

THURSDAY, APRIL 3, 1913.

DESERT LAND FORMS.

Das Gesetz der Wüstenbildung in Gegenwart und Vorzeit. By Prof. Johannes Walther. Zweite, neubearbeitete Auflage. Pp. xv+342; illustrated. (Leipzig: Quelle and Meyer, 1912.) Price 12 marks.

DESERT regions have received much attention during recent years, and in this volume Prof. Walther presents a very instructive geographical study of the north-eastern part of Africa. This is something more than a new edition of that which he published under the same title in 1900, for the fourteen essays on different aspects of desert conditions which there appeared have been recast and rearranged under the headings of the character of the desert, erosion in the desert, and deposition in the desert, together with a fourth chapter in which the evidence for the identification of desert areas in the past history of the earth is assembled. A visit to Egypt and the north Sudan in 1911 provided the opportunity for extending and supplementing his earlier observations, and recent railway extensions enabled him in the time at his disposal to visit the oasis of Kharga, Khartum, and to cross the Red Sea hills between the Sudan plains and Suakin. The result is a very interesting and instructive work dealing primarily with a part of the north African desert, but introducing many examples from other arid regions of the world.

In treating of precipitation in the desert the author has, we think, in following Sickenberger, gone somewhat too far in saying that dew is entirely absent in the interior of the desert. The absolute humidity is usually not very low, and on cold clear nights dew is not infrequently formed. Stress is rightly laid on the action of rainfall in areas which are fairly described in general terms as rainless, for such falls of rain are not at all uncommonly reported when a wide region is considered, though each fall may be extremely local in extent. The rock tombs on the west of the Nile at Thebes are quoted as providing evidence that the water from the Nile does not there percolate to any distance from its bed. Here the river flows in its alluvial flood plain for the most part. Grabham has shown that the varying levels of the Blue Nile are to be traced so far as 900 metres from its banks in the Sudan, and it appears from discharges which have been measured that a considerable loss from the river takes place, over and above that due to evaporation, in such long reaches as that near Dongola, where the river flows for long distances in the Nubian sandstone.

An especially interesting part of this book deals with the Sudan desert and the "half-desert" on the northern fringe of the monsoon rains, where the extreme aridity of the Nubian and Libyan deserts gives place to less inhospitable conditions and vegetation can develop to a limited extent. The Red Sea hills furnish most instructive instances of this, and of the erosion characteristic of such regions. Many interesting examples of erosion and of deposition are described, and are particularly well illustrated by characteristic and well-chosen photographs. Doubtless because the parts of the country which the author visited do not exhibit good examples of the process, there is not much reference to the filling of wide valleys and depressions with rock waste swept down from the higher levels which may be seen so finely represented further north than the Berber-Suakin route which was followed, in the valleys of the complex of crystalline ranges which form the western shore of the Red Sea. This greatly enlarged edition of a work already well known will be most acceptable to both geographers and geologists. H. G. L.

THE PROPERTIES OF STEAM.

The New Steam Tables: together with their Derivation and Application. By Prof. C. A. M. Smith and A. G. Warren. With an introduction by Sir J. Alfred Ewing, K.C.B., F.R.S. Pp. xii+101. (London: Constable and Co., Ltd., 1913.) Price 4s. net.

PROF. CALLENDAR, in his Royal Society paper of 1900, suggested the use as the characteristic for steam of $v-b=R\theta/p-C\theta^{-n}=V-c$, say. This is suggested by the Joule-Thomson equation for gases, where $n=2$, and by Grindley's result for steam, in which $n=3.8$. Only a man of Prof. Callendar's reputation could have received attention, for he gave rather fanciful reasons for taking $n=3.5$, and for his values of the specific heats when p is very small. Again, it is probably quite untrue that c is a function of temperature only. Nevertheless, when steam tables are calculated by means of the above characteristic, the constants b , C , and n (and, indeed, R also) can be given such values as make the calculations agree with what Prof. Callendar regards as the best experimental results, and he recommended in 1900 that tables calculated from his formulæ should be substituted for the usual tables as given by Regnault and modified by Griffiths and others. The numbers of the new tables are consistent with each other, and this is a great advantage, because we generally need differences

of total heats, for example, rather than their absolute amounts.

Prof. Mollier, of Dresden, in 1906 published tables and sheets of curves calculated on Callendar's methods, and these were published by Sir J. A. Ewing in the third edition of his book on the steam engine in 1910. Prof. Smith and Mr. Warren have recalculated all the numbers (with slight divergences from Mollier's results), using values of the constants which seem to them best, and they reproduce Prof. Mollier's curves showing total heat on an entropy base. They give both Centigrade and Fahrenheit tables. If Prof. Callendar's methods are right there can be no doubt that Prof. Smith and Mr. Warren have done a great service to steam engineers. They nowhere state what is their unit of heat, but it is probably that which agrees with $J=1399$ or 1400 . This will not agree with their figures for the total heat of water. It is also a pity that they do not give the actual experimental results on which their calculations are based; no doubt great weight is given to the Joly-Callendar value of L at 100°C ., and to Callendar's specific heat as well as the Munich results.

Fair agreement of the steam tables with measured values of L , &c., is no proof that Prof. Callendar's method is legitimate, because good agreement may be effected even if we take c to be a constant, b being the volume of water, or, indeed, if we take steam to be a perfect gas. The only real test would be that the calculated specific heat for various temperatures and pressures should agree with measured values. This test cannot be applied until we have better experimental results.

J. P.

PRACTICAL AGRICULTURAL CHEMISTRY.

Practical Agricultural Chemistry. By Prof.

S. J. M. Auld and D. R. Edwardes-Ker. Pp.

xxiv+243. (London: John Murray, 1913.)

Price 5s. net.

UNTIL recently the teacher of agricultural subjects in this country suffered from the disadvantage (or advantage if one looks upon it in that light) that very few textbooks were available to help him in his teaching. The result was that each man had to devise his own course and modify it as time went on and experience accumulated. There is a tendency at the present time for teachers to put their courses on record, and the plan has much to commend it.

The latest scheme thus printed is the laboratory course for students of agricultural chemistry used by Dr. Auld and Mr. Edwardes-Ker. It opens with a good section on plant-life which is dis-

tinctly fuller than usual, including experiments with certain plant constituents not commonly studied in other laboratories. The teacher will find material here that may be new to him and that he may advantageously embody in his own course. The section on soils presents few novel features; indeed, there are some directions in which marked improvements might be made. Above all things, it is necessary to be clear in dealing with the agricultural student. But we find that on p. 86 the "clay" in soil is estimated by a method which will bring out particles less than 0.002 mm. in diameter; on p. 90 by a method which brings out particles less than 0.01 mm. in diameter; while on p. 62 a scheme of classification of soils is given which supposes that "clay" is something altogether different from either. Yet there is no hint that the word is being used in three different senses. The precise definition of clay must be a matter of convention; it is much better for the young student to begin on the British convention and defer the detailed study of other conventions until he is more advanced in the subject.

We should like also to have seen some of the newer and improved methods of analysis brought in. The Neubauer method of examining soil extracts, and the titration method for determining phosphates, are much simpler and quicker than those given, while the perchlorate method of estimating potassium is at least as accurate as, and much cheaper and more convenient than, the costly and cumbersome platinum method. These, however, are essentially matters of detail, and as the authors have shown courage in introducing some new matter in their course, it may be hoped that they will have the further courage to test the newer methods that are now available and adopt them in their teaching.

E. J. R.

SCIENTIFIC EGYPTOLOGY.

(1) *Service des Antiquités de l'Égypte. Catalogue Général des Antiquités Égyptiennes du Musée du Caire.* Nos. 61,051-61,100: The Royal Mummies. By G. Elliot Smith, F.R.S. Pp. vii+118+103 plates. (Le Caire: Imprimerie de l'Institut Français d'Archéologie Orientale, 1912.)

(2) *British School of Archaeology in Egypt. Studies Series. Vol. iii. The Formation of the Alphabet.* By Dr. W. M. Flinders Petrie, F.R.S. Pp. iv+20+9 plates. (London: Macmillan and Co., Ltd., and Bernard Quaritch, 1912.) Price 5s. net.

(1) **P**ROF. ELLIOT SMITH'S studies of mummification, the result of work carried out during the years he spent in Egypt,

have been brought to a fitting conclusion by the issue of this sumptuous catalogue of the royal mummies in the Cairo Museum. The work forms an exhaustive supplement, from the anatomical side, to Sir Gaston Maspero's monograph on the same subject. We meet with many old friends, but there is scarcely one about which the author has not something new to tell us. The earliest and perhaps the most tragic of these dead kings is the seventeenth dynasty Pharaoh Seqenen-Ra, whose agonised hands and battered face and skull bear witness to a violent death upon the field of battle. We note that Prof. Elliot Smith supports Maspero's view that the body was hastily mummified on the field, not transported to Thebes and subjected to partial decomposition, as Dr. Fouquet would have it. Another interesting mummy, or rather skeleton, is that of the heretic King Akhenaten, which was found five years ago by Mr. Theodore Davies in the tomb with Queen Tii's furniture, and was at first supposed to be that of the queen herself; we are glad to have the anatomical evidence as to age, &c., set forth in greater detail.

A subject of controversy on which these important researches throw new light concerns the influence which, it has been supposed, phallic ideas may have exerted on the technique of embalming in Egypt. The evidence against the theories appears conclusive, and cases quoted in support, such as the mummy of Rameses II., can be otherwise explained (see especially p. 61).

It is perhaps scarcely necessary to add the warning that the catalogue is for the scientific, not the general reader, who would find that much of it reads like a detailed report of a series of post mortem examinations; some of the photographs, too, though of the greatest possible value for the anthropologist, are naturally rather gruesome. But, as Prof. Elliot Smith justly remarks, since these valuable historical "documents" have come into our possession (mainly, it may be added, through the depredations of ancient Egyptian grave-plunderers), it is the duty of the man of science to read them as fully and as carefully as possible.

(2) In his latest work, "The Formation of the Alphabet," Prof. Flinders Petrie has given us fresh proof of his versatility. De Rouge's theory of the derivation of the Phœnician alphabet from the Egyptian hieratic writing of the twelfth dynasty is now generally discarded, and some ingenious theories have within recent years been propounded in its place. Prof. Delitzsch, of Berlin, for instance, has worked out for it an elaborate cuneiform ancestry; while Prof. Sayce has more recently suggested a purely Semitic

source in Syria. Prof. Petrie holds that, instead of coming into existence as a small alphabet, enlarged and corrupted by later additions, its evolution was spread over a far greater area and longer period. It had its origin in a gradually formed signary, current far and wide throughout the ancient world, until it was slowly contracted and systematised. Thus the majority of the signs Prof. Petrie would trace back to a remote antiquity, no fewer than forty-four of his sixty elements beginning with pottery-marks in pre-historic Egypt. We have not space to discuss this very attractive theory in detail, but we would suggest to the professor in quite general terms the possibilities of fortuitous resemblance in cases of parallelism where the lines of cultural contact seem remote.

L. W. KING.

PHILOSOPHY AND ETHICS.

- (1) *The Dynamic Foundation of Knowledge.* By Alexander Philip. Pp. xii+318. (London: Kegan Paul, Trench, Trubner and Co., Ltd., 1913.) Price 6s. net.
- (2) *High-School Ethics.* Book I. By J. Howard Moore. Pp. xiv+182. (London: G. Bell and Sons, Ltd., 1912.) Price 2s. 6d. net.
- (3) *The Positive Evolution of Religion: Its Moral and Social Reaction.* By Frederic Harrison. Pp. xx+267. (London: William Heinemann, 1913.) Price 8s. 6d. net.
- (4) *The Value and Destiny of the Individual.* The Gifford Lectures for 1912. Delivered in Edinburgh University. By Dr. B. Bosanquet. Pp. xxxii+331. (London: Macmillan and Co., Ltd., 1913.) Price 10s. net.

(1) ENERGY is the real thing, not matter. The keynote of philosophy is change. Sensation is not sensation of thing changing and of change; it is simple consciousness of change. Change implies power. All science is an interpretation of appearance in terms of power, which is the fundamental postulate. And our notion of power arises from our awareness of our own motor activity, which awareness is one of the first data of experience. Causation is a derivative postulate arising from this same awareness of self-activity; if we were passive photographic plates, we could have no conception of causality. We attribute potent efficacy to the things of sense which resist us, on the analogy of our own activity.

Philosophic systems come and go, as did theological discussions in their mediæval day; but the hope of the future is in the triumph of science. It offers the clue, viz., "to conceive of things in terms of their organic potency."

Reality is an ever-transmutable energy, and with this conception the contradiction between materialism and idealism is got rid of.

The book is well written, and contains much sound analysis of perception and the like, with much that is debatable but suggestive and stimulating.

(2) Lectures delivered by the author at the Crane Technical High School, Chicago, in his department as instructor in ethics; the volume is Book I. in a four-years' course which he is working out. It is not a text-book of "ethics" as we understand the word over here, but a series of moral lessons aiming at the improving of character rather than the imparting of knowledge concerning a science. They are admirably arranged, and deal with honesty, industry, earnestness, obedience, courtesy, self-control, sport and its cruelties, &c. Suitable anecdotes are introduced, and the style is breezy and interesting. It is to be hoped that many schools will use this pioneer volume as a manual. As Mr. Moore remarks, we have scarcely yet begun to educate the human young. When we become enlightened, we shall not consider when a new being comes into the world that the first and most important thing to do is to pounce upon him and teach him to read and write. The art of putting oneself in the place of others is a more important art, and the inculcation of this is a more important anxiety in child education than the art of reading and writing. It is noteworthy that the Illinois legislature passed a law three years ago requiring the teaching of morals and humanity in all the public schools of the State for thirty minutes every week. Illinois was the fourteenth State to adopt such a law.

(3) Mr. Harrison is always readable, and this collection of essays and discourses will serve as a useful popular compendium of Positivist doctrine. It suffers in places from a certain garrulity, and also the reader occasionally feels that the author is laboriously slaying the slain—as when he refutes "orthodox criticism," with its "scheme of personal salvation" and its "Almighty, Absolute, incomprehensible God." And, in view of the parade of "science" and "logic," he is rather dogmatic, though at the same time vague and general—*e.g.* "there can be little doubt that the average Orthodox Dissenter is far inferior in learning, culture, and breadth of view and nature to the average Churchman" (p. 171). These hasty personal judgments are injudicious, and, besides, such phrases as "average Orthodox Dissenter" and "average Churchman" are too vague to be of much use. It may even be doubted whether Mr.

Harrison knows much about Dissent, for he speaks of some unnamed publication as the "authoritative organ of Orthodox Nonconformity" (p. 207). No such publication exists. Most of the greater dissenting sects have their own organ, but no one of these speaks for all. And, indeed, what is "Orthodox Nonconformity?" On the question of miracles, Mr. Harrison uses the antiquated phrase "suspension of the laws of nature," and talks of "violation" quite in the style of Hume. Surely after Mill and Huxley this language ought not to be used. With Mr. Harrison's agnosticism about a "Creator," and his emphasis on social effort and character-building, probably most scientific readers will heartily agree.

(4) After Mr. Harrison's relegation of metaphysics and absolutes to the lumber-room of outworn things comes Dr. Bosanquet's "truth which for us is now established, of the reality and perfection of the Absolute" (p. 260). No doubt they will read each other's books—or perhaps they will not—and will remain of the same opinion still. But there is a great difference between the two, in the eyes of what Mr. Harrison would probably call an "average reader." The one is a *littérateur*, the other is a thinker and philosopher. We have no space for an adequate review of Dr. Bosanquet's book (which embodies the Gifford lectures for 1911-1912), and must content ourselves with saying that the title well describes the contents, and that the author's view of time seems more satisfactory than that of Bergson, which he criticises.

OUR BOOKSHELF.

Plant Diseases. By Dr. Werner F. Bruck. Translated by Prof. J. R. Ainsworth-Davis. Pp. 152. (London: Blackie and Son, Ltd., 1912.) Price 2s. net.

It is difficult to see to what class of readers this book can be of use. The book claims to be "a concise introduction to the subject of plant diseases," and the field surveyed is very wide, fungous and animal parasites and diseases caused by adverse cultural or weather conditions being included. Except in a few instances, as, *e.g.* in the chapters on diseases of coniferous wood and on beet and mangold diseases, little is said on the changes produced by disease in the plant. In some cases the enumeration of the "pests" carries no information at all, *e.g.* in the list of "animal pests" of leguminous plants there is a bare list of nine names. Unfortunately much of the information is given in so vague a manner that the book cannot be recommended as a "primer" for the student, and it does not claim to give the detailed advice as to remedies necessary for the practical grower. One wonders what idea a student would carry away after reading the

following description (which is unaccompanied by any illustration):—"The *accidium* is found below the cortex of a stem or the epidermis of a leaf"; and shares his bewilderment on reading, in the paragraph dealing with cultural methods, the sentence:—"Artificial solutions . . . ought to contain the substances present in the diseased specimens."

Although "mykoplasm" is mentioned, no reference is made to the discovery of "specialisation of parasitism" by Eriksson and others. This leads the author wrongly to assume that the hop and pea mildews spread from their numerous wild host-plants to the cultivated plants in question. The view expressed that *Nectria ditissima* is always the secondary and not the primary cause of apple-"canker" was disproved some time ago. By a slip *Fusicladium dendriticum* is stated to attack pears; and it may be pointed out that *Alternaria* is not an Oomycete, *Hypochnus* is not an Ascomycete, and that green vitriol is not copper sulphite.

The illustrations are bad, some extraordinarily so—e.g. those of corn-mildew, vine-mildew, apple-scab, and Orobanche. The last-named is certainly worthless; six botanists (all familiar with the plant), to whom it was shown by the reviewer, all failed to recognise the plant.

The best we can say is that the descriptions of the various fungi mentioned are clear, and the book is very free from misprints. E. S. S.

Technical School Organisation and Teaching. By C. Hamilton. With a preface by G. Udney Yule. Pp. xii+178. (London: George Routledge and Sons, Ltd., 1913.) Price 2s. 6d. net.

THE great and rapid changes which have recently taken place in the organisation of technical education in evening schools have (says Mr. Yule) created a demand for a new series of text-books specially adapted to the new circumstances. The present volume is issued as a general introduction to the series. Its aim is to define the proper scope and function of evening school work, to discuss the organisation necessary to make that work effective, and to provide—especially for those who, without previous training or experience, become instructors in evening schools—a simple exposition of the chief principles of teaching. It is evident that the author has excellent qualifications for performing his task. In his introductory section he shows so clear a grasp of the problems of evening school work, so sane a view of its possibilities and of the part it should play in a national scheme of education, that he gains at once the confidence of his readers. The same lucidity, liberality, and practical good sense characterise the subsequent section on the arrangement of courses, the details of administration and the functions of examinations. The final sections show a refreshingly sound appreciation of the principles of method, and much skill in applying them to the special problems of the technical teacher. It is probable that these 120 pages will prove the most helpful and informative part of a thoroughly useful book.

T. P. N.

LETTERS TO THE EDITOR.

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An Attempted Photochemical "Resolution" of Silver.

THE recent correspondence between Prof. Schuster and Mr. Soddy in these columns suggests the placing upon record of a bold but unsuccessful attempt to split up the element silver which I made some years ago with one of my students. In these days, when tentative speculations are figuring so largely in the scientific world for positive knowledge, it may be necessary to point out that the research was prompted by no theoretical views concerning the compound nature of silver. But while there was no special *a priori* reason for suspecting the elemental character of that metal it was well known as a fact that its chloride, &c., on exposure to light only underwent a limited decomposition—i.e. that the photo-reduction ceased when a certain minute proportion of "photo-salt" had been formed. The consideration of this property of the silver halides suggested the interpretation (purely hypothetical!) that the "element" contained a constituent (say, α -silver) of which the chloride was sensitive to light, and another (say, β -silver) less sensitive or insensitive to light. From this it followed that if, after exposure and complete saturation with "photo-salt," the unchanged chloride could be separated from the photo-reduction product, the latter, on reconversion into chloride, should furnish a salt very highly sensitive as compared with the main portion of unchanged chloride.

For various reasons the research was never completed, chief among these reasons being the difficulty of effectively separating the minute trace of photo-reduction product from the large excess of unchanged chloride. Notwithstanding our failure, the experiment might be worth repeating under more favourable conditions since the relative sensitiveness to light of two specimens of silver chloride—the hypothetical α and β modifications—could be easily detected and possibly measured. Even if a negative result is obtained it would seem worth the expenditure of time and trouble in order to set at rest the question raised by the hypothesis. Should the result be positive it is needless to point out that the discovery might have important practical bearings upon photographic processes. It may be worth mentioning that in the course of our experiments it was found that a boiling saturated solution of aniline hydrochloride was a good solvent for silver chloride. What is wanted, however, for the present purpose is some inorganic solvent which dissolves the unchanged silver chloride at ordinary temperatures more freely than the metallic chlorides (lithium, &c.) hitherto used for this purpose. Reagents like thiosulphates, cyanides, &c., which form salts with and freely dissolve silver chloride, appear to decompose too much of the "photo-salt" to be of use in such an inquiry. The bearing of the present discussion upon our abortive attempt to "resolve" silver is sufficiently obvious—is the darkening of a silver salt under the influence of light a case of "physical analysis"?

R. MELDOLA.

Bournemouth, March 22.

Dana's Proof of Darwin's Theory of Coral Reefs.

IN connection with Prof. Davis's paper on Dana's proof of Darwin's theory of coral reefs, which appeared in NATURE on February 6, it is interesting to point out that land valleys which extend beneath the

sea are not always proofs of subsidence. Such valleys, like coral reefs, may owe their existence to different factors in different cases.

The harbours of this coast are the high parts of submarine fault valleys, and the portion bordered by land is often only a small part of the whole. Yet the evidence is very clear that the coast has risen regularly since the Red Sea was made, and that river erosion has had nothing to do with the formation of these steep-sided rifts. The coast of equatorial East Africa is essentially similar, though there the fault features are not so obvious, as they have been smoothed down somewhat by the heavy rainfall. Yet such harbours as Mombasa, Kilindini, Tanga, and Wasin are obviously homologous with those of Port Sudan, Suakin, and the desert harbours of the Red Sea.

Chwaka Bay, on the east coast of Zanzibar, is part of a depression which runs right across the island in a south-west direction, and forms long inlets where it reaches the sea on the other side.

The island of Pemba, a little north of Zanzibar, is dissected in a wonderful way on its west side by long fiords running far into the land, and ending in mangrove creeks, perfect slaver- and pirate-hiding places. The land is comparatively high and of great fertility, so that a coasting voyage among the fiords is one of great pleasure and interest.

Surely these are typical drowned valleys? Not at all; the island, like Zanzibar, was elevated in late Tertiary times, the fossils of its coral cliffs are Pleistocene or recent, and both islands have remained at or near their present level while their reefs were carved out. In places on the east coast of Zanzibar the reef is up to three miles wide, and is something between a fringing and a barrier formation. Yet it was all formed by abrasion of elevated coral land.

Along the edge of the deep water, in a line at right angles to the Pemba fiords, is a regular but broken line of reefs and islands, a typical barrier. Where the islands have not been worn away by the sea they are formed entirely of elevated coral, and the reefs have been formed by abrasion of land. When this process is complete, there will be a typical barrier reef, should the islands continue stationary at the level to which they were originally elevated.

The two islands, Zanzibar and Pemba, were originally regular oval cups of coral (or perhaps saucers rather, as in Pemba coral limestone is seen at lowest tide level a long way up Chaki Chaki Bay), and were connected with the mainland. These were filled with the sand and pebbles which now form most of the hills. After elevation they were cut off from the mainland by marine erosion, possibly (in the case of Pemba at least) also by a comparatively deep fault. Other faults on this side cracked the saucers, and irregularity was further induced by marine abrasion, in some places made excessive by powerful silt-bearing currents, in others neutralised by the protection afforded by growing coral and algæ. As along the deep water conditions more uniformly favour the growth of protecting organisms, the edges of the saucers retain their regularity, while within the mass of sand and the limestone on which it lies is subject to rapid degradation. The fiords are extending into the land among the mangrove swamps at their heads. The roots of the mangroves penetrate the crevices of the coral and cause shallow accumulations of mud, both factors for the disintegration and solution of coral limestone. I take the extremely complicated outline of the south end of Pemba Island to be an example of the barachois described by Prof. Gardiner in the results of the Percy Sladen Trust expedition to the western Indian Ocean.

In the Red Sea the heads of the harbours are being filled in with blown sand and flood-borne alluvium, but in Pemba there are no delta-like formations; the marine currents are far too powerful to allow of them, even if the streams were big enough to convey any quantity of alluvium.

In the Red Sea and equatorial East Africa we thus have, on stationary or rising coasts:—(1) Submarine valleys which are scarcely altered from the original fault rifts; (2) those of similar origin somewhat disguised by the effects of tidal currents and fresh-water streams.

The above have little if any continuation into the land, but in Pemba are found:—(3) Long fiords simulating drowned valleys, but of the same origin as (1) and (2); (4) barrier reefs formed by abrasion alone, in Zanzibar and Pemba.

In the Red Sea are (5) barriers which are features of the sides of a rift valley merely coated with coral.

(6) The barriers of the equatorial coast may be of the same origin as those of the Red Sea, but, if Zanzibar Island be reckoned a part of this barrier, removal of the intervening land has been at least the cause of the final separation, as proved by the fauna of the island. Probably they are comparable to the barrier of the west side of Pemba in structure and origin, due to the faulting and erosion of the heterogeneous material of coral deposits.

My statements here are dogmatic for want of space, but details are given in my papers in Proc. Camb. Phil. Soc., 1902, and Journ. Linn. Soc., vol. xxxi., 1907 and 1911.

My being in a distant and isolated village, which is, however, a few yards from coral reefs, is my excuse for the delay in your receipt of this contribution to the discussion.

CYRIL CROSSLAND.

Dongonab, Red Sea, February 24.

Elliptical Lunar Halos.

ON the morning of January 26, 1908, while observing with the Keeler reflector of this observatory, I noticed a curious lunar halo, which I described as follows in the notes made at the time:—

"At 4.25 a.m. (Eastern standard time) I saw an elliptical halo close to and concentric with the moon. Its major axis was vertical, and was about 7° long, the lunar diameter being used to make this estimate. The horizontal axis was a little less than half the vertical, or about 3°. The halo lasted only about one minute, but was unmistakable, being well defined (except near the bottom) on both its inner and outer edges. It reappeared less distinctly at 4.31 a.m., lasting only a few seconds. I watched the moon until 4.50 a.m., but saw no third appearance. The halo was white in colour. There was a light east wind blowing at the time, and there was a little haze in the sky. The temperature was 28° F., and had been very constant all night. The moon was at last quarter."

At my request the other observers here have watched for such a halo, and on December 1, 1908, both Prof. Jordan and Dr. Baker witnessed a much longer appearance of it. Prof. Jordan's notes read as follows:—

"An elliptical lunar halo was visible here on the evening of December 1, 1908. The night began with a very clear sky, but about eight o'clock a slight haze became visible in the neighbourhood of the moon. This soon began to take definite form, and the halo developed. It remained visible until about 9 p.m., when it gradually disappeared and the sky soon became cloudy. The halo varied greatly in brightness because of the varying amount of haze in the atmosphere: very

definite and bright when the amount was large, and occasionally disappearing in part or even completely as the atmosphere cleared. Sometimes the whole halo became uniformly faint, while at other times portions of the circumference disappeared. The major axis was vertical, the moon being about on the meridian. The axes were estimated to be about 7° and 4° respectively, but no careful measures were made. The colour, if any, was very slight. The moon was at first quarter."

None of my astronomical friends to whom I have described these elliptical halos has ever seen one. They must be rare phenomena, and well worth recording.

FRANK SCHLESINGER.

Allegheny Observatory, February 24.

The halo appears to be that known as "Hall's halo," but the diameters given are rather less than those observed by Hall. The phenomenon is mentioned in Pernter's "Meteorologische Optik" (p. 262), and an explanation is suggested by him on p. 381 of that work.

[ED. NATURE.]

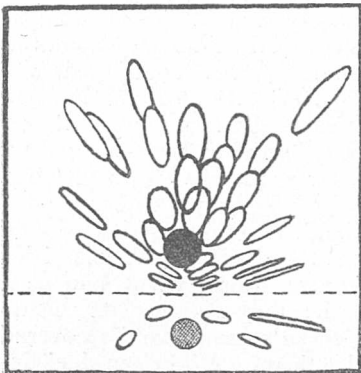
The Reflection of X-Rays.

IN continuation of the experiments of Mr. W. L. Bragg (NATURE, December 12, 1912, p. 410), I have investigated the reflection of X-rays by mica. Mr. Bragg finds one reflected beam, while Messrs. Hupka and Steinhaus (NATURE, March 6, 1913, p. 10) find two beams. Using a parallel pencil and an angle of incidence of 70° , I find no difficulty in photographing five beams emerging from the "incident" side of the mica, of which that obeying the ordinary laws of reflection is the most obvious.

From the "transmitted" side of the mica sheet there are certainly no fewer than thirty distinct beams apart from the intense primary beam which has passed through the crystal (0.33 mm. thick) without much absorption. The plane of the mica sheet was perpendicular to that of the photographic plate. In the reproduction given below, the intense black spot is produced by the transmitted primary beam, while beneath it is seen another circular patch due to the ordinary reflected beam.

The greatest photographic intensity occurs in those transmitted beams which have suffered the least deviation, the ordinary reflected pencil being feeble in comparison with some of them.

The greatest photographic intensity occurs in those transmitted beams which have suffered the least deviation, the ordinary reflected pencil being feeble in comparison with some of them.



It will be evident that the transmitted pattern is analogous to that obtained by Messrs. Laue, Friedrich, and Knipping (NATURE, November 14, 1912, p. 306), using a pencil of X-rays falling normally on a crystal of zincblende. Repeating my experiments, using a normal pencil, a transmitted pattern is obtained similar to theirs.

Besides giving rise to numerous pencils in definite directions, the mica sheet exhibits the ordinary incident and emergent scattering. It is well known that this effect is small in the plane of the radiator. This is borne out in all the negatives which exhibit general fogging, except along a line which represents the line of intersection of the photographic plate by a plane

containing the mica sheet. This line is represented in the diagram by the broken line. Similar results are obtained using rock salt and galena.

Since the photograph described above is unsuitable for reproduction by a half-tone block, I have been obliged here to substitute a diagrammatic copy for it.

H. B. KEENE.

Physics Department, University of Birmingham,
March 15.

The Presence of Protozoa in Soils.

UP to the present, so far as I am aware, the only method of demonstrating the presence of Protozoa in soils has been by cultures. This method, of course, leaves untouched the really important question as to what Protozoa are leading a trophic existence at any given time in a soil sample, since many of the forms found later on in cultures may be derived from cysts. In these circumstances I thought it might be of interest to direct attention to a method by which the presence of Protozoa in the trophic stage in the soils can be readily demonstrated, even though this method from a quantitative point of view probably gives low results.

A small quantity of the soil to be investigated is mixed, as soon as it is collected, with about an equal volume of picric acid. The mixture is then placed in a wide dish and carefully stirred, so that the organisms on the surface films between the soil particles are free. If the mixture is then allowed to stand for a time it will be found that most of the bacteria, diatoms and Protozoa that were present come up to the surface film. The coverslips, cut according to the method which I have previously described, can then be floated on the film, and then placed in tubes containing corrosive. These cover-slips can then be handled as though they were ordinary smears. The best method of staining seems to be to stain for some time in strong acid haemalum, followed by eosin. I have tried mixing the soil in the first instance with other fixatives in the place of picric acid, but have not obtained such good results. By this method perfectly clean preparations, showing large numbers of amœba and flagellates, have been obtained from a six weeks old bed, which had been used for growing seedling cauliflowers. These have been used to compare the active fauna of such a soil with the fauna derived from the same soil in cultures.

As might be expected, it has been found that the prevalence of any given Protozoon in the cultures is not an indication of its prevalence in the trophic stage in the soil, though by varying the methods of culture it has been found possible to cultivate all the Protozoa that have been found by the above method leading a trophic life in this soil at the date of fixation.

C. H. MARTIN.

The Hill, Abergavenny, March 19.

Jelly-fish of the Norquane River.

THE discovery of a jelly-fish in the northern watershed of the Limpopo will be of some interest to zoologists.

During the new year holidays, while making zoological collections in the Bembezi district (thirty miles north-east of Bulawayo), I noticed some jelly-fishes in a pool of the Norquane River, a tributary of the fourth degree of the Limpopo.

With the scanty literature at my disposal, it is not possible at present to identify or determine it as a new species, but judging by the figures in Lankester's "Treatise on Zoology" and in the "Cambridge Natural History," and also by Mr. Moore's statement ("The Tanganyika Problem") that *Limnocnida tanganyikae* varies in size from that of a shilling to

a two-shilling piece, and is as flat as those coins, these jelly-fishes are not referable to that species.

In life, they are almost hemispherical and slightly flattened on top; the largest do not measure more than 16 mm. in their widest part, and the smallest measure about 6 mm.

The Norquane is a narrow stream with a sandy bed cut into a succession of pools by granite bars. In all the pools over a distance of a mile, hundreds of the jelly-fishes were to be seen. The first specimen was found in a pool about 20 ft. by 30 ft. and 7 ft. deep, late in the afternoon, and a careful search did not at first reveal any more. Shortly after my having a bathe in the same pool, numerous specimens came to the surface, and subsequent observation showed that the creatures swim near the surface in the earlier part of the day, and retire to the deeper water during the hotter hours, from which they were disturbed by the bathing. Their stinging powers, however feeble, probably render the jelly-fishes unpalatable to the fishes in the pool (chiefly *Barbus 3-maculatus* and *Tilapia* sp.), which left them severely alone.

I hope to be able soon to obtain Günther's paper in the *Q.J.M.S.* on *Limnocyda tanganyikae*, when it will be possible to decide whether or not this is a new and the fifth known species of fresh-water medusa. I should add that a careful examination of several pools during three days failed to reveal any signs of a hydrosome stage.

G. ARNOLD.

The Rhodesia Museum, Bulawayo, February 21.

An Experiment for Showing Lines of Force in an Electrostatic Field.

THE general directions of the lines of force between charged conductors can be shown by a method which, though extremely simple, shows as much as the elegant but somewhat elaborate apparatus described by Mr. R. F. D'Arcy (*NATURE*, March 20) would seem capable of.

It is simply to allow a scrap of cotton-wool to fall between the knobs of a Wimshurst machine, or among any conductors connected with them. As soon as the bit of fluff touches one of the conductors it moves off rapidly along a line of force. If the other conductor is oppositely charged the fluff will strike it, and again be repelled, usually in a slightly different direction, thus traversing a different line of force, and so on.

The scrap of charged fluff moves so rapidly under the electric forces that, owing to the persistence of vision, the shape of its path is very evident, and, owing to its lightness and the relatively great resistance offered by the air to its motion, its path approximates very closely indeed to the line of force.

BERNARD M. NEVILLE.

William Ellis School, London, N.W.

Snail-cavities in Stones.

REFERRING to Mr. E. W. Swanton's letter in *NATURE* of March 20, may I point out that the Agglestone rock is a sandstone composed of quartz grains bound together by a ferruginous cement.

I believe the excavations of *Helix aspersa* on rock surfaces are produced by chemical action, and that the secretion only acts as a solvent where salts of lime are present. This assumption seems reasonable on the supposition that the snails require lime for the construction of their shells.

Sandstones, unless calcareous, would have to be attacked mechanically by snails for cavities to be formed. Is there any evidence to prove that such cavities have been produced in sandstones?

C. CARUS-WILSON.

COMPLETION OF THE DISCOVERY OF THE GREENLAND COASTS.¹

THE last part of the coast of Greenland to remain undiscovered is the north-eastern tract between Germania Land and the area reached by Peary on his famous journey across the northern ice-sheet to Independence Fiord. This gap has been filled by the Danish expedition under Erichsen, which discovered that instead of the coast continuing in a fairly direct course from Germania Land in 77° N. to Peary Land in 82½° N., Greenland projects in a long peninsula for 5° to the east. The work of the supporting parties of this expedition made some interesting additions to the glacial geology of Greenland, which have been published in Koch and Wegener's memoir on the glacial observations. Erichsen's expedition achieved its object, but he and his two companions, Hagen and the Eskimo Brönlund, perished during the return journey. Brönlund was able to reach nearest home. His body and diary, with a map by Lieut. Hagen, were found by a search-party under Captain Koch. These papers announced the success of the expedition and its tragic end. The journals of Erichsen and Hagen were not recovered, and an expedition to search for them was dispatched under Captain Ejnar Mikkelsen in 1909. This expedition was successful in recovering some messages left by Erichsen in his depôts, but it also nearly perished on the return journey.

The expedition sailed in a small sloop, the *Alabama*, but its plans were disorganised at the start. It called at the Farøe Islands to receive its dogs. But of the fifty dogs which had been bought in Greenland, twenty-three had died on the voyage to the Farøes, and the rest were so diseased that they had to be shot. The *Alabama*, therefore, had to go to the Eskimo settlements in south-eastern Greenland to buy dogs, and was thus seriously delayed. The expedition reached its base, Shannon Island (lat. 75° 10' N.), on August 27, and a party in the autumn sledged up the eastern coast as far as Lambert's Land (79°), where they found Brönlund's grave. After wintering on Shannon Island, Captain Mikkelsen and Lieutenant Iversen marched across the inland ice to the head of Denmark's Fiord, which had been discovered by Erichsen; they searched its coasts, found the site of Erichsen's camps, and recovered the messages left in them. Mikkelsen had intended to return to the Eskimo settlements on the western coast through the strait which, according to Peary, extends across northern Greenland; but this plan had to be abandoned when it was found from one of Erichsen's notes that "the Peary channel does not exist, Navy Cliff being connected by land with Heilprin Land." The author has commented severely on this mistake, but, considering the sufferings it caused him, his annoyance is intelligible.

¹ "Lost in the Arctic." Being the Story of the *Alabama* Expedition, 1909-12. By Ejnar Mikkelsen. Pp. xviii+400+plates. (London: W. Heinemann, 1913.) Price 18s. net.

The two explorers therefore started back from the mouth of Independence Fiord around the north-eastern peninsula of Greenland in order to

had been laid for Erichsen. When at length they arrived at Shannon Island, they found that the *Alabama* had been wrecked and their companions had left. They had to spend two further winters at their base before their rescue in the spring of 1912.

The main geographical result of the expedition was the discovery from Erichsen's notes that the Peary canal is not a continuous strait but two fiords, so that the northern end of Greenland is not a separate island. Captain Mikkelsen's own work has added to the topography of this most inaccessible part of the Greenland coast. His book is most graphically written; it

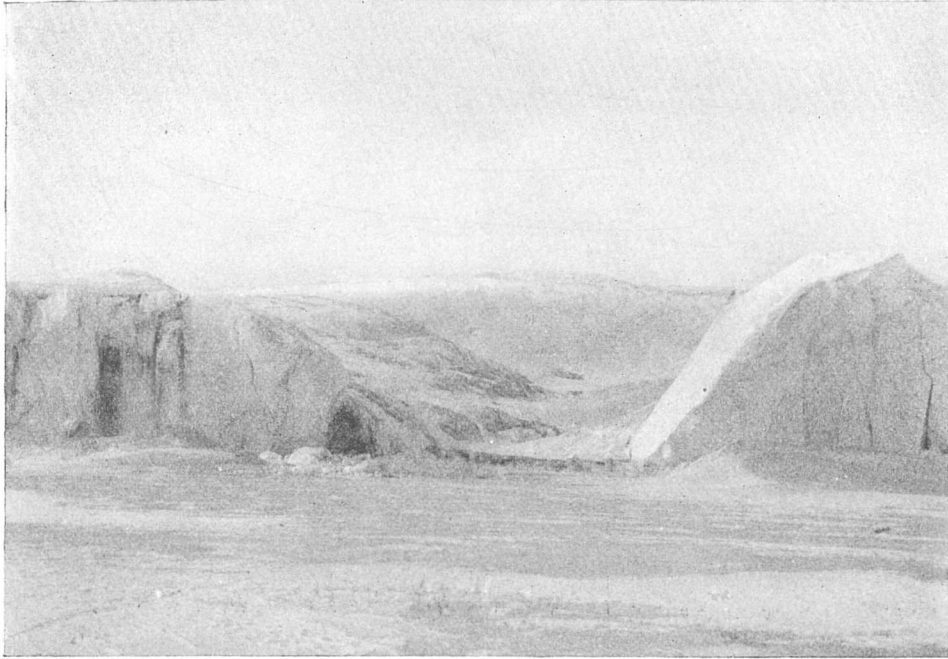


FIG. 1.—The glacier front. From "Lost in the Arctic."

reach their base on Shannon Island, 7° to the south. They were delayed by the rotten condition of the thawing ice and the difficulty of crossing the numerous water-leads. They were compelled

to wait until the return of colder weather improved the conditions of travel. During most of the return march the two travellers were on very short rations, and the conditions of the season were so unfavourable that there was very little fresh food to be obtained. The seals were so thin that they sank when shot, so seal-meat was not procurable. Both men were attacked by scurvy, from which they were once cured by killing a few birds. Without

dog transport their position would have been hopeless; but by eating the last of their dogs they managed to reach some of the depôts that

tells the story of perhaps the most adventurous arctic journey from which the explorers returned to narrate their experiences. The two men succeeded in their errand owing to the same sound

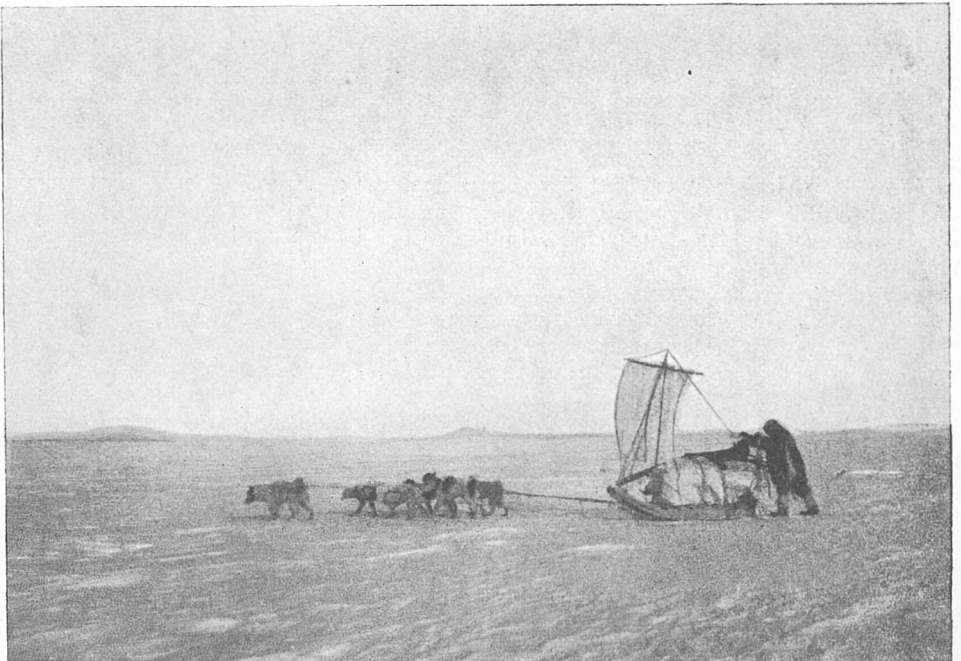


FIG. 2.—Iversen's sledge. From "Lost in the Arctic."

judgment and geographical insight which enabled them to survive the terrible hardships of their return journey.

The book does not give any of the scientific results of the expedition, which will no doubt prove to be valuable from an observer of such wide arctic experience as Captain Mikkelsen. The book is illustrated by many instructive photographs, which are arranged haphazard, and by a map which is the most inconveniently placed that we remember to have seen.

*CORONÆ, GLORIES, AND
HEILIGENSCH EIN.*

DURING May and June, 1912, several correspondents described a number of optical phenomena, principally solar haloes, which they had observed just before the commencement of the remarkable haze which covered the sky in the northern hemisphere during the summer months of last year, and a short article dealing with the simpler haloes and mock suns appeared in *NATURE* (vol. lxxxix., p. 377). Recently attention has been directed to certain less generally known and less majestic phenomena (possibly also less ominous), which are described as (1) coronæ, (2) glories, Ulloa's rings, anthelia, or Brocken spectres; (3) haloes, or more strictly Heiligenschein or dew glories, and a note on these may supplement the earlier article.

Coronæ are luminous rings around the sun or moon, usually, although not necessarily, smaller than the smallest halo properly so called, which has a radius of 22° . The order of their colours is opposite to that of haloes, red being outside and blue inside for each ring. Inside the first ring is the aureole of a peculiar pale-tinted blue near the luminary, with brownish-red next to it. Sometimes the aureole alone is visible.

Coronæ are produced by diffraction either by small drops of water or possibly by ice-needles, although Dr. Simpson, from observations in the Antarctic with a party led by Captain Scott in September, 1911, and from theoretical considerations, concluded that coronæ there were not produced by ice-crystals, but by super-cooled drops of water, and drew the very important deduction that "liquid" water exists in the atmosphere at temperatures far below the ordinary freezing point. The more uniform the size of the drops in the cloud producing a corona, the more brilliant is the phenomenon. The angular radius θ of a coronal ring is proportional to the wave-length λ of the colour of the ring and inversely proportional to r , the radius of the drops, but a small correction is necessary on account of the fact that the sun or moon is not a point-source of light, but has a definite diameter. Observed radii θ must be diminished by $16'$ before they are used in the formula $\sin \theta = c\lambda/r$, where c is roughly 0.8, 1.3, 1.9 for the first, second, and third rings. The intensity of the light in the rings is of the order of $1/100$ of the intensity of the direct light from the source. The diameter of the drops in clouds producing coronæ varies from about 0.01 to 0.04 millimetres.

Glories are luminous rings seen around the

head of the shadow of the observer upon a cloud. They are specially frequent upon mountains, hence the name Brocken-spectre. Antonio de Ulloa, the Spanish captain who took the French scientific expedition to Peru in 1735 and explored the Andes with Bouguer and Condamine, shares with Bouguer the honour of having first given a precise description of the phenomenon which is sometimes associated with his name. Scoresby, the arctic explorer, observed glories frequently in polar regions, with clouds rising from the sea, by climbing the mast of his ship. On one occasion he saw as many as four coloured rings.

Accounts of glories occur on almost every page of the logbook kept by the observers on Ben Nevis, and on one occasion, November 23, 1884, they saw as many as five together, varying in radius from less than 2° to more than 10° . According to Pernter, glories are coronæ produced by reflected light. They are consequently much less intense than direct coronæ, and are usually seen by sunlight. Out of nearly 200 glories described by the Ben Nevis observers, only three were seen by moonlight. Mascart, however, attributes glories to diffraction of the incident light in the same way as if it were travelling in the opposite direction, and against this explanation the objections which Miss A. Everett quotes (January 23) from Prof. Richarz would not hold.

Haloes or glories around the shadow of the head thrown on dewy grass in early morning or evening have been called "Heiligenschein" to distinguish them from haloes of the ordinary type. The "Heiligenschein" is a real phenomenon which can be photographed, and it extends some distance from the edge of the shadow. It is not to be confused with the apparent brightness around the shadow thrown on a flat surface, which is a purely subjective phenomenon. This latter may explain the brightness along the shadow of an overhead tram-wire mentioned by Mr. Merrick in a letter. The Heiligenschein is most clearly seen in meadows where the grass is more or less uniform in length and orientation, and is covered with small drops of dew. The height of the sun should be such that the length of the shadow is 40 ft. or more. The phenomenon is attributed to the light reflected from the spherical dew-drops both directly and after two refractions and one or more internal reflections. These effects give a maximum intensity in the direction of the incident light, the intensity falling off continuously without alternation of colour. It is, therefore, quite distinct from haloes, coronæ, and glories.

The halo on ruffled water described by Prof. Worthington in *NATURE* of February 13 (p. 647) appears to be akin to Heiligenschein, although the condition of slight turbidity which he postulates suggests that the turbid constituents may act in a similar way to fog particles.

In addition to the letters already published in *NATURE*, several others have been received. Mr. T. S. Patterson, of Glasgow University, refers to Benvenuto Cellini and the consolation which

golfers may gain by contemplating the Heiligenschein when they are searching in the lengthening shadows for a missing ball; Mr. G. A. Shakespeare, of Birmingham University, also refers to Cellini and to the subjective effect at the edge of a shadow, and to the peculiar effectiveness of the leaves of the white pink in producing Heiligenschein; Mr. G. Merrick, of Newcastle, states that he has observed Heiligenschein around the head of a person 4 ft. from him—an unusual occurrence—and along the shadow of an overhead tram-wire; Mr. G. M. Davies, of Croydon, describes an observation of a "glory" on Snowdon at 3 p.m. in September, 1905; Mr. Howard Fox, of Falmouth, relates an experience in Cornwall forty years ago as he was driving along the road, when he saw a glory on a low fog, followed later by a white "fog-bow." A note has also been received of a "halo" of about 15° diameter seen on the surface of Lake Suwa in Central Japan by Viscount Tanaka. In this case the phenomenon might be attributed to diffraction by minute water-drops condensed in the air just above the surface of the lake, but such an explanation would fail if, as stated, the colour-bands were radial. The phenomenon is discussed in an article (in Japanese) in the Journal of the Meteorological Society of Japan (December, 1912).

"H. V. G." refers to the radial appearance of dust on the surface of a mirror owing to the particles of dust and their images presenting to the eye the appearance of short straight lines.

E. G.

THE OIL-SHALES OF THE LOTHIAN.¹

THE memoir on the oil-shales of the Lothians published by the Geological Survey of Scotland in 1906 contained so much valuable information that the first edition was exhausted in 1911, and the second edition, brought thoroughly to date, has now been issued, and forms a most welcome and valuable addition to our knowledge at a time when the Scotch shale-oil industry is exciting so much interest as a possible asset to the Empire in the supply of fuel oil.

Nearly the whole of the industry is confined to a belt of land some six miles in breadth, which stretches from near Dalmeny on the Firth of Forth in a southward direction to the moorlands around Cobbinshaw and Tarbrax. The first portion of the memoir is devoted to the geology of this shale-oil field, the survey of which was commenced by Sir Archibald Geikie in 1857, carried on by Mr. H. M. Cadell and the late Mr. James S. Grant Wilson, and is now brought up to date by Mr. R. G. Carruthers. The second part deals with the methods of working the oil-shales, and has been entrusted to Mr. W. Caldwell, whose wide experience as mining engineer to the Pumpherston district makes this section of special

value: whilst in the third and concluding portion of the work Mr. D. R. Steuart describes the treatment of the shale from the time it leaves the mine until its products are ready for marketing.

The history of the shale-oil industry is one that always appeals strongly to the imagination as an illustration of how every obstacle can be surmounted by dogged perseverance and determination, and the fact that to-day the industry still holds its own after a forty years' war with the powerful oil combines of America and the East is one of which every British subject should be proud.

The late Lord Playfair often declared that he was the founder of the Scotch shale-oil industry, and certainly it was he who in 1847 directed the attention of James Young to a trickle of oil from the shale in the Riddings Colliery, near Alfreton. On distilling this oil Young produced an excellent lubricant, the demand for which soon exhausted the supply, and imbued with the idea that the oil had been formed by a low temperature distillation of the coal, he experimented with many varieties and found that boghead cannel from West Lothian was best suited for his purpose. In 1850 the Bathgate works were started by Messrs. Young, Meldrum and Binny, and for twelve years the boghead coal, or Torbanehill mineral as it was often called, yielded an ample supply of oil for illuminating and lubricating purposes, as much as 120 gallons of crude oil per ton being obtained from it.

The supply of this material becoming exhausted, in 1862 shale was used in its place, but yielded only a third of the volume of crude oil; in spite of this, the expiry of Young's patent in 1864 led to a rapid expansion of the shale-oil industry, which, however, received a severe check soon after. In 1859 Drake had discovered how to obtain natural oil in enormous volumes by boring in Pennsylvania, and by 1864 it began to be imported into England in large quantities, with the result that lamp oil, which during the existence of Young's patent had varied from 3s. 6d. to 2s. 6d. per gallon, fell to 1s. 5d. to 1s., whilst, to make matters worse, the Americans began to import into this country lubricating oils and paraffin wax, which before had been practically a monopoly with the Scotch distillers.

In 1873 the Russian fields also entered into the competition, and for a time it appeared as if the Scotch industry must succumb, but by amalgamating the small works with the larger, by organisation, the adoption of labour-saving appliances, and the introduction of every form of economy the crisis was survived, and the manufacture of sulphate of ammonia from the nitrogen in the shale helped the Scotch oil industry to hold its own in spite of the overwhelming odds.

In 1871 there were fifty-one works in Scotland, producing 25,000,000 gallons of crude oil per year, but in 1894 these had been reduced to thirteen oil companies, and at the present time there are only seven, but the production of crude oil has risen to 70,000,000 gallons.

¹ Memoirs of the Geological Survey, Scotland. The Oil-shales of the Lothians. Part I. The Geology of the Oil-shale Fields. By R. G. Carruthers, based on the work of H. M. Cadell and J. S. Grant Wilson. Part II., Methods of Working the Oil-shales. By W. Caldwell. Part III., The Chemistry of the Oil-shales. By D. R. Steuart. Second Edition. (Edinburgh: Morrison and Gibb, Ltd., 1912.) Price 2s. 6d.

At the present time two of the most important questions in the public mind are how the enormous demand for motor spirit that has of late developed is to be met, and the imperial question of securing fuel oil for our Navy in the case of war interfering with our over-sea supply, and it will be of interest to see how far the Scotch shale-oil industry can help in these directions.

The rapid increase in the number of motor-driven vehicles during the past few years has doubled the consumption of motor spirit since 1908, the amount used in this country during 1912 reaching the enormous total of 80,000,000 gallons, whilst the quantity of motor spirit produced by the Scotch distilleries would be about 600,000 gallons, or 0.75 per cent. of the total used, an amount which is practically negligible. Considerations of safety on board limit the proportion of the oil that can be used for naval fuel, and the total amount of oil of satisfactory character that is at present produced by the Scotch industry and would be available for such purposes would be only about 50,000 tons, which again is only a small fraction of the quantity needed, but the proximity of the shale fields to the new naval base at Rosyth encourages the hope that the Government will secure and accumulate a sufficient quantity of liquid fuel from this source to safeguard the supply in case of war.

In the portion of the memoir dealing with the chemistry of the oil-shales, Mr. Steuart has collected a mass of most interesting facts, not only with regard to the shale oil, but also bearing upon the probable formation of the shale beds, and the whole work is so full of interesting and suggestive points that no one interested in oil or allied subjects should fail to read it.

THE ANALYSIS OF COLOURING MATTERS.

THE Eighth International Congress of Applied Chemistry, which was held in New York in September last, adopted a report submitted by a subcommittee of the Commission Internationale d'Analyses, to which was referred the question of the possibility of unifying the methods of analysis of organic colouring matters.

The subcommittee was international and very representative in character, the British members being Prof. E. Knecht and Mr. C. Rawson of Manchester. The report, which was presented by the president, Dr. F. Reverdin (Switzerland), in a short historical summary of the subject, states that the first systematic scheme was that of O. N. Witt, who, in 1886, suggested a differentiation of the various types of colouring matters by their behaviour on reduction. This reaction, developed and improved by other workers, notably by A. G. Green, is now the basis of the usual method of identification. So early as 1874 Kopp proposed the use of the characteristic absorption spectra of dyes as a means of identifying them, and this method has been greatly improved and extended by Formanek, Grandmougin and others. The photo-spectroscopic method proposed in 1911 by

Porai-Koschitz and Auschkap has not yet been much used.

The individual reports from the various national representatives, which constitute the bulk of the report, deal mainly with the analysis of colouring matters for Customs purposes.

The subcommittee finally reports that the unification of the methods employed in the analysis of colouring matters is not possible in the present state of the industry, and would not be of much practical use. It considers, however, that an international agreement would be advantageous in certain cases, such as that of the organic dyestuffs used in colouring foodstuffs, and also where the assessment of Customs duties is required.

The subcommittee has therefore been re-appointed by the International Commission of Analysis and instructed "to investigate special cases in which the unification of the methods of analysis of organic dyestuffs offers some interest from the international standpoint."

The committee requests that anyone interested in the subject will communicate information or suggestions to the president (Dr. F. Reverdin, Geneva) or to the British representatives above named.

NOTES.

THE death of Lord Wolseley on March 25, in his eightieth year, should not pass unrecorded in a scientific journal, for he was distinguished among great soldiers by his devotion to scientific methods. His capacity for organisation, recognition of the value of knowledge, and regard for accuracy and completeness are attributes not always associated with military careers. His "Soldier's Pocket-Book," now published by the War Office, is rich in details relating to medical, engineering, and other aspects of field operations which depend upon science for their success. He held that it was essential for every officer to have a good knowledge of his science in order to be able to apply that knowledge usefully in the field, when cut adrift, perhaps, from civilisation. We share with the rest of the nation the feeling of regret that a life which has brought so much credit to the British Army is now ended. Lord Wolseley's body was laid to rest in St. Paul's Cathedral on Monday, with impressive funeral ceremonies, but his works will long remain a monument to his memory.

THE construction of trustworthy and enduring flying machines has been much encouraged by various large money prizes given by *The Daily Mail*. When in 1906 our enterprising contemporary offered a prize of 10,000*l.* for a flight by aeroplane from London to Manchester in twenty-four hours, with not more than two stoppages, there was little anticipation that it would be won, yet M. Paulhan accomplished the feat in 1910. A further prize of 10,000*l.* for a circuit of Great Britain, covering a distance of 1000 miles in one week, with eleven landing-places, or control stations, at each of which a descent had to be made, was won by M. Beaumont in 1911. Now *The Daily Mail* offers a third prize of 10,000*l.* for a flight by

waterplane either way across the Atlantic in seventy-two continuous hours, without any limitation as to nationality of pilot or place of construction of the machine. A prize of 500*l.* will also be awarded to the pilot who takes a waterplane of entirely British invention and construction round England, Scotland, and Wales, and within one mile of Kingston Harbour, in seventy-two continuous hours. The waterplane is a very promising type of aircraft, and we have little doubt that both prizes will eventually be won. From a national point of view it is important that encouragement should be given to the design and performance of a machine which can start from a water surface or come to rest upon it. The prescribed tests are severe, but not more so than are necessary to decide the efficiency of the waterplane both as regards flexibility and range of action. The new prizes offered by *The Daily Mail* will encourage aviation engineers and pilots to produce a machine by which the two courses will be successfully traversed, and thus bring us nearer that conquest of the air which will be the distinguishing characteristic of the present century.

IN America it is quite common for waters to have an unpleasant fishy, oily, or "geranium" taste, due to the excessive growth of certain algæ. Some species grow best during the colder months of the year, others attain their maximum development during the summer. The water supplies of the United Kingdom are usually free from these unwelcome visitations, but many instances have occurred of temporary unpleasantness arising from this cause. London has been singularly fortunate in this respect, yet there can be no doubt that the present commendable policy of storing river water antecedent to filtration increases the risk of algal troubles arising in the future. At Easter time the consumers of West Middlesex water became unpleasantly aware that the supply had a peculiar aromatic taste and smell, which, with apologies to horticulturists, may be likened to geraniums. The water is derived from the Thames, and is stored for a long period in the Staines reservoirs. After re-storage at Barn Elms and Barnes, it is filtered and pumped into supply from the Hammer-smith side of the river. First the complaints arose along the line of direct supply from the pressure mains, later the Hampstead area became affected owing to the back-flow of tainted water which meanwhile had accumulated in the service reservoirs. Dr. A. C. Houston informs us that the growth was largely composed of *Tabellaria*, together with some *Asterionella*, and the taste developed chiefly during the process of filtration. Remedial measures were at once carried out, and all the implicated filter beds were closed, with immediately satisfactory results. The water, although unpalatable, was at no time unsafe for drinking purposes. The best way of killing algæ is to treat the affected water with copper sulphate (dose, from 1 to 10 lb. per million gallons), and Dr. Houston has found that the most satisfactory way of removing the taste from a water which has become already tainted is to use potassium permanganate (dose, about 2.5 to 5 lb. per million gallons).

THE International Geographical Congress was opened at Rome on March 27 by King Victor Emmanuel. We hope to give an account of the proceedings in an early issue.

WE are informed that the Royal Botanic Gardens Department, Ceylon, has been replaced by a Department of Agriculture, and that communications should in future be addressed to the Director of Agriculture, Peradeniya, Ceylon. The work of the Royal Botanic Gardens will be continued under the new department.

ON the nomination of the Gassiot Committee of the Royal Society, the Meteorological Committee has appointed Mr. L. F. Richardson, assistant lecturer in physics at the Municipal School of Technology, Manchester, to be superintendent of the Geophysical Observatory at Eskdalemuir, in succession to Mr. G. W. Walker, resigned.

THE Vienna correspondent of *The Times* announces that Prof. J. Hampel, the eminent Hungarian archæologist, died at Budapest on March 25. As one of the directors of the National Museum and the leading authority on the pre-Christian archæology of Hungary, Prof. Hampel was held in high esteem in his own country and in archæological circles throughout Europe.

WE are informed that the optical and mechanical engineering works of Ernst Leitz, of Wetzlar, which recently completed their 150,000th compound microscope, have presented this instrument to his Excellency Prof. Ehrlich, of Frankfort-on-Main, thus doing honour to a genius of scientific discovery. It may be remembered that the 100,000th Leitz microscope was presented to the late Prof. Robert Koch, the famous bacteriologist, who was director of the Imperial Institute for Infectious Diseases, Berlin.

ARRANGEMENTS are being made for the starting, in July next, of an expedition to Crocker Land, under the auspices of the American Museum of Natural History and the American Geographical Society. One of its special features will be a seismological investigation. The seismograph, which will be in charge of Ensign Fitzhugh Green, of the U.S. Navy, is of the Weichert horizontal type, and carries a stationary mass of 80 kilos. It will be sheltered in a hut of special design, so arranged as to preclude violent changes of temperature. The instrument will be furnished by Georgetown University, Washington, and an attempt will be made to carry on daily communication, by means of wireless messages, between the explorers and the seismographers of the University.

THE inauguration of a new President at Washington has necessarily been followed by many changes in important Federal offices. Among them is the appointment of Dr. D. F. Houston to be Minister of Agriculture, succeeding Mr. J. Wilson, who has held that post continuously for sixteen years, under four administrations. Dr. Houston was president of the Agricultural and Mechanical College of Texas from 1902 to 1905, and of the University of Texas from 1905 to 1908. Since that date he has been

Chancellor of the Washington University at St. Louis. He is now in his forty-eighth year. A change has also been made in the assistant secretaryship of the Department of Agriculture, where Mr. W. M. Hays is succeeded by Mr. B. T. Galloway, who has been since 1900 chief of the Bureau of Plant Industry. Mr. Galloway had previously spent twelve years as chief of the Division of Vegetable Pathology and Physiology. Before entering the Government service he was an assistant in the horticultural department of the University of Missouri, of which he was a graduate in agricultural science. He is the author of a large number of works on botany and horticulture.

An official guide, who commenced his duties on April 1, has been appointed to conduct parties of visitors round the collections in the Royal Botanic Gardens, Kew. Two tours will be made daily, except on Sundays and public holidays; one of about an hour and a half, starting at 11.30 each morning, and one of about an hour at 3 each afternoon, except during June, July, and August, when the afternoon walk will start at 5. Morning parties will be limited to six persons, and will visit the plant houses and museums; in the afternoon twenty persons will be conducted round parts of the outdoor collections. In the morning each member of the party will be charged 2s. 6d., and in the afternoon the charge per person will be 1s. Visitors wishing to join a party should attend at the stone portico of Cambridge Cottage, Kew Green, shortly before the time of starting. The new arrangement will meet the needs of those visitors who, in addition to their desire to enjoy the beauty of the gardens, wish to understand something of the scientific value and botanical significance of the unique exhibits at Kew.

DISASTROUS floods have followed the severe windstorms in the United States on March 23. The areas chiefly affected are the middle western States. The storms seem to have started on the eastern side of the Rockies, and to have rapidly developed energy occasioning the heaviest rains in the Ohio and Mississippi valleys. Immense tracts of country have been submerged, and many large towns have become flooded. Much of the ground is below the flood level of the rivers, and in parts the embankments have given way, whilst many tributary rivers have overflowed their banks. Dayton, Indianapolis, Columbus, and numerous other smaller towns have suffered immensely during the last week of March and much loss of life has occurred. Hundreds of houses have been washed away, and immense suffering has been caused. At Louisville the river is said to have passed the level of the great flood of 1907. Fortunately the immense loss of life given in the earlier reports was somewhat exaggerated, and later estimates at the end of March give the total casualties in the stricken area as 500. The rivers are said to be still rising in many places, and the full result of the disaster will depend largely upon the weather for the next week or two.

We have received the first two monthly issues of *The O.S. Review, the Journal of the Organisation Society*. This society (which has offices at 15-16 NO. 2266, VOL. 91]

Buckingham Street, Adelphi) aims at applying objective methods of analysis and presentation to the data upon which all social legislation and administrative activity upon the large scale must be based. This aim necessarily implies that the society must itself "be outside politics, parties, and every kind of movement" in order to become "a centre of authority and reference," the activities of which will tend to bridge the present "gap between legislation and fact," and to minimise the distorting effects of political bias. The two numbers of the review offer illustrations of the proposed methods of research and of the application of the society's cardinal principle that "society is an extension of the individual." The society has a branch—"the Andrological Institute"—the special function of which is to collect and analyse measurements of bodily organs and physical and mental functions. As an *exposé* of its aims and methods it has published an elaborately illustrated pamphlet which deals in particular with measurements of mental "perseveration."

THE general meeting of the American Philosophical Society will be held in Philadelphia on April 17-19, when the president, Dr. W. W. Keen, will take the chair. A very varied programme will be provided, and it is possible here to refer to a few only of the numerous papers. These include:—"Interpretations of Brain Weight," Prof. H. H. Donaldson; "Heredity and Selection," Prof. W. E. Castle, of Harvard University; "The Nature of Sex and the Method of its Determination," Prof. C. E. McClung, of Pennsylvania University; "The Control of Typhoid Fever by Vaccination," Prof. M. P. Ravenel, University of Wisconsin; "New Spectroscopic Evidence for the Solvate Theory of Solution," Prof. H. C. Jones, Johns Hopkins University; "The Magnetic Field of the Sun," Dr. G. E. Hale, director of the Solar Observatory at Mount Wilson, Cal.; and "Progress of New Lunar Tables," Prof. E. W. Brown, Yale University. On the evening of April 18, Prof. G. G. MacCurdy, Yale University, will give an illustrated lecture on "The Antiquity of Man in the Light of Recent Discoveries." On April 19 a symposium on wireless telegraphy has been arranged, in which the following physicists will take part:—Dr. L. W. Austin, head of the U.S. Naval Radio-Telegraph Laboratory; Prof. G. W. Pierce, Harvard University; Prof. M. I. Pupin, Columbia University, N.Y.; and Prof. A. G. Webster, Clark University, Worcester.

THE problem of the cooperation of museums with education is being seriously considered in America. In No. 3, vol. iii. of *The Museum Journal* we have a description of the means by which the museum is being made accessible and interesting to school children. The arrangement of the exhibits is geographical, and special attention is naturally paid to the large collections illustrating the life of the American Indian, his arts and industries. A native and his wife, of the Chilkat tribe, are employed on the museum staff, and, dressed in their national costume, take an active part in class-work, moving among the children, explaining the exhibits, and answering questions regarding them. This arrangement is described to be

successful in promoting among the children an intelligent interest in the collections.

AMERICAN ethnologists generally accept the view that the American native race did not originate in that continent, but that it is the result of a comparatively recent, post-glacial, immigration, and that the Indian, closely related to the yellow-brown peoples of eastern Asia and Polynesia, represents, in the main, a gradual overflow from north-eastern Siberia. To supply evidence in support of these conclusions, Dr. A. Hrdlicka, of the U.S. National Museum, has recently made an extensive tour in Siberia and Mongolia, the results of which are summarised in No. 16, vol. ix., of the Smithsonian Miscellaneous Collections. His inquiries tend to establish the origin of the American Indian from eastern Asia. Dr. Hrdlicka points out the immense archæological remains, in the shape of burial mounds, or Kourgans, which still await excavation in north-eastern Asia. When the scientific exploration of this region is systematically undertaken, much important material for the examination of American ethnological problems will certainly be provided.

In *Man* for March Mr. J. Edge-Partington, under the title of "A Note on Certain Obsolete Utensils in England," gives an account of a collection of old-world appliances, mostly connected with cooking and brewing, which have passed out of use. Mr. Digby-Wyatt, in his house, Weston-Corbett, Hants, has furnished an old room with a very interesting series of such utensils. Mr. Edge-Partington's collection includes all sorts of curious specimens—fire-dogs, pestles and mortars, bread shovels, gophering-irons, meat-jacks, pot-hooks, and "lazy backs," brewing appliances, and many other things of the same kind, which throw much light upon the domestic life and manners of our ancestors. It is surely time that the suggestion for the establishment of a museum of folk culture, to contain specimens of this kind, which are rapidly disappearing and soon can never again be brought together, was seriously considered.

THE campaign against tuberculosis has advanced a further stage. A general order of the Local Government Board, extending the principle of compulsory notification to all forms of human tuberculosis came into force on February 1. A further order of the Board of Agriculture and Fisheries makes the notification compulsory of tuberculosis of the udder, indurated udder, and other chronic diseases of the udder, and of tuberculosis or apparent tuberculosis of any bovine animal. This order is to come in force on May 1. Animals found to be suffering from tuberculosis are to be slaughtered, and compensation will be given on a scale depending on the extent of the tuberculous disease.

An appreciative memoir, accompanied by an excellent portrait, of Dr. E. A. Wilson, the naturalist to Capt. Scott's expedition, appears in the March number of *British Birds*, Dr. W. S. Bruce being the author; while the story of Wilson's life and work is sympathetically told by Dr. Shipley in the April number of *The Cornhill Magazine*.

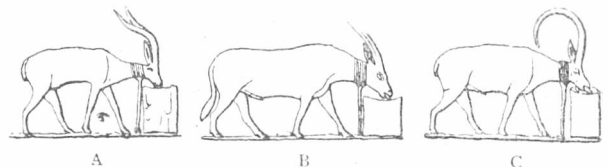
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A VALUABLE report, by Mr. J. Johnstone, on some mussel beds in Lancashire and North Wales as regards their liability to sewage contamination has been issued by the Lancashire and Western Sea Fisheries District, under the direction of Prof. Herdman, F.R.S. The beds in several districts are found to be polluted. Mr. Johnstone, in his introduction, makes some interesting remarks on methods of examination and on "standards" from the statistical point of view.

WE have to acknowledge the receipt of the fourth annual report—for the year ending March 31, 1912—of the Superintendent of Dominion Parks, Canada. It is there stated that the predictions made a few years ago "in regard to the mountain parks have been more than realised, and their development has already exceeded the most sanguine expectations. . . . Judging from past development and present indications, it is a difficult matter to estimate the limit of the usefulness of these mountain parks as unique pleasure and health resorts, not only for the Dominion, but for visitors and tourists from almost every part of the world." The report is profusely illustrated with photographs of striking scenery.

ADDITIONAL evidence of the affinity of the Tertiary fauna of eastern Europe and western Asia to that of North America is afforded by Mr. E. Kiernick's description of a new species of Titanotherium from the neighbourhood of Prague, in *Bull. Ac. Cracovie* for December, 1912. The Titanotheres are essentially an American group of perissodactyle ungulates, but in 1876 a specimen from Transsylvania was referred to the family under the new generic term *Brachydia-stematherium*, while in 1892 Prof. Toulou referred a jaw from Rumelia to the American genus *Menodus*, as *M. rumelicus*. Some doubt has been thrown on the reference of the former to the Titanotheriidae, but Mr. Kiernick considers that it is a member of that family, albeit of the aberrant group *Palæosyopinae*. The Prague fossil, which consists of part of a lower jaw, with the last molar, is assigned to the typical genus, under the name of *Titanotherium bohemicum*.

FROM an interesting article by Dr. Claude Gaillard, of the Museum of Lyons, published in the *Revue d'Ethnographie et Sociologie*, Paris, 1912, Nos. 11 and 12, it appears that the ancient Egyptians were in the habit of keeping several of the wild ruminants



Dorcas gazelle (A), white oryx (B), and Nubian ibex (C) from the tomb of Mera at Sakkara. (After Gaillard.)

of north-eastern Africa in a state of semi-domestication for the purposes of the table. Among the species thus kept were the dorcas gazelle, the addax, the white oryx, and the Nubian ibex, representations of all of which are shown in a bas-relief in the tomb of Mera at Sakkara, dating from the sixth dynasty, in asso-

ciation with those of domesticated cattle and goats. That they were kept in a captive condition is indicated by the circumstance that in each case they are shown feeding out of a trough and haltered, and also by the prefix or the word *ran*, apparently indicating domestication, to their names.

THE January number of *The Quarterly Journal of Microscopical Science* (vol. lviii., part 3) again bears witness to the large amount of experimental investigation which is being carried on by biologists. The eggs and larvæ of sea-urchins afford material for no fewer than three papers by different writers. There is an interesting paper by the late G. H. Grosvenor, whose untimely death has inflicted a great loss upon zoological science, and Geoffrey Smith, on the life-cycle of the small fresh-water Crustacean, *Moina rectirostris*. These authors point out that, according to Weismann, sexual forms should be produced in every parthenogenetic generation independently of external conditions, but they actually find that by isolating the parthenogenetic females at birth until the production of the brood at a temperature of 25° to 30° C., the production of sexual forms is entirely suppressed. They conclude that the influence of isolation and of a high temperature on the suppression of the sexual forms may be ascribed either to the comparative absence of excretory matter or else to highly favourable nutritive conditions. Another memoir of special interest to students of animal bionomics is on stolon formation in the remarkable polychæte worm, *Trypanosyllis*, by F. A. Potts, which forms an important contribution to our knowledge of the very curious processes of asexual multiplication by budding that take place in this group. We must, however, enter a protest against the use of the term "stolon" for the reproductive individuals which arise by budding in such cases.

ALTHOUGH much work has been done in recent years on the bacteriological conditions in soils in temperate zones, there has been hitherto a scarcity of data relating to soils in tropical and subtropical countries. On this account a report of studies on Indian soils, by Mr. C. M. Hutchinson (Memoirs of the Department of Agriculture in India, Bacteriological Series, vol. i., No. 1), forms a welcome addition to the subject. Investigations have been undertaken with the view of testing the methods already in general use for the purpose of ascertaining their value under Indian conditions. The phenomena associated with the partial sterilisation of the soil, the occurrence of bacterio-toxins, and the rapidity of biochemical changes, such as ammonification, nitrification, and nitrogen fixation, have been subjected to a critical study. The view that the decomposition of cellulose is due chiefly to the activities of anaërobic organisms is perhaps given too much prominence in the discussion of the utilisation of organic residues.

MR. J. VAN BAREN, of the Landwirtschaftliche Hochschule in Wageningen, Holland, publishes in the *Compte rendu* of the eleventh International Geological Congress a paper on red stony loam as a product of interglacial weathering. He notes the

occurrence of this material as isolated sheets in eastern Holland, overlain by Boulder Clay or Boulder Sand, and points out that the fragments of iron-bearing silicates in the red loam show, by their rusted condition, signs of atmospheric weathering. The small pebbles are also strikingly attacked, in distinction from those obtained from the sandy residue of the overlying Boulder Clay. The author urges that the Red Boulder Loam is decidedly older than the second series of glacial deposits above it, and that its weathered condition indicates exposure during an interglacial epoch. The analyses given do not support his contention that the products of weathering are lateritic. Comparisons are made with similar materials in north Germany, north Italy, the east coast of England, and the United States, and the desirability of chemical investigations of these is pointed out. In the discussion on the paper Mr. van Jentsch urged that a red colour in such deposits does not always imply a weathered condition.

WE have received a separate copy of the address given by Prof. J. von Kowalski to the Swiss Naturforschenden Gesellschaft at the Altdorf meeting last year. It deals with the relations between radiation and energy, and, after giving an account of the work of Wien and others, sketches the quanten theory as advanced by Planck, and stated with great clearness by Einstein in 1905. After showing how fertile the theory has been in suggesting new lines of research in both theory and experiment, the author emphasises the fact that at the present time the point of view provided by the theory is already known to be too restricted. Having served the true function of a theory—to indicate the line of advance—it must soon be replaced by some more general conception which will make clear to us those relations between matter and energy of which the quanten theory has given us a misty glimpse.

OBSERVATIONS on the seiches of Japanese lakes were begun in 1901, on the suggestion of Prof. Nagaoka. Four years later, the seiches of the nearly circular lake Toya, in the island of Hokkaido, were found by Prof. Honda to have a period of 9.29 minutes. In 1911, Mr. N. Mori found the period to be 4.5 minutes, and suggested that the mean depth of the lake had increased by about fifty metres during the interval of seven years. Mr. K. Sano shows, however, that the two periods may be the result of different modes of vibration if account be taken of the existence of the circular island in the middle of the lake (*Journ. Meteor. Soc. of Japan*, January). He finds that the period of the seiches would be 10.25 minutes if the water oscillate with a straight nodal line through the common centre of the lake and island; and 3.9 minutes if there were a circular nodal line midway between the boundaries of the island and lake.

A PAPER on measurement of the flow of the River Derwent, Derbyshire, by Mr. E. Sandeman, read before the Institution of Civil Engineers on April 1, contains some interesting particulars. The flow of the river has been measured since 1905, when a weir was built by the Derwent Valley Water Board, to

ascertain the yield from an area of about fifty square miles of the northern portion of the watershed. The area in question varies in elevation from 500 to 2060 ft. Rain-gauges to the number of forty-six were fixed on this area, being approximately 1 to each 700 acres. In the last thirteen years the recorded rainfall has averaged 46.34 in. The lowest rainfall of any of the gauges was 34 in., and the highest 61 in. The flows over the measuring weir are recorded on a rotating drum driven by clockwork with cam attachment. The highest flood on the drainage area occurred before the building of the weir. It was calculated to have reached a flow of 486 cu. ft. per sec. per 1000 acres from an area of 9321 acres. The minimum flow recorded was 0.29 cu. ft. per sec. per 1000 acres. Records of evaporation from a water surface 6 ft. square showed a variation from 10.25 in. in 1907 to 19.62 in. in the year 1911. The general result of the measurement of the rainfall and the yield of the river showed that the quantity of water collectable was—on the average of the seven years under consideration—equal to 75.2 per cent. of the rainfall.

MESSRS. LONGMANS, GREEN AND CO. have in preparation a series of monographs on physics, which will to some extent follow the lines of their monographs on biochemistry and on inorganic and physical chemistry. The editors of the physical series will be Sir J. J. Thomson, O.M., F.R.S., and Dr. F. Horton, of the Cavendish Laboratory, Cambridge. The first volume in the series will be "Rays of Positive Electricity," by Sir J. J. Thomson.

MESSRS. HENRY SOTHERAN AND CO., 140 Strand, and 43 Piccadilly, London, have issued part viii., forming part iii. of the Supplement, of their "Bibliotheca Chemico-Mathematica." The catalogue not only contains an unusually complete collection of works on the exact sciences, including many old works of rarity and interest, but also on such kindred subjects as ballooning, horology, and meteorology. The net prices of the volumes are given in every case.

THE classified list of Smithsonian publications, available for distribution on January 1 last, has been published by the Smithsonian Institution of Washington. The institution is able to supply papers only as an aid to the researches or studies in which applicants are especially interested. The papers included in this list are distributed gratis, except as otherwise indicated. Of the serial publications of the institution, the volumes of "Contributions to Knowledge" and of "Miscellaneous Collections" are distributed only to public libraries and to learned societies.

MESSRS. J. AND A. CHURCHILL announce the following works for early publication:—"Liquid Air, Oxygen, and Nitrogen," by G. Claude, translated from the French by H. E. P. Cottrell; "The Examination of Waters and Water Supplies" (second edition), by Dr. J. C. Thresh; "A Laboratory Text-book of Chemistry," part i., by V. S. Bryant; vol. vii. of the new edition of "Allen's Commercial Organic Analysis," rewritten, under the editorship of W. A. Davis and S. S. Sadtler.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR APRIL:—

- April 6. 5h. 33m. Sun eclipsed, invisible at Greenwich.
 ,, 12h. om. Jupiter at quadrature to the Sun.
 8. 5h. 10m. Venus in conjunction with the Moon (Venus $4^{\circ} 1' N.$).
 9. 22h. 41m. Saturn in conjunction with the Moon (Saturn $6^{\circ} 22' S.$).
 20-22. Maximum of Lyrid meteors.
 24. 14h. om. Venus in inferior conjunction with the Sun.
 ,, 17h. om. Mercury at greatest elongation W. of the Sun.
 26. 2h. 13m. Jupiter in conjunction with the Moon (Jupiter $5^{\circ} 9' N.$).
 27. 16h. 24m. Uranus in conjunction with the Moon (Uranus $3^{\circ} 52' N.$).
 ,, 21h. om. Uranus at quadrature to the Sun.

THE RADIAL VELOCITY OF α PERSEI.—Hnatek having recently published the conclusion that the radial velocity of α Persei varies in a period of 4.1 days, it appeared desirable to Mr. J. H. Pitman (Lick Observatory Bulletin 224) to undertake a comprehensive treatment of the subject based on all available observations. In addition to the many results already published by various authorities, the chief being the long series by Goos and Hnatek, the author has employed ten hitherto unpublished determinations. Six of these made during October, 1912, give a mean velocity of -2.49 ± 0.42 km. per second. The discussion leads to the conclusion that the radial velocity of α Persei must be either constant or only minutely variable in a period still undetermined.

THE SMITHSONIAN ASTROPHYSICAL OBSERVATORY.—The report on the operations of the Smithsonian Astrophysical Observatory for the year ending June 30, 1912, has been received. The director, Mr. C. G. Abbot, is to be congratulated on the success at last attending his persistent efforts to obtain a grant from Congress. This enabled simultaneous spectrophotometric determinations of the solar constant of radiation to be made at Bassour, Algeria, by the director, and at Mount Wilson by Assistant Aldrich, on twenty-nine days during August–November, 1911. The observations have not yet been completely reduced, but so far as the first half of September the values obtained at Bassour agree with those previously determined at Washington and Mount Whitney in indicating a local condition at Mount Wilson tending to make the results too small by about 2 per cent.

Further, it appears that high solar constant values obtained at Bassour coincide with high values at Mount Wilson, and *vice versa*. This relation is exhibited in two diagrams; in the first the curves obtained by plotting the successive values at the two stations show a rough parallelism; in the second the simultaneous values are plotted, and instead of grouping round a centre they are seen to be strung out along a line. It is further stated that a solar variation of 4 per cent. was indicated at both stations. The importance of setting at rest the question of the variability of this fundamental factor in meteorology is thoroughly realised by the energetic director, who returned to Bassour last May to extend his former observations. Mr. Fowle had already commenced work at Mount Wilson in April. It is confidently anticipated that the combined results will be decisive. The solar constant work has received help from valuable results obtained by Mr. Fowle in continuation

of the research on the absorption of radiation by water vapour. To him is due a spectrophotometric method of determining (within 1 or 2 per cent.) the total quantity of water vapour between the observer and the sun. This method should supersede the approximations based on psychrometric observations at different levels.

This observatory undertakes the fitting up, standardisation, and packing of the copies of the silver disc pyrheliometers supplied at cost price by the Smithsonian Institution. During the past year ten of these instruments were sent out, chiefly to Governmental meteorological stations.

THE SPECTROSCOPIC BINARY BD -1° 943.—The star δ Orionis was found by Hartmann in 1904, to be a spectroscopic binary, but the K-line did not take part in the regular displacements of the other lines. The hypothesis he has put forward to explain this apparent anomaly is that the K-line was due to the absorption of a calcium cloud which lay between stars of this class and the solar system. In the *Astronomische Nachrichten*, No. 4633, Zacchaeus Daniel informs us that a star the position of which is 5h. 28.9m. -1° 13', and was announced by Adams to be a spectroscopic binary, has a similar peculiarity to the one mentioned above. Its Harvard magnitude is 5.37, and its spectrum B2. Measurements of five, on the thirteen spectrograms secured at the Alleghany Observatory, of the best hydrogen and helium lines indicate a range in velocity of more than 200 km., a period of 3.05 days satisfying these velocities. Measurements of the K-line on eleven plates give velocities ranging from +5 to +25 km., the mean being +17 km. This value is nearly the same as that deduced by Hartmann from his measures of δ Orionis, which star is less than a degree from the binary under the above heading.

VARIABLE STAR CHARTS.—In the *Annales* of the Astronomical Observatory of Moscow, published under the direction of Prof. W. Ceraski (supplement to vol. v., second series), Prof. Ceraski publishes a third series of thirty photographic charts of variable stars discovered by Madame L. Ceraski on the clichés of the observatory. The size of each chart represents eighty minutes of arc, and the charts are oriented after the Bonner Durchmusterung. The position of the variable is the centre of the plate, and is indicated by a small cross. Twelve of the variables represented are of the Algol type. The charts serve the very useful purpose of identification of the variables recorded, and are well reproduced.

EDUCATIONAL ORGANISATION IN AUSTRALIA.

TWO events which are certain to have great influence in the future development of education in Australia have recently taken place in New South Wales. One concerns the secondary schools of New South Wales, the other the University of Sydney. But in both cases their effects are sure to extend beyond the boundaries of the State to which they apply.

The first is that the Department of Public Instruction has introduced into New South Wales the system of intermediate and leaving certificates, as begun and carried out with success by the Scotch Education Department. An examination for the intermediate certificate has just taken place. Between 1500 and 2000 candidates presented themselves; but on this occasion the examination was only open to pupils of the State schools. At the close of next year the first complete leaving certificate examination will be held,

and probably about 1000 candidates will come forward. That examination, and those in later years, will be open not only to the pupils of the State schools, but also to those of private secondary schools which have submitted to inspection, and have been placed upon the register as providing a satisfactory four-years' course of secondary education. A further increase in the number of State high schools is promised, both in the country towns and the city, and the number of candidates for the final examination is expected to grow rapidly in the next few years.

Written examinations enter only as part of the scheme. The candidates present themselves for the intermediate examination when they have completed an approved two-years' course in a secondary school; they come up for the leaving certificate examination when they have reached the end of an approved four-years' course.

In several minor matters the New South Wales system differs from that upon which it has been modelled, but to these one need not refer. One point, however, must be mentioned; to some it may seem an unnecessary alteration, to others a serious defect. The certificate of the Department of Public Instruction of New South Wales is to be granted on the recommendation of a board of examiners, appointed by the Governor. This board is to consist of four officers of the Department, and not fewer than four professors or other teachers of the University, nominated by the Senate of the University. In other words, the University of Sydney is associated with the Department of Public Instruction in the conduct of the examination.

To explain all the reasons for this association would take too long; nor is it necessary. It is chiefly due to the fact that until recent years the Departments of Public Instruction in the Australian States concerned themselves chiefly with primary education. For the most part secondary education was left to the private schools; or, as in Queensland, to grammar schools receiving a Government subsidy. In these circumstances the universities had organised a system of public examinations, somewhat after the pattern of the Oxford and Cambridge Locals. These public examinations had gained the confidence of the people and set a high standard of attainment. Of course, they had, and still have, some of the vices of all written examinations which are completely divorced from the school work and independent of inspection. But by accepting the cooperation of the University in the examination for the leaving certificate, the Department hopes not only to benefit by the service of skilled and independent examiners, but to graft upon the new system all that is best in the old.

The second event mentioned in the opening sentence is the more important, though it is not unconnected with the first. After prolonged debate, an Act entitled "The University (Amendment) Act, 1912," has been passed. In this Act provision is made for certain changes in the constitution of the governing body of the University of Sydney, and its endowment is materially increased. But these two objects were not the main reason for the introduction of the measure, nor was it either of these which principally attracted public attention. The vital principle of the Bill was that a large number of exhibitions were to be founded, entitling the holders to exemption from fees at the University, so long as they made satisfactory progress with their studies. A fixed number of these public exhibitions is to be allotted each year, the number having a definite ratio to the population. One exhibition is to be given for every 500 persons in the State between the ages of seventeen and twenty,

as shown by the last preceding census. With the present population this works out at 200 per annum. If we take the length of the average course as four years, when the scheme is in full working order there should be 800 students at the University each year, for whom the State would pay.

At first it was intended that the exhibitions should be awarded only to holders of the leaving certificate. However, it was pointed out that in this way a deserving class would be deprived of the benefits of the measure. No exhibition could have been given to the man who desired to enter the University several years after he had left school; nor could one be gained by the lad who had been educated privately, or at a school below the standard required for registration. To remedy this defect, it was provided that, while the exhibitions were to be given each year on the results of the written examination for the leaving certificate, any person other than a candidate for the certificate, who had been a resident in New South Wales for three years, might compete at such examinations, and should be considered equally with the holders of the leaving certificate in the allotment of the exhibitions, except that the number given in any year to these persons should not exceed 5 per cent. of the total for that year.

For this measure the Labour Government of New South Wales is responsible. One of the planks in the policy of that party is free education from the school to the University; and one of the principles for which the party contends is equality of opportunity for the ablest pupils in the schools to advance further with their studies when they have proved their ability and industry. Free university education has not been pressed, but equal opportunity has been demanded, and this measure is meant to provide that opportunity.

The primary and secondary schools of New South Wales are already free; but to make the secondary schools free, and to provide also a large number of exhibitions exempting from fees at the University, is not sufficient to remove the obstacle in the way of an able boy or girl whose parents have only the most moderate means. For such cases additional assistance is required, and for them suitable provision has been made. Bursaries are to be granted to the best pupils of the elementary schools, assisting them, when they stand in need of such assistance, in their passage through the secondary school. On the successful completion of the secondary-school course, University bursaries are given by the State with a similar end in view.

The measure has been criticised in various quarters. Representatives of the professional classes spoke of the cheapening of the professions and of the lowering of the standard. But it was an easy task to answer these objections. The exhibitions are to be granted on the results of an examination in the regulations for which it is expressly provided that the subjects and standards shall be such as the University determines are necessary for matriculation. Also the University shares in the conduct of, and the responsibility for, the examination. The difference which this measure has made is that in New South Wales the boy whose parents cannot afford the fairly large expense of university education will not be cut off from the chance of gaining its benefits, if he proves himself to possess distinct ability and application.

The only serious vital criticism of the measure was that which pointed out that the increase of 10,000*l.* in the endowment of the University would not cover the ultimate loss it would suffer from the non-payment of fees and enable it to meet the other charges im-

posed upon it by the Bill. The University has, however, no real cause to be anxious on this account; it possesses the confidence of the people, and it is receiving each year largely increased sums of money on the Estimates. So far as this measure is concerned, Mr. Carmichael, the Minister for Education, to whom it is due, stated the situation in the Legislative Assembly as follows:—

"I have given my word on behalf of the Government that before 1916, when the University will receive the full flow of graduates, we shall increase the statutory endowment to meet the demands. I propose, if the Government has an opportunity—and, if not, I hope our successors will recognise the obligation—to raise the endowment in 1915 by another 10,000*l.* From the present day on to 1915 the University is to the good on this deal. I think we may fairly claim to have shown a liberality to the University which I hope our successors in office—if we do not remain here—will follow up. After 1915 the endowment will be increased to meet the requirements of the future."

It is now two years since the change of Government in New South Wales which for the first time gave the power into the hands of the Labour Party. These two years have been marked by great advances in the cause of education from the lowest to the highest level. To those who watch the evolution of democratic government in Australia it may be an interesting fact that, where the democratic tendency is most marked, the claims and advantages of the highest education have their strongest advocates and fullest recognition. New South Wales and Victoria have the advantage over the other Australian States which accompanies larger resources, a greater population, and further development. They have been able more thoroughly to undertake the work of school and university education, and so far as this State is concerned, it may be claimed that the leaders of the democracy, to whatever party they belong, have already abandoned the idea that the highest work can be done without the highest educational preparation for it.

H. S. CARSLAW.

RECENT WORK ON INVERTEBRATES.

THE Entomologists' Monthly Magazine for December, 1912, contains two beautifully coloured plates of Lepidoptera, illustrating new and rare species described by Messrs. Hamilton and Herbert Druce and Dr. T. A. Chapman.

In concluding, in the same issue, their notes on the British representatives of the leaping beetles of the genus *Longitarsus*, Messrs. Tomlin and Sharp direct attention to the apparently instable state of evolution of these beetles, some individuals of a species being winged, while others are apterous. This condition seems to point to the progressive disappearance of the wings in the group; and it is suggested that this may be due to the development of the saltatorial powers. Why it should be more advantageous to jump than to fly is not, however, very apparent, although it may be that the former mode of progression facilitates escape from enemies. A similar suggestion, it may be remembered, has been made in the case of the jumping Australian mice and rats, as compared with ordinary mice and rats, the leaping movement not improbably tending to baffle birds of prey.

In the second part of *Verh. Naturhist. Vereins der preuss. Rheinlande u. Westfalens* for 1911 (1912), Dr. C. Röttgen completes his long account of the beetles of Rheinland. In the same issue Dr. F. Haas

discusses the geographical distribution of the west German Unionidæ, including extinct forms.

The manner in which spiders make their webs forms the subject of editorial notes in the December number of *The Country-Side*. It is stated that all the published accounts which have come under notice describe spiders as constructing their webs in narrowing circles from the periphery towards the centre; but first-hand evidence of the opposite mode of procedure (that is, working from the centre outwards) is cited, and the writer concludes that the published descriptions refer only to the repair of broken webs.

In the introduction to an elaborate monograph of the crinoids of the Indian Ocean, forming part 7 of "Echinoderma of the Indian Museum," published at Calcutta, Mr. A. H. Clark dwells on the extreme richness of the crinoid fauna of this area, which he regards as representing the stock that has given origin in the past to similar faunas in many other parts of the world. Nearly 400 Indian forms are now known, of which about 350 are comatulids and the remainder stalked types. They are arranged in nineteen families, with eighty-two genera, all the species being peculiar to the Indian region. The only family absent from this is the monogeneric Holopidæ. "All the genera of the Atlantic, Antarctic, and Arctic Oceans are closely related to East Indian genera, from which they were evidently derived in the remote past; but in many cases a single East Indian genus has apparently given rise to two or more Atlantic genera, all nearly equally related to the parent stock." It is also stated that crinoids may be utilised for obtaining an idea of the nature of the plankton of the seas in which they grow, thus affording a clue as to the suitability, or otherwise, of any given area for the support of food-fishes, sponges, coral, or pearl-oysters.

The fifth part of vol. x. of the *Annals of the South African Museum* is devoted to an account by the Rev. T. R. R. Stebbing of the local representatives of the group of small marine crustaceans known as Sympoda, or—if we follow the *Cambridge Natural History—Cumacea*. Although the members of the group are readily distinguishable from other crustaceans, their classification is a matter of difficulty, owing to the interlacing of characters and the existence of fine gradations. The author, who recognises a larger number of families than is adopted in the work cited, describes nine genera and fourteen species as new.

The pseudo-scorpions of the country form the subject of vol. x., part 4, of the *Annals of the South African Museum*. According to the author, the Rev. E. Ellingsen, less than half-a-dozen local representatives of the group were known at the beginning of the century, but the list is now very large, and has been increased in the article before us. The type genus, *Chelifer*, it is pointed out, will ere long have to be divided.

R. L.

FOAM STRUCTURE OF METALS.

IN a paper on the "foam structure" of metals, in *The International Journal of Metallography* (iii., 1), Prof. Quincke gives a summary of the conclusions which he states as the result of researches dating from 1858 to the present day. While Prof. Quincke's views may well claim respectful consideration, his statement of them in the present paper is far from convincing, and his effort to extend to metals his theory of foam structure of matter appears to be singularly strained. To begin with, there is the fundamental assumption that before solidification commences even in a "pure" metal the liquid be-

comes heterogeneous, being divided into foam-cells by minute cell-walls differing in viscosity and surface-tension from the cell-contents. Quincke supposes these to be so minute that experimental evidence of their existence cannot be obtained, and he depends for the justification of his assumption upon the power of his theory to explain all the known phenomena of the structure and properties of metals. The present paper gives an outline of this explanation, but while it is distinctly ingenious it suffers from the defect that its author is obviously incompletely acquainted with the modern developments of metallography. As a result, one finds again and again that the proffered explanations are incompatible with well-established facts. One example, out of many which might be given, must suffice.

According to Quincke, the growth of crystals during annealing is due to the collapse of a foam-wall lying between two adjacent foam-cells, and forming what is usually termed an intercrystalline boundary, with the consequent coalescence of the two adjacent crystals into a single crystal. Direct observation of the process of crystal growth has, however, definitely shown that this is not the true *modus operandi*. The crystals do not grow by the bodily absorption of their neighbours, but by a process which may be likened to gradual invasion and conversion. The growing crystal gradually pushes its boundary outward into its neighbours, and frequently does so by pushing out one or more arms which gradually spread laterally as well as advance longitudinally. Nothing could be more unlike the picture suggested by Quincke's explanation, and similar difficulties can be raised at every turn.

On reading the paper, however, while those intimately acquainted with the behaviour of crystalline aggregates will scarcely be disposed to accept the "foam-cell" theory, they will yet be struck by the fact that the forces of surface-tension upon which Quincke lays such stress must powerfully affect the structure of metals and alloys—forces the importance of which has not perhaps been sufficiently recognised by current metallographic theories. In eutectic alloys particularly one constantly meets with structures which bear strikingly close resemblance to those assumed by films of liquid under the action of surface-tension. It has even been thought that the constituents of such eutectics may assume their actual forms just before solidification, in the shape of bags or sacks of the kind imagined by Quincke as foam-cells.

Experimental evidence is, however, against this view. The experiment has been tried of allowing eutectic alloys to solidify slowly under the action of centrifugal pressure in a powerful centrifuge, and the resulting structure is entirely unaffected. Had liquid sacks or "foam-cells" really been formed they must have been flattened or deformed under this treatment, but such was not the case. On the other hand, recent metallographic researches seem to indicate that the intercrystalline boundaries of a metal are of the nature of cell-walls formed by very thin layers of the same metal in the amorphous or under-cooled liquid state, and here there is a decided approximation to Quincke's ideas, only that these cell-walls are regarded as the result of the meeting of adjacent growing crystals, and not as the primary limitations to crystal growth. Still, although Quincke's theory of foam-cells can scarcely be accepted as being in reasonable accordance with the known facts of metallography, a study of his views should be useful and suggestive to all those interested in the physics and physical chemistry of crystalline aggregates.

W. ROSENHAIN.

THE MELBOURNE MEETING OF THE
AUSTRALASIAN ASSOCIATION.

THE Australasian Association for the Advancement of Science met at Melbourne, under the presidency of Prof. T. W. E. David, F.R.S., on January 7-14. The meeting proved most successful. There was a large and representative gathering of members from all the Australian States and New Zealand. Owing to the approaching visit of the British Association, it was decided to postpone the Hobart meeting, which in the ordinary course of events would have been fixed for 1915, until the beginning of 1916, and the cordial invitation, which the New Zealand delegates brought, that the succeeding meeting be in Wellington, was accepted.

The subject of the presidential address was "The Australian Climate, Past and Present," but before passing to it, Prof. David spoke of the interest the Federal Government had shown in scientific work relating to the Commonwealth. Its action in organising the recent scientific expedition to the northern territory, under Prof. Baldwin Spencer, and in arranging for his presence there for the last year, had commended itself both to the general public and to workers in science. The reports already published showed that the northern territory had far greater possibilities than most people had imagined, in regard both to its pastoral and mining features. The appointment of a man of science, Prof. Gilruth, to the important position of administrator was a step for which the association was grateful to the Government.

Papua also had not been neglected, and the mission of Mr. Carne to that country had been most successful. Among other things, he had located an extensive belt of oil-bearing sandstones, which he believed to be an extension of the great Burmese oil-belt, which ran through Sumatra, Borneo, and Java, to Timor, and thence to New Guinea. The oil-belt was full of possibilities, and he thought there was no more fascinating field for exploration than this island.

Dealing with the Australian climate, Prof. David spoke of the importance of the scientific observations of the Antarctic expeditions, especially those of Capt. Scott and Dr. Mawson. The meteorological data, communicated by wireless telegraphy from Macquarie Island by members of Mawson's expedition, showed most distinctly the association between the weather conditions of Australia and those of the subantarctic. It was to be hoped that in the near future some joint arrangement would be made between the Governments of Australia and New Zealand, providing for the continued upkeep of the station on that island.

From the evidence he had collected, he believed that the reason for the great climatic and biological differences between the north and south polar regions is mainly geographical; that it depends on the present distribution of land and water, and on the modifications which they introduce into the circulations of air and water in either hemisphere. The existence of the large continent of Antarctica, with an average elevation of about 6000 ft., acts as a great refrigerator in the southern hemisphere, and causes extremes, which otherwise would not exist, between the south polar and equatorial temperatures. This factor tends to increase the rapidity of air circulation in the southern hemisphere. It accounts for the periodic fierce out-rushes of blizzard winds, which accompany the development of the Antarctic low-pressures, and often profoundly affect Australian weather conditions.

On the other hand, the absence of land in the north polar regions, and the presence of open water in the summer, cause the temperature in those regions to be

much higher at that season in the Arctic than in the Antarctic.

In the course of his address, Prof. David made particular reference to the need for further development of the Department of Meteorology in Australia, and he stated that there was every prospect of the Federal Government making the Australian Solar Physics Observatory an accomplished fact in the near future.

A noteworthy feature of the meeting was a lecture on the northern territory and its aborigines, delivered in the Melbourne Town Hall, by Prof. Baldwin Spencer, who had just returned after a year's absence in the territory on a special mission from the Federal Government. The Governor-General and the Prime Minister were present, and the large hall was crowded long before the hour at which the lecture commenced.

Prof. Spencer began by a reference to the vastness of this part of Australia. It was four and a half times as large as Great Britain, but its population, excluding the aborigines, was less than 4000; and of the aborigines he did not think there were more than 40,000. The Commonwealth Government now had control of this region, and it had organised a series of important departments in which work of a valuable character was already being performed. It was necessary to remember that for forty years practically very little had been done in the territory. Now they had in their administrator a strong, straight, and fearless man, who had quickly won the complete trust and confidence of everyone working under him. The climate was undoubtedly trying, particularly in the wet season, which extends from March until September. But inland, on the "downs" country, it is infinitely better than on the coastal fringe. He believed that this cool winter climate would make a very great difference in the opening up, at any rate, of these inland regions, and the existence of these cooler temperatures at certain seasons of the year made the country differ from other tropical regions where such changed conditions were unknown.

Dealing with the natives, he was able to show the audience by kinematograph views and phonograph records some of the results of his investigations. A stay of about two months had been made on a station in the Alligator River district, and this time devoted wholly to acquiring information upon the habits, beliefs, and customs of the natives. He found these differed somewhat from those of the southern tribes.

A visit had also been paid to Melville Island, some forty miles from the mainland, which he reached in a small lugger from Port Darwin. The aborigines inhabiting that island were of a better type than those on the mainland. He saw ceremonies performed which were entirely new to him, notably a weird performance in connection with the burial of a man. A small plot of ground having been cleared of vegetation, a number of fantastic grave-posts were placed upright in the ground on either side of the prepared spot. Some fifty natives lined up, after the fashion of soldiers, whilst four other men ran between and around the grave-posts, stamping with their feet, which action was supposed to drive the spirit of the departed into the ground. Other films depicted the islanders in the canoes, in which they often negotiated the stretch of open ocean between the island and the mainland, forty miles across.

In his concluding remarks, Prof. Spencer said that the natives of the northern territory had certain attributes of a high character. Undoubtedly it was a great problem to know what to do with them; their entire lack of knowledge of agricultural methods rendered the problem all the more difficult of solution. He hoped very shortly to lay a scheme before the

Government whereby they would be in great reserves, protected from contaminating influences, and led to a higher and better life.

Many papers were communicated to the various sections, but limitations of space will not permit us to describe them. The presidents of sections and the subjects of their addresses, where this information has reached us, were as follows:—A, "The Relation between Pure and Applied Mathematics," Prof. H. S. Carslaw; B, Prof. C. Fawsitt; C, "The Evolution of the Physiographic Features of South Australia," Mr. W. Howchin; D, "The Present Aspect of Some Problems of Heredity," Prof. H. B. Kirk; F, "Practical Aspects of Anthropology," Dr. W. Ramsay Smith; G, Observations regarding the Production and Distribution of Consumable Wealth and Economic Capital, with an Inquiry into the Probable Effect of Arbitrary Regulations of Minimum-wage Standards upon the Cost of Living; H, "A Review of the Existing Conditions of the Twin Professions of Engineering and Architecture in Australia"; K, "The Relation of Fertilisers to Soil Fertility," Mr. F. B. Guthrie.

A large number of reports received the approval of the general council of the association, but we can only refer to a few of them.

It was approved that a committee be appointed with instructions (a) to bring under the notice of the Federal Government the desirability of its providing for a re-determination of the difference of the longitudes of Singapore and Darwin, and of the differences of longitude of the Australian observatories from each other; (b) to communicate with the Indian Government with respect to the possibility of re-determining the difference between Madras and Singapore.

Prof. David brought up a recommendation that in view of the already proved importance to pure science, to weather forecasting, and to shipping, of the meteorological station and wireless installation at Macquarie Island, a committee be appointed with power to add to its number to take all steps necessary to maintain the station on a permanent basis. Macquarie Island is situated just half-way (a) between Australia and New Zealand, and (b) between both those countries and the Antarctic continent.

In the reports presented to the Glacial Research Committee, Prof. W. G. Woolnough records an extensive area of Permo-Carboniferous glacial beds discovered by him on the Manning River and the Macleay River, some 150 to 250 miles north of Sydney. The Boulder beds are associated with marine strata, and near Tane, on the Manning River, the more southern locality, the boulders are embedded in limestone. This occurrence is compared with the marine glacial beds of Jervis Bay, New South Wales. Mr. R. Speight summarises the results of recent investigations into the glaciation of New Zealand.

It was resolved that in view of the rapid decadence and disappearance of the Australian aborigines it is urgent that, in the interests of science, further records and collections, illustrative of the beliefs, customs, and manner of life of the aborigines should be made for public preservation, more especially with reference to Queensland and Western Australia. It was resolved also to take such steps as may be deemed necessary to enforce the existing law with regard to the exploration of anthropological material, and further to prevent the indiscriminate exportation of other anthropological and ethnological specimens from any part of the Commonwealth.

A committee was appointed to consider the best means of securing the efficient teaching of English pronunciation in Australasian universities, training colleges, and schools.

A committee appointed at the Sydney meeting, 1911,

brought up a progress report on the steps to be taken with the view to the compilation of a list of the scientific serial periodical literature, both in public and private possession, in each of the principal cities of Australia.

REPORTS OF THE SMITHSONIAN INSTITUTION.¹

THE report of the secretary of the Smithsonian Institution for the year ending June 30, 1912, has been received from Washington. The general report reviews the affairs of the institution proper, with brief paragraphs relating to its several branches. The numerous appendices provide, in addition, detailed reports of the work—placed by Congress under the direction of the Board of Regents of the Smithsonian Institution—in the United States National Museum, the Bureau of American Ethnology, the National Zoological Park, and some four or five other organisations.

It is worthy of note that the total permanent fund of the institution amounts to 197,384*l.* The income for the year was 21,432*l.*, of which 11,675*l.* was interest on the permanent fund. The disbursements for the year amounted to 21,107*l.* More than this, the institution was responsible to Congress for the spending of the grants to the scientific organisations named above, and these reached a total of 148,400*l.*

The report of the Board of Regents consists of two main divisions: first, the annual report of the secretary, giving an account of the operations and conditions of the institution for the year ending June 30, 1911, and following the same general lines as the more recent report by the secretary dealt with above; and, secondly, the general appendix, comprising a selection of miscellaneous memoirs of interest, chiefly belonging to the year 1911, likely to be useful to men of science and others.

Among the original contributions to the general appendix is one by Mr. F. Alex. McDermott, of Washington, on recent advances in our knowledge of the production of light by living organisms; others are by Mr. N. C. Macnamara, on organic evolution: Darwinian and De Vriesian; by Mr. Paul C. Standley, on some useful native plants of New Mexico; and by Mr. William R. Maxon, on the tree ferns of North America.

Prof. A. M. Tozzer, of Harvard University, in a paper reprinted from the Proceedings of the American Antiquarian Society (Worcester, Mass., April, 1911), gives much interesting information concerning the value of ancient Mexican manuscripts in the study of the development of writing. These manuscripts, and those of Central America, constitute important examples of primitive ideas regarding art and illustration, as well as data of great ethnological value. The countries of Mexico and Central America are the only fields of the New World where any appreciable data on prehistoric life other than monuments, implements, and other objects are found. The manuscripts of Mexico are divided by Prof. Tozzer into two classes—those written before the advent of the Spaniards, and those written during early Spanish occupation.

Prof. Tozzer describes the manuscripts under discussion, and follows the development of writing from the period of reminders or mnemonics, to actual pictures, from them to a symbolistic and conventional

¹ Report of the Secretary of the Smithsonian Institution for the Year ending June 30, 1912. (Washington: Government Printing Office, 1912.)

Annual Report of the Board of Regents of the Smithsonian Institution showing the Operations, Expenditures, and Condition of the Institution for the Year ending June 30, 1911. (Washington: Government Printing Office, 1912.)

ideographic system, thence to characters expressing sounds as well as ideas, and the beginning of syllaby, the first step in the development of phonetic writing. The Spanish priests made the last advance, in the form of an alphabet, by selecting syllabic characters to express initial sounds.

The volume is rich in translations, and among these may be mentioned an article by M. H. Marchand from *Cosmos*, on the invention of the gyroscopic compass and its practical utilisation on board ship; that by Dr. Jules Courmont, from the *Revue générale des Sciences*, on the sterilisation of drinking water by ultra-violet radiations; that by Dr. M. Philippot, in the "Annuaire Astronomique pour 1912," Belgium, on the legal time in various countries; that by Prof. S. Pozzi, from the *Revue scientifique*, on the garden of serpents, Butantan, Brazil; the translation from the German of Mr. W. Belk, in *Zeitschrift für Ethnologie*, under the title "The Discoveries of the Art of Iron Manufacture"; that of Mr. A. Lissauer's article, from the same German source, on the Kabyles of North Africa; and of Dr. A. F. Legendre's article in the *Revue de l'Ecole d'Anthropologie*, on the Lolos of Kientchang, western China.

Among the numerous reprints from English journals and magazines a small selection only can be given. We notice Sir David Prain's obituary notice of Sir Joseph Hooker, which appeared in *NATURE* for December 21, 1911. Numerous Royal Institution discourses are included, such as Commendatore Marconi's on radio-telegraphy; Prof. Wood's on recent experiments with invisible light; Prof. Richards's Faraday lecture on the fundamental properties of the elements; and Prof. H. S. Hele-Shaw's on travelling at high speeds on the surface of the earth and above it.

The addresses delivered at the meetings of the British Association also have been drawn upon, Sir William Ramsay's presidential address at the Portsmouth meeting being given a prominent place.

As usual, the illustrations are numerous and excellent.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

SIR JOHN RAMSDEN has sent a subscription of 100*l.* to the fund which Mr. Austen Chamberlain is raising for the extension of the London School of Tropical Medicine.

We learn from *Science* that by the death of Mr. J. Lyman, Yale University will receive 130,000*l.* He held the life interest in that sum, which was willed to the college by his brother, the late Mr. S. Lyman, who died in 1910. From the same source we find that both houses of the legislature of the State of Washington recently adopted the biennial budget. The University of Washington will receive a grant of some 201,000*l.* The matter of the replacement of the temporary university buildings by adequate modern structures has been submitted to the legislature separately. The recently adjourned legislature of West Virginia, too, voted larger grants to the State University than in any previous year.

A copy of the programme of the Irish Training School of Domestic Economy for the session 1913-14 has been received from the Department of Agriculture and Technical Instruction for Ireland. The school is a residential institution, maintained by the Department for the purpose of training teachers of domestic economy, and also for providing a training in household management for girls who have already received

a satisfactory general education. The school is situated at St. Kevin's Park, Kilmacud, Stillorgan, co. Dublin. The premises stand in grounds of about three acres. The house provides ample accommodation for the staff and students, in addition to class and recreation rooms. A large fruit and vegetable garden is attached to the house.

A NEW provincial technical college was opened at Workington, Cumberland, on Friday, March 14, by Sir John S. Randles, M.P., in the presence of a distinguished company. The college provides a complete course of day and evening training for students in engineering and metallurgy, serving especially the needs of the district. It is intended to commence day apprentice classes in connection with the local iron and steel works in September next. Inasmuch as the premises are used in the daytime for the accommodation of a day secondary school and a trade preparatory school, a complete scheme of education and instruction is provided. The school buildings comprise a block of twelve class-rooms, many specially fitted for the teaching of some specific subject, together with chemical, physical, mechanical, mining, and metallurgical laboratories, art-rooms, dining-hall, cookery-room, laundry, woodwork and metalwork shops, and the usual administration rooms. A gymnasium is in course of erection, and it is proposed to establish a hostel for boys and girls in order to overcome the usual geographical disabilities suffered by children in rural districts. The school generates its own electric current for lighting and power purposes, and a complete and elastic system of distribution has been arranged. Each class-room is fitted with a small table, with gas, water, and waste arranged, so that illustrative work may be carried out in any room; electric lanterns are also available in each class-room and laboratory. The building has been erected at a cost of nearly 30,000*l.* It is situated at the railway centre of west Cumberland, and already its accommodation is taxed to the utmost. There are well above 300 scholars in the daytime, and more than 500 evening students at present in attendance. The college is the only technical college in Cumberland, and it is financed out of county higher education funds. The staff numbers twenty full-time members. In opening the college, Sir John Randles (who had previously given a scholarship value 50*l.*) presented the governors with the sum of 1000*l.*, the interest upon which was to be used in giving a student of the metallurgical department a travelling scholarship for the purpose of visiting metallurgical centres abroad.

THE International Kinematograph Exhibition and Conference was held at Olympia on March 22-29 inclusive, and aroused the keen attention of many distinguished people in various branches of knowledge. Though no advance in the general science of kinematography could be seen, there were many improvements of detail on view in machines, in films, and in pictures. Two kinematograph projector machines, shown by Messrs. Pathé Frères (one suitable for the class-room and the other for the theatre, both of which could be worked by being attached to the electric lighting current), represented one of the finest productions of mechanical art in every way. Their uses for educational means are further enhanced by the very great safety of using non-inflammable films and by the possibility of stopping the projector so as to display a still picture in case the teacher wished to describe or explain it. The pictures reflected great credit on the enterprise of the firms exhibiting, but except for one firm, already mentioned, no attempt had been made to produce pictures of direct educa-

tional bearing. The kinematograph trade would be well advised to consult educationists in order that its films may be produced with the requisite essential of scholarship and art, without which they may be only entertaining or useless or positively harmful. The Educational Conference, organised by Mr. A. P. Graves, was most successful. Addresses dealing with the various educational uses of the kinematograph were delivered by Canon Lytton, Mr. A. P. Graves, Miss Von Vyss, Dr. Sleight, Mr. F. W. Sanderson (headmaster, Oundle School), Mr. A. Burrell, Mr. Morley Dainow, Dr. Hayward, Prof. R. A. Gregory, and Miss Marsh. Amongst the chairmen were Sir A. K. Rollit, Dr. Kimmins, and Prof. Lyde. The discussions were vigorous, and many headmasters, teachers, doctors, civil servants, and representatives of educational organisations took part, while amongst the audience were two representatives of the Board of Education. The essence of the discussion was that the power of the kinematograph as an educational force is enormous. Every attempt should be made to guide and control it. Three important resolutions were passed embodying these views, and a committee was appointed to carry them out. The proceedings of the conference are being compiled by Mr. Morley Dainow.

LORD HALDANE addressed a large joint meeting of secondary- and technical-school teachers on March 29 at the University of London. There is a notion in the head of the man in the street, said the Lord Chancellor, that secondary education is a luxury with which he need not trouble himself, and so long as that notion is in his head it will be very difficult to get him to pay any taxes for secondary education. But if it can be brought home to him that the state of the education question in this country is at this moment a peril to the nation and that it is a question of national safety with which we are dealing, then he will take a larger view. We are behind the level which has been reached by several of our competitors, a level which will put us in peril. We cannot dissociate national progress from the basis of knowledge even when it comes to the question of making money; and if the level of the national income is to be maintained, if our industrial pre-eminence is to stand, Lord Haldane said deliberately that the nation will have to make an effort to put its educational system in order. One reason why the universities have suffered is because we have never understood fully the significance in the educational system of the secondary school. In Germany it has been different. The whole educational fabric there rests upon the basis of the secondary school. The boy goes into the secondary school young, and remains there if he goes through the full course for about nine years, and at the end of that time he is so qualified that he goes straight to the university. There is no matriculation examination, but the student has to produce his entrance certificate showing that he has gone through the mill and has been in the atmosphere of the secondary school. We have, continued Lord Haldane, outgrown the period of the old-fashioned examination. What we want is a record, and everybody who goes to the university should have that record. The time has not yet come when we can deprive the external student of his chance of getting an external degree. It will come when people realise that the external degree means nothing comparable to the degree which is the hall-mark of having lived in the atmosphere of the university. Education is the greatest reform we can take in hand, and expenditure on education is productive expenditure which we are justified in making a sacrifice to incur.

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SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, March 14.—Dr. A. Russell, vice-president, in the chair.—Dr. J. A. Fleming: (1) Some oscillograms of condenser discharges and a simple theory of coupled circuits. A short method for arriving at a formula for the time of free electrical oscillation of a leaky condenser in series with an inductive resistance, the oscillations being damped. The formulæ can be confirmed by oscillograms taken at low frequency with a Duddell oscillograph. (2) Some Braun kathode-ray tubes used as high-frequency oscillographs, and an electrostatic influence machine, giving a steady current of 300 to 350 microamperes for working them. The Braun tubes have electrostatic deflection plates in them and an embracing field coil for providing a longitudinal field to keep the kathode spot in a central position on the screen.—B. B. Baker: Stretching and breaking of sodium and potassium. Wires made of metallic sodium and potassium collapse when stretched, not to a point, as is the case with most plastic substances, but from two opposite sides only, into a chisel end. Wires made by running the metal, molten under oil, into a glass tube and allowing it to solidify, also showed, on extension, two sets of equidistant rings on their surface, each inclined at an angle of 45° to the axis, the rings of opposite sets touching along the line of greatest thinning and bisecting one another along the line at which no thinning takes place.—R. G. Lunnion: The latent heat of evaporation of steam from salt solutions. The experimental method was to supply a measurable quantity of heat electrically to the solution boiling inside a calorimeter. The steam from the inner vessel passed into a detachable condenser, which was weighed at intervals. The difference between the measured heat L , and L_+ the known heat of evaporation of water, is the heat of solution Q ; and the present results indicate that for salts of the same acid Q is proportional to the concentration.

Zoological Society, March 18.—Mr. E. G. B. Meade-Waldo, vice-president, in the chair.—Miss Edith E. Bamford: Variations in the skeleton of the pectoral fins of *Polypterus*. An examination had been made of the material brought back by Budgett from his West African expeditions, in order to account for the discrepancies which occur in the descriptions of the fins of *Polypterus* as given by different investigators. These discrepancies were found to be due to the very numerous variations in the fins and to the previous scarcity of material. A description is given of the variations found in the radials, mesopterygium, propterygium, metapterygium, and the distal cartilages, and their bearing on the different descriptions and the theories of other investigators is indicated.—Dr. H. H. Stirrup: A descriptive study of an Oligochæte worm of the family Enchytræidæ. A number of new and interesting observations were recorded, including an account of the structure and significance of the so-called "septal glands," which had been found to contain two definite anatomical components.—Dr. W. Yorke: The relationship of the big game of Africa to the spread of sleeping sickness. The author stated that sleeping sickness in Nyasaland and Rhodesia is due to a different parasite from that causing the disease in other parts of tropical Africa. In these countries the disease is transmitted by *Glossina morsitans* and not by *G. palpalis*. As *G. morsitans* is ubiquitous, and not limited in its distribution to water-courses, this fact has an important bearing on the measures that can be recommended with a view to prophylaxis.

Geological Society, March 19.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—B. **Thompson**: The geology of northern Peru: Tertiary and Quaternary beds. Some 600 square miles of territory in the westernmost part of South America, between the fourth and fifth degrees of south latitude, are dealt with. A great uplift and folding of the rocks took place in late Oligocene or early Miocene times, followed by a comparatively short terrestrial epoch. A subsequent depression allowed of the deposition of Miocene and possibly later beds. In recent ages the area has been spasmodically rising. The exposed rocks probably attain a thickness of 5000 ft. or more. Eight palæontological zones are established, and about 150 species of fossils are recorded. The origin of the petroleum is traced to animal organisms.—G. A. **Frost**: The internal cranial elements and foramina of *Dapedius granulatus*, from a specimen recently found in the lias at Charmouth. Owing to the envelopment of the skull and its pyritisation, the bones and interorbital septum are preserved in perfect condition. There is no foramen in the parasphenoid in front of the basipterygoid processes, as in *Lepidotus*. The basicranial canal differs from that in *Amia calva*, in its extension to the rear of the skull.

CALCUTTA.

Asiatic Society of Bengal, March 5.—F. W. **Edwards**: Tipulidæ and Culicidæ from the Lake of Tiberias and Damascus. Three species at least are new to science, one of them (the *Uranotænia*) being the first of its genus to be found within the Palæarctic region. The occurrence of *Conosia irrorata* makes a notable extension of the known range of this widely spread species.—F. H. **Gravely**: A preliminary account of a revised classification of Indo-Australian Passalidæ. The Passalidæ inhabiting the Indo-Australian region can conveniently be divided into six subfamilies. This necessitates a rearrangement of the recognised genera, and the erection of a new genus with *Tiberius kuwerti*, Arrow, as type.—J. S. **Gamble**: Materials for a flora of the Malayan Peninsula, No. 24.—Capt. R. B. **Seymour Sewell**: Notes on the biological work of the R.I.M.S. *Investigator* during the survey seasons 1910-11 and 1911-12.—E. **Ghose**: The internal anatomy of the blind prawn of Galilee (*Typhlocaris galilea*, Calm).—C. F. **Roussellet**: A note on Rotifers from Galilee. Recognisable specimens of four widely distributed species were found in a tow-netting taken on the surface of the Lake of Tiberias in October, 1912; while two sessile forms were reared in Calcutta in large numbers from dried mud from the bed of a small pool between Tiberias and Nazareth. One of these (*Occister socialis*, Weber), although widely distributed, is a rare species.—B. L. **Mukherji**: The identification of the Soma plant.—M. H. **Shastri**: The ancient civilisation of Bengal. The early inhabitants of Bengal were not Aryans, but a race known for their industry and commerce, colonisation, and philosophy. Buddhism took its rise on the borderland of the Aryan culture, and it owed more to eastern India than to western India.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part vii., for 1912, contains the following memoirs communicated to the society:—

January 13.—P. **Koebe**: Foundations of the continuity method in relation to conformable representation and uniformisation (preliminary considerations).

May 28.—W. **Voigt**: Electric and magnetic double refraction (ii.).

June 22.—L. E. J. **Brouwer**: The freedom from singularities of the modular manifold.—P. **Koebe**: A

new method of conformable representation and uniformisation.—W. **Behrens** and E. **Hecke**: The rectilinear motion of Born's rigid electron.

July 6.—G. **Tamman**: The method of determining p - T -lines for the construction of phase diagrams.

August 22.—D. **Hilbert**: Foundations of the elementary theory of radiation.

October 26.—G. **Tamman**: The theory of polymorphism (in crystals).—W. **Voigt**: Electric and magnetic double refraction (iii.).

November 23.—F. **Körber**: The relations between the volume-surfaces of the isotropic and anisotropic phase, and the course of the neutral curve, $\Delta v = 0$.

December 7.—A. von **Koenen**: The geological relations of the southern Reinhard and Bram Forests, especially on the Münden-Blatt.

The supplement contains a long paper by L. Schlesinger on Gauss's memoirs on the theory of functions, being part iii. of the "Materials for a Scientific Biography of Gauss," collected by F. Klein and M. Brendel.

BOOKS RECEIVED.

The Story of the Forth. By H. M. Cadell. Pp. xvii+299+plates+maps. (Glasgow: J. MacLehose and Sons.) 16s. net.

Union of South Africa. Mines Department. Geological Survey. The Geology of the Country round Warmbaths and Nylstroom, including the Rooiberg Tinfields. By H. Kynaston and Dr. E. T. Mellor. With notes by Dr. W. A. Humphrey. Pp. 52. (Pretoria: Government Printing and Stationery Office.) 2s. 6d.

Planetologia. By Ing. E. Cortese. Pp. vii+387. (Milano: U. Hoepli.) 3 lire.

Einführung in die höhere Mathematik für Naturforscher und Aerzte. By Dr. J. Sappeter. Pp. xii+336. (Jena: G. Fischer.) 12 marks.

Memoirs of the Department of Agriculture in India. Veterinary Series. Vol. i., No. 1. Anaphylaxis in the Larger Animals. By Dr. J. D. E. Holmes. Pp. 86+iii plates. Vol. i., No. 2. Salvarsan in the Treatment of Surra in Horses, Dogs, and Rabbits. By Dr. J. D. E. Holmes. Pp. 89-148. (Calcutta: Thacker Spink and Co.) 2 rupees and 1.4 rupees respectively.

Government of India. Meteorological Department. Indian Weather Review, Annual Summary, 1911. Pp. 131-194+cccxxxviii+ccccc+vi plates. (Simla: Government Central Branch Press.) 3 rupees.

Thèses présentées à la Faculté des Sciences de Paris pour obtenir le Grade de Docteur ès Sciences Mathématiques. By J. Bosler. 1^{re} Thèse: Sur les relations des Orages Magnétiques et des Phénomènes Solaires. 2^e Thèse: Propositions données par la Faculté. Pp. iv+96. (Paris: Gauthier-Villars.)

List of North American Land Mammals in the U.S. National Museum, 1911. By G. S. Miller, jun. Pp. xiv+455. (Washington: Government Printing Office.)

Mind and Health. By Dr. E. E. Weaver. Pp. xv+500. (London: Macmillan and Co., Ltd.) 8s. 6d. net.

Ueber Zonenbildung in kolloidalen Medien. By Dr. E. Küster. Pp. x+111. (Jena: G. Fischer.) 4 marks.

Jahrbuch der drahtlosen Telegraphie und Telephonie. Edited by Dr. G. Eichhorn. Band vi., Heft 3-6. (Leipzig: J. A. Barth.)

Lessons on Elementary Hygiene and Sanitation, with Special Reference to the Tropics. By W. T. Prout. Third edition. Pp. xx+184. (London: J. and A. Churchill.) 2s. 6d. net.

Fauna Hawaiiensis, or the Zoology of the Sandwich (Hawaiian) Isles. Edited by D. Sharp, R. C. L. Perkins, and Prof. A. Forel. Vol. i., parts 1 to 6. Vol. ii., parts 1 to 6. Vol. iii., parts 1 to 6. (Cambridge University Press.) Prices various.

Laboratory Text-Book of Chemistry. By V. S. Bryant. Part i. Pp. vii+246. (London: J. and A. Churchill.) 4s. net.

Modern Pumping and Hydraulic Machinery. By E. Butler. Pp. xvi+473. (London: C. Griffin and Co., Ltd.) 18s. net.

Vererbungslehre mit besonderer Berücksichtigung des Menschen. By Dr. L. Plate. Pp. xii+519+3 plates. (Leipzig: W. Engelmann.) 18 marks.

Genetics: an Introduction to the Study of Heredity. By Prof. H. E. Walter. Pp. xiv+272. (London: Macmillan and Co., Ltd.) 6s. 6d. net.

A School Algebra. By F. O. Lane and J. A. C. Lane. Pp. viii+333. (London: E. Arnold.) 3s. 6d.

Pond Life. By E. C. Ash. Pp. viii+94. (London and Edinburgh: T. C. and E. C. Jack.) 6d. net.

Handwörterbuch der Naturwissenschaften. Edited by E. Korschelt and others. Lief. 38 to 40. (Jena: G. Fischer.) 2.50 marks each Lief.

Western Australia. Geological Survey. Bulletin No. 43. Petrological Contributions to the Geology of Western Australia. By R. A. Farquharson. Pp. 100+iv. Bulletin No. 47. The Mining Geology of the Kanowna Main Reef Line, Kanowna, North-East Coolgardie Goldfield. By T. Blatchford and J. T. Jutson. Pp. 106+3 maps+iv. (Perth, W.A.: F. W. Simpson.)

Elements of the Precision of Measurements and Graphical Methods. By Prof. H. M. Goodwin. Pp. 104. (London: Hill Publishing Co., Ltd.)

DIARY OF SOCIETIES.

THURSDAY, APRIL 3.

ROYAL INSTITUTION, at 3.—The Bridge into Life: Dr. E. Frankland Armstrong.

LINNEAN SOCIETY, at 8.—Some Forms of *Aichenilla vulgaris*: C. E. Salmon.—Report on H.M.S. *Sealarh*, Calcareæ: Prof. A. Dendy.—*Embria major*, sp. nov., from the Himalayas: Prof. A. D. Imms.—A Free-swimming Neuploid Stage in *Palmiris*: Dr. J. D. F. Gilchrist.—The Classification of the Order Symphylla: R. S. Bagnall.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Further Discussion: Some Effects of Superheating and Feed-water Heating on Locomotive Working: F. H. Trevithick and P. J. Cowan.

FRIDAY, APRIL 4.

ROYAL INSTITUTION, at 9.—The Spectroscope in Organic Chemistry: Dr. J. J. Dobbie.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of the Nottingham District: B. Smith.

SATURDAY, APRIL 5.

ESSEX FIELD CLUB (at Essex Museum, Stratford), at 6.—Fairy-flies (*Mymaridae*) and their Hosts: F. Enoch.

MONDAY, APRIL 7.

ROYAL SOCIETY OF ARTS, at 8.—Aeronautics: Prof. J. E. Petavel.

SOCIETY OF ENGINEERS, at 7.30.—The Status of Engineers and Engineering, with Special Reference to Consulting Engineers: W. Ransom.

ARISTOTELIAN SOCIETY, at 8.—Some Points in Kant's Transcendental Aesthetic: W. W. Carille.

VICTORIA INSTITUTE, at 4.30.—Discussion: The Gunning Prize Essay read on March 17. *Opener*: Dr. J. W. Thirle.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Production of Steel Sections and their Application in Engineering Structures: A. T. Walmisley.

TUESDAY, APRIL 8.

ROYAL INSTITUTION, at 3.—Recent Discoveries of Early Man: Dr. A. S. Woodward.

ZOOLOGICAL SOCIETY, at 8.30.—(1) A Collection of Fishes made by Prof. Francisco Fuentes at Easter Island: (2) A Revision of the Fishes of the Genus *Kuhlia*: C. Tate Regan.—The Affinities of *Cavis antarcticus*: R. I. Pocock.—A Collection of Mammals from the Hebrides, Scotland: Major G. E. H. Barrett-Hamilton and M. A. C. Hinton.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Discovery of a Human Skeleton in a Brick-earth Deposit at Halling, Kent: W. H. Cook.—Description of Human Remains: Dr. A. Keith.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Further Discussion: The Yield of Various Catchment-Areas in Scotland: W. C. Reid.—Measurement of the Flow of the River Derwent, Derbyshire: E. Sandeman.—*Probable Paper*: Coastal Sand-travel near Madras Harbour: Sir F. J. E. Spring.

WEDNESDAY, APRIL 9.

ROYAL SOCIETY OF ARTS, at 8.—Electric Supply in London: F. Bailey.

AERONAUTICAL SOCIETY, at 8.30.—Propellers: W. O. Manning.

GEOLOGICAL SOCIETY, at 8.—The Variation of *Planorbis multiformis*, Brown: Dr. G. Hickling.—The Structure and Relationships of the Carbonicolæ: Miss M. Colley March.

THURSDAY, APRIL 10.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Various Inclinations of the Electrical Axis of the Human Heart: A. D. Waller.—The Nature of the Toxic Action of the Electric Discharge upon *Bacillus coli communis*: Prof. J. H. Priestley and R. C. Knight.—(1) Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland. II. The Wild Game Strain; (2) Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland. III. The Wild *Glossina morsitans* Strain; (3) Infectivity of *Glossina morsitans* in Nyasaland: Surg.-General Sir D. Bruce, Majors D. Harvey and A. E. Hamerton, and Lady Bruce.

ROYAL INSTITUTION, at 3.—Colour in Flowers: Dr. E. Frankland Armstrong.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Self-synchronising Machines (Self-starting Synchronous Motors and Rotary Converters): Dr. E. Rosenberg.

CONCRETE INSTITUTE, at 7.30.—Structural Engineering: E. F. Etchells.

FRIDAY, APRIL 11.

ROYAL INSTITUTION, at 9.—The Winds in the Free Air: C. J. P. Cave.

PHYSICAL SOCIETY, at 8.—Some Errors in Magnetic Testing Due to Elastic Strain: A. Campbell and H. C. Booth.—Note on Cathodic Sputtering: Dr. G. W. C. Kaye.

ROYAL ASTRONOMICAL SOCIETY, at 5.

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Editorial and Publishing Offices:

MACMILLAN & CO., LTD.,

ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.

Telephone Number: GERRARD 8830.