most interesting; the beds of other localities consist largely of ferruginous sandstones and grits, types only too prevalent in either of the two Nigerias.

[1] "The Geology and Geography of Northern Nigeria." By Dr. J. D. Falconer, with notes by the late A. Longbottom and an appendix on the Palæontology of the Cretaceous Deposits by H. Woods. Pp. xv+295+24 plates. (London: Macmillan and Co., Ltd., 1911.) Price 10s. net.

These sandstones are unfossiliferous, and an absolute proof of their Eocene age must accordingly be wanting; but, *faute de mieux*, Dr. Falconer makes out an excellent case and presents his facts clearly.

The book concludes with chapters on "The Superficial Accumulations," "Tertiary Crustal Movements," and "Tertiary Volcanic Action," each worthy of the close attention of the student of African geology. Two periods of Tertiary volcanic activity are recognised, respectively middle Eocene and late Pliocene; to the latter are referred some excellently preserved puys (Fig. 2) developed in the Province of Yola, the middle Benue valley and on the Bauchi plateau.

The rocks of the earlier outburst are an interesting series of phonolites and nepheline-basalts, of which the conspicuous stumps of the Tangale Peak and the Wase rock may be taken as typical examples.

In regard to the late earth movements, one conclusion of general interest may be recorded here, viz., that the culmination of the Tertiary oscillation resulted in the formation of the Bauchi plateau and the establishment of the present river system.

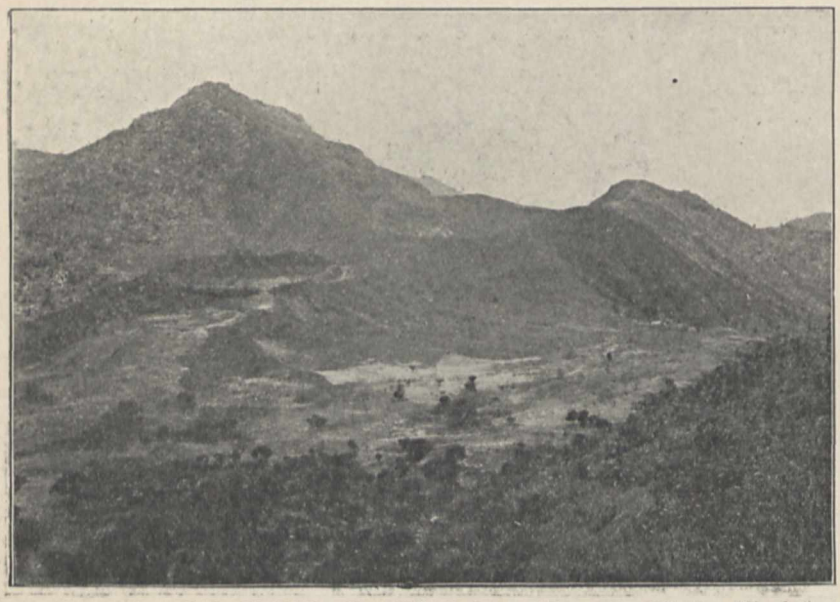

FIG. 2.—Craters in the Mboi Hills. From "The Geology and Geography of Northern Nigeria."

The Bauchi district is inseparably connected with the tin industry, and we could wish that Dr. Falconer had seen his way to more details, put in plain and concise phraseology, of the alluvium-containing cassiterite.

The sudden prominence into which the tin-mining industry has burst in northern Nigeria naturally leads the reader, in such a work as this, to expect authoritative information in a form to be readily assimilated.

Mr. Henry Woods has contributed an appendix on the palæontology, and the book as a whole is full of valuable information to the student; the geological map on a scale of 1 : 2,000,000 is indispensable to those interested in the structure of this part of Africa.

As Dr. Falconer himself readily admits, his work may require some modification in the future, but all who are acquainted with the difficulties of the African pioneer will give him full measure of praise for the results he has attained. In such circumstances to quibble over detail is an ill task, but the first chapter on the "Physical Geography" might be compressed and summarised with advantage to the general reader, and perhaps many will find a too great elaboration of detail throughout the work. JOHN PARKINSON.

DR. HARRY BOLUS.

THE name of Dr. Harry Bolus is closely associated with the story of South African botany for the last forty years. In April, 1874, a letter to Sir Joseph Hooker was read at a meeting of the Linnean Society, of which Bolus had recently been elected a fellow (December 18, 1873), in which he criticised Grisebach's limitation of the Cape and Kalahari floral provinces (see Journ. Linn. Soc., xiv.). This was the beginning of a series of publications embodying the results of his observations on the flora of a peculiarly rich and attractive botanical area. In 1886 Bolus wrote for the official handbook of the Cape of Good Hope a valuable "Sketch of the Flora of South Africa," in which he proposed a series of natural botanical divisions, forming, roughly, successive zones from the coast northwards. From 1881 to 1889 he communicated to the Linnean Society a number of contributions to South African botany, containing critical notes on various genera and species, as well as descriptions of many novelties; but it was to the heaths and orchids that he was especially devoted. The results of his study of the large and intricate genus Erica are found in his monograph (in part of which he had the help of the late Prof. Guthrie) in the "Flora Capensis" (vol. iv., sect. 1, issued in 1905), where the 469 species are described in detail, and arranged under forty-one sections.

In his volumes on South African orchids, Dr. Bolus has established a model of detailed description and illustration; accompanying each species is a plate, drawn by Dr. Bolus himself, in which a judicious combination of outline and colour gives exactly what is wanted by the botanical student. Dr. Bolus had just completed this important work at the time of his death, which occurred on May 25, when on a visit to England. Mention should also be made of the excellent series of specimens illustrating the Cape flora, by the distribution of which to various great herbaria Dr. Bolus brought his collections within reach of a large number of students of systematic botany. An account of his services to botany would be incomplete without a reference to his generous support of the Cape University, which owes to him the foundation of its chair of botany; and Dr. Bolus himself would have wished some acknowledgment to be made of the help which he received in all his later work from his niece and pupil, Miss Louisa Kensit. A. B. R.

NOTES.

THE Croonian lecture of the Royal Society will be delivered on June 15 by Prof. T. G. Brodie, F.R.S., on "A New Conception of the Glomerular Activity."

ON Tuesday, June 13, Prof. Ernst Cohen, of the University of Utrecht, will give an illustrated lecture before the Faraday Society on "Allotropic Forms of Metals." Prof. T. W. Richards, of Harvard College, has been invited to take the chair on this occasion. Applications for tickets should be made to the secretary, 82 Victoria Street, London, S.W.

PROF. A. WILLEY, F.R.S., of McGill University, Montreal, has directed our attention to the inclusion in his article "Amphioxus" in the eleventh edition of the "Encyclopædia Britannica" of two cuts (Figs. 2 and 3) which, though described there as "original," and therefore inferentially as drawn by himself, are really reproduced from Sir E. Ray Lankester's article "Vertebrata" in the ninth edition. We understand that these illustrations of amphioxus were added to Dr. Willey's article without his knowledge by the editor of the zoological section of the eleventh edition, in accordance with his scheme for the reorganisation of the whole series of articles; but, by an oversight, the description "original" was not altered to "Lankester," as it should have been. We have received a letter from the editor-in-chief regretting the error, which will now be corrected, and making it clear that Dr. Willey himself is not responsible for what might appear to ignore the original work of another distinguished zoologist.

THE fine collection of African birds formed by the late Mr. Boyd Alexander, and bequeathed by him to the Natural History Museum, has now been handed over to that institution by his executor, Mr. Robert Alexander. The collection includes the birds obtained by Mr. Alexander during his expeditions to the Cape Verde Islands, the Zambezi and Kafue Rivers, the Gold Coast Hinterland, and the Island of Fernando Po, as well as those secured during the Alexander-Gosling expedition in 1904–7 from the Niger to the Nile. The collection includes, also, all the specimens obtained during his last journey to the islands of San Thomé, Principe, and Annobon, in the Gulf of Guinea; on the Peak of Cameroon and mountains to the north; and in Wadai up to the time of Mr. Alexander's death. This bequest to the Natural History Museum is of great value, for it supplies beautifully prepared skins and complete series of the avifauna of islands and countries hitherto very imperfectly represented in the national collection of birds. The present collection comprises nearly 4000 bird-skins, and includes the type-specimens of no fewer than eighty species described for the first time by the late Mr. Alexander in his papers published in *The Ibis* and elsewhere.

WITH the object of promoting and systematising chemical work of general importance to all engaged in the development of that science by research or by teaching, an International Association of Chemical Societies has been formed as the result of a conference of delegates from the chemical societies of England, France, and Germany, held in Paris on April 25 and 26. The three leading societies of the countries named had been invited by the president of the Chemical Society of France to cooperate in this movement and to nominate delegates to represent their respective societies at the inaugural meeting. The representatives of the Chemical Society of London were Prof. P. F. Frankland (president), Prof. Meldola, and Sir Wm. Ramsay. The Chemical Society of France was represented by Profs. Béhal, Haller, and Hanriot, and the German Chemical Society by Profs. Jacobson, Ostwald, and Wichelhaus. With the exception of Prof. Meldola, who was unable to attend, all the delegates were present at the opening meeting, when the association was formally founded and the statutes framed and adopted. From these statutes we learn that the objects of the association are to be promoted by the appointment of committees charged with the consideration and investigation of questions submitted by the council, by the publication of the results of such investigations, and by the holding of conferences and congresses. It was decided at the opening meeting that the first international committees should be appointed for dealing with the questions of nomenclature in mineral and organic chemistry, and with the unification of the modes of stating physical constants. The next meeting of the association is to be held in Berlin on April 13, 1912, with Prof. Ostwald as president, and the 1913 meeting is to be held in Great Britain.

THE death is announced, at seventy-two years of age, of Dr. A. E. Törnebohm, the Swedish geologist.

THE twenty-second annual conference of the Museums Association will be held at Brighton on July 10–15 under the presidency of Mr. H. M. Platnauer.

THE President of the Board of Education has appointed Mr. H. H. Thomas to succeed Dr. J. S. Flett as petrographer to the Geological Survey of Great Britain.

PROF. JOHANNES HARTMANN, professor of astronomy at Göttingen and director of the University observatory there, has been appointed, says *Science*, director of the Argentine Observatory at La Plata.

MR. A. J. WILMOTT, late scholar and Hutchinson student of St. John's College, Cambridge, has been appointed an assistant in the department of botany of the British Museum (Natural History). Mr. Wilmott will devote himself especially to the European and British collections.

DR. IRVING has found the remains of another horse at Bishop's Stortford. As the bones were lying under some 6 feet of peat along with those of a small ox of the *Bos longifrons* type, it may be provisionally assumed they belong to the Neolithic age.

AT the recent annual meeting of the Paris Society of Friends of Science, Prof. M. L. Joubin, the general secretary of the society, announced that during the preceding year 80,000 francs had been distributed to men of science and their families who were in need.

THERE will be a meeting of the Biochemical Club at the Rothamsted Experimental Station, Harpenden, Herts, on Saturday next, June 10. The director and staff of the station have kindly consented to conduct members round the various plots in the morning and in the afternoon. The honorary secretary of the club is Mr. R. H. Aders Plimmer, University College, Gower Street, W.C.

THE death is reported of Mr. Samuel Hubbard Scudder, the veteran American naturalist, in his seventy-fourth year. Nearly fifty years ago he was a museum assistant to Louis Agassiz. He subsequently held various posts in connection with the Boston Society of Natural History, the Harvard University Library, and the U.S. Geological Survey. He had a wide reputation as an entomologist, particularly on account of his numerous volumes on butterflies.

IN a recent letter to *The Times*, Prof. Marcus Hartog directs attention to the fact that there is no provision made in the new Copyright Bill in reference to reproduction on lantern-slides for teaching by recognised teachers. He points out that an actual researcher is usually gratified at the implied recognition of his work when it is utilised by others, and that permission to copy the figures in original papers is not, as a rule, asked for, save, perhaps, as a matter of form. But with reference to standard textbooks there seems to be much doubt. Prof. Hartog asks, "Would it not be possible to insert a clause specifying that unless the right were expressly reserved, no prosecu-

tion would lie for the making, obtaining, and using of lantern-slides taken from a publication by or for a recognised teacher for class demonstration or the illustration of a paper before a learned society?"

AN appeal against the use of the New Forest for military manœuvres, signed by a large number of distinguished zoologists, botanists, ornithologists, entomologists, and other naturalists, appeared in *The Times* of June 2. The appeal, after referring to the use of the New Forest in this way in May, points out that May and June are exactly those months of the whole year in which non-disturbance is of vital importance to the birds, insects, and plants which give to the New Forest its unique interest, not only for men of science, but for all educated persons who take an interest in natural history. The damage done by bodies of troops during this period must inevitably result in a destruction of the wild life of this area that can never again be repaired. The signatories recognise that manœuvres must be held, but express the wish that wild tracts of country other than the New Forest might be utilised for the purpose; and, if this cannot be, that future manœuvres may at any rate be deferred until after July 15, when less harm would be done.

A SPELL of exceptionally bright and warm weather was experienced over the British Isles at the close of May and at the beginning of the present month, and some exceptionally high temperatures for the time of year have occurred. For thirteen consecutive days, from May 25 to June 6, the shade temperature at Greenwich exceeded 75°, and on June 5 the thermometer registered 84°, which is 1° warmer than any previous reading on the corresponding day since 1841. A heavy thunderstorm occurred in and around the metropolis on May 31, when the rainfall at Greenwich measured 1·0 inch and at Epsom 2·86 inches, of which 2·44 inches fell between 5.20 p.m. and 6.10 p.m. The summary of the weather for the week ending June 3 issued by the Meteorological Office shows that extreme temperatures of 80° and above occurred during the period in nearly all parts of Great Britain, whilst the mean temperature for the week was largely in excess of the average over the entire kingdom, the excess amounting to 9·9° in the west of Scotland to 8·4° in the north-west of England, and to 8·2° in the south-west of England. The bright sunshine exceeded 70 per cent. of the possible duration in nearly all districts. May was exceptionally bright and warm, and at Greenwich the mean temperature was 5° above the normal, whilst on fifteen days the shade thermometer exceeded 70°, and on five days towards the close of the month the thermometer in the sun's rays exceeded 140°. The aggregate rainfall for the month was 1·88 inches, of which 1 inch fell on May 31, and in all rain only fell on nine days. The duration of bright sunshine was 212 hours, which is twenty-five hours more than the average.

THE death is announced of Dr. J. C. Oman, author of several books on Indian customs and beliefs, at seventy years of age. From *The Times* we learn that in 1877 Dr. Oman joined the staff of the Lahore Government College as professor of natural science. In the Punjab capital, where he remained for twenty years, he won the esteem and regard of a great number of Indians of all castes and creeds by his sympathetic interest in their doings. When he retired from the Government service he was appointed to the principalship of the Khalsa (Sikh) College at Amritsar, and held the position for two years. His first book, "Indian Life, Religious and Social" (1889), was also, in a much revised and enlarged form, his last, for three years ago it was again issued under the title of "The Cults, Customs, and Superstitions of India." Among his other works are "The Great Indian Epics," which was included in Bohn's Standard Library, "Mystics, Ascetics, and Saints of India," and "Brahmans, Theists, and Muslims of India." Dr. Oman was a Fellow of the Linnean Society; and in recognition of his contributions to Indian ethnology, the degree of D.Litt. was conferred upon him by the Punjab University.

IN connection with the recent discovery of remains of Palæolithic man in Jersey, the elaborate monograph by MM. M. Boule and R. Anthony on the skull found at La Chapelle-aux-Saints, published in the March-April issue of *L'Anthropologie*, is of more than ordinary interest. The morphological characteristics of this specimen are very remarkable, and in its simian type it is intermediate between man and the anthropoids. The writers thus record the result of their examination:—"L'encéphale de l'Homme fossile de la Chapelle-aux-Saints est déjà un encéphale humain par l'abondance de sa matière cérébrale. Mais cette matière manque encore de l'organisation supérieure qui caractérise les Hommes actuels."

THE question of the existence of that strange birth rite known as the Couvade among the Basque race has been again raised in correspondence in the March-April issue of *L'Anthropologie*. It is now denied that any word in the Basque language describes the practice, which is said to be opposed to the national family system. On the whole, while the extent of the area in which the practice has been alleged to prevail may have been overstated, its existence in certain districts seems to be certain. In view of the rapid modification of national customs now in progress, the writer with some force appeals for a complete re-examination of the question so far as it affects the Basque people.

THE July-December (1910) issue of the Journal of the Royal Anthropological Institute, which has recently made a rather belated appearance, is full of interesting matter in connection with the problems of early man. Prof. Boyd Dawkins issues his Huxley lecture on the arrival of man in Britain in the Pleistocene age, in which he confirms his original theory, published in his book on "Early Man in Britain," issued in 1880. He still believes that the cave men have handed down their culture to the Eskimo by means of the post-Glacial hunters in northern Asia. He now so far modifies this theory as to suggest that the facts do not, as he originally supposed, imply identity of race; it may have been brought about by tribes of different race. This must, he imagines, remain an open question until we have more evidence than we now possess of the Palæolithic hunters of Siberia, as well as more evidence from the caves of Europe.

IN the July-December (1910) issue of the Journal of the Royal Anthropological Institute Dr. J. H. Anderson, a promising recruit to the school of physical anthropology in Australia, subjects to a searching analysis the existing formulæ for the estimation of cubic capacity in the living, and gives the results of a series of experiments on the actual capacity as determined by the displacement method. This he follows up by a paper of more general interest on the proportionate contents of the skull as demonstrated from an examination of forty Caucasian crania received from the metropolitan hospitals and benevolent asylums of the City of Melbourne. The results are that the brain volume probably decreases with advancing age; that the variation in the volume of the brain is compensated by

an inverse variation in the amount of cerebro-spinal fluid present; and that the dura mater does not vary in proportionate volume with increasing age, but remains constant with a volume from about 4·5 to 5·5 per cent.

IN *The Malaya Medical Journal* for April (vol. ix., part ii.) Mr. E. D. Whittle directs attention to what is undoubtedly a description of sleeping sickness published in 1721. It is by a surgeon of the Royal Navy named John Atkins, who in that year sailed to the Guinea coast, and subsequently published a book, "The Navy Surgeon," in 1732, which in an appendix contains a chapter on "the sleepy distemper." This is probably the earliest account of the disease that has yet been found.

IN the Bulletin of the Johns Hopkins Hospital for April (xxii., No. 241), Drs. Margaret and Warren Lewis record experiments on the growth of embryonic chick tissues in artificial media. The medium which gave the best results consisted of a mixture of Ringer's saline solution with a little agar and bouillon. In this a fragment of liver from a nine-day-old chick embryo enlarged to four times the original size in forty-eight hours, and the cells of the tissue radiated and migrated into the media and showed all forms of mitotic figures.

IN a lecture delivered to the Manchester Clinical Society on the life-history function and inflammation of the appendix (and now issued in book form), Mr. E. Comer points out that appendicitis first became frequent in America at a time more or less contemporaneous with the preparation of flour in steel roller mills; in England the disease approximately dates from the introduction of this milled American flour, and among the blacks in America it similarly appeared when the milled flour became so cheap that it was simpler for them to buy their bread than to take the trouble to prepare their own. It is a curious coincidence if nothing more.

IN a circular (No. 110) issued by the United States Department of Agriculture on food customs and diet in American homes, the author, Dr. Langworthy, points out how frequently erroneous statements regarding food and diet are made. Thus it is commonly said that the Chinese and other Oriental races live on a few handfuls of rice a day. Actually, rice with them takes the place of wheat with us as the chief source of starchy food, and is largely supplemented with other food-stuffs. Likewise, if due allowance be made for difference of body-weight, the American professional and business men and Japanese of similar employment consume a diet very similar in amount of protein and number of calories of available energy.

IN No. 1828 (vol. xl., pp. 429–33) of the Proceedings of U.S. National Museum Mr. R. L. Moodie describes a third specimen of a salamander (*Eumicrerpeton parvum*) from the Carboniferous of Illinois in which the intestinal tract is preserved. The new specimen is larger and more developed than either of the other two. All three appear to be females, and not one shows any traces of branchiæ. In the new specimen the intestine is longer and more convoluted than in the others, lying in five longitudinal folds and ending in a cloaca, near which are impressions of two glands, provisionally regarded as the terminations of oviducts. Eumicrerpeton is a member of the Branchiosauria. Mr. Moodie also describes a microsaurian from the same formation, referred to the genus Amphibamus, as *A. thoracatus*.

A NOTE on the flowering of *Davidia involucrata* in Messrs. J. Veitch's Coombe Wood nursery, communicated by Mr. W. J. Bean to *The Gardener's Chronicle* (May 27), supplies some details regarding this unique monotypic genus, which is placed in the same family with Nyssa, but is not very closely related. The solitary pendulous flower, produced terminally on the branch, has two showy white bracts which subtend a conical receptacle bearing numerous stamens; arising out of the centre of the receptacle is an egg-shaped ovary surmounted by a few apparently barren stamens and several stigmas. The tree now flowering was raised from seed ten years ago, and has meantime reached a height of 14 feet; root pruning in the winter of 1909 may have induced premature flowering.

A MEMORANDUM compiled by Mr. F. Booth-Tucker with the object of promoting the more extensive planting of Eucalyptus trees in India has been issued as Bulletin No. 21 of the Agricultural Research Institute, Pusa. Failure in the past being attributed to the selection of unsuitable species, the chief object is to provide a list of suitable species and to indicate the conditions required individually. The species *amygdalina* is strongly recommended, both on account of its hardy nature and also for its economic value; *globulus*, the blue gum, requires a tolerably even climate such as that of the Nilgiris; *marginata*, jarrah, is only suitable for humid regions near the coast; *goniocalyx* is recommended for general forest cultivation.

IN connection with the dispersal of fruits and seeds by ocean currents, the example most commonly quoted is that of the coconut, and the coconut palms growing on Krakatau since the eruption are attributed to this agency. This opinion has been previously combated by Dr. O. F. Cook, and he returns to the same charge in a recent number of the Contributions from the United States National Herbarium (vol. xiv., part ii.). His evidence is first directed towards refuting de Candolle's views pointing to the original home of the plant in the Old World, and controverting arguments, amongst others, are taken from a manuscript published in 1625, and the description by Cieza de Leon in the sixteenth century. Then, proceeding from the fact that all other species of Cocos and all species of closely allied genera are natives of South America, the author submits the argument that the coconut palm is a native of inland temperate plateau regions in South America, for which contention notes and illustrations are supplied of coconut palms growing in inland districts in Guatemala.

GEOGRAPHICAL distribution and morphological modifications developed in species of Pelargonium form the subject of a paper by Dr. R. Knuth published in Engler's *Botanische Jahrbücher* (Beiblatt No. 103). The genus, comprising about 250 species, is almost entirely confined to Africa, where the chief centre of distribution lies in the extreme south-west. Annuals are few in number and confined to one section; they are characterised by having a short spur. Modifications are most pronounced in the perennials, and are mostly of a xerophytic nature. A string of tuberous thickenings—starch storing—are occasionally formed on the underground stem, and in *Pelargonium moniliforme* several such nodosities lie one above the other. In *P. squamulosum* an apparent collar is produced by the shrinkage of the cortex. In other cases the thickening occurs on the lower aërial portion of the stem, as in the section Otidea, and serves for water storage. Woody development of the petioles becomes most evident when the blade falls away and the petiole persists as a spine, as in *P. spinosum*.

DR. MILBURN has recently issued his reports on field trials with oats, mangolds, and nitrogenous manures carried out at various centres in Lancashire. The work is still in progress, but it was thought advisable to publish the available information for the benefit of farmers during the coming season. Demonstrations of this kind have been found of considerable benefit to the farmer, as they deal with problems that he cannot solve by himself, but that affect his profits considerably.

THE South African Association for the Advancement of Science issues each month *The South African Journal of Science*, containing original papers by its members, and notes extracted from other sources. No. 5 of the Journal contains an account by Messrs. Lundie and Hallack of seaweeds as manure, illustrated by several analyses of South African seaweeds. A new Cape thermal chalybeate spring is described by Mr. Rose; it contains 1·7 grains of ferrous carbonate and 25·7 grains of sodium chloride per gallon, and has a temperature of 129° Fahr. It is being exploited for curative purposes. There is also an article by Profs. Gilchrist and Thompson on the Cape klip-fishes (Clinus).

THE value of nicotine as an insecticide has long been recognised. A wash containing one ounce in ten gallons of water kills many of the worst insect pests that trouble the fruit- and hop-grower, including the apple sucker (*Psylla mali*), all kinds of aphides (Aphididæ), thrips or thunder-flies (Thripidæ), the larvæ of the winter moth (*Cheimatobia brumata*), and most young caterpillars. But unfortunately nicotine is too expensive for common use at present, and its price seems likely to rise, since it is now in demand for sheep-washes; the only hope for a fall in price is the more extended cultivation of tobacco. Experiments by Mr. Garrad at the Wye Agricultural College indicate that coarse varieties of tobacco can be grown here to produce nicotine at a rate much below the present market price.

The Agricultural Ledger, No. 3, issued from the Indian Government printing office, contains an account of the soya bean in India, by Mr. David Hooper, of the Indian Museum, Calcutta. Although the crop is not indigenous to India (its home being the extreme east of Asia), it has long been cultivated by certain hill tribes, mostly of Mongolian origin. Only recently, however, have any attempts been made at cultivation on the large scale, and it is not yet clear how far it is likely to succeed. Mr. Hooper points out several advantages of the crop: it is highly nitrogenous, and is therefore a valuable article of human diet in rice-eating countries; it can be made into certain food preparations—the Japanese make a soy-bean milk, a soy-bean cheese, and the shoyu sauce—and it also constitutes excellent cattle food, either in the unripened state as hay or as an oil cake. Numerous analyses of samples of the beans grown in India are given.

AN insect pest known as the froghopper has for some years been a source of serious trouble to the West Indian sugar planters. Not only does it cause a reduction in the weight of cane per acre, but it also adversely affects the quantity of sugar per ton of cane and the purity of the juice. The insect has now been identified by Mr. F. W. Urich as *Tomaspis varia*, Fabr., and a complete account of present knowledge of its life-history, its effect on the cane, and methods of control is given by Dr. L. H. Gough in Bulletin 67 of the Department of Agriculture for Trinidad. In the same publication Mr. Urich describes the cacao thrips (*Heliothrips rubrocinctus*, Giard), and gives some well-drawn coloured illustrations of the insect and the damaged pods and leaves.

AMONG various useful items contained in the meteorological charts of the North Atlantic and Indian Oceans for the month of June, issued by the Meteorological Committee, there is an interesting article on the phenomenon known as St. Elmo's Fire or corposants (*corpus sanctum*), the harmless luminous electricity of low intensity seen sometimes at night on ships' masts, &c., during unsettled weather. Many examples of authenticated experiences in olden and modern times are quoted, *e.g.* one by Columbus in October, 1495, during a severe storm. It was then assumed that the light emanated from the saint's body, and was a sure sign that the gale was at its maximum. In Dampier's time, 1687, a display was also accepted as a favourable omen, but in this case proved to be misleading, as the force of the wind continued to increase. The phenomenon is not unfrequent on land; it was quoted by Cæsar and others. On the summit of Ben Nevis the observatory was at times ablaze with it; the observers were not in any way inconvenienced, except by a slight tickling sensation in head and hands. Its behaviour furnishes an illustration of the elementary principle relating to the action of points on electrified bodies.

As an abstract from the *Jahrbuch de Hamburgischen wissenschaftlichen Anstalten*, vol. xxvii., we have received a brochure in which Dr. B. Walter describes and discusses a number of photographs of lightning. These photographs were taken in pairs, simultaneously, one plate being exposed in a stationary camera, the other in a camera which was moved by clockwork at a known rate. In the case of a single discharge, both plates register, of course, the same form, but in the frequent event of several subsequent flashes travelling down the lane of air ionised by the first discharge, the several flashes are seen separately; knowing the rate of angular motion of the moving plate and the focal length of the objective, it becomes a simple matter to determine the intervals of time separating these several flashes. On the five plate reproductions accompanying Dr. Walter's paper, such multiple flashes, sometimes occurring with single discharges from the same cloud, are clearly shown. For one of the sets of multiple discharge shown Dr. Walter finds that the time-intervals between five flashes taking the same path were 0·038s., 0·110s., 0·163s., and 0·080s., making a total duration of 0·391s. for the whole discharge. Dr. Walter considers a number of such cases, and deduces valuable results concerning the nature, intensity, and duration of the various forms of discharge.

THE special facilities which Prof. Raoul Pictet possesses in his laboratory at Berlin for carrying out experiments on low temperatures justify the interest with which the account he gave of his work at the meeting of the Royal Society of Arts on May 17 has been received. The experiments cover a wide field, but they centre round the fact that chemical processes which take place with freedom at ordinary temperatures are completely stopped at low temperatures, and for each process a temperature can be found for which it is just possible for it to occur. The determination and tabulation of these temperatures would, in the opinion of Prof. Pictet, constitute an important advance towards a dynamical theory of chemical processes. Such a theory, he points out, was published by him in the *Archives des Sciences phys. et Nat.* thirty-two years ago. It is founded on the definition of temperature as the mean amplitude of the vibratory oscillations of the molecules of a body, and of specific heat as the mean attraction of the body on the molecule. By means of these definitions he arrives at the conclusion that all physical and chemical phenomena can be accounted for by the existence of two distances apart at which two attracting masses will be in

stable equilibrium, and a third intermediate distance at which they are in unstable equilibrium. As Prof. Pictet's definitions differ so materially from those generally accepted at the present time, and his method of deduction is not very conclusive, or even at times clear, the theoretical portion of his address falls far behind the experimental in point of interest and importance.

THE launch of the *Titanic* took place at Belfast on May 31, and forms the subject of an illustrated article in *The Engineer* for June 2. The arrangements for launching were similar to those of the *Olympic*, and the ship took sixty-two seconds from the first movement until she was afloat. The launching weight was 25,000 tons. The hydraulic rams fitted in order to start the ship were not requisitioned. We understand that the *Olympic* has completed most satisfactory trials, and has been handed over to her owners a month before her time.

Engineering for June 2 contains an illustrated description of the yacht *Progress*, fitted with 100 indicated horse-power gas engine and produced and owned by the Empire Oil Engine Syndicate, Ltd., of London. Owing to the cost of oil fuel in many parts of the world, it seems certain that marine internal-combustion engines must be capable of using gas derived from ordinary coal. The engines of this yacht are on the two-cycle double-action principle, driving the propeller direct without the interposition of any gearing. The gas supply is from a suction producer, which has been worked with anthracite, with coke, and with coalite. The patentees are convinced that their accumulated experience will enable them to supply a producer capable of working satisfactorily with ordinary steam coal. The engines are so arranged as to secure great ease in manipulation; as instancing the handiness of the engines, it may be stated that, on coming out of dock on one occasion, twenty-six different movements were made in the course of twenty-one minutes. The time taken to reverse has been found to be from three to four seconds after the order is given. It is intended to build a second engine to develop from 350 to 400 horse-power, and a corresponding gas plant, in both of which a number of improvements in detail will be embodied. This plant will be fitted on board a vessel of the commercial type.

A "GRAPH TEMPLATE," designed by Mr. J. T. Dufton, by means of which standard rectangular hyperbolas and parabolas of large size can be drawn readily on squared paper, has been put upon the market by Messrs. Macmillan and Co., Ltd. The price of the template in transparent celluloid, with instructions, is 6*d.* net, and in nickel-plated metal 3*d.* net.

BY a printer's error, the inscriptions of the two illustrations from "Kearton's Nature Pictures" reproduced in last week's NATURE (p. 450) were unfortunately transposed.

OUR ASTRONOMICAL COLUMN.

NOVA SAGITTARII No. 4.—Circular 164 of the Harvard College Observatory announces the discovery of yet another nova in the constellation Sagittarius. This object was found by Miss Cannon during a rapid comparison of various photographs of the Harvard Map of the Sky on Map 43. It appears on eleven photographs taken between May 22 and July 9, 1901, but no trace of it can be found on 148 other plates taken in 1892, 3, 5, 6, 7, 8, and 9, and each year from 1900 to 1910 inclusive; each of these shows the C.D.M. star $-27°12411$, of magnitude 9·7, with which the nova at its maximum was equal in photographic magnitude. The exact date of the nova's appearance cannot be fixed, but the greatest observed brightness was 10·3 on May 22, 1901, and it is not shown on a plate taken on April 10, 1901, although this plate shows a fourteenth-magnitude star 0·3′ south of the nova. The fluctuations of brightness appear to be somewhat similar to those of Nova Persei (2). It is of interest to note that seven novæ are now known to have appeared in the region covered by Map 43.

THE MECHANICAL PRODUCTION OF THE STREAMERS SEEN IN THE SOLAR CORONA.—In order to test the theory that the shapes of observed coronal streams may be accounted for on the assumption that they are the natural production of certain defined mechanical forces, Prof. J. A. Miller examined the excellent series of corona photographs now available at the Lick Observatory, and he publishes the results of his discussion in No. 4, vol. xxxiii., of *The Astrophysical Journal*.

If the streamers are formed of particles ejected from the sun under the influence of the solar rotation, of the attraction and of the radiant pressure of the sun, certain shapes should theoretically ensue, and the velocity and direction at any point of the stream can be calculated. Prof. Miller has done this, and finds that not only do the observed streamers largely conform with his theoretical results, but he is able to compute and draw theoretical streamers, for the conditions obtaining at any one eclipse, which agree with those actually observed. Various modifications occur, but may be accounted for by reasonable assumptions of modified conditions; for example, the particles at the end of a stream are probably finer than those at the base, and therefore the sun's radiant pressure would act more strongly on them, or it may be that the particles of a stream are moving in a resisting medium which is denser in the inner than in the outer corona, and each of these causes would produce the differences observed between the computed and the observed results.

THE GENERAL PERTURBATIONS OF EROS.—A lengthy discussion of the general perturbations of the planet Eros is published by Herr H. Samter in No. 4498 of the *Astronomische Nachrichten*. The author tabulates his results for the combined perturbations by Jupiter, Saturn, and Venus, which were easily determined by Hansen's method, and in further tables gives the results of the earth's perturbations and those of Mars.

DETERMINATION OF THE APEX.—From the study of 620 stars having large proper motions, Dr. A. Wilkens has made a new study of the position of the apex. The stars are given in the Wilkens catalogue of 620 stars between 29° 50′ and 35° 10′ N., for 1875, and the Leyden A.G. catalogue, and include 267 having proper motions of $0''$–$5''$; 173, $5''$–$10''$; 76, $10''$–$15''$; 35, $15''$–$20''$; and 69 greater than $20''$ per century. They also include 233 stars brighter than 8·5, but mostly fainter than 7·5, mag., 282 between 8·5 and 9·0 mag., and 105 fainter than the ninth magnitude. The resulting value for the position of the apex is $A=286°$, $D=+37°$, which is in good agreement with most modern estimations (*Astronomische Nachrichten*, No. 4499).

THE SPECTRA OF COMETS.—Visual observations of the spectra of comets 1908 III. (Morehouse), 1909*c* (Halley), and 1910*a*, are recorded by Herr von Konkoly in No. 4499 of the *Astronomische Nachrichten*. Bands were measured at 561·0 $\mu\mu$, 544·0 $\mu\mu$, and 515 $\mu\mu$ in the spectrum of 1908 III. on September 18, 1908, their respective intensities being 0·4, 0·6, and 1·0; the same bands were seen on September 22, but the wave-length in each of the last two was 1 $\mu\mu$ less. The red end of the spectrum was much brighter than the violet, and of the band at 470 $\mu\mu$ there was no trace.

Halley's comet on February 12 and May 26, 1910, gave a faint spectrum in which the same bands, with slightly varying wave-lengths, were seen. With a larger instrument, two other bands at 586·0 $\mu\mu$ and 472 $\mu\mu$ were seen, and possibly a third at 482 $\mu\mu$. The bands were very bright while the continuous spectrum was abnormally faint. From nineteen separate observations, the wave-lengths of the bands in Halley's comet were found to be 586·0, 561·5, 543·7, 514·7, and 472·0 $\mu\mu$.

The spectrum of comet 1910*a* gave bands at 556·0, 537·0, 512·0, and 481·0 $\mu\mu$.

THE BRITISH SOLAR ECLIPSE EXPEDITION.[1]

Aboard H.M.S. "Encounter."

April 12, 1911.

MY last letter was concluded when the Tonga Islands came in sight, for I knew that as soon as we dropped anchor my time would be fully occupied. We have now been here ten days, so there is much eclipse matter to report. The approach to our destined spot, namely, Neiafu, was beautiful in the extreme. The numerous islands of various sizes which form this large group opened out one by one. Some amounted only to rocks sticking up out of the water, whilst others extended over several acres, and were densely covered with trees, the useful cocoanut palms towering above them. Every island was so luxuriant with this thick verdure that I began to think we should have to utilise some of the ground at the Neiafu village itself.

Hunga on our port side and Nua Papu on the starboard were the first two large islands we passed, and then we took a more easterly course and came to the large island of Vavau, with the conspicuous hill called Moungalafa ahead. We entered a narrow channel separating the island of Pangai Motu from Vavau. Passing up this channel, it looked as if further progress would be impossible. Right ahead were two pyramid-shaped landmarks at the foot of Kilikili, a hill 220 feet high, and here was the gate to the chief town Neiafu; the channel became still more narrow, until it looked as if the good ship *Encounter* would be too large to swing round to go through the small entrance. In fact, it was a case of turning a sharp corner to keep in the middle of the fairway. The manœuvre was splendidly made, and we slipped into this nearly land-locked harbour; looking back, one began to wonder how it had been accomplished, so invisible was the entrance.

Well, here we were at Neiafu at last. Our anchor was dropped at 3.40 p.m. on April 2, and before us lay a picturesque-looking island town, with numerous flags flying over the houses.

It was not long before the health officer, Dr. Anderson, pushed off from the shore, for he had heard the gun which is always fired as soon as a ship is seen coming into the harbour. He was pulled out to the ship by a crew of finely built Tongaus. It was noticeable that all, even the doctor, were covered with hundreds of flies, and these (including mosquitoes) I later found to be the most populous inhabitants ashore.

Dr. Anderson told us that "measles" had been passing through Vavau, and that there were still a few cases, one of them being a European who was in hospital. This news suggested that it would be policy to find a site for our eclipse camp somewhere out of the town. Dr. Anderson kindly placed the ground about his house at my disposal for a site for the instruments, but when I inspected it later in the afternoon I found that it was not large enough, and unsuitable for so large a party. In fact, when I was ashore I could see no site that was at once a favourable spot. Mr. Worthington and Mr. Cruickshank, who had preceded us from England to observe the eclipse, had already been on the island some three weeks, and we visited their living tents and eclipse site, which were in the heart of the village.

Before reaching Vavau I had carefully studied the chart of the region, and came to the conclusion that it was well worth while visiting the spot, marked as an Admiralty coaling station, about a mile from Neiafu. Here I thought we should be free from all the disadvantages of a native town. The same evening I dined alone with the captain, and we determined that this site should be inspected.

[1] Continued from p. 463.

Accordingly, next morning, April 3, the captain, Mr. McClean, Fathers Cortie and Pigot, and myself set off in the steamboat and landed up the boat passage near the coaling ground called Umuna. We found that part of the ground was fairly level, high up, and partially cleared, and that by cutting down only about six cocoanut trees and doing a small amount of scrub clearing we should have a first-rate observing station. It did not seem difficult either to find a place where our instruments could be landed, so while Captain Colomb returned to the ship to meet the Governor, Mr. McClean, Father Pigot, and I remained and explored the seashore for possible landing places. In most places there was a steep coral front, but at Bai bai we found an admirable spot, and very close to the site. Fortunately, the captain returned to the ground with the Governor while we were still making investigations. The Governor, who is a native, and communicated with us by means of a native interpreter, told us that the ground was Admiralty property, and that the native who used it as a garden was only a kind of caretaker. This made things easy, for we were then entitled to cut down the necessary trees and make any clearing that was required. Most suitable and picturesque places for the guards' camp, the living tents for the shore astronomical party, and other spots for the captain's wife and the officers' wives, who were coming from Australia, could be seen at a glance. In fact, the site could not really have been a better one, and the soil on which the instruments were to be placed was sufficiently rigid and dried very hard. The result of this inspection was so eminently satisfactory to the captain, Father Cortie, and myself that the first-named decided to move the ship right up the harbour and lay her off the observatory site.

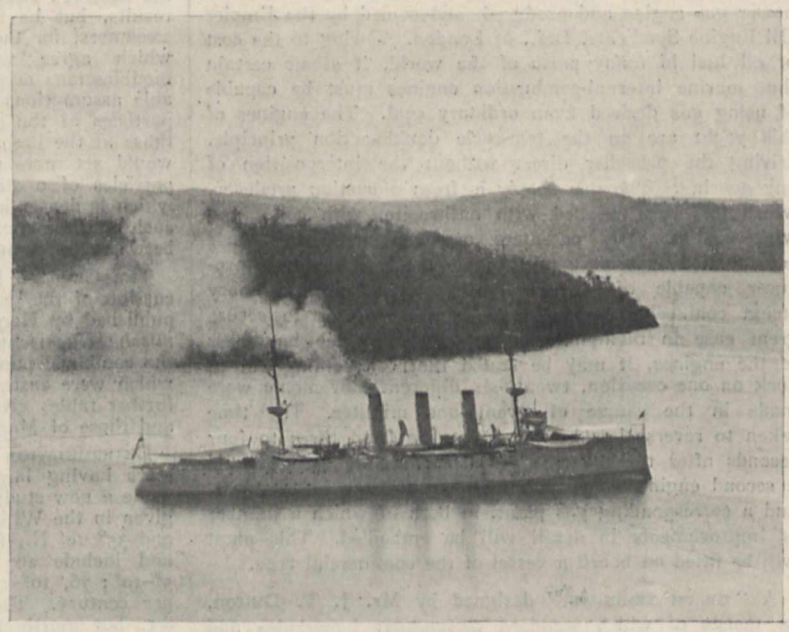

FIG. 1.—The position taken up by H.M.S. *Encounter* close to the Eclipse Station. The photograph was taken from the Hill Muikilekila, 180 feet high.

The same afternoon anchor was weighed, and we steamed slowly up this beautiful inland sea, dropping it again at the mooring mark, which had been placed in position by the navigating officer, Lieut. Hurst, as a result of his survey in the morning. A shore party, including officers, then went off to the site to get a general idea of the nature of the selected spot.

Tuesday, April 4, was a very busy day. Clearing the ground was at once taken in hand, and a path was cut straight down to the spot selected for landing the cases. Numerous natives came on the scene to clear away the yams, a kind of bread fruit, which were growing on the site. A party from the ship set to work to erect the living tents. The site for Captain and Mrs. Colomb's quarters, selected by the Governor, had been previously

cleared by the local authorities. Great signs of activity were being shown, for the Union Steamship *Atua* was due to arrive in the afternoon with the officers' wives and three members of my party, namely, Messrs. Brooks, Raymond, and Winklemann. Owing to the living accommodation on shore not being quite ready, Captain Colomb kindly permitted the latter three to remain on the ship that night. The *Atua* brought also a portion of the Australian party, namely, Messrs. Moors, Merfield, Holloway, Paradice, and Burne, the site of whose camp had been settled near the Catholic Mission Church at Neiafu.

Since we arrived it has been very hot. On shore it is comparatively cool up to about 7 a.m. The temperature, however, quickly rises after, and between two and four o'clock in the afternoon it is extremely hot, the thermometer being at a maximum about 3.30 p.m. The two self-recording instruments which I set up in the camp tell us the temperature and the humidity of the shade air. The daily curves of these are the reverse of each other, the temperature rising when the humidity is falling. This is very fortunate, for the humidity is always high and the shade temperature at a daily maximum of about 86°. The self-recording barograph I still keep in my cabin on

FIG. 2.—The shore party's tents on the east side of the hill on which is situated the observatory station. The marks from left to right when looking at the photograph indicate :—1. Brother McKeon. 2. Dr. W. J. S. Lockyer. 3. Mr. Raymond. 4. Mr. Brooks. 5. Lieut. Clover. 6. Mr. F. K. McClean.

board, and this is daily marking out the two small diurnal oscillations with a long secular wave extending over many days.

Wednesday, April 5, was occupied mainly in bringing all the instrumental gear from the ship to the instrument tents ashore. A most effective method was adopted to obviate the difficulty of the rise and fall of the tide: a landing stage jutting out several yards was improvised, and the boats came alongside and discharged their cargo. Block and tackle and a stout tree at the top of the 20-foot sharp rise at the shore, coupled with the strength of several hale and hearty bluejackets, quickly settled the question of hauling the cases up the inclined spars. If the cases were not too heavy, two men with one case slung over a spar carried it to the camp, whilst if it were rather heavy the limber from the gun (which had been previously landed) and a team of bluejackets made short work of it all. Working from 8.30 a.m. to 11.30 a.m., and from 2.30 p.m. to 4.30 p.m., both Father Cortie's cases and mine were all transferred from the ship to the instrument tents. In this way eclipsing is made very easy.

Up to this time no cocoanut trees had been cut down, as it was desired to preserve as many as possible, for each tree brings in an annual income of four shillings a year and takes six years to grow to a bearing condition. However, four trees had to come down as a first approximation, and these were felled the same afternoon; it has only been found necessary at the time of writing to cut down five altogether. On Wednesday a record, so far as I am aware, has been broken in eclipse expeditions with a man-of-war, for the guards' camp ashore and the ship have been connected by telephone, most of the cable being under water; on previous occasions a signal station and flag waving was the procedure adopted. Until to-day, Messrs. Brooks, Raymond, and Winklemann of my party have been sleeping ashore, as the three tents were fully prepared. To-day two more tents were completed, so Mr. McClean and Mr. Anderson joined them, and I still remained on board at night. The row of seven tents and the large mess tent dotted among the cocoanut trees, and situated on the trade-wind side of the hill, forms a very pretty picture and a cool spot when one has been on the eclipse site for some time. Flies and mosquitoes are there, however, in abundance, and spiders, large and small, galore.

The dark-room lies in a cool shady corner near the living camp. This position was chosen as all water has to come from the ship, and most of it daily goes to the living quarters, so labour is saved. To-day the positions of all the large instruments were carefully pegged out, and parties were sent to skirmish for sand and deal coral for the pillars, which will be erected immediately. Mr. Brooks has been busy with his theodolite, laying out the north and south lines for the siderostats and the correct azimuths for the cœlostats. To-day a crow's-nest has been erected on a tall cocoanut tree overlooking the ground, so that our hard-working photographer, Mr. Winklemann, and his two assistants can secure a good view of the whole eclipse camp as it progresses daily.

After consultation with my party, I have decided to sleep on board at night, so as to be a link between the ship and the shore party. This I consider to be advisable, as we require so much material and help each day. To-night three sharks were swimming about the ship, and many lines with hooks and pork were over the sides to tempt these hated brutes. Although almost daily sharks are present, no catch has been successful yet. According to the statements made by the Europeans here, the Tongaus can call the sharks by uttering native words. We have not seen this put into practice, but there is yet time.

Daily we have quite a lot of small fracto-cumuli clouds moving slowly across us, but the weather is thoroughly hot and tropical. Those living here inform us that we are having rather abnormally fine weather, as was the case in Australia. The weather, therefore, seems to be abnormal in this portion of the southern hemisphere, and we are hoping that the fates will be kind to us when we come to eclipse day.

Every day the camp shows great signs of progress. Levelling, making concrete pillars, covering small huts with willerden canvas, and similar operations being in progress. On April 7 several parties who could be freed from the eclipse camp went off collecting for the "'ologies" specimens of coral, flowers, butterflies, fossils, shells, &c. This specimen collecting is taken up very keenly, and I hope to have a good selection to bring back. The navigating officer is leaving the ship next week with a diving staff for Nukualofa to help salvage the ss. *Bouveric*, which has piled up on a coral reef. The captain was asked whether the *Encounter* could assist, but in reply to his message to the Admiralty for instructions he was informed that he could only render assistance if it did not affect the eclipse parties. At our present site we are now entirely dependent on the ship, and most especially for water, so Captain Colomb has decided that Lieut. Hurst, the navigator, should go by mail steamer and do what he can with divers and

explosives. Lieut. Hurst was a volunteer for the time determination as observed by the cusps, so he has now been replaced by Lieut. Clover.

On the evening of April 7 Commander Mellor, Father Cortie, and I went ashore after dinner to Neiafu to inquire about Prof. Moor, one of the Australian party, who had an accident yesterday. It seems that after a hard day's work he went to bathe, and while undressing fell from the

FIG. 3.—Preparing concrete for the pillars. Sand, cement, and dead coral (the last-mentioned quarried from the top of the hill) were used.

bathing platform into very shallow water on to coral. He not only cut the back of his head badly, but his back, and he was in bed suffering from concussion. He is now (April 12) progressing, but he is suffering with his sight, and may have to return to Australia by the next steamer.

After another hard day's work on Saturday, when good progress was made in all directions, Sunday was considered a day of rest. Mr. McClean and Mr. Brooks preferred to stay ashore, Mr. Raymond and Mr. Winklemann went to Neiafu photographing, while Mr. Anderson and I went off for a sailing picnic with some of the officers. We visited the famous "Swallows'" Cave; hundreds of swallows flew out as we rowed in. The cave is of considerable dimensions, and its upper portion is a mass of stalactites. One projects vertically upwards from a ledge on the side, and when hit with a boat-hook it gives out a beautiful low tone like a large bell. The water in this cave is very deep and clear, and when it was thought no sharks were about some of the party indulged in a bathe. Lunch was partaken on a small sandy beach a mile or so away in the presence of thousands of flies, and there I made a collection of several shells and seeds. On our return in the evening we again entered "Swallows'" Cave, as the sun was well round and shining nearly in it. The colours of the water were superb, but the heat and the innumerable mosquitoes and flies made our stay shorter than we intended.

On Monday (April 10) at 2 a.m. very heavy rain fell, but as there was little wind and my bunk was placed well in the middle of the quarter-deck, I did not wake. Every night many of us sleep on the quarter-deck or after-bridge, and we dine on the former also. The ward-room gets very hot after the day's sunning, and the ship is so kedged that the wind strikes the starboard side; the port side is therefore the sunny and leeward side. The temperature in my cabin, with scuttle open and electric fan working, varies during the day time from about 84° to 90° F.

Unfortunately, on Monday Mr. Brooks, while chopping a piece of wood with an axe, cut his left-hand thumb badly. Staff-Surgeon Milln soon stitched it up for him when he got on board.

In the evening, during dinner, clouds appeared in the east, indicative of vertical currents, very tall cumuli clouds with flat bottoms. The wind began gradually to increase from a slight zephyr to a cooling breeze, and became fairly strong about 9.30 p.m., and the rain came down in torrents. While thinking of those living ashore and the instruments, we had to rush to remove our bunks from the deck, for the awning was of no apparent use.

This shower gave one some idea of how it can rain here, although up to now we have experienced very little of it. I made up my mind, therefore, to prepare for all eventualities. Thus Tuesday morning was chiefly spent in digging trenches. Fortunately, the dark-room had previously been dealt with in this manner, and could not be washed out. That afternoon was the climax. Down the rain came again in torrents. Mr. McClean and I went round the camp to see that all was in order, and at the same time obtained a good idea of what to do in the future. Although these rain squalls may not be numerous, they are tremendously heavy when they do come, and one thickness of canvas barely keeps the rain out. Fortunately, the ship can supply a great number of small waterproof coverings, and I expect we shall indent for most of them. Even to-day (April 12) rain has been frequent, and prevented much opening up of instruments. The sky was completely overcast in the early morning, and all day blue sky has been rarely seen. Later in the afternoon we had another deluge; but now we are well prepared, and do not mind so much. The humidity here is very high, and everything exposed to the air quickly rusts, even keys in one's pockets.

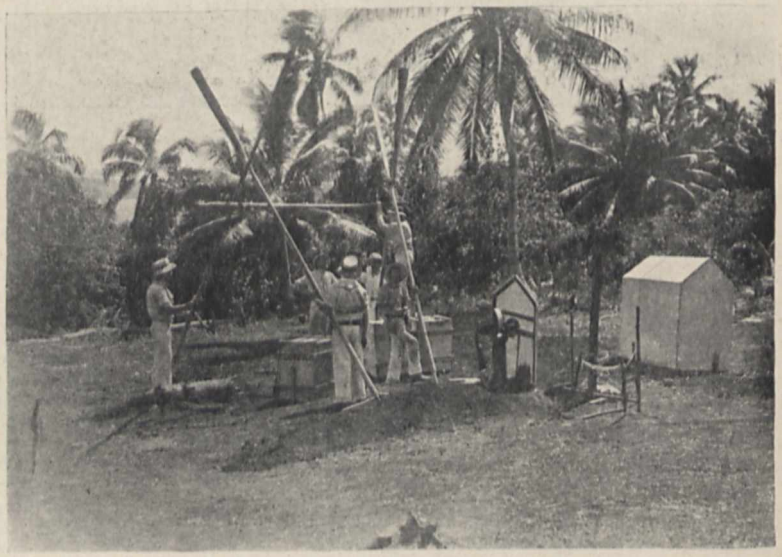

FIG. 4.—The 6-in. prismatic camera in course of erection.

Nevertheless, we are all a very cheerful party, and the assistance from the ship is magnificent. This evening the *Tofua* is expected to arrive, bringing more of the

Australian party, namely, Messrs. Baracchi, Cooke, Dodwell, Kenney, and Beattie, and Mr. Short for Worthington's party. This is the last post until after the eclipse. We will do our best to keep the flag flying on that eventful day, but we must have a clear sky.

W. J. S. LOCKYER.

N.B.—The photographs accompanying this letter were all taken (with one exception) by Mr. Winklemann. They were printed by a bluejacket on board H.M.S. *Encounter*, as conditions were not favourable for the process ashore. This bluejacket is a volunteer for our photographic department, and a very valuable one. W. J. S. L.

PHYSIOGRAPHIC STUDIES IN THE FRENCH ALPS.

THE former of the two memoirs included in the publication before us is a report by MM. Flusin and Bernard upon an apparatus for boring into a glacier, devised by MM. Hess and Blümcke, the working of which they had studied on the Hintereisferner in the Austrian Tirol. As the scientific interest of this is at present more indirect than direct, we may pass on to the second memoir, "Etudes Glaciaires Géographiques et Botaniques dans le Massif des Grandes Rousses," by MM. Flusin, Jacob, and Offner.

The Grandes Rousses is a rather lofty and insulated range in the French Alps, which rises on the right bank of the Romanche, roughly north-east of Bourg d'Oisans. On its jagged crest, which runs approximately from N.N.E. to S.S.W., two peaks, though some distance apart, attain the same altitude—11,395 feet. Its western side descends more abruptly than the eastern, so the glaciers on the former are shorter and steeper than on the other. It is an island ridge of crystalline rock—granites more or less gneissoid, and schists—rising from a hilly district of Lower Mesozoic (chiefly Liassic) rocks, mainly, no doubt, a result of the second of the two great folding processes which have given birth to the Alpine chain.

First in order, to the west of the watershed between France and Italy, is the great mass of crystalline peaks which rise around the headwaters of the Vénéon—two of them, the Ecrins and Meije, exceeding 13,000 feet in height—and are linked by the Col du Lautaret to the mountains south of the Arc. Farther west is the range of the Grandes Rousses, and still farther in that direction, separated by another syncline of Mesozoic rock, comes that of the Belledonne, the highest peak on which attains 9781 feet. The Ecrins *massif* is probably an extension (though perhaps not a simple one) of the Mont Blanc axis; the Grandes Rousses and the Belledonne, a prolongation of that of the Arguilles Rouges, which has either bifurcated or raised up another earth-wave in front. But the Grandes Rousses *massif* affords evidence of a much more ancient system of disturbances, for two strips of Carboniferous rocks (as may be seen in the valley of the Romanche) are sharply infolded in the crystalline series—just as occurs in the valley of the Rhone and on the way from Vernayaz to the Tête Noire. The author attributes this folding to the Hercynian movements, though its strike is much more nearly north and south than east and west. It was, at any rate, succeeded by enormous denudation, for in this part of the Alps the base of the Mesozoic series may be seen resting on the denuded edges of these huge folds.

The report includes a study of the Alpine plants in the three regions or stages into which the range may be divided, and a very full account of the snowfields and glaciers. The snow-line, of course, varies in different localities, but the authors take 8720 feet as an average, which very nearly coincides with the limit of the *névé*, that is, where ablation balances accumulation, or expenditure just exhausts income in the matter of snow. This limit, they point out, rises as the altitude of a group increases, being about 650 feet higher in the Grandes Rousses than in the Belledonne, while in the eastern *massif* it overtops the former by 400 or 500 feet, a result which seems to call for explanation. Particulars also of the retreat of the glaciers are given, with maps and some interesting photographs; in short, the memoir is a most elaborate one, though we cannot forbear remarking that if a similar exhaustive treatment is applied to other parts of the Alps—and the practice seems to be growing—conscientious students will before long often have to choose between hours in a library and work in the field.

T. G. B.

[1] Ministère de l'Agriculture — Direction de l'Hydraulique et de Améliorations Agricoles—Service d'Etudes des Grandes Forces Hydrauliques (Région des Alpes)—Études Glaciologiques. Tirol Autrichien. Massif des Grandes Rousses. Pp. vi+112 + ix plates + ix panorama views (1909).

THE MOVEMENT OF SUBSOIL WATER.[1]

IN all densely populated areas the water supply is a matter of primary importance, especially where the rainfall is scanty, and where a large proportion of the supply is derived from shallow wells. Dr. W. F. Smeeth, of the Geological Department of Mysore, has prepared a report dealing with this subject, which is based upon observations made during the year 1909, so that it provides rather a basis for further study than a complete discussion of the subject. The Mysore plateau extends over some 29,400 square miles, and is composed almost entirely of gneisses, granites, and crystalline schists, which are more or less decomposed to a depth of from 50 to in some places as much as 100 feet; the upper 50 feet of this forms a reservoir which is fed by the rainfall, and will hold a quantity of water varying with the porosity of the materials, and from it the wells derive their supply. On account of the seasonal character of the rainfall the level of the water-table varies considerably, and from various considerations the author takes a zone of intermittent saturation having a mean depth of 10 feet, and an average porosity of 12 per cent., as representing the average conditions which occur.

The rainfall varies greatly, from 73·21 inches in the west to 21·27 inches in the east of the area, and from the average variation of the water-level in wells, compared with a ground water supply which is taken as equal to 10 per cent. of the variation in the water level in each district, a "percolation factor" is obtained. No river discharges are included, nor is evaporation determined in order to obtain an independent value of the amount accounted for by percolation, which by the method employed is given as from 19·9 to 66·7 per cent. of the average rainfall. The rainfall also differs considerably in type in different portions of the area, having a strongly marked maximum in July due to the south-west monsoon in the west, while in the east the rainfall of the north-east monsoon in September and October is more important.

Observations were collected so far as possible from all villages, and 2563 wells were recorded from which fairly representative deductions for the year under investigation were possible. The mean depth of the water from the surface varied from about 38 to 4 feet, the mean values for maximum and minimum depths being 30 and 18, while the mean variation in the course of the year was 12·4 feet, and 37·5 per cent. of the wells were reported as drying up during the year. The variations of level ranged from an average of 15·3 feet for shallow wells in which the minimum depth to water-level was under 10 feet, to 8·2 feet in those where it was over 40 feet. Details of the water met with in the Mysore mines is included, but not much is deducible from such information at present. A series of diagrams show the position of the maximum and minimum water-levels in the village wells observed, and it is clear that a large number of them do not reach the depressed water-table of the dry season, since the conditions are not realised by the well owners. Deeper and fewer wells are recommended with pumping where necessary, and a systematic distribution of the permanent supply so obtained. Further investigation is recommended for the seasonal variation of water-level in different districts has not been considered. While diagrams are abundant, maps of the region, whether topographical, orographical, or showing the distribution of the rainfall, are conspicuous by their absence, and render a satisfactory study of the report difficult.

Although the Nile and its system of canals provide most

[1] "Notes on the Underground Water Resources in Mysoer." By Dr. W. F. Smeeth. Pp. 69, plates 1-69. (Government Press, 1911.)

of the water needed by the population of Egypt, nevertheless many questions connected with the increase of population in towns and with intensive cultivation have lately directed attention to the position and the movements of the water-table in the alluvial plain of the Lower Nile. After some preliminary work in previous years, a more systematic investigation was started in Upper Egypt from Aswan to Cairo, in 1907–8, to obtain definite information. This has now been published in the form of a departmental paper by Mr. H. T. Ferrar, of the Geological Survey of Egypt.[1] Observations were made at 239 wells which were visited, and the water-level recorded an average of eight times during the twelve months from one flood of the river to the next; since no rainfall occurs to complicate the conditions, these data were sufficient to define with adequate accuracy the range and movement of the water-table in that year. The rock trough in which the Nile flows is largely filled by pleistocene sands and gravels, over which the alluvial deposits have been laid down, and into these the wells from which water-wheels lift water are usually dug down through the alluvium and into the underlying sands; from these wells most of the observations were taken. At many points the Nile itself has cut into these sandy diluvial deposits, or flows against them at the margin of the valley, so that the river water is in communication with both deposits. A series of diagrams show the variation of the water-level in each well throughout the year, and also the position of the water-table for each month at fifteen different points of the river. Slight differences due to variations in porosity, &c., are to be seen, but the whole gives a very clear picture of the movement of subsoil water. The lines for September and October show its rapid rise, after which the fall commences, being greatest between December and January and afterwards decreasing. In these later months there is often a slope towards the river, and an appreciable amount of stored water is then returned from the flood plain to the river. It would have been preferable if the observed values had been indicated on the diagrams and the depths of the wells drawn, as the curves do not show to what extent they are controlled by data without reference to the printed tables.

In subsequent chapters an attempt is made to compute the quantity of water which the alluvial plain can hold, 60 per cent. by volume being taken as the water absorbed by the soil, but measured discharges of the river and canals are not utilised, and the values obtained cannot be regarded as more than rough approximations. Data for determining the direction of movement are scanty; near the river, results vary greatly within short distances, and in villages any use of colouring matter in such investigations would arouse much hostility. A large amount of valuable data has been collected, which greatly increases our knowledge of the water in the Nile valley, and must be of the greatest value for agriculture and for public health. The wells of the flood-plain are grouped into those of the river margin which are immediately affected by its changes of level, those of the plain which have an annual rise and fall about a month and a half after that of the river, and those close to the desert margin where the range is comparatively small. Further investigation on the same lines has been carried on since in the delta, which will be published in due course, forming a study of much value which, it is to be hoped, will be continued in the future.

[1] "The Movements of the Subsoil Water in Upper Egypt." By H. T. Ferrar. (Cairo: Survey Dept. Paper No. 19, 1911.)

THE ROYAL OBSERVATORY, GREENWICH.

MR. DYSON'S first report—as Astronomer Royal—was read at the annual meeting of the Board of Visitors held at Greenwich on June 2, and covers the year ended May 10. Below we give a brief summary.

The transit circle was employed for the usual observations and for the observation of stars of magnitude 9·0 and brighter between +24° and +32° north declination. The latter research, commenced in 1906 with the intention of securing five observations of each star, includes some 12,000 stars, and about 48 per cent. of the observations were completed at the date of report.

From the transit-circle and altazimuth observations of the moon's limb and Mösting A, made during 1909, the mean error of the moon's tabular place was found to be −0·423s. in R.A. and −0·53″ in N.P.D.; from ninety-eight observations with the transit-circle, the mean error in R.A., for 1910, was found to be −0·543s.

A new mercury trough has been added to the altazimuth. It is carried on iron rails quite isolated from the floor, and the steadiness of the star images has become greatly improved.

Values for the moon's parallax have been obtained from the Cape-Greenwich observations of Mösting A, made during 1905–10, and the probable error of the result, so far as it is independent of the earth's ellipticity, is ±0·06″. For values of $1/e$ ranging from 293 to 300, the correction to Hansen's value of the parallax ranges from +0·53″ to +0·12″; the combined results give +0·44″ as the correction and 294·5 as the value of $1/e$.

Bimonthly investigations of the R–D discordance revealed a nearly constant discordance, amounting to 1·14″, in the yearly mean, which changes sign when the instrument is reversed, and although the object-glass has been remounted, the cause of this has not yet been discovered.

The mean error in R.A. of the moon's tabular place for 1910 is −0·59s. from meridian observations of the limb and −0·55s. from those of Mösting A.

The reflex zenith tube observations for 1906–9, discussed by Mr. Eddington, give results in fair accordance, on the whole, with those published by Dr. Albrecht for the International Latitude Service.

About 600 double-star observations were made with the 28-inch refractor, including observations of 110 pairs under 0·5″ separation and 153 pairs between 0·5″ and 1·0″.

In the 30-inch Thompson equatorial the mirror, last silvered in February, 1910, is still in good condition owing to the cover having been made air-tight by a band of pure rubber. This instrument was employed in photographing Saturn and its ninth satellite, comets 1909*c* and 1910*b* and *e*, and some of Herschel's nebulæ, the latter for identification and position determination.

The 26-inch refractor was chiefly employed in the photographic determination of the parallaxes of stars in the Greenwich astrographic zone, Kapteyn's method of exposures on the same plate at intervals of six months being followed.

As the southern declination of Jupiter made observations at Greenwich impossible, the director of the Helwan Observatory undertook to continue the observations of J viii, and eight photographs, taken on eight nights, have already been received at Greenwich for measurement. Approximate measures of the first two photographs of the satellite indicate that the Cowell-Crommelin ephemeris is only 20″ in error.

Since November, the Greenwich astrographic telescope has been employed in the photographic determination of the magnitudes of stars given in the two published volumes of the Greenwich zones, Pickering's plan of polar sequences being employed.

An interesting investigation now being carried out at the observatory is the enumeration of the stars of different magnitudes on the photographs of the whole sky taken by Mr. Franklin-Adams, who is bearing the cost. Twenty-six plates, covering the sky between the North Pole and +53°, have been dealt with, and 42,284 stars counted. The greatest number counted on any one plate (in twenty-five 20′ squares) was 5138, the least 301.

The Dallmeyer photoheliograph is now housed in the dome of the old altazimuth, where one quarter of the original dome was cut away and a corresponding sector fixed permanently in the north, so that the large dome-aperture thus secured is easily closed by bringing it under the fixed sector. For 1910 the solar photograph record is complete, the ninety gaps in the combined Greenwich and Cape series having been filled by photographs received from the Dehra Dûn and Kodaikánal observatories in India. Since the beginning of May, one of the photoheliograph observers has attended from 7 to 9 a.m., thus adding two hours to the period of observation, and also securing better results.

The mean daily spotted area of the sun's disc in 1910 was less than half that of 1909, and during the five months ended March 31, 1911, the disc was free from spots on sixty-seven days. During the rapidly approaching minimum the direction of the sun's axis is to be determined

from the thirty-seven years' observations now available.

The principal results for the magnetic elements in 1910 were :—

Mean declination	... ...	15° 41·2″ West.
Mean horizontal force	... ...	0·18532 (C.G.S. units.)
Mean dip (with 3-inch needles)	...	66° 52′ 37″.

There were no days of "great," and only six of "lesser," magnetic disturbances.

The mean temperature for 1910, 49·7°, was 0·1° above the 1841–95 average, but the sunshine recorder showed a deficiency; July provided only about half the average number of hours of bright sunshine, and May was the only month when the amount was appreciably above the average. The rainfall, 25·93 inches, was 1·81 inches in excess of the 1841–95 average, and the number of "rainy days" was 175.

In the time department, the performance of chronometers is reported as satisfactory, and that of chronometer watches as exceptionally good. The increase of electrical devices on board ships having made the question of the magnetic disturbance of chronometers an urgent one, special experiments are being carried out with strong magnetic fields at the observatory.

THE HARD AND SOFT STATE OF METALS.

DR. G. T. BEILBY, F.R.S., delivered the second annual May lecture of the Institute of Metals on Friday, May 12, taking for his subject "The Hard and Soft States in Metals."

In the course of his lecture Dr. Beilby said that the hardening effect of cold working on ductile metals, and the softening effect of reheating, must have been known to the earliest workers in metals. To the general mind, the phenomena were sufficiently explained as being due to the "compacting" effect of hammering and the "opening up" effect of heat. The advent of scientific methods of inquiry led to the exposure of this fallacy, and to the discovery of new points of difference in a metal in the two states. The discovery that the polishing of all substances, even of those so hard or brittle as antimony or calespar, involves the transient liquefaction of a thin layer on the surface, led to the study of this subject from an entirely new point of view. In a pure ductile metal which has been slowly cooled from the molten state, the structure of the solid is completely crystalline, and the metal is in its softest condition. Any permanent deformation of the mass, whether by hammering, by rolling, or by wire drawing, hardens and stiffens it. The microscopic examination of the hardened metal shows that its original crystalline structure has been broken up and replaced by a new type of structure. If the hardened metal is raised to a sufficient temperature, the softness is completely restored *and the crystalline structure is also restored.* In the ductile metals the greatest degree of softness is always associated with well-developed crystallisation.

The composite character of the hardened structure, which in some cases resembles a bed of broken and distorted strata concreted or cemented together by a matrix, can only be explained by the presence of two constituents, namely, the broken-down remains of crystals and an amorphous or glass-like form of the metal by which the mass is so firmly cemented together that it has become vastly more rigid and mechanically stable than the crystalline structure. This amorphous or vitreous form of the metal stands in the same relation to the crystalline form as glass does to the crystalline silicates of which it is composed, or as the clear, vitreous "barley sugar" does to the ordinary crystals of the breakfast table.

The pure ductile metals cannot be obtained in the vitreous state by cooling, because their molecules retain sufficient mobility to enable them to marshal themselves in crystalline formation for a range of about 800° below the solidifying point. All the facts show, however, that when liquefaction is produced by mechanically induced flow the solidification is so rapid that the solid which results is in the vitreous condition.

Microscopic analysis of the surface skin produced by polishing a plate of calcite shows that the disturbance due to polishing has penetrated to a depth of one thousandth of a millimetre, and that the subsequent healing over of the disturbance has been so perfect that it can only be explained by the assumption that the transient liquefaction of a layer some thousands of molecules in thickness has occurred. It is evident that the conditions necessary to bring about liquefaction and solidification at the outer surface must equally exist within the substance at all surfaces of slip or shear, and the microstructure of the hardened metal confirms this view.

The direct bearing of these researches on the obscure subject of molecular structure in solids was pointed out, and a "pulsation cell" hypothesis of the three states of matter was outlined.

Prof. Quincke's "foam-cell" theory of solidification was referred to, and was applied to the explanation of certain observations made by Prof. Carpenter some years ago. In view of the possible bearing of this theory on questions of foundry practice, it was suggested that the Institute of Metals might offer a prize for the best research on the subject.

HYDRO-ELECTRIC PLANTS IN NORWAY AND THEIR APPLICATION TO ELECTRO-CHEMICAL INDUSTRY.[1]

THE physical configuration of Norway is remarkably favourable for the utilisation of the large number of waterfalls to be found on the seaboard of the mountain chains which almost cover the country, and through the valleys of which the enormous quantity of water precipitated from the western and south-eastern sea breezes finds its way as rivers flowing down to the sea. In the winter the rainfall takes the form of snow, so that the volume of water brought down by the rivers is at its greatest from May to July, when the snows melt on the mountains. To make use of the water-power, storage is therefore necessary, and for this the nature of the country is peculiarly adapted, being covered with lakes that have very contracted outlets, and which can be easily converted by damming into storage reservoirs. Thus in the watershed of Skien the natural water-power of 50,000 horse-power has been increased to an available horse-power of 375,000, while the Mösvand reservoir has increased the water-power of the Rjukan factories from 30,000 to 250,000 horse-power, with a capital outlay of only some 85,000*l.*

The total water-power in Norway has been estimated at from five to seven million horse-power, but as much of the country has not been hydrographically surveyed, this is probably too low an estimate. The power stations can supply power at from 22*s.* to 44*s.* per e.h.p.-year, and in some cases even for less; and as the quantities available are as high as from 50,000 to 100,000 horse-power for a single fall, the conditions are ideal for the development of electrochemical and electrometallurgical industries. Many such industries have already reached an advanced stage of development. Thus nearly 180,000 horse-power will be utilised this year in the manufacture of nitrates of lime, soda, and ammonia from the air by the Birkeland-Eyde process and the Badische Analin und Sodafabrik Company's process; about 60,000 horse-power are employed in the manufacture of calcium carbide, and other electrochemical and electrometallurgical industries absorb at present some 20,000 horse-power. Now that a suitable electric furnace—the Grönwall—has been designed for the smelting of iron ore, a furnace that has yielded excellent results on a practical scale, electric iron and steel smelting is likely to develop largely in the near future, for Norway possesses extensive deposits of iron ore. Three plants, aggregating 16,000 horse-power, with provision for increasing to nearly 60,000, are now being erected at Hardanger, Arendal, and Tinfoss. Other ores, notably copper, nickel, zinc, will also possibly be electrically smelted at no distant date.

The second portion of the paper describes in some detail the various hydro-electric schemes now being developed in

[1] Summary of a paper read before the Faraday Society on May 2, by Mr. A. Scott-Hansen, of Christiania.

Norway. On the Glommen River, in the east, three falls are utilised. The uppermost, Kykkelsrud, yields about 40,000 horse-power, of which 10,000 kilowatts is transmitted at 60,000 volts (3-phase 50 periods) to Christiania, thirty-one miles away, and the remainder to Sarpsborg. At Sarpsborg occurs the lowest fall of the Glommen, and here there are two power stations—Hafslund, supplying 24,000 horse-power to calcium carbide works and for zinc smelting, and Borregaard, the output of 26,000 horse-power of which is utilised by the Kellner Partington Paper Pulp Company, Ltd., owning the largest works in Norway. The intermediate fall on the Glommen is at Vamma, where a dam is now in course of construction under considerable difficulties. This dam will have a height of 90 feet, and will be one of the largest in Europe. The power station will be in the centre of the river bed below the dam, and will yield some 70,000 to 80,000 horse-power.

A large number of the minor power stations in the south supply the towns with light and power. Among the smaller electrochemical works are the electro-iron and steel works at Arendal, the experimental nitrate works of the Badische Company at Christianssand, and nickel and aluminium factories near the same town. The nickel works refine nickel matte, and turn out about 400 tons of the pure metal per annum. At Gjössingfjord is Mr. Albert Hiorth's small experimental electro-steel works. At Vadheim, on the west coast, is a sodium factory, and at Trondhjem, in the north, carbide, ferro-chrome, and ferro-silicon are manufactured.

Another great power centre is in the Telemarken district in the south-east of Norway. The Svaelgfoss power station supplies 40,000 horse-power to the nitrate factory at Notodden at a voltage of 10,000, delivered without transformation. The four 10,000-horse-power machines—capable of developing 13,000 horse-power—are among the largest in the world. A power station now being constructed at Lienfoss will be able to furnish Notodden with a further 20,000 horse-power. The Tinfoss Works, also at Notodden, are intended to generate 15,000 horse-power, to be used mainly for iron and steel smelting.

The third of the great Norwegian falls is the celebrated Rjukanfoss waterfall on the Maaneely River. The Mösvand dam, above this fall, provides a reservoir of about 840 million cubic metres (tons) of water, and five miles below is another dam, forming the intake for the power station, situated 1000 feet below. A lower fall of about 1000 feet provides the power for a second station. Both of these power stations—the largest in Europe—will yield 140,000 horse-power, there being in each 10 units of 14,000 horse-power. The turbines, on account of the great height of the falls, are Pelton wheels. The construction of the dams, flumes, and power stations at Rjukanfoss was attended with great engineering difficulties, which are described in the paper. The power from these stations is transmitted through sixty copper and aluminium cables to Saaheim, where factories for the manufacture of nitrogenous products to employ from 2000 to 3000 persons are in course of erection.

The paper concludes with a description of the power plant at the Tysse falls, which consists of seven units, each of 4500 horse-power, and from which electric energy is transmitted at 12,000 volts to Odda, where it is used for the manufacture of calcium carbide and of cyanamide. Here again, on account of the steep, mountainous character of the country, great difficulties presented themselves, particularly in the drilling of tunnels 1320 feet above the fjord, and in fixing the flumes, some against a smooth precipice, with an inclination of 60°. The Tysse power station will eventually yield some 100,000 horse-power.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—At the last meeting of the council the following resolution was passed:—"The council of the University has heard with great regret of the death of Prof. Whitcombe, who for twenty-three years was professor of mental diseases at Queen's College, Mason College, and the University, and desires to place on record its appreciation of the valuable services he has rendered to the University."

Dr. Helen M. Wodehouse has resigned her appointment as lecturer in philosophy on being elected to the principalship of the West Riding of Yorkshire Training College.

At the forthcoming degree congregation, official degrees are to be conferred on Prof. C. E. Martineau (M. Com.), professor of accounting, and on Miss S. M. Fry (M.A.), the warden of the Hall of Residence for Women Students.

BRISTOL.—Mr. Herbert Bolton, curator of the Bristol Museum of Natural History, has been appointed reader in palæontology in the University.

The thanks of the council have been accorded to the Local Committee on Agricultural Development for passing the following resolution:—"In view of the valuable research work now being done in the University of Bristol in the interests of the cheese industry, and also in the investigation of plant diseases, this meeting urges that a substantial grant for a given period of time be provided by the Development Commission, to enable the investigations to be proceeded with until practical results are arrived at."

CAMBRIDGE.—An offer to contribute 200*l.* a year for the next five years to the Geographical Education Fund has been made by the council of the Royal Geographical Society, which has further granted an additional 100*l.* for the year ending Michaelmas, 1912. A private benefactor has also offered 100*l.* for the ensuing academic year. It is proposed that these offers be gratefully accepted by the University.

A lecturer in historical and economic geography, a lecturer in regional and physical geography, and a lecturer in surveying and cartography, will be appointed by the General Board for five years from Michaelmas. The two latter will be known as the Royal Geographical Society's lecturers.

It is proposed to confer the degree of Doctor of Letters, *honoris causa*, upon Prof. Wilhelm Dorpfeld, principal secretary of the Imperial German Archæological Institute in Athens; and the degree of Master of Arts, *honoris causa*, upon Mr. John Watson.

OXFORD.—The following is the text of the speech delivered by Prof. Love in introducing Prof. H. L. Bergson for the degree of D.Sc. *honoris causa* on May 27:—"Adest Henricus Ludovicus Bergson, inter huius aetatis philosophos insignis, vir multis nominibus laudandus, doctrinae novae et singularis suasor, eiusdem variis in rebus probator, rationis sibi constantis et late patentis inventor, orationis vi lumine venustate pollens. Qui cum non solum mathematicam et scientiam naturalem, sed etiam litteras et philosophiam penitus hausisset, id consecutus est ut, si quis alius, ipsius scientiae rationes corrigere et quasi terminos statuere posset. Nova profecto eius est sententia, esse quaedam, velut durandi notionem, sine qua vita et libertas esse non possint, quae in scientiam physicam mathematicis fundamentis exstructam non cadant: nova etiam eius doctrina, esse quoddam cognitionis genus ipsi scientiae non obnoxium, quo usa mens ipsam veritatem capiat, et durandi, vivendi, mutationis, motuum naturam comprehendat. Hanc ad sententiam, cum multa alia, tum rationem Darwinianam exegit, qua de re magna controversia exorta est, cum multi multis in terris huic suffragentur, ii qui adhuc dissident eius acumen admirentur.

SHEFFIELD.—Mr. Llewellyn Lloyd, assistant curator of the Museum of Zoology, has been appointed entomologist to the Sleeping Sickness Commission of the British South Africa Company, and is leaving England at once for northern Rhodesia.

THE fourth holiday course and second nine months' training course in physical instruction for men and women at Silkeborg, Denmark, sanctioned by the Danish Board of Education, will commence respectively on July 31 and September 2. Particulars can be obtained from the principal, H. G. Junker, Silkeborg, Denmark.

A COURSE of three lectures on "The Evolution of Coasts" will be given by Prof. Albrecht Penck, director of the "Institut für Meereskunde," Berlin, at Burlington House, Piccadilly, London, W., at 5.30 p.m. on June 27, 28, and 29. The following is an outline syllabus:—development of English coastal scenery; formation of

Romney Marsh, Chesil Beach, Plymouth Sound. The lectures are addressed to advanced students of geology of the University of London and to others interested in the subject. Admission is free, without ticket.

WE learn from *Science* that a Bill has been signed by which the Massachusetts Institute of Technology will receive 20,000*l.* annually from the State for ten years. By the terms of the measure, the institute will maintain eighty free scholarships to be apportioned among the forty senatorial districts of the State. The California legislature has passed a Bill, which has been recently signed, appropriating 5000*l.* for a soils laboratory building, equipment, and other improvements at the Citrus Experiment Station. The work of the laboratory is to be confined to the study of citrus soils. The legislature of Hawaii has voted 15,000*l.* for a new building for the College of Hawaii and 4000*l.* for maintenance expenses.

THE report has been issued (Cd. 5662) of the Departmental Committee appointed to inquire into the administration of (*a*) endowments the income of which is applicable, or is applied to or in connection with, elementary education, and (*b*) small educational endowments other than the above, in rural areas, the application of which to their proper purposes presents special difficulties; and to consider how far under the existing law it is possible to utilise them to the best advantage; and whether any, and, if so, what, changes in the law are desirable in the direction of conferring upon county and other local authorities some powers in respect of such educational endowments or otherwise. The committee makes a number of recommendations, which are summarised in the report under twenty-two headings. Especially important is the proposal that, subject to certain exceptions and modifications, county councils in their capacity as local education authorities under the Education Act, 1902, should perform the functions at present performed by the Board of Education with regard to the administration of the endowments within the terms of reference, that there should be an appeal to the Board of Education from any scheme made by a local education authority, and that the range of educational objects to which trustees may apply their funds should be widely extended. It is also recommended that the local education authority should have the same powers of demanding accounts and investigating the administration of charities as are at present exercised by the Board of Education, but that the Board of Education should have a concurrent power of demanding accounts, though trustees will no longer be under any obligation to render accounts to the Board. Certain of the suggestions are not made unanimously, and memoranda at the end of the report provide particulars of the points on which some few members of committee do not agree with the main recommendations.

ATTENTION has recently been directed to a somewhat anomalous situation which had come into existence during the last few years in connection with medical education. The General Medical Council exercises a supervising control over the standard of the tests required by the various qualifying authorities in this country. In the regulations published by the Council, students are required to study the preliminary sciences at an institution recognised by the council, and *after* passing an examination in general education when above sixteen years of age. The council requires no elementary science at all in the general education. These regulations, which are obviously designed to make sure that students shall not scamp their literary, for the sake of their scientific, education, and that they shall study elementary science under generous conditions, probably achieve their purpose satisfactorily for a certain class of student. But, since public schools are not recognised by the council as places where elementary science can be studied, they evidently do not meet the case of the very large number of boys who enter the medical profession from the public schools. The difficulty has been met in the past by the fact that those qualifying authorities most used by public-school boys have not conformed to the regulations of the council. For though termed "regulations," they are not legal requirements, but more in the nature of recommendations. Thus the Conjoint Board of London and the Universities of Oxford, Cambridge, and London, the professional tests of which are beyond suspicion, allow students to pursue the study of the preliminary sciences at the public schools. Hence a boy following the usual school curriculum, and working at elementary science as part of his general education, has been able to offer himself for examination in these subjects on leaving school at eighteen or nineteen years of age. Recently, however, an increasing number of boys have gone from public schools to the newer universities and other authorities where they have to conform to the requirements of the Council. To observe the regulations, these boys have had to study again the elementary science which they have already, in many cases, satisfactorily done at school. Representations have been made to the council by the public schools directing attention to the difficulty thus raised; and on May 29 last at the meeting of the General Medical Council a resolution was proposed by Sir Henry Morris to remove the disabilities from which public-school boys suffer by "recognising" the schools under certain conditions. This resolution was adopted by 24 votes to 5.

THE fifth annual Conference of the Association of Teachers in Technical Institutions was held at Southport on June 5. Mr. Barker North, of the Bradford Technical College, in his presidential address, said that during the year the membership of the association increased by more than 20 per cent., and branches were formed in Ireland and Wales. More than 50 per cent. of the full-time technical teachers of England and a large percentage of the part-time teachers are now in the association, which is the only organisation representing all grades of the profession. Many technical institutions, he said later, suffer from the unsatisfactory nature of the constitution of education committees, and he urged the co-option of experts to remedy the present lack of special knowledge. Mr. North gave a tabular statement from the recently published census of production which shows that the net output in the nine leading industries of the country rose with an increase in the percentage of salaried persons. This suggests that, within certain limits, the employment of a large number of skilled technologists would develop the industry into higher forms and increase productivity. The state of the chemical industries shows how fatal is the system of limiting the employment of research chemists. Referring to the reforms necessary in education, he argued for the closer affiliation of continuation schools with the higher institutions; the work of the former should be a real continuation of that of the primary schools, and in technical institutes and universities provision must be made alike for the rank and file of the industrial army and for their officers—the second type being evolved from the first by means of natural selection. The defects of the present system would be remedied by drafting the best of the evening students systematically into day courses and by concentrating them for the highest class of work in specialised institutions. Such institutions should be affiliated to form technical universities. On these lines, he thought, the development of the Imperial College should be carried out. The time is ripe, said the president, for the appointment of another Royal Commission, with broader terms of reference than those assigned to the present, so that the whole question of the organisation of higher technical education in this country may be subjected to an exhaustive inquiry. Papers were read by Prof. W. W. Haldane Gee and Mr. T. J. Burnett, and resolutions were adopted urging the formation of an Advisory Council on Technical Education, consultative committees of teachers, the representation of teachers on education committees, and advisory committees for juvenile employment.

SOCIETIES AND ACADEMIES.

LONDON.

Faraday Society, May 2.—Mr. James Swinburne, F.R.S., president, in the chair.—A. **Scott-Hansen**: Hydro-electric plants in Norway and their application to electrochemical industry (see p. 501).—Edgar **Stansfield**: Two simple forms of gas-pressure regulators. The two regulators described give a steady pressure, easily adjusted, not influenced by the rate of flow of the gas. They consist merely of an outer containing vessel into which water is

poured, and an inner cylinder open top and bottom containing a floating beaker to which a valve is connected. When gas is passed into the inner cylinder through the valve, the position of the floating beaker adjusts itself so that the pressure of gas rises until the valve just closes.—Dr. W. C. McC. **Lewis**: Internal, molecular, or intrinsic pressure—a survey of the various expressions proposed for its determination. If we consider an imaginary plane of unit area placed in any direction well inside a liquid mass, equilibrium across this plane is maintained by the balanced attractive and repulsive molecular forces, which we have reason to believe are of very great magnitude, amounting to hundreds, or even thousands, of atmospheres. The attractive force per unit area is defined as the molecular, internal, or intrinsic pressure of the liquid, and is usually denoted by the symbol K. The present paper is a survey of the various attempts which have been made to estimate the value of K for various liquids.

May 23.—Dr. R. T. Glazebrook, C.B., F.R.S., vice-president, in the chair.—Dr. Arthur L. **Day**: Recent advances in high-temperature gas thermometry. The paper reviews the work done in recent years to increase the range and accuracy of the temperature scale upon which the various methods of measuring high temperatures depend for their calibration.—Dr. J. A. **Harker**: The high-temperature equipment of the National Physical Laboratory. The paper dealt with the methods of construction and the use of the various forms of apparatus for the attainment of temperatures above 100° C. which have been designed at the laboratory during the past ten years.—H. C. **Greenwood**: The boiling points of metals. In view of the scanty and uncertain nature of our knowledge of these important constants, a general investigation of the question was greatly needed. The present experiments may be divided into three sections:—(1) A study at atmospheric pressure of the boiling points of a number of metals which are unaffected by carbon at high temperatures (antimony, 1440° C.; bismuth, 1420° C.; copper, 2310° C.; lead, 1525° C.; magnesium, 1120° C.; silver, 1955° C.; tin, 2275° C.). (2) A study at atmospheric pressure of the boiling points of some metals which readily combine with carbon (aluminium, 1800° C.; chromium, 2200° C.; iron, 2450° C.; manganese, 1900° C.). (3) The influence of pressures varying from 10 cm. of mercury to 50 atmospheres on the boiling points of bismuth, copper, lead, silver, tin, and zinc.—A. **Blackie**: The behaviour of silica at high temperatures. This communication gives an account of some experiments made to determine the effect of heat on the strength and devitrification of the opaque and transparent varieties of fused silica. A determination was also made of their relative coefficients of expansion at high temperatures.—Prof. Max **Bodenstein**: Methods of maintaining constant high temperatures. Three general methods are in use:—(1) By means of a vapour in equilibrium with its liquid. Suitable substances are only available for a moderate range of temperature, but a uniform temperature over a large volume is easily maintained. On the other hand, constancy of temperature over a long period cannot be relied upon. (2) A liquid heating bath controlled by a thermostat. For high temperatures the method is restricted by the difficulty in obtaining a suitable substance, although for moderate temperatures oil or paraffin in a suitably constructed bath are fairly satisfactory, and temperatures up to 350° can be maintained within 0·05° for several months if a sensitive gas regulator be employed. (3) For high temperatures air baths only can be employed. Tube furnaces heated electrically, either directly or by means of coils, are now exclusively used, but although a constant temperature is easily maintained, uniformity of temperature is more difficult of attainment.—M. Charles **Féry**: Stellar pyrometry. The temperatures of incandescent terrestrial bodies can be measured by reference to the laws of radiation, either the law of Stefan or the law of monochromatic radiations, but these cannot be applied in the case of stars, owing to the small amount of radiation. The author has therefore devised an instrument, based on Weiss's displacement law, according to which temperature is measured by an appreciation of the colour tint of the star. In the instrument described, the colour of an image of the star is compared with that of a standard lamp the tint of which can be varied. The pyrometer is standardised by reference to an electric furnace, an arc (3500° C.), and the sun (6500° C.).

Royal Microscopical Society, May 17.—Mr. H. G. Plimmer, F.R.S., president, in the chair.—J. E. **Barnard**: A method of disintegrating bacteria and other organic cells. The author first mentioned that bacterial toxins were of two kinds, extracellular and intracellular. The former were excreted into the medium, *e.g.* beef broth, on which the organism was cultivated, so that by a process of filtration the organisms could be removed and the toxin was obtained in the filtrate, but the majority of pathogenic micro-organisms did not excrete their toxins, at least to any extent, and the toxins were retained within and formed integral parts of the cells of the organisms. One method of obtaining these toxins was mechanically to disintegrate the bacterial cell, so that the cell contents were expressed, and the apparatus described accomplished this. It consisted essentially of a containing vessel in which, by a suitable rotation of steel balls, the organisms were crushed. The principal conditions to be filled in such an appliance were:—(1) approximately every cell should be brought under the grinding action; (2) little or no rise of temperature should take place; (3) the disintegration should be carried out in a vessel which was sealed so that, when dealing with pathogenic organisms, none could escape at any stage of the process. These conditions were, in the main, complied with in the apparatus described. Experiments indicated that by this method the cell-juices were obtained unaltered, and so were suitable for investigations on the chemical composition and properties of the bacterial proteins and other cell constituents. Also that, after the grinding process had been carried on for a sufficient time, practically no cells remained which could be stained properly by any recognised bacteriological method, and which, therefore, could be regarded as whole cells containing a normal quantity of cell-juice.—James **Murray**: Third portion of a Report on the rotifera observed by the Shackleton Polar Expedition of 1909. This portion of the report dealt with the new species, &c., from the Pacific Islands, in which the author said that in Fiji fifteen bdelloid rotifera were collected, in Hawaii twenty-four. Ten species were common to the two groups. In Fiji two new species were distinguished, *Callidina pacifica* and *Habrotrocha nodosa*, the latter previously known as a variety in India and elsewhere. In Hawaii there were no peculiar species, but some very distinct varieties. In the various Pacific islands there have been recorded thirty-one species of bdelloids.

Zoological Society, May 23.—Dr. A. Smith Woodward, F.R.S., vice-president, in the chair.—Dr. J. Stuart **Thomson**: Alcyonaria of the Cape of Good Hope and Natal. The author dealt exclusively with the order Gorgonacea, and recorded nineteen species, of which six were described as new.—Dr. A. Hopewell **Smith** and Dr. H. W. Marett **Tims**: Tooth-germs in the wallaby (*Macropus billardieri*). The material upon which their observations were based had been kindly sent to the authors by Mr. Brooke Nicholls, of Melbourne. It consisted of three embryos of *M. billardieri*. The smallest specimen (allowing for the difference in size of the adults of different species) was considerably younger than that of any other Diprotodont previously examined. In the upper jaw they had identified six incisors, thus confirming M. F. Woodward's original statement. The functional incisors of the adult appeared to be the second, fourth, and sixth of the series. There were four premolars, of which the first, third, and fourth persisted. There was also one molar tooth. In the lower jaw, owing to the difficulty of interpreting the conditions, it was not certain whether there were representatives of five or six teeth in front of the premolars. Presuming there were five, the large functional incisor of the adult was the fourth of the series. As in the upper jaw, there were four premolars and one molar, the second premolar not fully developing. There were evidences of vestigial predecessors to the large lower incisor and to pm^4. The following points of histological interest were noted:—(1) The heaping up of the epithelium along the alveolar margins, a character often supposed to be peculiar to the ungulates. (2) The precocious development of the enamel. (3) The compactness of the stellate

reticulum of the enamel-organ. (4) The abundant evidence of blood-vessels within the enamel-organ, thus confirming the observations of Poulton and Howes in the rodents. The opposite opinion is usually held. (5) Some slight evidence in support of the fusion of enamel-organs. Such fusion has been recorded in the fishes and reptiles, but not hitherto in mammals.—Rev. A. Miles **Moss**: The Sphingidæ of Peru, based on studies of Lepidoptera, with special reference to the larvæ, made during a three years' residence at Lima.—Dr. R. **Broom**: The structure of the skull of cynodont reptiles. The author, after a study of all the available material contained in the British and South African museums, gave a detailed comparative account, illustrated by a series of figures, of the morphology of the skull in the chief genera of the Cynodontia, including Bauria, Nythosaurus, Cynognathus, Trirachodon, Gomphognathus, Diademodon, Sesamodon, and Melinodon. He also discussed in some detail certain peculiarities of the mammalian skull, apparently derived from a cynodont ancestor.—Dr. C. W. **Andrews**: A new species of Dinotherium from British East Africa (see p. 457).

Geological Society, May 24.—Prof. W. W. Watts, F.R.S., president, in the chair.—R. J. Lechmere **Guppy**: The geology of Antigua and other West Indian islands, with reference to the physical history of the Caribbean region. After noticing the work of former observers on the geology of Antigua, the author gives a brief description of the formations of that island, showing that it is divided into three principal regions:—(1) the volcanic (or igneous) region; (2) the central plain; and (3) the calcareous formation, the first-named being, according to previous authors, the oldest, as it is pre-Tertiary, and the others following in succession. The calcareous formation, hitherto considered the newest, contains fossils, of which the most remarkable is a species of Orbitoides. After a discussion of these formations, and especially of the evidence for the so-called "Oligocene" age of the calcareous formation, the conclusion is reached that this formation is the oldest, not the youngest, and is probably Eocene or older. The island was raised above sea-level by the development of the great Antillian dislocation, which is described, and divides each of the islands of Guadeloupe and Antigua into two parts, of which the eastern is calcareous and the western volcanic. In Antigua the central plain intervenes between the two parts, while in Guadeloupe they are only separated by a narrow channel. In support of this proposition, the physical features of Antigua are discussed, and it is shown that the island has not been submerged since the volcanic period.

Institution of Mining and Metallurgy, May 31.—Mr. H. Livingstone Sulman, president, in the chair.—C. O. **Schmitt**: Future economies in Rand reduction plants. The main idea permeating this paper is a defence of the stamp tube-mill combination, against which arguments have been adduced by other authorities, with the further argument that, if either component of this combination is abandoned in the future, it will be the gravity stamp rather than the tube-mill that will be replaced by a machine capable of producing a finer product at a reduced cost. Naturally, a chief point of this paper is to promote discussion on a matter concerning which there are two distinct schools of thought. The author points out in introduction that, if working costs remain at their present figure, the limit of profitable mining will be reached approximately at a vertical depth of 5000 feet in a period of time that can be readily estimated. To increase the depth at which profits may be obtained, and consequently the period of life of a mine, it will be necessary to reduce working costs and capital charges, the former being the factor as regards which most improvement can be effected. What is known as the "big mill" policy was introduced on the Rand with the view of reducing working costs, and gave satisfactory results within proper limits. The author proceeds to analyse the work accomplished respectively by the sorting and breaking plant, and the milling or crushing plant, and he urges that, in view of recent developments and exhaustive experiments made on a sufficiently large scale, the efficiency of the tube-mill when dealing with material of a fineness suitable to produce the best results will be an important factor in the lowering of reduction costs to meet increased expenditure necessitated by seeking ore at depth. A considerable amount of data has been collected for this purpose, much of it in the form of tabular matter and diagrams of typical flow sheets in modern practice, with the view of showing that double-stage crushing is a certain means of effecting marked economies in operating costs and securing better extraction.—A. C. **Hoare**: The roasting of complex ores in gold assaying. Opinion is divided as to the advisability of roasting before fusion when assaying complex gold ores, and though in consequence of experiments it is now established that there is no loss of gold by volatilisation when telluride gold ores are roasted, the volatilisation losses, if any, met with in roasting other complex ores have not been definitely established. The author therefore undertook this investigation with respect to sulphide ores containing iron pyrites, which after careful assay had a base sulphide, such as zinc blende, stibnite, cinnabar, or mispickel, added to them, so that the influence of the sulphide on the roasting could be determined by subsequent assay. The results of these experiments showed that there was no loss of gold in roasting low-grade ores containing zinc blende or antimony, but that there is a loss when the ores contain arsenic, cinnabar, or mispickel.—G. M. **Austin**: A prospector's method of gold assay. In this paper the author details the outfit necessary for carrying out assays in a remote district without the need of taking an elaborate equipment, and he furthermore gives the results of a number of tests made with the view of determining the degree of accuracy attainable by means of a comparatively simple outfit, using one of two methods of assay of which he gives full particulars.

MANCHESTER.

Literary and Philosophical Society, May 9.—Prof. F. E. Weiss, president, in the chair.—Ernest F. **Lange**: Some remarkable steel crystals, coupled with some notes on the crystallisation of the iron-carbon alloys. The crystals were discovered by Colonel T. E. Vickers, C.B., in the cavity of the rising head of a large steel casting, and were preserved by him in view of the known rarity of the occurrence of such a mass of perfectly developed steel "pine-tree" crystals, as the crystalline structures of steel are usually allotrimorphic instead of idiomorphic, that is to say, their geometrical forms do not, except in very unusual circumstances, correspond with their internal crystalline symmetry. A photograph of the cavity was exhibited which showed the walls covered with pyramidal apices of the crystals formed in the liquid metal, and masses of crystals up to 14 or 15 inches in length pendant from the upper portion of the cavity, where they had slowly formed and elongated with the sinking metal with remarkably little interference and in exceptional circumstances of size of casting and casting head and slowness of cooling. Reference was made to the columnar structure of steel castings and ingots as cast, and to the fact that although steel ingots show such a strongly defined columnar structure, the experiments of Müller in Germany had shown that the interior of "bled" ingots was invariably smooth, and that ordinarily solidification proceeded in smooth parallel layers without intrusion of any crystal growths towards the interior. These steel "pine-tree" crystals had never been reproducible in a laboratory experiment, and the problems of the crystallisation of steel had been worked out by experiments upon the allotropic forms of the iron and iron-carbon alloys, the work of Stead and Osmond and Cartaud being specially mentioned for its laboriousness and ingenuity. The author illustrated the internal symmetry of the crystalline structures of various steels by lantern-slides showing the structures that had been obtained in some of his own experiments in the heat treatment of steel, some of which had led to the scientific control of certain metallurgical operations formerly guided by rule-of-thumb practice only.—Prof. S. J. **Hickson**, F.R.S.: *Osteocella septentrionalis*. Some pieces of a very fine pennatulid well preserved in spirit were sent to Prof. Bell by the Rev. J. H. Keen from 30 fathoms off Lucy Island, British Columbia. They were sent by Prof. Bell to the author for examination and report. The specimen was, when caught, about 2 metres in length, and possessed a long, hard calcareous axis reaching a diameter of 7 mm. in its thickest region. On comparing the axis with that

of the type-specimen of *Osteocella septentrionalis* from Burrard's Inlet, British Columbia, preserved in the British Museum, no doubt could be entertained that the specimen from Lucy Island belongs to the same species. Large pennatulids from the same waters similar to this in structure have been described by different authors under the names Verillia, Halipteris, Pavonaria, and Ballicina. There can be no doubt that most of these specimens belong to the same species, and the proper name for it by the rules of nomenclature is *Osteocella septentrionalis*. The paper contains some general account of the structure of Osteocella, but, apart from the characters of the axis, the most important character is the great development of fleshy substance on the ventral side of the rachis and the presence of ventral radial canals.

DUBLIN.

Royal Irish Academy, May 8.—Rev. Dr. J. P. Mahaffy, president, in the chair.—K. T. **Wang**: The differentiation of quaternion functions. Quaternion functions are considered which involve only one quaternion, the constants being scalars. The formula

$$df q = f'q\, dq + (f'q.\nabla q - \nabla fq)\nabla(\nabla dq : \nabla q)$$

is obtained, where $f'(q)$ is the differential coefficient of $f(q)$ formed as if q was a scalar. Several examples are given, and also application to the operator $\square$ (defined by $d = -Sdq\,\square$).—I. **Arwidsson**: Some Irish Maldanidæ. The paper dealt with a small collection of polychaet worms belonging to the family Maldanidæ, collected in Irish waters. One new genus, Cæsicirrus, and two new species, *C. neglectus* and *Nichomache maculata*, were described. Both species had been found previously by various naturalists, but were erroneously identified.—G. A. J. **Cole**: Glacial features in Spitsbergen in relation to Irish geology. The paper arises out of the excursion made in connection with the International Geological Congress of 1910. The comparison of Spitsbergen with Ireland towards the close of the Ice age is rendered an apt one, both on account of the scale of the surface features and the proximity of the open oceanic waters through a large part of the year. The effect of frost action, and especially of "nivation-hollows," is pointed out as originating the recesses, which are ultimately converted into cirques. It is urged that in plateau areas, like those of the eastern part of the Ice Fjord and around Killary Harbour in Ireland, cirques arise by the notching of the plateau edges below the snow-line. The Irish cirques, it is argued, belong to a late stay in the glaciation of the country. The possibility is discussed of the retention of lowland ice in the central areas of Ireland after regions to the east had become free. Interglacial phenomena may thus be traceable only on the margin of the Irish "ice-island," though pronounced in other areas.

May 22.—Rev. Dr. Mahaffy, president, in the chair.—James **Murray**: *Rotatoria bdelloida* (Clare Island Survey). No fewer than sixty-five species of bdelloid rotifers have been collected on Clare Island and the neighbouring mainland by Mr. Murray and his helpers, among them one species (*Habrotrocha hibernica*) new to science. The Irish bdelloids correspond closely with those of Scotland, only two species being, so far, unknown from that country.

Royal Dublin Society, May 23.—Prof. T. Johnson in the chair.—Prof. James **Wilson**: The inheritance of milk-yield in cattle. This investigation involved considerable preliminary inquiry, especially on the following points:—(*a*) the corrections to be made in short and prolonged lactations in order to bring them to the normal; (*b*) the allowances to be made for age; (*c*) in determining how far a cow's total normal yield might be estimated from her yield early in a lactation. These points having been determined, it was found that in full-sized breeds there are three grades of cows, a low grade giving from 450 to 600 gallons, a high grade giving from 1000 to 1200 gallons, and an intermediate grade giving from 750 to 950 gallons, and it was found, also, that the high and low grades are approximately "pure" strains, while the intermediate grade is a "Mendelian" hybrid between them.—Prof. T. **Carroll**: Experiments carried out at the Albert Agricultural Institution, Glasnevin, Dublin: an inquiry into the potato disease *Phytophthora infestans*. The experiments consisted of (*a*) placing in a field of potatoes a case protected by cotton-wool from the entrance of disease spores. The potatoes planted in the case belonged to a variety liable to disease; but the haulms and tubers of these protected potatoes were not attacked, whilst the surrounding unprotected crop was badly affected. (*b*) A portion of ground in which potatoes were growing was completely covered with cotton-wool immediately after the plants had made their appearance, when it was found that the tubers of the crop were completely free from disease, although the surrounding crop was much diseased, as were the haulms of the protected potatoes. (*c*) Between the drills (*anglice* ridges) holes were made 12 inches, 6 inches, and 3 inches deep, into which immature potato tubers were put, the haulms of the potatoes being placed over them. The potatoes from the 12-inch hole were free from disease; those from the 6-inch and 3-inch holes were one-third and two-thirds diseased respectively. Experiments with diseased tubers were also undertaken. (*a*) These were planted in a cool conservatory; disease did not appear in the plants nor in their tubers, although crops in the neighbourhood were badly diseased. (*b*) One of the tubers of this experiment planted in the conservatory showed no sign of disease up to September of the following year. The haulms of this plant were removed, and, the soil having been carefully removed from the tuber, diseased haulms from a plant grown outside were shaken over the exposed tubers after they had been sprayed with pure spring water. Almost all the tubers contracted the disease on their exposed surfaces. These and other experiments were undertaken in order to test whether the disease *Phytophthora infestans* is carried to the tubers of potato plants from the leaves through the stems, and with the object of proving the value of preventive spraying and suggesting its *raison d'être*.

PARIS.

Academy of Sciences, May 29.—M. Armand Gautier in the chair.—H. **Deslandres**: A simple explanation of the solar protuberances and other phenomena by very weak magnetic fields. By assuming the existence of a solar magnetic field analogous to that of the earth and also the ionisation of the gas of the black filaments and protuberances with the predominance of ions of the same sign. The consequences of this assumption are developed and compared with various experimental data.—Ch. **Lallemand**: A project for an international map and aëronautical fixed points. Proposals for a map for the use of aëronauts, enabling the position to be readily determined. The necessity for an international agreement is pointed out.—A. **Haller** and Ed. **Bauer**: The oximes and phenylalkylisoxazolones obtained with ethyl, methyl, and dimethylbenzoylacetic esters. The oxime of benzoylethylacetic acid described by MM. Hantzch and Miolati does not exist, and is, in fact, phenylethylisoxazolone. The esters of monomethyl, monoethyl, and dimethylbenzoylacetic acids, whatever their mode of preparation, give rise to substituted phenylisoxazolones when treated with hydroxylamine hydrochloride and alcoholic potash. The oximes, however, can be obtained by treating these esters in alcoholic solution with the chlorzincate of hydroxylamine (Crismer's salt).—Ch. Ed. **Guillaume**: The coefficient of the quadratic term in the formula of the expansion of nickel steels. The value of the coefficient of the quadratic term in the expansion is plotted against the percentage of nickel, the data from eighty-four alloys being utilised. The disturbing effects of chromium and manganese are discussed.—S. **Arloing**, M. **Fern**, and J. **Chattot**: The influence of the anæmia of the organs on the incidence of tuberculous lesions. Tubercle bacilli, varying in virulence, do not produce lesions in an organ deprived of circulation by aseptic means.—M. Godlewski was elected a correspondant for the section of rural economy in the place of the late M. Fliche.—J. **Guillaume**: Observations of the sun made at the Observatory of Lyons during the first quarter of 1911. The results of observations on fifty-nine days are given in three tables showing the number of spots, their distribution in latitude, and the distribution of the faculæ in latitude.—Jules **Drach**: The determination of the asymptotic lines to the general surfaces of the third degree.—Lucien **Godeaux**: Linear congruences of

conics.—G. **Kœnigs**: The law of the curvatures of conjugated superficial profiles.—M. **Lemeray**: The principle of relativity and the forces exerted between bodies in motion.—H. **Larose**: The propagation of a discontinuity along a telegraph line with uniform loss.—G. A. **Hemsalech**: The air spectrum given by the initial discharge of the self-induction spark. It has been shown in a previous note that the spectrum of the initial discharge of a self-induction spark differs from that emitted by the oscillations, the spectrum having a large proportion of lines. A further study of these spectra of the initial discharge shows that the intensity varies inversely as the capacity of the condenser and directly as the self-induction of the discharge circuit. An increase in the capacity of the electrodes produces a strengthening in the line spectrum and a weakening of the bands.—André **Léauté**: The irregularities of the disruptive potential.—H. **Lioret**, F. **Ducretet**, and E. **Roger**: A self-recording telephone. A combination of a loud-speaking telephone and phonograph is described.—Pierre **Sève**: The measurement of magnetic fields in absolute value. The simultaneous use of the Cotton balance and the induction method described allows fields up to 15,000 Gauss to be measured with an accuracy of 1 in 1000.—E. **Baud**: The molecular heat of fusion.—A. **Tian**: The radiations causing the decomposition of water and the extreme ultra-violet spectrum of the mercury arc. The radiations decomposing water, forming hydrogen and hydrogen peroxide, are localised in the extreme ultra-violet at about 1900 Angström's. The light from a quartz mercury arc lamp determines this decomposition, owing to the presence of rays 1846, 1848, and 1851. —Georges **Dupont**: The catalytic isomerisation of acetylene pinacone. The synthesis of tetramethylketohydrofurane. The pinacone

$$(CH_3)_2.C(OH).C\quad C.C(OH).(CH_3)_2,$$

treated with an aqueous solution of mercuric sulphate gave, not the expected dioxyketone, but its internal anhydride, tetramethylketohydrofurane. The latter gives both ketonic and enolic reactions.—Emile **André**: A new method of preparing β-diketones. Ketones of the type $C_6H_5.C\quad C.CO.R$. combine with amines forming compounds $C_6H_5.C(NR'R'').CH.CO.R$. The latter, under the influence of acids, readily hydrolyse, forming the salt of the amine and the β-diketone $C_6H_5.CO.CH_2.CO.R$. Examples are given proving the generality of the method. —P. L. **Viguier**: Tetrolic aldehyde.—V. **Grignard** and Ch. **Courtot**: The magnesium derivative of fluorene. In xylene solution at 135° C. fluorene reacts with ethylmagnesium-bromide, the magnesium compound

$$\begin{matrix} C_6H_4 \\ | \\ C_6H_4 \end{matrix} \!\!> CH.Mg.Br.$$

being formed, several reactions of which are described.— M. **Battandier**: Experiments on the germination of an aquatic plant, *Damasonium Bourgaei*.—P. **Vuillemin**: Remarks on a disease of the Weymouth pine (*Pinus Strobus*). Reasons are given for supposing that this disease is not really a new one in France.—Pierre **Bonnier**: The monostatic capacity in aviators.—A. **Marie** and Léon **MacAuliffe**: The influence of the social medium on the development of height in women. The average female height increases with the social position. —L. **Le Nouëne**: The addition of a microphone apparatus to the ear trumpet for the relief of deafness.—Charles **Nicolle**, A. **Cuénod**, and L. **Blaisot**: Some experiments on trachoma (granular conjunctivitis). An account of attempts to transmit trachoma from human subjects to monkeys.—A. **Magnan**: The influence of the nature of the food upon the large intestine and cæcum of birds.— N. **Lehmann** and C. **Vaney**: The relations between the climatic conditions and frequency of the larvæ in the Hypoderma of the ox.—M. **Maisonneuve**: The fecundity of Cochylis.—Adrien **Lucet**: The influence of agitation upon the development of *Bacillus anthracis* cultivated in liquid media. If the liquid cultures of anthrax are kept agitated, the bacilli tend to assume the same form as in blood, and the yield in a given time is increased.— A. **Marie**: The development of a neutralising substance in the brain of mammals.—Eloy de **Stœcklin**: The oxydase properties of oxyhæmoglobin.—Gabriel **Bertrand** and Arthur **Compton**: The action of heat upon emulsin. —Stanislas **Meunier**: The *rôle* of biological force in the evolution of the terrestrial surface.—G. **Vasseur**: Western France during the Stampian epoch.—M. **Deprat**: The importance of recent epirogenic movements in south-eastern Asia.—L. **Cayeux**: Dislocations in the islands of Delos, Rhenee, and Mykonos (Cyclades).—Francis **Rey**: The presence of the Gothlandian in the plain of Tamlet, on the Algeria-Morocco border.—Charles **Moureu** and Adolphe **Lepape**: The ratio of argon to nitrogen in natural gaseous mixtures and its signification. This ratio has been determined for fifty-two natural gases from springs, and varies between 0·76 and 3·37, with an average of 1·15.—M. **Boudry**: A new method of utilising thermal waters at a distance from the spring.

CALCUTTA.

Asiatic Society of Bengal, May 3.—I. H. **Burkill**: Swertiæ chinenses quatuor novæ ex herbario G. Bonati. Four new Swertias from Yunnan are described, viz. *S. Bonatiana*, *S. Duclouxii*, *S. rosea*, *S. patens*; *S. patens* is a very marked species.—W. W. **Smith**: Note on *Sterculia alata*, Roxb., var. *irregularis*, a remarkable instance of leaf variation. The author directs attention to the wide range of variation in the leaf of this peculiar variety as represented on a tree in cultivation at the Royal Botanic Garden, Calcutta. Seedlings from the tree may vary like the parent.—W. W. **Smith**: A new Gentian and two new Swertias from the E. Himalaya. Descriptions of a small Gentian and two Swertias from Sikkim, *Gentiana pluviarum*, *Swertia ramosa*, and *S. Burkilliana*. —W. W. **Smith**: Plantarum novarum in Herbario Horti Botanici Calcuttensis cognitarum Decas. Descriptions of *Oritrephes septentrionalis*, *Senecio biligulatus*, *S. Lagotis*, *S. Kingianus*, *S. Chola*, *Saussurea fibrosa*, *S. Pantlingiana*, *S. Nimborum*, *S. Laneana*, and *Veratum shanense*. The first and last are from Burma; the others are from the Sikkim Himalaya.—Lieut. F. H. **Malyon**: Some current Pushtu folk-stories.—D. **Hooper**: The composition of Indian yams. Proximate analyses are given of forty samples of the tubers of identified species and varieties of Dioscorea, grown wild or cultivated in India. The food value of the best kinds is shown to agree with that of the potato. The poisonous principle, dioscorine, is described, and its presence or absence is recorded in the samples examined. The chemical changes that take place when the poisonous roots are treated with water to render them edible is shown by comparative analysis of the raw and prepared tubers.—D. **Hooper**: Some Asiatic milk-products. Peculiar forms of dried cheese, called *Karut* in Baluchistan and Afghanistan, and *Chema* in Tibet and Mongolia, are described, and the analysis of samples from Nepal and Quetta are recorded. They consist largely of casein, with more or less free lactic acid. Examinations are also made of Bengal curds, called *chhana* and *dahi*, the first being a rich cream containing more casein than ordinary cream, and the second being buttermilk undergoing lactic fermentation. *Karut* is prepared from fermented skimmed milk by pressing and drying the coagulated proteids.—Kashi P. **Jayaswal**: Elucidation of certain passages in I'tsing.—Biman Behari **Dey** and Hemendra Kumar **Sen**: Interaction of hydrazine sulphate with nitrites, and a new method for the determination of "nitritic" nitrogen. On attempting to prepare hydrazine nitrite by the double decomposition of barium nitrite and hydrazine sulphate, barium sulphate is precipitated, and the new salt appears to be formed at low temperatures, but readily decomposes. A systematic examination was made of the gases evolved, and it was found that by collecting the gases in an endiometer, nitrous oxide and nitrogen existed in the proportion of two to one. By calculating the weight of the gases evolved, the formation of monacid hydrazine nitrite is demonstrated according to theoretical equations. Nitrites of the alkalis, the alkaline earths, the heavy metals, and, in fact, nitrites in general, were decomposed in a similar manner, and the estimation of the volumes of residual gases indicated the amount of nitritic nitrogen formed in the reactions.—Prof. W. **West**, with notes by Dr. N. **Annandale**: Descriptions of three new species of Algæ associated with Indian fresh-water polyzoa. The algæ described are from the Western Ghats and Orissa, and represent the genera Tolypothrix, Dactylococcopsis, and Microcystis.

DIARY OF SOCIETIES.

THURSDAY, JUNE 8.

ROYAL INSTITUTION, at 3.—Practical Progress in Wireless Telegraphy: T. Thorne Baker.

MATHEMATICAL SOCIETY, at 5.30.—On the Multiplication of Dirichlet's Series: G. H. Hardy.—On the Range of Borel's Method for the Summation of Series: G. H. Hardy and J. E. Littlewood.—On the Convergence of Fourier Series and of the Allied Series: Dr. W. H. Young.—On some Two-dimensional Problems in Electrostatics and Hydrodynamics: W. M. Page.—On Groups of Linear Substitutions of Finite Order with Rational Coefficients: Prof. W. Burnside.

FRIDAY, JUNE 9.

ROYAL INSTITUTION, at 9.—Applications of Physical Chemistry to the Doctrine of Immunity: Prof. S. Arrhenius.

ROYAL ASTRONOMICAL SOCIETY, at 5.—(1) The Transformation of the Moon's Latitude; (2) On the Progress of the New Tables of the Moon's Motion: Ernest W. Brown.—Measures of the Proper Motion Star Sh. 190: S. W. Burnham.—Further considerations relating to the Systematic Motions of the Stars: J. Halm.—Observations of Saturn's Ninth Satellite (Phœbe): Royal Observatory, Greenwich.—On the Detection of a New Element (Dysprosium) in the Solar Chromosphere: Alex. D. Ross.—*Probable Papers*: On the Law which Governs the Variations of SS Cygni: E. T. Whittaker.—Preliminary Results of the Photographic Method of obtaining Differential Places of Reference Stars: H. H. Turner.—The Hartmann-Cornu Formula: F. J. M. Stratton.—The Galactic Distribution of Gaseous Nebulæ: A. R. Hinks.

PHYSICAL SOCIETY, at 8.—The Lüders Lines on Mild Steel: W. Mason.—Exhibition of a Model illustrating the Passage of a Light Wave through Quartz: Dr. H. S. Allen.—Tables of Circular and Hyperbolic Functions for Complex Values of the Argument: A. Johnstone.—On the Measurement of Contact Differences of Potential: Prof. Anderson and J. G. Bowen.—Exhibition of some Gyroscopic Apparatus: Sir G. Greenhill.—A New Method of Approximate Harmonic Analysis by Selected Ordinates: Prof. S. P. Thompson, F.R.S.

MALACOLOGICAL SOCIETY, at 8.—Description of a New Species of Acmæa from Bombay and Notes on other Forms from that locality: E. A. Smith.—Description of Three New Species of Operculate Land Shells from Grand Cayman Island: H. B. Preston.—Further note on Preoccupied Molluscan Generic Names and Proposed New Names: G. K. Gude.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of the District of the Bergen Arches: Dr. C. F. Kolderup.—The Rock Formation of the Bergen District: Horace W. Monckton.

SATURDAY, JUNE 10.

ROYAL INSTITUTION, at 3.—Types of Greek Women: Dr. W. L. Courtney.

ARISTOTELIAN SOCIETY (at Corpus Christi College, Oxford), at 9.—Real Being and the Object of Thought: G. F. Stout.

MONDAY, JUNE 12.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Observations on Cotton and Nitrated Cotton. Part III.: H. de Mosenthal.—Methods of Testing Inflammable Gas and Vapour Detectors: A. Philip and T. Stenhouse.—A New Form of Automatic Detector of Inflammable Gases and Vapours: A. Philip and L. G. Steele.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Some Explorations in the Himalayas: Dr. Arthur Neve.

INSTITUTE OF ACTUARIES, at 5.—Annual General Meeting.

TUESDAY, JUNE 13.

ZOOLOGICAL SOCIETY, at 8.30.—On Antelopes of the Genera Madoqua and Rhynchotragus from Somaliland: Dr. R. E. Drake-Brockman.—On an Amphipod from the Transvaal: Hon. Paul A. Methuen.—The Somali Rhinoceros and the Nigerian Klipspringer: R. Lydekker.—A Contribution to the Ornithology of Western Colombia: C. E. Hellmayr.—The Subspecies of the Spanish Ibex: Prof. Angel Cabrera.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Saints of the Indus Valley: Major A. J. O'Brien.

ROYAL STATISTICAL SOCIETY, at 5.30.—Under the Crown: Sir J. Athelstane Baines.

MINERALOGICAL SOCIETY, at 5.30.—On Zirkelite from Ceylon: G. S. Blake; with Notes on the Crystallography of the Mineral: Dr. G. F. H. Smith; and on the Chemical Composition: Dr. G. T. Prior.—Note on some Crystals of Artificial Gypsum: Rev. Mark Fletcher.—The larger Diamonds of South Africa: L. J. Spencer.—Brecciation in Mineral Veins: F. H. Butler.—On a New Mineral from the Binnenthal: R. H. Solly.—Prehnite from the Lizard District: Arthur Russell.

FARADAY SOCIETY, at 8.—Allotropic Forms of Metals: Prof. Ernst Cohen.

WEDNESDAY, JUNE 14.

GEOLOGICAL SOCIETY, at 8.—On a Monchiquite Intrusion in the Old Red Sandstone of Monmouthshire: Prof. W. S. Boulton.—Notes on the Culm of South Devon. Part I., Exeter District: F. G. Collins; with a Report on the Plant Remains: E. A. Newell Arber; and Notes on the Cephalopoda: G. C. Crick.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—The Diurnal Inequality of Barometric Pressure at Castle O'er, Dumfriesshire: Dr. C. Chree, F.R.S.—Rain Drop Experiments: S. C. Russell.—Investigation of the Electrical State of the Upper Atmosphere, August, 1910: A. J. Makower, Dr. W. Makower, W. M. Gregory, and H. Robinson.

THURSDAY, JUNE 15.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: A New Conception of the Glomerular Activity: Prof. T. G. Brodie, F.R.S.

LINNEAN SOCIETY, at 8.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Research Meeting. Report on River Investigation: Dr. A. Strahan.

FORTHCOMING CONGRESSES.

JUNE 28, 29.—Conference on Education and Training of Engineers. London. President: Mr. Alexander Siemens, President of the Institution of Civil Engineers. General Secretary: Dr. J. H. T. Tudsbery.

JULY 18–22.—International Association of Seismology. Manchester. President: Prof. Arthur Schuster, F.R.S.

JULY 25–28.—British Medical Association. Birmingham. President: Dr. H. T. Butlin, Pres.R.C.S.

JULY 26–29.—First Universal Races Congress. University of London. President: Lord Weardale. General Secretary: G. Spiller, 63 South Hill Park, Hampstead, London.

JULY 29–AUGUST 5.—Congress of French Geographical Societies. Roubaix. President: Prince Roland Bonaparte.

JULY 30–AUGUST 2.—Annual Meeting of the Swiss Society of Natural Sciences. Soleure. President: Dr. A. Pfaehler. Inquiries to Secretaries: Dr. Küng (German) and Prof. Brönnimann (French).

AUGUST.—Centenary of the Foundation of the University of Breslau.

AUGUST 12–18.—First International Congress of Pedology. Brussels. President: M. Alexis Sluys. Secretary: M. Vital Plas, 35 Avenue Paul de Jaer, Brussels.

AUGUST 13–20.—Prehistoric Society of France. Nîmes.

AUGUST 31–SEPTEMBER 6.—British Association. Portsmouth. President: Sir William Ramsay, K.C.B., F.R.S. Address for inquiries: General Secretaries, Burlington House, W.

SEPTEMBER 4–6.—Centenary of the University of Christiania. President of Festival Committee: Prof. Brögger.

SEPTEMBER 9–20.—International Congress of the Applications of Electricity. Turin. President of the Committee of Honour: H.R.H. the Duke of the Abruzzi. Honorary Secretary of the Committee: Signor Guido Semenza, Via S. Paolo 10, Milano. International Secretary: Col. R. E. Crompton, C.B., R.E., Crompton Laboratory, Kensington Court, W.

SEPTEMBER 24–30.—International Congress on Tuberculosis. Rome. Address for inquiries: Honorary Secretary of the National Association for the Prevention of Consumption, 20, Hanover Square, W.

OCTOBER 2–7.—Third International Congress of Hygiene. Dresden. General Secretary: Dr. Hopf, Reichsstrasse 4, Dresden.

OCTOBER 15–22.—Tenth International Geographical Congress. Rome. President: Marquis Raffaele Cappelli. General Secretary: Commander Giovanni Roncagli, Italian Geographical Society, Rome.

DECEMBER 27.—American Association for the Advancement of Science. President: Dr. C. E. Bessey, University of Nebraska. Permanent Secretary: Dr. L. O. Howard, Smithsonian Institution, Washington, D.C.

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