THURSDAY, JANUARY 29, 1914.

MILLIONAIRE AND NATURALIST.

Letters and Recollections of Alexander Agassiz. With a Sketch of his Life and Work. Edited by G. R. Agassiz. Pp. xi + 454 + plates. (London: Constable and Co., Ltd., 1913.) Price 14*s.* net.

THIS is an unusually interesting and well-conceived biography, for it gives us a vivid and often a pathetic picture of a truly remarkable man, and a thoroughly readable account of his great scientific enterprises as they followed, one growing from another, during his marvellously active and productive life. Alexander Agassiz was as astonishing for his energy and the magnificent scale of his scientific investigations as he was fascinating and lovable in personal intercourse. It was my good fortune to know him well. Whenever he was in London we dined together; he was my guest at Oxford when I was professor there, and we spent some days together in Paris about ten years ago, when he had settled in his favourite hotel—the *Athenée*—to do a spell of literary work. Few men, if any, of his day gave such an impression of power and intellectual capacity combined with so much light-heartedness and charm of manner.

Alexander was the only son of the great naturalist Louis Agassiz, who came from a long line of Swiss Protestant ministers in the Canton de Vaud. He was born at Neuchatel in 1835, when that place was under the dominion of Prussia. As a boy he was, we are told, "rather quiet, with the bewitching smile so characteristic of the man," and at ten years of age actively sympathised with the Swiss or anti-Prussian party. He incurred the displeasure of the retired Prussian general who was governor of the town by not saluting him politely. That functionary complained to Louis Agassiz of his son's conduct, who accordingly thrashed Alexander. The latter revenged himself by publicly refusing to receive his school prizes at the hands of the governor, and turning his back with scorn on the representative of the king. Subsequently he organised a band of confederates of his own age, stormed the castle on the night of a large dinner party, and smashed all the windows of the state dining hall! In after years Alexander remarked that it was perhaps fortunate he emigrated to the United States at an early age, as, with his views, he would surely in due time have been hanged or shot.

Louis Agassiz went to the United States in 1846, leaving his family (his wife, son, and two daughters) to follow. In 1849 he became settled as Professor of Natural History at Harvard, and sent for his son, whose mother had died in the previous year. Alexander soon imbibed the atmosphere of freedom of his adopted country, and records that "he could scarcely realise that it ever had been possible for a small boy to be nagged and punished for political opinions." A year after Alexander's arrival in Cambridge, Mass., his father brought home his second wife, a rare and devoted woman, who was to Alexander (as he tells us), in the subsequent trials and griefs, joys, and triumphs of life, "his mother, sister, companion, and friend all in one." She died in 1907, only three years before her stepson, having long survived his young wife, who died in 1873, and his father, who died at the same time. Alexander writes of his step-mother:—

"The like of her we shall not see again. From the time that I first saw her, and I only a small boy of thirteen, there never was a word of disagreement. She belonged to me and I to her; it could not have been otherwise."

I have just turned over the pages of the book which they produced together in 1865—"Seaside Studies in Natural History"—the admirable drawings and observations (many of them new and of great importance) on Medusæ, Polyps, and Echinoderms and their young stages, by Alexander, whilst the text is written by his "mother," for so he always called her.

The young Agassiz, after a couple of years at school in Cambridge, entered at Harvard in the autumn of 1851, at the age of fifteen. His friends tell us that he already possessed an unusual power of concentration and a gift of accomplishing what he intended to do. He was slight but remarkably powerful and active. He pulled in the University crew and retained his interest in rowing all through his life. After four years "in college" (corresponding, apparently, to the old bachelor-of-arts course of Oxford and Cambridge a hundred years earlier), Agassiz entered the engineering department of the Lawrence Scientific School, and graduated in 1857, at the age of twenty-two, and then studied chemistry. In 1859 he obtained the position of aid on the United States Coast Survey, but gave it up and returned to his father's museum in Harvard on a salary of 300*l.* a year. On this income he married Miss Anna Russell, the sister of the wife of his classmate, Theodore Lyman, and settled down to a life of the most rigid economy, but surrounded by friends and occupied with interesting work. He now published his classical works on the embryology of Echinoderms and on North American Acalephæ, illustrated by 360 figures drawn by his own hand. He had a laborious duty in the charge of the correspondence

and exchanges of the great museum which his father was gradually building up by the aid of grants from the State and handsome private subscriptions in procuring which he was irresistible. Alexander's filial devotion was intense, and he willingly gave himself to the furtherance of his father's great plan.

Now, in 1867, came the great opportunity of his life. The story is given in full and interesting detail in the volume of "Letters and Recollections." Briefly it is this, and, as his son observes, it reads more like a page of "Monte Cristo" than a forgotten leaf from the early history of Northern Michigan. A road surveyor named Hulbert stumbled on to a deserted Indian "cache" of native copper at Calumet, in North Michigan, and blasting below it discovered a great lode of copper conglomerate. Alexander Agassiz's two sisters had married men of some means, and these gentlemen acquired the copper-bearing district discovered by Hulbert, and some neighbouring copper-bearing land in which Alexander, after inspecting it, also secured an interest, borrowing a small sum for the purpose. Alexander, who was a trained engineer and had gained valuable practical knowledge in managing a coal mine, was entrusted by his relatives with the job of getting the property (which was being mismanaged) into working order. He gave up his work at the museum and made the great effort of his life. Meeting in the streets of Boston his friend Charles W. Eliot, who later became President of Harvard, he said:—

"Eliot, I am going to Michigan for some years as superintendent of the Calumet and Hecla mines. I want to make money; it is impossible to be a productive naturalist in this country without money. I am going to get some money if I can, and then I will be a naturalist. If I succeed I can then get my own papers and drawings printed, and help father at the museum."

Seldom, indeed, as his biographer remarks, have the aspirations of youth proved in such harmony with the achievements of maturity.

Agassiz stayed from the early spring of 1867 to October, 1868, in the wild region where the copper mines were situated. He entirely altered the method of extraction, introduced new machinery on a very large scale, chose his subordinate officials with unerring judgment, and was the very life and soul of the place; but it nearly killed him, and, in fact, he never recovered from the strain and exhaustion of that eighteen months. In the midst of it he writes to his brother-in-law:—

"Keep up courage, and never give up. We shall be all right yet. The thing I drive and look after is the only thing that goes; and just as fast as I pass from one thing to another, just so fast do things move. There is not a thing done, down to seeing that cars get unloaded, which I don't have to look after myself, and some days I am in utter despair."

By October, 1868, he had overcome all difficulties and opposition and returned to the more congenial labours of the man of science awaiting him at Harvard. Ever afterwards, even to the end of his life, he paid a visit to the mines in the spring and another in the autumn, and more than one voyage of exploration was postponed owing to an unsatisfactory condition at the mine that required his personal attention. His care was given not only to profits, but to the welfare of his employés. A few years ago the Governor of Michigan said that there was one man who had done more than all others in that country for humane and reasonable conditions of life among its working people—Alexander Agassiz.

In August, 1868, the Hecla and Calumet mines produced 330 tons of refined copper. In 1909 the product of refined copper for the year was at the rate of 4000 tons a month. The area which has been mined and opened up in the region of the conglomerate lode since Agassiz set it going can be measured now in square miles, the shafts and drifts amount to 200 miles in length, and 37 million tons of rock have been lifted, 9000 tons are removed every day, and 5600 men are employed in the works. Since the Hecla and Calumet mines paid their first dividend in 1869, the company has paid to its stock-holders the huge sum of 20 million pounds sterling. Called as a last resort to prop up a failing enterprise, Alexander Agassiz transformed it into one of the most prosperous and extensive mines known in the history of industry. He has left the mine as a remarkable proof of his extraordinary executive ability and business foresight. Few men can show such a monument as the result of a life's work; yet in this case it was the by-product of the brain of a man whose life's interest was abstract science. And to scientific research and the realisation of his father's great project of a vast museum he devoted the leisure and the wealth which now became his.

"His versatile and restless energy (writes his son) covered an extraordinarily wide field. The morphologist considers his earlier work the most important; the geologist that his reputation rests chiefly on his extensive investigations of coral reefs; the zoologist remembers his vast collections of marine life gathered in a dozen extended voyages widely scattered over the surface of the globe; and to still others he appears as the creator of a vast museum and one of the greatest benefactors of the oldest university in

America. In the world of affairs he was known as an extremely capable and successful mining man, who was said to employ his leisure moments in some sort of scientific study."

The story of his numerous expeditions in tropical seas which became almost annual fixtures, since he suffered severely in later life from exposure to the winter climate of New England, is given with some fullness in the present volume, and especially good is the account of his series of investigations of coral reefs and atolls in the West Indies, and in the Indian and Pacific oceans. These chapters will well repay the reader.

But here I am more anxious to cite passages illustrating the personal qualities of Alexander Agassiz, first as shown in his deliberate application of the great wealth which he acquired by his own efforts so early in life, and secondly as exhibited in the contrast which in many respects he presents when compared with a man of an equally wide public reputation, his much-loved and gifted father Louis Agassiz. During his life Alexander Agassiz made contributions to the Museum and University of Harvard which amounted to three hundred thousand pounds sterling, and a further very considerable sum will eventually pass to the University which he has specially ear-marked to provide posts in the Museum for the maintenance of investigators who are to be free from the burden of class-teaching. On university matters I was in entire sympathy and accord with him. He deplored, in regard to Cambridge, Mass. (as noted in this book), the same antiquated and seemingly irremovable errors in organisation, and the same failure to recognise the university as a great seat of living progressive science, which we still bravely struggle against in the old country. He wished to see American universities modelled on the German system. Writing not long ago of his expenditure for science, he says:—

"While the sum total seems a large expenditure, and one which appeals to the public and to the University officials, I hope that my influence on science at Cambridge will not always be measured by the dollar standard, as it is so apt to be. What I care for far more is the recognition of the fact that, having the means, I have backed up my opinion of what was worth doing by a free expenditure of funds, and furthermore that I have since 1870 devoted my time as completely to the interest of the Museum as if I had been working on a salary of fifteen hundred a year. And that since that I have published the results of my work continuously, and hope to be judged by that, and not by the total I may have spent for the same. I want to go down as a man of science, and not to be temporarily known by a kind of cheap notoriety as an American millionaire."

Whilst pouring out his fortune for science with one hand, he was (his son tells us) generous almost to a fault to his children with the other.

Alexander Agassiz inherited from his father a love of science and an extraordinary ability and love for work; but his sensitive and apprehensive temperament he acquired directly from his mother. Father and son had less in common than may be supposed. The father's optimism was always a cause of anxiety and trouble; the son possessed a singularly clear sight for the rocks ahead, and a very remarkable ability to steer his course clear of them. The older Agassiz, buoyant and robust, loved appreciation, was fond of teaching, and had a genius for stimulating his students. He had a large measure of the poetic and imaginative quality which is necessary for the making of an original discoverer. Alexander, retiring and reserved, had no gift or desire to excite popular interest; he hated notoriety, disliked teaching, and his intellectual life was devoted to research. He was extremely cautious in speculation, and, indeed, on this account—though he rendered immense service to science by the accumulation of important facts and the discovery and description of new species often of great interest, and the exploration in a magnificent way of regions of the ocean previously unvisited—he yet is not the author of any great generalisation or theoretical advance in the science to which he devoted himself.

As he matured and saw his way to large results, he aimed at the solution of two big problems; (1) the amount of variation from type that may be expected in a given period of geological time, as illustrated by the difference which has ensued in the oceanic fauna on the two sides of the Isthmus of Panama since the days *when the Caribbean was virtually a bay of the Pacific*. He made immense collections by means of large and costly expeditions, and employed pretty well all the specialists of Europe as well as America, and his own special knowledge of the Echinoids, to report on the material collected on each side of the Isthmus *with this end in view*. It is one of the tragedies of a life so full and richly employed as his was that his "Panamic Report," so long looked forward to, was never written.

The other problem dealt with by Alexander Agassiz was that of the formation of coral reefs and atolls. He visited every coral island region in the world, and published richly illustrated surveys of them. He was opposed to Darwin's theory of the origin of coral atolls by the subsidence of the areas in which they occur. And he certainly succeeded in showing that the views advocated by Darwin and by Dana are not capable

of universal application, nor, indeed, possessed of general validity.

Alexander Agassiz was drawn into his life-long occupation with zoological science by his love for his father, and a determination that the Harvard Museum commenced by that father should be carried through and become, as his father had intended, as great or greater than the greatest zoological museum in Europe. He frequently said that he did not care for museum work himself. He preferred to study fresh living material. But a determination once made by Alexander Agassiz, and based upon the strongest and most beautiful feature in his character—his filial devotion—was an irresistible force. The Museum of Comparative Zoology is now what he determined it should be—marvellous for its rich collections, its spacious galleries and laboratories and its splendid organisation and equipment in staff and facilities for investigation. On a tablet in the entrance hall is inscribed "Ludovici Agassiz Patri filius Alexander."

Alexander Agassiz had not studied as his father had done—medicine. His zoology did not rest upon a physiological basis. I cannot but think that the cast of mind, which dealing with definite physical problems enabled him to overcome all obstacles and to organise the Michigan copper mines with such triumphant success, would have led him to even greater achievements in the field of experimental science than those which were the outcome of his magnanimous devotion to the work and development of the museum begun by his father.

A few more personal details remain to be told, and I have finished. Like many other great men who have found a large part of their life's interest on the ocean, he suffered frequently from sea-sickness, but never let it interfere with his purpose. He was a man of quick temper, and, as he showed in childhood, resented injustice and arrogant domination. An instance of this virtue is related by his son, telling how in his later life, on one of his visits to Berlin, he was insulted in a restaurant by two German officers, one of whom, after some altercation, started to draw his sword. But before he could get it out of the scabbard, Agassiz knocked him down with a chair. The matter was taken up by the American Embassy, with the upshot that the officer was forced to apologise.

A great grief came to Alexander Agassiz only four years after he had established the Michigan copper mine and assured for himself a magnificent fortune. In 1873, when he was thirty-eight years old, he lost in the space of eight days both his father and his young wife. The life-long sorrow increased the natural reserve of his character. He wrote some months later to Huxley:—

"Few young men have reached my age and attained, as it were, all their ambition might desire; and yet the one thing which I crave for and which I want to keep me interested in what is going on is wanting. How gladly would I exchange all that I have for what I have lost."

And as late as 1891 he writes:—

"I have been in all that I have undertaken most successful from the world's point of view, but from mine—it has lost its charm long ago."

Yet there were many happy days in store for him. His wife left him three young sons who grew up to be the companions and devoted admirers of their father. They are remarkable men, worthy bearers of their illustrious name. One of them has produced the admirable book which has been the subject of this article. But there is no zoologist among them.

Let me conclude with a citation of a piece of wisdom from a letter on educational problems written by Alexander Agassiz to his friend Charles Eliot Norton:—

"The sooner the educators of the country recognise the fact that at sixteen to eighteen a boy's brain will do some things and not others, the better; and furthermore that all brains are not alike, and never will be, and cannot up to that time be developed alike, nor in the same direction."

Weighty words from so determined and successful a man!

Alexander Agassiz died quietly in his sleep on Easter Sunday, March 27, 1910, at sea, on his way home from Egypt, where he had passed the winter. The ship (the *Adriatic*) was four days out, and he had spent the evening chatting in the smoking room with a few friends. He lies beside the wife of his youth, whom he had buried thirty-six years before in Forest Hills.

E. RAY LANKESTER.

SCHOOL GARDENING.

(1) *Principles and Practice of School Gardening.* By A. Logan. Pp. xv+313. (London: Macmillan and Co., Ltd., 1913.) Price 3*s.* 6*d.*

(2) *Educational School Gardening and Handwork.* By G. W. S. Brewer. With an introduction by the Rt. Hon. Henry Hobhouse. Pp. xi+192. (Cambridge: University Press, 1913.) Price 2*s.* 6*d.* net.

(1) THE author points out that nature-study, as usually carried on in elementary schools, is purely observational, and that, at twelve years of age, the pupil's interest in the acquisition of information by this means begins to

flag, unless it aids him in action that requires thought. It must, in fact, be "thought-compelling with a view to action, mental or physical, or both." Gardening is held to provide the new stimulus that is necessary. In gardening, however, the study of nature must still be continued. A course of practical work is therefore described, in which the principles underlying each operation are sought for, these being often made the subject of experiment. The only danger is that in following the course the teacher's zeal for experiment may outrun the pupil's desire for information. Probably Mr. Logan, whose reputation as a leader in the school gardening movement in the north of Scotland has long been established, would be the first to warn teachers against making this mistake.

The practical work of the school garden is well described. The chapters on the cultivation of the plots are followed by chapters on propagation, manuring, soil organisms, fruit culture, and plant diseases. Each is full of useful suggestions for the teacher. The workshop is made the adjunct of the garden, and a number of garden appliances are described which can be made in the woodwork class. This, together with "correlated exercises" in geography and arithmetic, help to show how to link up gardening with the rest of the school curriculum.

The book can be commended to teachers of rural schools, both elementary and secondary.

(2) In the opinion of the author, school gardening is more often carried on as if the mere acquisition of knowledge were the object, than as a process of discovery, which, as in other forms of handwork, leads to self-dependence gained through experience of both failure and success. His book therefore contains less horticulture than in previously published manuals, but more educational suggestion, and this is put so forcibly that every school teacher of gardening would do well to read it.

A vivid idea is given of the educational possibilities of gardening. Though Mr. Brewer deprecates any forced correlation, his pupils' knowledge of even the primary subjects would develop by working in the manner he suggests. Moreover, the natural history of the garden has to be studied, garden requisites have to be made in the workshop, and simple, though exact, experiments of a kind likely to suggest themselves to the pupils have to be made. The practical examples given are of exactly the right type to capture the interest of boys of eleven to fourteen. In fact, working on such lines they would want no teaching; they would teach themselves.

OUR BOOKSHELF.

Vergleichende Physiologie und Morphologie der Spinnentiere unter besonderer Berucksichtigung der Lebensweise. By Prof. F. Dahl. Erster Teil: Die Beziehungen des Korperbaues und der Farben zur Umgebung. Pp. vi+113. (Jena: Gustav Fischer, 1913.) Price 3.75 marks.

THIS book is the first instalment of a work dealing exclusively with one class of Arthropods, to wit the Arachnids. It is an account of the external form and coloration of these animals in relation to their surroundings, and the author's point of view set forth in the preface will commend itself to many zoologists, especially those who have to teach young students.

The first thirty pages contain a systematic review of the group down to the families thereof, and the illustrative woodcuts are excellent. After proclaiming himself a convinced Darwinian, Prof. Dahl discusses such topics as the advantages of a land and of a water existence, changes of function resulting from changes in the mode of life, and the physiological meaning of bilateral symmetry. The forms of appendages and eyes are next dealt with, though we are not told why the sessile rather than the stalked eye is the rule in Arachnids, while the number of "legs" in the Pycnogonids is admittedly baffling. In his account of the parasitic members of the group and the changes in form dependent on parasitism, the author is at his best; and it will be news to many that a pseudoscorpion is to be found on children's heads hunting for other ectoparasites, while a mite (Tyroglyphus) lives on harmful fungi in the bones of birds, and is itself preyed upon by two species of another mite (Cheyletes). Finally, the question of coloration is fully discussed, with many interesting illustrations, though no allusion is made to Sclater's discovery of a spider that mimics a leaf-cutting ant.

Matter and Some of its Dimensions. By W. K. Carr. Pp. 120. (London and New York: Harper Brothers, 1913.) Price 2*s.* 6*d.* net. (Harper's Library of Living Thought.)

THIS book will scarcely be appreciated by those who like an author to remain in touch with actual fact when presenting scientific achievement in a popular manner. It abounds with misstatements, such as that "bodies which emit electrons are known as radio-active," and that "radio-active bodies emit an emanation which . . . wholly disappears by transforming itself into electric particles" (p. 22). The æther, as usually in this type of work, plays a prominent part. It is described (p. 37) as a "jelly-like mass," and "mathematicians" are said to assume that there are several æthers, possibly five. But the author supposes that they are infinite in number, and adds, "We have at least conceived a method, and a very orderly one, by which man can evolve for all time, existing in each ring, or plane, or dimension of matter so long as he supplies the

conditions of existence." There are some rather more pleasing chapters on truth and on the "fourth dimensional consciousness," but one would have preferred these speculations without their quasi-scientific sprinkling.

Continuity. The Presidential Address to the British Association, Birmingham, MCMXIII. By Sir Oliver Lodge. Printed in full and supplemented by explanatory Notes. Pp. 118. (London: J. M. Dent and Sons, Ltd.) Price 1*s.* net.

IT will be remembered that Sir Oliver Lodge's presidential address to the British Association was printed in full in the issue of NATURE for September 11 last (vol. xcii., p. 33). Its republication with twenty-four pages of explanatory notes should ensure renewed attention to the important subjects with which it dealt.

LETTERS TO THE EDITOR.

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

Aristotle's Physics.

I AM unable to find the passage in his works, but I think it was Prof. Ostwald who pointed out that while Aristotle was much more impressed with the retarding effect on the velocity of the mass of the medium through which the falling mass fell, than with the laws of "free fall," Galileo ignored friction, and discovered the law of fall in a vacuum. Neither was right; but air at atmospheric pressure has a very small effect on a dense mass falling, and hence Galileo was able to establish his law. Had Aristotle pursued his line of thought, he might, with adequate experimental appliances (which he had not got) have discovered Stokes's law.

This forms a very good example of the necessary restrictions in all scientific reasoning. In all events the factors are too numerous to permit of absolute coincidence between theory and experiment; the successful discoverer is he who takes care to eliminate the less important factors; it is he who arrives at a law, which, though not exact in correspondence with fact, still enables progress to be made. Further progress ensues, when account is taken of each disturbing factor, one by one; the initial simple law becomes more complicated, but a nearer approximation to truth is arrived at. WILLIAM RAMSAY.

19 Chester Terrace, Regent's Park, N.W.
January 23.

CAPT. HARDCASTLE'S authentic quotations from Aristotle are most interesting. May I as a teacher emphasise the fact that "terminal velocity" is the best instance of Newton's first law of motion in actual operation—an instance strangely neglected by elementary exponents. On anything moving at constant speed in a straight line (like a passenger in a railway train) the resultant force acting *must* be zero, and, so far from "inertia being eliminated" from such a body, its progress is due wholly and solely to its own inertia. Non-Newtonian mechanics need not be referred to in treating so rudimentary a matter.

OLIVER LODGE.

Mariemont, Edgbaston, January 24.

The Eugenics Education Society.

WILL you allow me, through your columns, to point out another aspect of the present methods of popularising "eugenics"? I had recently occasion to criticise this popularisation, and especially the methods of the Eugenics Education Society. I then used the following words:—"Sir Francis Galton was in the problems of race an optimist—a splendid optimist; but even he *in the last few months of his life* saw that the popular movement he had started was likely to outgrow its knowledge, and feared that more evil than good might result from it" (*The Times*, October 15, 1913).

In the present number of the organ of the Eugenics Education Society there is some criticism of the words used by me. It starts as follows:—"We would, if possible, avoid all controversy with one who has done so much for our science, and who was, moreover, so highly trusted by its founder, Sir Francis Galton, as is evidenced by his will. One sentence, however, cannot be passed over in complete silence, namely, the following: 'But even he (Sir F. Galton) *in the last years of his life* saw that the popular movement, &c.'"

The italics are mine, and these words are followed by quotations from the letters Sir Francis wrote in 1909, and one from October, 1910. The controversial methods which can change "last months" to "last years," and then cite letters of 1909, are characteristic of that looseness of procedure which must eventually be fatal to any popular movement run by this society. It suffices to say that on my last visit to Sir Francis Galton at Haslemere at the end of December, 1910, he expressed distrust of the lines on which the society was being run, that he was then in doubt as to whether he would not do better to resign his honorary presidency, and that I personally declined to influence his judgment in any way by discussing the subject, because he was as able then as when he was fifteen years younger to decide for himself.

When my "Life of Sir Francis Galton" is published his letters will show the exact field of work he proposed for the society and his appreciation of the dangers that might arise from its action. My only excuse, sir, for troubling you in this matter is that the organ of the Eugenics Education Society is a quarterly, and I have no other effective means except through the courtesy of your columns to correct a wholly erroneous statement, which the editor of that society's journal has put into my mouth.

KARL PEARSON.

Galton Laboratory, University of London,
January 23.

Some Habitats of a Marine Amœba.

IN a letter to NATURE (No. 2300, vol. xcii.) I described a common habitat of a marine Amœba, and in view of the subsequent discussion of this matter in letters to NATURE it will be of interest to record some further observations bearing on that discussion.

In the letter to NATURE mentioned above it was shown that a marine Amœba, which agreed in many of its characters with *Amoeba crystalligera* of Gruber, could be fairly constantly obtained from sponges of the genus Sycon, by squeezing out the contents of the gastral cavities of these animals. At the same time it was stated that this habitat of the Amœbæ is not likely to be an exclusive one. When, therefore, Prof. Dendy suggested in NATURE (No. 2301) in the following week that these Amœbæ might be sponge germ-cells, or even metamorphosed collar-cells, I at once began a search for the Amœbæ in other situations. This search was successful; Amœbæ in all respects similar to those obtained from the sponges were found in

three separate places. On one occasion they were found among matted masses of the Polyzoan, Bowerbankia, on another in a pocket occurring in a pendulous colony of Botryllus, and on another occasion they may have been in the same situation as the last, or they may possibly—but not probably—have been present in the mantle cavity of the Botryllus colony. On obtaining these free-living Amœbæ I started a culture of them in petri dishes, and also a culture of Amœbæ from sponges. The former culture is now in a healthy condition, and there has been a large increase in the number of individuals. The culture from sponges begun on December 10 yielded an increasing number of Amœbæ, until on December 24 there were numerous specimens all over the bottom of the dish. About December 30 this culture began to decline, the Amœbæ becoming replaced by Ciliates, so that at present only occasional specimens can be found even by careful hunting. The food of the Amœbæ in these cultures was probably bacteria, but occasionally algal inclusions were to be observed, and in one case an included diatom was almost certainly a Nitzschia, a culture of which I added to the Amœbæ.

During the progress of these cultures no dividing Amœbæ were seen, although they were looked for, but a few days after starting the cultures a large number of small Amœbæ were noticed. These small ones undoubtedly grew larger, as the progress of the cultures showed. And indeed various sizes of these Amœbæ from about 30 μ by 12 μ to 80 μ by 40 μ were obtained, both from sponges and the free-living habitats mentioned above. Unfortunately in my former letter I gave the size only of what I considered to be the adult form, and have thus misled Prof. Dendy into the error of supposing that they are too large to be the germ-cells of the sponge. The mature oocytes of Sycons are about 35 μ in diameter, when stained and mounted, whereas a large, living Amœba in a spherical condition, measured about 45 μ in diameter, but even allowing for shrinkage of the oocyte, it is probable that it would be somewhat smaller in the living state than a large Amœba. Moreover, as Mr. Bidder has pointed out, the adult Amœbæ are too large to be the metamorphosed collar-cells of the sponges, and it may be added so also are probably even the smallest ones.

Indeed, the identity of the free-living Amœbæ and those obtained from sponges as indicated by their general characters and their similar behaviour under culture, apart from the fact of the ingestion of diatoms, is sufficient to establish these animals as independent organisms.

It is an interesting fact that the largest forms of these Amœbæ when flowing quickly can travel their own length in about 40 seconds. One specimen was observed to travel nearly six times its length in a little more than seven minutes, making various stops and meanderings on the way. J. H. ORTON.

The Marine Biological Laboratory,
The Hoe, Plymouth.

Projective Geometry.

ARE not the references to the "epidemic of projective geometries" in a note in NATURE of January 1 (p. 510) somewhat unfair?

It is complained that they "may teach pupils to copy out proofs of stereotyped bookwork." The best of the treatises contain an excellent selection of problems calculated to give the student a firm grasp of fundamental geometrical ideas. As for "problems in mechanics involving a conic, cycloid, or catenary," the geometry required is usually closely connected with the calculus, and is to be found in text-books on that subject.

Without doubt the calculus is the most important branch of mathematics, and should come as early as possible, but to those who are interested in the geometry of conics the powerful methods of projection and reciprocation form a natural and attractive sequel to the usual elementary course on the straight line and circle. H. PIAGGIO.

University College, Nottingham, January 1.

I AGREE with Mr. Piaggio that projective geometry is a pleasant and suitable subject of study for arts students, especially women, who are reading for honours with a view of entering the teaching profession. But for such students a single text-book written by an eminent pure mathematician would be better than the present array of books, the authors of many of which have not added much to our knowledge of mathematical science. Further, Mr. Piaggio forgets that these arts candidates are not the students who want their calculus so early; indeed, they flourished and prospered as well thirty years ago, taking their calculus late, as to-day, perhaps better.

It is for the science student who combines pure mathematics with mechanics, physics, and chemistry that the early calculus is most needed. The geometrical properties of space involved in the study of physical problems are almost invariably essentially metric, and a course in projective geometry will appear to such a candidate as a blind-alley, affording very little outlook. Although I liked the subject myself, I cannot remember a single outside problem to which I could apply my knowledge of it. On the other hand, the geometrical properties of conics and other curves are constantly involved in applications to mathematical physics, where their significance can only be properly understood when the curves have been studied from first principles. Mr. Piaggio considers that this geometry is contained in text-books on the calculus, but the treatment in these books—especially in the case of the conic—is quite inadequate, and, moreover, is almost invariably too analytical. The old dividing line between geometrical and analytical conics was, of course, a mistake, but its abolition has led to the failure of students to study these curves *from first principles*, with the result that the metric geometry of curves, especially conics, is neglected, and students of physics get into the difficulties mentioned in my note. Now it will be found that the authors of many of these text-books run down the study of geometrical conics, and propose these projective methods as a substitute, and my object is to point out that so far as my experience goes this substitution leaves the student of mathematics combined with physics much worse prepared than he was before.

A former pupil, now a lecturer, once brought me a proof that the path of a certain particle (I believe an electron) was a cycloid. He had worked it out analytically; but I pointed out that the result followed immediately from first principles.

By all means let projective geometry be taught, but let its place be beyond the dividing point at which students of pure mathematics and of physics branch off in different directions. There is plenty of other work which is now crowded out of the course common to all candidates, which possesses pressing and urgent claims for inclusion therein.

THE WRITER OF THE NOTE.

Zonal Structure in Colloids.

THE notice of Prof. Küster's work on zoning in colloids in NATURE of January 8 suggests to me that such an influence is often manifest in our concretionary formations.

In 1912 Prof. S. Leduc, after seeing some of my

photographs of the Sunderland Magnesian Limestone, suggested osmosis as the cause (see his "Biologie Synthetique," p. 176). This still awaits demonstration.

Two processes appear to me to have been at work in this concretionary limestone. The first step was, I believe, the production of rod structures starting at every possible angle from "bands of origin," and lying either parallel to or divergent from one another. Both forms are shown in the photograph of a vertical section at Fulwell Hill (×¼). The rods are often seen in a double series pointing in opposite directions, though they are certainly never of stalactitic origin. The second process seems to be similar to that which produces Liesegang's rings; this caused a deposit of lime in zones (Fig. 1) across the rods, whatever posi-

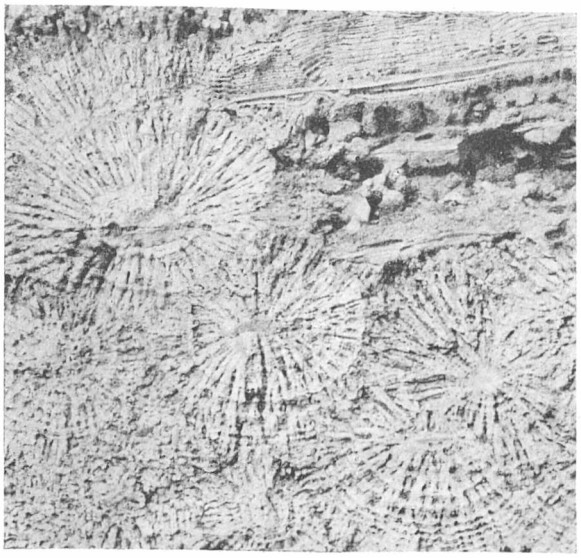

FIG. 1.

tion or arrangement. They commenced as nodes on the rods, ultimately by extension forming parallel bands. The process often halted at various stages of development, but specimens are found showing a complete series of such changes and suggesting an easy classification.

GEORGE ABBOTT.

2 Rusthall Park, Tunbridge Wells, January 15.

Weather Forecasting.

OF the sciences, meteorology is perhaps the one which most deserves and requires State-aid. Even to the individual whose business is not affected directly by the weather, a more certain knowledge of the atmospheric changes which may be expected to take place during the day would be of very considerable value. Thanks to our Meteorological Office, we can even now ascertain from the morning papers what the weather conditions of the day are likely to be; but it is generally conceded that even the official weather reports sometimes prove untrustworthy. By some weather experts forecasts are issued for three days in advance. Such forecasts, however, are much more untrustworthy than the daily ones. Indeed, weather changes are frequently so rapid that in the course of twenty-four hours the atmospheric conditions may be almost entirely changed over the whole of Europe.

There is no reason to suppose that any insuperable difficulty stands in the way of accurate weather forecasting; but individual effort cannot be expected to bring together, and put in proper form for study, the vast amount of detailed information from distant regions which must be dealt with.

To be of real service, correct forecasts should be published for at least seven days in advance. Such forecasts would be of great value to the agriculturist. It does not seem to be quite appreciated how great an interest agriculture is, even to a manufacturing country like England. Compared with it the 18,000*l*. per annum provided by the State for the carrying on of the work of the Meteorological Office is an insignificant figure. Indeed, that so little is spent on this department would seem to imply that those who are responsible for providing what is required take an altogether incorrect view of what might really be accomplished. One unexpected storm will often do ten times as much damage to agricultural produce and shipping as would provide all the money that is required.

It is difficult to believe that in these days when scientific method has led to such enormous improvements in the conditions under which we live, there are those who believe that meteorology is a science which cannot be expected to assist greatly in promoting the general welfare. That meteorology has not made more rapid strides is due to the fact that it is pre-eminently a science which requires organised effort of a kind which the individual meteorologist cannot undertake. What is required is an organisation the efforts of which are mainly directed to the accumulation of facts, and, what is of equally great importance, the publication of such facts in a form easy of comprehension.

A meteorological atlas gives us charts showing mean temperatures, mean atmospheric pressures, &c., but although such charts are useful, indeed indispensable for some purposes, we still require charts giving the actual conditions obtaining at certain times each day. The only charts of this description available are those issued by the British Meteorological Office each week. Although these have greatly improved during recent years, they still leave much to be desired. If they were printed on a larger scale they would be much more valuable. Such charts ought to show the isobars, isothermal lines, dew points, &c. The isothermal lines and dew points would, probably, be distinctive of each wind province.

At the present time the science of meteorology, in so far as the laws governing the changes produced in the air by vertical or horizontal movements are concerned, is well up to date. What is wanted is a clearer knowledge of the nature and origin of cyclones and anticyclones. Correct conclusions can only be drawn from charts showing correctly the conditions actually obtaining over large areas at particular moments.

It must not be forgotten that every cyclone as it reaches new areas finds there wind conditions the nature of which exercise a profound influence upon the form of the advancing cyclone. It is not, therefore, sufficient to know that a cyclone is advancing towards us along a certain path. The actual form of this cyclone and the wind and other conditions of the area into which it is advancing, are each of great importance. So complicated are the conditions, and so variable are they, that anything short of daily, or twice daily, charts will fail to provide the material required for ascertaining the laws which govern the circulation of the atmosphere and produce rain, wind, and change of temperature.

A rich country such as England, one in which agriculture and shipping are of such enormous importance, should not fail to furnish material for such a study of atmospheric changes as would render forecasts trustworthy, not only for one day, but for

several days in advance. However, any further expenditure of public money should not be granted, unless the information thereby obtained be published in such a detailed form and at such a price that it would be available for the study of all who take an interest in meteorological science. R. M. DEELEY.

Abbeyfield, Salisbury Avenue, Harpenden.

Liquid Air as a Fixative.

LAST year when Mr. Atkins and I were searching for a method of extracting sap unchanged from various vegetable tissues, treatment with liquid air suggested itself and proved a valuable means for attaining this object. The rapidity of its action in suspending vital processes and chemical changes and in rendering protoplasm permeable, suggested its further application as a fixative. Since then most promising results have been obtained in various cells and tissues by Miss E. S. Marshall, working in this laboratory, showing various nuclear and cytoplasmic structures with great clearness and with a complete absence of plasmolysis. HENRY H. DIXON.

School of Botany, Trinity College, Dublin.

Atomic Models and X-Ray Spectra.

IT seems scarcely possible that Prof. Nicholson (NATURE, vol. xcii., p. 583) requires his two rings of electrons, rotating under the inverse square law, to have one and the same angular velocity; because, if so, the impossibility of two different radii is self-evident; but his letter does not guard against this elementary misapprehension. OLIVER LODGE.

Mariemont, Edgbaston, January 24.

AUTOMATIC AËROPLANE CONTROLS.

MUCH interest has been excited in the announcement contained in the daily Press that Mr. Orville Wright has succeeded in fitting aëroplanes with a device which, according to his statements, renders them as nearly "fool-proof" as anything can be.

This device, as illustrated in the *Daily Mail*, is an absolutely simple one, and works by compressed air. Lateral control is effected by a pendulum which operates an air valve, by which the compressed air is admitted to a cylinder containing a piston connected with the warping device. For longitudinal control, Mr. Wright uses a flat vane, which rises or falls when the air impinges on its under or upper surface; and this is similarly made to operate the elevator.

The compressed air is generated by a small windmill, which will continue to work when the engines are stopped.

I have pointed out in NATURE, vol. xci., p. 556, that a pendulum, operating on the controlling devices of an aëroplane, instead of increasing the stability and damping out the oscillations, may produce the reverse effect. It is thus evident that there must be *definite conditions* under which such a device as this may be able to accomplish its object, and that there are equally definite conditions under which it may lead to disastrous accidents. The inference is that Mr. Wright has by experimental tests arrived at a result which satisfies the conditions favourable for automatic control as opposed to those favourable for automatic wreckage.

Apart from the use of a vane for longitudinal control, and a windmill as a generator of compressed air, the invention seems to differ very little from a patent previously claimed by Mr. H. G. Seager, of Colwyn Bay, which I have rather carefully examined, because I am interested in it, and he lives near. Seager uses a pendulum and air pressure, but instead of one he has eight valves, and the same number of cylinders or pneumatics, with the result that he can place his warping devices or elevators in eight different positions, according to the strength and sense of the disturbance requiring to be counteracted. It thus represents a more elaborate control.

There is a good deal of confusion at the present time as to what is meant by stability in aviation, and for this reason "automatic control" would probably be a safer name than "automatic stability" for self-righting devices involving moveable parts. The confusion arises largely from the want of an adequate theoretical basis of comparison in the early days of aviation. Had theory preceded practice, the first experiments would have soon disposed of the divergences between them, which appear to be leading to endless controversies, misunderstandings, and mis-statements at the present time.

Thus in a discussion on stability in *The Aeronautical Journal* for October, recently issued, Mr. J. H. Ledeboer, near the end, says: "So far, everyone who has contributed to this discussion appears to have made the cardinal mistake of confusing stability with controllability, which are essentially different qualities, and are, in fact, often contradictory." And in Mr. Berriman's recent book, while introducing the term "weathercock stability" to designate something which may or may not be synonymous with dynamical stability, he advances the opinion that an absolutely stable aëroplane would never vary its inclination to the horizon, and further that its centre of pressure would always coincide with its centre of gravity. So far from being absolutely stable, the last-named condition might theoretically be described as giving neutral equilibrium, but unstable would be a more correct description.

The success of the Wright device is described both by Wright himself and by his fellow-passenger, Griffith Brewer. The statement that Wright flew several miles without touching the handles is undoubtedly genuine.

While these things are happening in America, considerable interest is still being shown in this country in the Dunne machine, as is evidenced by the recent discussions before the Aëronautical Society. In this case an important feature is that the tendency to excessive banking up in turning curves is counteracted by making the angle of attack negative at the tips of the wings, so that these are really pressed downwards instead of lifted. The principle involved may be stated symbolically as follows, provided that we make the assumptions necessary to simplify the formulæ:—

Let S be an element of the sustaining surface, α its angle of attack, z its distance from the plane of symmetry. Then the lifting power of the surface is proportional to $\Sigma S \sin\alpha\cos\alpha$, while the tendency to bank up at the outer side in rounding curves is proportional to a coefficient which I call L_q, and is proportional to $-2\Sigma Sz^2 \sin\alpha\cos\alpha$, being negative in the ordinary case where an aëroplane tends to rise excessively on the outer side when rounding corners. Now the principle of the "negative wing tip," as Dunne calls it, is represented symbolically by the fact that by making α positive when z is small, and α negative when z is large, you can make—

$\Sigma S \sin\alpha\cos\alpha$ positive,
$\Sigma Sz^2 \sin\alpha\cos\alpha$ zero or negative,

thus giving lift and yet neutralising or reversing the banking action.

There is much to be said for Mr. Dunne's remark: "Finally I must remind you that all my work has been done by practical experiments. It is not the experimental facts which are in question, but the theory which I have evolved to cover these facts, which theory I submit to this learned Society for criticisms. But the facts are unquestioned. The aëroplane does do these things, and if the theory does not give warranty for the practice, then it is the theory which is wrong." G. H. BRYAN.

THE ATLANTA MEETING OF THE AMERICAN ASSOCIATION.

THE sixty-fifth meeting of the American Association for the Advancement of Science was held at Atlanta, Georgia, during the week December 29, 1913, to January 3, 1914, under the presidency of Dr. E. B. Wilson, of Columbia University. It was the first meeting which the association has held in the Southern States since the New Orleans meeting of 1905, and was marked by an important series of papers relating indirectly to the industrial advance in the south, to health conditions existing among its people, and to its geological and other resources. The attendance was not large, only about 400 members and fellows registering.

Nine of the national societies affiliated with the American association met at the same time and place, as follows:—

Astronomical and Astrophysical Society of America, Botanical Society of America, American Association of Economic Entomologists, Entomological Society of America, American Microscopical Society, American Physical Society, American Phytopathological Association, School Garden Association of America, Southern Society for Philosophy and Psychology.

The address of the retiring president, Prof. E. C. Pickering, Director of the Harvard College Observatory, was on the subject "The Study of the Stars."

The addresses of the vice-presidents, or chairmen of sections, were as follows:—

A, "The Influence of Fourier's Series upon the Development of Mathematics," E. B. Van Vleck, University of Wisconsin; B, "The Methods of Science: To What Do They Apply?" A. G. Webster, Clark University; C (on account of the absence of Vice-President Miller the address was omitted); D, "Safety and the Prevention of Waste in Mining and Metallurgical Operations," J. A. Holmes, Bureau of Mines; E, "Pleistocene History of Missouri River," J. E. Todd, University of Kansas; F, "The Story of Human Lineage," W. A. Locy; G, "The Evolution of a Botanical Problem," D. S. Johnson, Johns Hopkins University; H (the address was omitted on account of the absence of Vice-President Fewkes); I, "The Development of our Foreign Trade," J. H. Hammond, New York; K, "The Physiological Instruction of Medical Students," J. J. R. Macleod, Western Reserve University (read by title); L, "Science, Education, and Democracy," J. McKeen Cattell, Columbia University.

Two public lectures complimentary to the citizens of Atlanta were given—the first by Dr. C. W. Stiles, of the U.S. Public Health Service, on the subject "The Health of the Mother in the South." In this address, in which some very remarkable facts were told in a very plain way, the speaker urged in a most emphatic manner the segregation of the races in the south, an idea which has heretofore received little attention in the United States, although British sanitarians in the tropical British colonies have appreciated its importance for some years.

The second public lecture was by Prof. C. E. Munroe, of the George Washington University, on the subject "The Explosive Resources of the Confederacy during the War and Now: A Chapter in Chemical History." Prof. Munroe, one of the American authorities on explosives, and for a long time Professor of Chemistry at the United States Naval Academy at Annapolis, dwelt upon the extraordinary activity of the south, isolated as it was from other countries by the blockading vessels of the northern fleet, in developing such resources as they were known to possess, and in manufacturing from them the enormous quantity of explosives which were used by the large southern army during its four years' struggle for independence.

The papers read before Section E (geology and geography) were devoted practically entirely to the geology of the Southern States, and the council of the association has made a grant to secure the publication of these papers in a single volume.

An important symposium was held under the auspices of Sections D and I, on highway policies and engineering, and other joint meetings were held between the Section of Zoology and the American Entomological Society, and between the Section of Botany and the American Phytopathological Association. Under the Botanical Society of America was held a symposium on temperature effects.

Probably the most important symposium of the meeting was held under the auspices of Section K (physiology and experimental medicine), on the subject of Pellagra. The subject was opened by

a paper by Dr. J. W. Babcock, Superintendent of the State Hospital for the Insane at Columbia, S.C., on the medico-local relations of pellagra. Dr. E. Bates Block, of Atlanta, discussed the mental disturbances of this disease. Dr. G. M. Niles took an unusually optimistic stand in his discussion of prognosis. The main paper of the symposium was presented by Dr. W. J. Macneal, of the New York Post-graduate Medical School, for himself and his colleagues, Dr. J. S. Siler, Medical Corps, U.S.A., and Dr. P. E. Garrison, Medical Corps, U.S.N., and comprehended an announcement of the later studies of the Thompson-McFadden commission on the etiology of pellagra. During the summer of 1913 the commission has been actively at work at Spartanburg, S.C., and has accumulated and digested a mass of facts bearing upon the etiology which seem to discredit completely all questions of diet, either as to character or amount, and to place the responsibility for the disease upon unsanitary conditions as regards the disposal of excreta; in other words, upon food contamination. The remaining paper was entitled "The Entomological Aspects of the Pellagra Investigation of the Thompson-McFadden Commission," by Mr. A. H. Jennings, of the Bureau of Entomology, U.S. Department of Agriculture. Mr. Jennings having worked for two seasons with the commission at Spartanburg, practically absolved Simulium from any relation to the disease, and stated that if any insect is the vector of pellagra it is in all probability the stable fly (*Stomoxys calcitrans*).

Among the actions by the council were the acceptance of the Society of American Foresters as an affiliated society, the adoption of a resolution looking with favour upon the organisation of a Brazilian division of the association, the authorisation of the establishment of local branches of the association, the continuance of the associate secretary for the south, and the authorisation of the preparation of a directory of the funds available for research work.

A report of progress from the Committee on Expert Testimony was received. The movement to bring the force of the association, composing in its membership so many hundreds of scientific men constantly called upon to give expert testimony in the courts, towards a modification of the present system of employing experts by opposing parties in courts of law, was begun two years ago at Minneapolis. The committee in charge of the work consists of Prof. E. C. Pickering, of Harvard, chairman; Dr. E. B. Wilson, of Columbia; Dr. W. H. Welch, of Johns Hopkins; United States Senator Elihu Root; Dr. A. D. Little, formerly president of the American Chemical Society; and Dr. J. A. Holmes, of the U.S. Bureau of Mines. The committee reported a compilation of the laws of the different States of the union on this subject, and stated that a compilation of the laws of the different nations of the world is in hand. Positive recommendations are to be expected from this committee at the next meeting of the association, and, comprising as it does some of the most eminent scientific men in America, together with one of its most eminent lawyers, the report will carry great weight.

It was decided to hold the next meeting of the association during Convocation Week, 1914–15, at Philadelphia, with a summer meeting to follow in August, 1915, at San Francisco. The general committee recommended to the next general committee that Toronto, Canada, be chosen as the place of meeting for 1915–16, on invitation from the University of Toronto.

The officers elected for the coming year were as follows:—

President: Chas. W. Eliot, president emeritus of Harvard University. *Vice-Presidents (or Chairmen of Sections):* A. H. S. White, Vassar College; B, A. Zeleny, University of Minnesota; C (no election); D, A. Noble, New York; E, F. R. Lillie; G, G. B. Clinton, New Haven; H, C. Wissler, American Museum of Natural History; I (no election); K, R. M. Pearce, University of Pennsylvania; L, P. H. Hanus, Howard University; M, L. H. Bailey, Cornell University. *General Secretary:* W. A. Worsham, jun., Athens State College of Agriculture. *Secretary of Council:* Henry Skinner, Academy of Sciences. *Associate Secretary:* R. M. Ogden, University of Tennessee.

DR. S. C. CHANDLER.

DR. S. C. CHANDLER, whose death we recorded with regret last week, was not the least conspicuous in that earnest band of American astronomers whose energy and resource have done so much to advance astronomical science. He began his scientific career in the United States Coast Survey, a school that has trained many brilliant observers, who, in positions of greater independence, have rendered valuable service. Dr. Chandler's claim to a place among the most famous of these rests upon three notable achievements. First, the invention and use of the Almacantar, an instrument in which the small circle perpendicular to the meridian passing through the pole is adopted as a fundamental circle of reference, and gravitational action round an imaginary vertical axis is substituted for the motion of rotation round the pivots of the horizontal axis in the case of a vertical circle. Secondly, for his valuable catalogues of variable stars, in which he systematised the results collected by many observers, thereby encouraging and facilitating further observations. His work in this direction was by no means confined to simple compilation. He was both an indefatigable observer and the fortunate discoverer of many interesting objects of this class, ever directing attention to a branch of astronomy that has proved both suggestive and fructiferous.

This habit of industrious examination and critical scrutiny, acquired in discussing many series of observations, proved of remarkable assistance in the successful inquiry with which his name will ever be associated, the detection of the variation of latitude, due to the want of exact coincidence between the axes of the earth's figure and of rotation. This work was exceedingly laborious,

necessitating the reduction and collation of many series of observations of zenith distance, and that it was pursued with unswerving determination is the more meritorious as previous computers, misled by Euler's investigation of the behaviour of an absolutely rigid earth, had decided that no term of a periodic character could be detected. Undismayed by this negative result, Chandler, putting aside all suggestive hypotheses, based his inquiry solely on the observations themselves, and accepted the results these offered. He was thus driven to the inevitable conclusion, first, that the latitude variation had a period of 428 days, a decision that was subsequently modified by showing that the complicated motion could be best explained by the superposition of two variations, one in fourteen, and the other in twelve months.

These valuable investigations merit in the highest degree the attention not only of those who are especially devoted to astronomical and mathematical researches, but also of that large and ever-increasing class which is anxious for general knowledge with regard to the physical phenomena of our globe. This work merited and obtained the recognition of the Royal Astronomical Society, which awarded Dr. Chandler the gold medal. It was his greatest achievement, but there are other grounds on which he merits the gratitude of astronomers, who will regret the loss of one who equally adorned the threefold divisions of computational, observational, and instrumental astronomy. W. E. P.

NOTES.

WE announce with profound regret the death on Saturday, January 24, in his seventy-first year, of Sir David Gill, K.C.B., F.R.S., formerly H.M. Astronomer at the Cape of Good Hope.

BEFORE Lord Strathcona was carried to his grave in Highgate Cemetery on Monday, there was an impressive memorial service at Westminster Abbey, at which the King and Queen and Queen Alexandra were represented. The ten pall-bearers, selected on account of their special connection with Canada, or personal relationship with Lord Strathcona, were :—Lord Aberdeen, Lord Lansdowne, Lord Lichfield, the Very Rev. George Adam Smith (Principal of Aberdeen University), Mr. W. L. Griffith (secretary of the Canadian High Commissioner's Office), the Duke of Argyll, the Lord Mayor, Mr. Harcourt (Colonial Secretary), Sir William Osler (regius professor of medicine, Oxford), and Sir Thomas Skinner (deputy-governor of the Hudson's Bay Company). A large number of distinguished people were present at the Abbey service, including representatives of many scientific societies and similar bodies. Among these were Sir William Crookes and Sir Archibald Geikie (Royal Society), the President of Magdalen (the University of Oxford), the Master of Downing (the University of Cambridge), Mr. J. G. Colmer (Canada Club), Sir William Ramsay, Sir Boverton Redwood, and Lady Lockyer (British Science Guild), Sir Frederick Macmillan (National Hospital for Paralysis and Epilepsy, of which Lord Strathcona was president), Sir Francis Champneys, Sir Henry Morris, and Mr. J. Y. W. MacAlister (Royal Society of Medicine), Colonel Sir T. H. Holdich (Royal Geographical Society), Dr. I. H. Tudsbery (Institution of Civil Engineers), and Sir Charles Lyall and Prof. Ernest Gardner (League of the Empire). Lord Strathcona was one of the trustees of the British Science Guild, and took a practical interest in developments of scientific and educational work. His benefactions to McGill University, Montreal, exceeded a quarter of a million; he gave 25,000*l.* to Marischal College, Aberdeen, and endowed a chair of agriculture in Aberdeen University. He also established and endowed the Royal Victoria College for Women at Montreal, and made many other generous gifts to higher education. The Toronto correspondent of *The Times* reports that at a memorial service held on Monday at McGill University in honour of Lord Strathcona, Principal Peterson said :—"The late Chancellor's contribution to education constituted no mere stereotyped or conventional form of benevolence. In scientific, medical, and higher education for women he was a pioneer with a marked power of initiative which had been felt all over Canada."

THE wife of Dr. Weir Mitchell survived him only a few days. She became ill shortly after his funeral, and died of pneumonia on January 15. Mrs. Mitchell was in her seventy-ninth year.

PROF. D. H. TENNENT, of Bryn Mawr, has completed a biological investigation he has been conducting in Thursday Island in connection with the Carnegie research fund.

PROF. W. M. DAVIS, the Harvard geologist, is about to carry out an exploration of some of the coral islands in the Pacific. He is so arranging his tour as to be able to attend the meetings of the British Association in Australia.

DR. E. C. SPITZKA, a former editor of *The American Journal of Neurology*, has died in New York in his sixty-second year. From 1885 to 1887 he was professor of medical jurisprudence and neurology at the New York Post-Graduate Medical College.

THE death is reported, in his sixty-ninth year, of Dr. G. W. Peckham, a former president of the Wisconsin Academy of Sciences, Arts, and Letters, and librarian of the Milwaukee public library. He was distinguished by his studies in entomology, and had collaborated with his wife in writing numerous works on that subject.

THE death is reported, in his sixtieth year, of Dr. B. O. Peirce, who had held the Hollis chair of mathematics and natural philosophy at Harvard since 1888. He was the author of "Experiments in Magnetism," "Theory of the Newtonian Potential Function," and "Table of Integrals," besides numerous papers on mathematics and physics.

ON Thursday next, February 5, Sir Thomas H. Holland will begin a course of two lectures at the

Royal Institution on types and causes of earth crust folds. The Friday evening discourse on February 6 will be delivered by Dr. H. S. Hele-Shaw on the mechanics of muscular effort, and on February 13 by Prof. J. Norman Collie on production of neon and helium by electric discharge.

MR. H. LAMSLEY, writing from Watford, states that a queen wasp was seen by him upon his desk in an office on January 22, although the weather was very cold. This early date for a queen wasp to appear is worth putting on record. Curiously enough, we notice that two wasps are recorded in *The Times* of January 24 as having been among the finds reported from the old Roman city of Silchester, Berkshire, during the past week.

AT the last monthly general meeting of the Zoological Society it was announced in the monthly report read by the secretary that the number of visitors to the society's gardens during the month of December was 29,820. The total number admitted during the year was 1,157,974, being an increase of 145,076, as compared with the total for the year 1912. The money received for admission at the gates was 28,223*l*., or an increase of 4479*l*. as compared with the total for the year 1912. The total number of fellows on the roll at the close of the year 1913 amounted to 4733.

WE learn from *The British Medical Journal* that arrangements have nearly been completed for the establishment, as a memorial to Lord Lister in Edinburgh, of a Lister Institute. It is proposed that the institute, which will be devoted mainly to research in bacteriology and pathology, shall work in connection with the University, but that it shall be managed by an independent board consisting of representatives of the Royal Colleges of Physicians and Surgeons, and of the University, and probably of the Carnegie trustees, who have recently become interested in the laboratories of the Royal College of Physicians.

ANOTHER Antarctic expedition is announced, for departure in 1915, and an absence of five years. The Swedish Antarctic Committee, which includes Admiral Palander, Profs. Nordenskjöld, and Gunnar Andersson, and Dr. Nathorst, has secured the financial support of the Government to the extent of half the estimated cost of 15,000*l*. It is proposed to equip a station in Graham Land, with a scientific *personnel* ten in number, which will be supplied during the long sojourn in contemplation by whaling ships, and will carry a wireless telegraphic installation. This appears to be one of those expeditions which will be the logical corollary to the attainment of the south pole, including no sensational feat of travel, and making, therefore, no direct popular appeal, but attempting substantially to extend the scope of scientific research in the Antarctic.

THE annual general meeting of the French Physical Society was held in Paris on January 16. The officers for the new year were elected, and the accounts for the past year presented to the members. From the figures given in the report it is evident that the society is in a most flourishing condition. More than 100 new members joined during the session, the membership now being more than 1600; Paris, the rest of France, and countries outside France each providing about a third of the total. It possesses more than 10,000*l*. of invested capital, and its income for the past year exceeded 1700*l*. The expenses for the year were slightly less, the principal items being the printing of the *Journal de Physique*, 570*l*., and other books and reports issued to members, 300*l*. A series of six lectures on recent advances in physics is to be given during the next three months, the lecturers being Profs. Madame Curie, Mauguin, Mouton, Cotton, Fabry, and Becquerel.

A PHYTOPATHOLOGICAL Congress, commencing on February 24, will be held at the International Institute of Agriculture, Rome, to which all the chief Powers are invited to send representatives. The object of the congress is the devising of an international system for the control of plant diseases, and based upon the suggestions made in 1912 by M. Louis Dop and Prof. G. Cuboni, on the occasion of the general assembly of the delegates of the above institute. Prof. Cuboni has set forth his views on this subject very clearly in an *aperçu* which he contributed to the Bulletin of Agricultural Intelligence and Plant Diseases (November, 1912). In this he states that, though the protection of agricultural plants from disease is a matter of the most vital importance for all civilised nations, little has hitherto been done to obtain any concerted action in this direction. The sole exception is afforded by the Berne Antiphylloxera Convention, established in 1878, and modified in 1881. This, as it stands, is only of interest to vine-growing countries. If, however, its scope were enlarged, so as to include the control of all other contagious or parasitic plant diseases, whether due to the attacks of fungi, or insects, it could be expanded into an International Phytopathological Convention.

A NEW X-ray tube invented by Mr. W. Coolidge, of New York, marks an important step in the progress of radiography and possibly radio-therapy. The principal feature of the apparatus consists in a small spiral of tungsten wire which, when strongly heated by an electric current, becomes a source of electrons, and thus serves as the kathode of the tube.—Surrounding the spiral there is a tungsten ring connected with the negative pole of an induction coil or static machine. This electrified ring repels the electrons from the hot wire so as to bring them to an approximate focus upon a tungsten target (antikathode), where X-rays of varying degrees of penetration are produced. The vacuum within the tube is extremely high, and comparatively wide variations of it do not appear to affect the working of the apparatus. Perhaps the most striking advantage of Mr. Coolidge's tube over the usual kind lies in the readiness with which it can be controlled. The output of X-rays is simply a function of the temperature of the hot kathode, all other factors remaining the same. When once set in action the bulb requires little attention. Thus a tube of this design has been run continuously for about an hour, taking 25 milliamperes of current through it for the whole time, and emitting a uniform radiation of intense penetration. The idea underlying the invention

is not quite new, for Dr. Lilienfeldt, of Leipzig, recently introduced a focus tube in which the source of electrons is a heated body.

A DISTINCT advance toward the adequate organisation of sea fisheries investigation has been made by the publication of the first report of the Advisory Committee on Fishery Research. This committee was appointed by Mr. Runciman on January 1, 1913. Its report, now before us, begins with a short account of the deliberations of the subcommittees, and then deals with the various lines of investigation that are regarded as desirable in a series of appendices. Suggestions as to the nature of the work which seems to be required are made with reference to (1) the bottom deposits and fauna; (2) plankton and hydrography; (3) statistical fishery matters; (4) marine pisciculture, including lobster hatching, research on the natural history of the oyster, and experimental work on a large scale with reference to the purification of mussels from contained sewage bacteria; and (5) the detailed investigation of various edible fishes with regard to their distribution and life-histories. Suggestions as to a possible organisation of the various departments or other authorities or bodies competent to carry on such investigations are not made, since much depends on the amount of money available for such research, and on the possible reorganisation of the English Fishery Department; and it is suggested that marine laboratories already in existence may be asked to cooperate in the work of investigation. The report, however, formulates certain general suggestions for fishery investigations, and it now remains for the public departments to embody these suggestions in a working scheme.

The National Geographic Magazine for December last publishes a finely illustrated article by the Rev. W. M. Zumbro, on the religious penances of holy men in India. He gives a remarkable series of photographs representing the many varieties of Fakirs. We see them lying on piles of thorns, or on beds studded with nails, holding piles of water pots on their heads, burying themselves in the ground, swinging on wires, undergoing the ordeal of thirst, hanging head downwards, or holding up their arms until the muscles become atrophied. The subject is painful, but the article is most valuable to anthropologists and to students of Indian religious cults.

IN *Man* for January Messrs. R. B. Higgins and R. A. Smith describe a find of flint implements of the Moustier type, associated with mammalian remains, from the brick earths at Crayford. Not only does this discovery enable us to fix a precise date for the Crayford deposit, but the specimens provide an important link in associating the Thames valley with that of the Somme. It is clear that the implements date from the Moustier period, and they are found with remains of *Felis leo, Canis lupus, Elephas primigenius, Rhinoceros antiquitatis, Equus sp.*, and *Bos primigenius*, according to the identification by Dr. A. Smith Woodward.

IN vol. xxxiii., part ii., of *The Journal of Hellenic Studies*, Mr. K. T. Frost publishes, under the title of "The Critias and Minoan Crete," an interesting paper, a revised edition of a remarkable article which appeared in *The Times* of January 19, 1909. The theory advanced is that the famous legend of the lost island, Atlantis, told by Plato on the authority of Solon, represents the downfall of the great sea power in Crete, with its capital at Cnossus. This legend was derived from Egyptian priests, who preserved the records of the great struggle which ended in the ruin of Minos. The article is valuable inasmuch as it correlates the war in the eastern Mediterranean with the history of Egypt. The tale of the Minoan power before its destruction is identified with the strange description of the Phæacian culture in the Odyssey of Homer.

"ROOT-BORERS and other Grubs in West Indian Soils" is the title of a pamphlet (No. 73), by Mr. H. A. Ballon, issued by the Imperial Department of Agriculture for the West Indies, published apparently at Barbados. A large proportion of the offenders are the larvæ, among which those of the rhinoceros-beetles (Strategus) are capable, on account of their size, of inflicting a great amount of damage, although, as a rule, they act the part of scavengers. The pamphlet is illustrated with photographs of adults and larvæ of many species.

IN the course of an article on endeavours to prevent undue diminution in the number of animals valuable for their fur or plumage, the first part of which appears in the January number of *The Selborne Magazine*, Mr. C. H. Mühlberg gives some interesting details regarding the breeding in captivity of the black or silver fox, for the sake of its valuable fur, which is chiefly carried on in Prince Edward Island. Skins of good quality range in price from 35*l.* to 600*l.*, and it is stated that six pairs of pups were sold in 1912 to a Russian company for breeding purposes at no less than 3200*l.* a pair. The number of foxes now kept in captivity in Canada is estimated at about 800, of which, however, only about 200 carry the fine silvery-black coat which commands the highest price. Attempts are also being made, it is added, to breed chinchillas (which of late years have become exceedingly scarce), for the sake of their fur, both in Buenos Aires and in this country

METHODS for the extermination of locusts in the Anglo-Egyptian Sudan—the species usually met with being *Acridium* (*Schistocerea*) *perigrinum*, Oliv.—are discussed by the Government entomologist, Mr. H. S. King, in the *Cairo Scientific Journal* for November last. The device found most efficacious is to sprinkle a sweetened solution of arsenite of soda on the herbage on which the insects feed. As it is difficult to transport arsenite of soda and treacle on camels and donkeys, and a tent or native dwelling-house is not the most convenient place to carry out the weighing and mixing, Mr. King recommends that a concentrated solution should be prepared at headquarters, and carried to the spot in small iron drums. This can be diluted to the required strength, and thus an immense saving of labour is effected. If the operations are conducted by qualified officials, and the poison is not allowed to reach native hands, no danger can result from this scheme of operations.

THE legislation which has been adopted in Ceylon against the diseases and pests of cultivated plants is the subject of a special Bulletin (No. 6) by the Ceylon Department of Agriculture. The bulletin, drawn up by Mr. T. Petch, brings together in a convenient form the regulations as to both internal and import legislation. The latter was commenced in 1901. Under the regulations now in force all living plants, bulbs, &c. (except such as are imported for consumption), also oranges and other fruits of the Citrus family, and cotton seed, are subjected to fumigation with hydrocyanic acid, whilst the seed of tea is fumigated with formalin vapour. The importation of cacao plants from the Dutch East Indies, and pepper plants from India is totally prohibited. Internal legislation was not introduced until some years later, and only after it had been fully discussed with all the interested parties. It was first applied to the coconut beetles in 1907, but it is now extended to the shot-hole borer (*Xyleborus fornicatus*), Hevea canker, and the stem bleeding-disease of coconut.

WE have received a reprint of the article on plant ecology ("Oekologische Pflanzengeographie") contributed by Dr. E. Rübel to the "Handwörterbuch der Naturwissenschaften" now being issued by Gustav Fischer, Jena. In this article, which is practically a text-book of the subject, the author deals concisely with the various factors of the environment which determine the characters of the various types of plant community, and after reviewing the various systems of classification of these communities which have been proposed, sets out in detail the classification recently suggested by himself and Dr. Brockmann-Jerosch. In this scheme, plant communities are primarily divided into four types, composed respectively of woody plants, of herbaceous plants on relatively rich soil (meadows in the widest sense), of herbaceous plants on poor soil (deserts in the widest sense), and of free-floating aquatic plants (phytoplankton). The geographical distribution and biological characters of each type are given, and the author has compressed into fifty papers a remarkable amount of information, besides indicating the rapid progress which has been made in recent years in this branch of botany, and indicating the more important recent literature of the subject.

IN the second part of the *Verh. Naturhist. Vereins d. preuss. Rheinlande u. Westfaliens* for 1912 (1913) Dr. W. Gothan records the discovery in the neighbourhood of Dortmund, in the Ruhr basin, of a bed containing number of well-preserved Carboniferous ferns. They are of interest not only as being the first obtained from this locality, but from the fact that they include a new species, and also from a distributional point of view. The article is illustrated with three plates.

DR. FELIX OSWALD, whose hand-printed work on the geology of Armenia was reviewed in NATURE in 1906 (vol. lxxv., p. 197), has rendered his results more accessible by contributing the section on "Armenien" to the "Handbuch der regionalen Geologie," edited by Profs. Steinmann and Wilckens. This is illustrated by a tectonic and a geological map, and by sections (Heidelberg: C. Winter; price 2.80 marks). The author points out the rise of a large part of the region above the sea in late Jurassic times; the two types of marine Cenomanian strata, separated by a gneissic ridge south of Tiflis into an eastern and a western basin; and the folding of marine Miocene strata during the Alpine movements in the Tortonian epoch.

IN the *Atti dei Lincei*, vol. xxii. (2) 5, Prof. T. Levi Civita discusses the conditions that must be satisfied by a function in order that it may have an addition-theorem in which a function of $x+y$ is represented as the sum of products of functions of x and of y respectively. The ordinary exponential and circular functions afford illustrations of this property.

ACCORDING to Torricelli's theorem the velocity of efflux of a liquid from a small aperture in steady motion is equal to the velocity acquired by falling from the height of the liquid surface. From a note published in the *Comptes rendus* (vol. clvii., p. 48) by Prof. T. Levi Civita, it would appear that the same result holds good for the initial velocity of efflux when an opening is suddenly made in the walls of the containing vessel the liquid being previously at rest. It appears probable that this result could be easily tested experimentally.

NO. 2 of the *Jahrbuch der Drahtlosen Telegraphie* contains an article by F. Kiebitz on the refraction of electric waves in the atmosphere. Since the upper strata have a smaller density, luminous and electric waves are propagated more rapidly high above the ground than near the surface. This would lead to a bending forward of the wave-front, were it not for the curvature of the earth. The question now arises whether this curvature is sufficient to counteract the "prism effect" of the air. The author studies this question numerically, and finds that, to counteract the curvature, the densities on the ground and 1 km. above it should be in the ratio of 29 : 13. The actual ratio for dry air is 29 : 26, and for moist air about 10 per cent. greater. So far from bending forward, therefore, the waves will lean backward and be deflected into the upper atmosphere. There they encounter the conducting layer, and are reflected downwards, but only if the lower surface of this conducting layer is fairly uniform. Any folding or interruption of this surface will (as pointed out by Sir Oliver Lodge) lead to a reflection towards the origin or a dissipation into still higher strata. Such disturbances of uniformity must occur wherever there are irregular variations of temperature and moisture, more particularly over land areas. It is found indeed that sunshine on land has a deleterious effect on the clearness of wireless signalling. Ideal conditions would be presented by air saturated with moisture, together with a uniformly stratified distribution of temperature. The best conditions are presented in this respect by the Pacific Ocean, where we may expect to attain the maximum ranges of signalling.

A HANDSOME clockwork orrery has just been completed by Messrs. G. Philip and Son, Ltd., 32 Fleet Street, and we have had the opportunity of examining

it. Much trouble has been taken to construct a system which cannot easily be put out of order; and the result is an admirable piece of mechanism. The sizes of the planets, with the exception of the earth, are roughly to a scale of 50,000 miles to the inch. The earth is represented by a globe one inch in diameter, and additional mechanism makes the moon revolve around it while the earth itself traverses its orbit. The orrery may be moved by hand or by clockwork, which will keep the planets in motion for about three-quarters of an hour; and it is not put out of adjustment if the clockwork is started after the hand motion has been used. The planets can also be placed in any position in their orbits to begin with; and then when the clockwork is started, they will perform their orbital movements accurately. The satellites are carried round the sun with their respective primary planets, and can be placed in any position around them, but are not connected with the clockwork system. The instrument is mounted upon a heavy mahogany floor-stand, which gives stability to it, and it forms an attractive as well as instructive piece of furniture. Any attempt to represent the bodies in the solar system and their movements by a model cannot, of course, be more than a compromise, but the trouble taken by Messrs. Philip to produce an orrery which is compact and reasonably accurate is worthy of encouragement.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR FEBRUARY:—

Feb. 3. 19h. om. Venus in aphelion.
5. 5h. 32m. Saturn in conjunction with the Moon (Saturn 6° 50′ S.).
7. oh. 39m. Mars in conjunction with the Moon (Mars 1° 9′ S.).
8. 10h. 38m. Neptune in conjunction with the Moon (Neptune 4° 31′ S.).
11. 8h. om. Venus in superior conjunction with the Sun.
,, 16h. om. Saturn stationary.
12. 13h. om. Mars stationary.
22. 3h. 30m. Jupiter in conjunction with the Moon (Jupiter 2° 56′ N.).
,, 6h. om. Mercury at greatest elongation E.
,, 6h. 41m. Uranus in conjunction with the Moon (Uranus 2° 39′ N.).
24. 11h. 16m. Sun eclipsed, invisible at Greenwich.
,, 20h. 1m. Venus in conjunction with the Moon (Venus 1° 1′ S.).
26. 6h. om. Venus at greatest heliocentric latitude S.
28. 8h. om. Mercury stationary.

USE OF THE OBJECTIVE PRISM IN THE DETERMINATION OF RADIAL VELOCITIES.—M. Maurice Hamy, who recently proposed an ingenious method of utilising the objective diffraction grating in line of sight work (see NATURE, November 27, 1913, p. 383), has just published (*Comptes rendus*, No. 2, vol. clviii.) details of a way in which advantage may be taken of the superior light power of the objective prism for the same purpose. In order to supply the fiducial points necessary to obtain absolute wave-lengths, M. Hamy has devised means whereby the stellar spectrum may be photographed down the middle of a comparison spectrum of a terrestrial light source taken with the help of a collimator. Whilst the details of the instrumental contrivances by which the stellar and terrestrial spectra are brought into proper coordination, as well as the theory of measurement and reduction of the resulting plates are too complicated to be described here, we may indicate that this adjustment is secured by making successive images of the star and middle of the slit reflected by the polished and silvered base of the prism viewed in a second reflector near the camera end coincide with the point of intersection of two wires. The realisation of the idea should delight the heart of some instrument-maker. Measurement need not be confined to the particular star on which the settings are made, as M. Hamy shows that it is possible to utilise all the spectra registered during the one stellar exposure.

A MONUMENT TO "THE HOUR."—The *Revue Scientifique* for January 10 states that M. Lecornu, a member of the Paris Academy of Sciences, has suggested a proposal for the erection of a monument to "the hour," to perpetuate the remembrance of the international standardisation of the hour (March 9, 1911), and of the choice of Paris as the "centre horaire mondial," and the transmission of time by the wireless installation of the Eiffel Tower. A committee has been formed, and it is proposed to set up the monument at Villers-sur-Mer, a spot where the Greenwich meridian cuts France; this position has been accurately determined by the military geographical service.

"L'ASTRONOMIE" FOR JANUARY.—In the first issue of *L'Astronomie* for the current year it is announced that the council of the Astronomical Society of France has decided further to enhance the value of this very excellent journal by increasing the number of illustrations and their scientific and artistic interest; moreover, the number of pages of text will be also augmented. Another new feature will be the publication in the journal every three months of a new series of celestial charts, drawn especially by M. G. Blum, giving the aspect of the southern hemisphere sky. The first of these charts is printed in the present number. The new form of illustration is also depicted, and shows striking reproductions of numerous images of the planet Saturn, so successfully photographed by Prof. Barnard in 1911 with the large Mount Wilson reflector. This issue contains also much interesting matter. Thus an account with illustrations is given of the large fall of meteorites at Aztec, in Arizona, which took place on July 19, 1912. M. Camille Flammarion gives an excellent summary of the magnetic communication between the sun and earth, while the concluding article on stellar photometry is contributed by M. Jules Baillaud. Observers of Mars will be interested in the abnormal feature on this planet's surface observed by M. Fournier in October and December, 1911, in the Lybian and Arcadian regions.

INTERNATIONAL CONFERENCE ON THE SAFETY OF LIFE AT SEA.

THE International Conference on the Safety of Life at Sea, first suggested by the German Emperor and convened by the British Government, has now held its final meeting. As a result of its labours, a very important convention has been signed by plenipotentiaries of the following States:—The British Empire, including Australia, Canada, and New Zealand, which were represented separately, Germany, France, the United States, Austria-Hungary, Italy, Spain, Sweden, Norway, Holland, Belgium, and Denmark. The text of the convention will not be published until February 15, but the chairman of the conference, Lord Mersey, has outlined its principal

points in a speech moving its acceptance by the delegates. The convention must be ratified by the different States prior to December 31, 1914, and comes into force on July 1, 1915.

An international service is to be established and placed under the control of the United States for the purpose of ice patrol and observation and for the destruction of derelicts in the North Atlantic. The masters of all vessels are to cooperate with this service. Safety of construction has been dealt with under the headings of "New Vessels," and "Existing Vessels." The convention provides that the degree of safety shall increase in a regular and continuous manner with the length of the vessel, and that vessels shall be as efficiently subdivided as is possible having regard to the nature of the services for which they are intended.

The convention provides that all merchant vessels of the contracting States when engaged upon international (including Colonial) voyages, whether steamers or sailing vessels, and whether they carry passengers or not, must be equipped with wireless telegraphy apparatus if they have on board fifty persons or more (except where the number is exceptionally and temporarily increased to fifty or more owing to causes beyond the master's control). There are certain exemptions to this regulation. A continuous watch for wireless telegraphy purposes is to be kept by all vessels required to be fitted with wireless apparatus, as soon as the Government of the State to which the vessels belong is satisfied that such watch will be useful for the purpose of saving life at sea. Meanwhile certain classes of vessels are specified as being required to maintain a continuous watch. The wireless installations must have a range of at least 100 miles. A transition period is provided to enable wireless apparatus to be fitted and operators and watchers obtained.

The convention lays it down that there must be accommodation in lifeboats or their equivalents for all persons on board, and that as large a number as possible of the boats and rafts must be capable of being launched on either side of the ship, so that as few as possible need be launched on the weatherside. The convention specifies a minimum number of members of the crew competent to handle the boats and rafts. All ships are to have an adequate system of lighting, so that in an emergency the passengers may easily find their way to the exits from the interior of the ship.

Ships of the contracting States which comply with the requirements of the convention are to have furnished to them certificates of the fact, which are to be accepted by all the States as having the same value as the certificates issued by them to their own ships.

RECENT TEMPERATURES IN EUROPE.

SEVERAL features of especial interest were associated with the recent cold spell of weather experienced over the central and southern parts of western Europe. It is common enough in January for lower temperatures to prevail over Germany than in England, but in the coastal regions of the south of France the normal temperatures at this season of the year are warmer than in the British Isles. The temperatures taken from the Daily Weather Report of the Meteorological Office show that for the twelve days January 12–23, which approximately comprise the cold spell, the mean temperature in London was 34°, the mean of the maxima being 36°, and of the minima 32°. At Biarritz the mean for the whole period was 33·5°, the mean of the maxima 38°, and the mean of the minima 29°; nine nights out of the twelve were colder than in London; the lowest temperatures were 21° on January 16, and 22° on January 15, whilst in London the lowest temperature in the twelve days was 24° on January 23. The mean temperature at Perpignan for the period was 34·5°, the mean of the maxima 40°, and of the minima 29°, the latter being 3° colder than in London, and nine nights had lower minima; the lowest readings were 22° on January 20 and 22. At Nice the mean was 40·5°, the mean of the maxima 47°, and of the minima 34°; frost occurred on the three consecutive nights, January 14–16. Paris had the mean temperature 24·5°, the mean of the maxima 30°, and the mean of the minima 19°; January 20 was the only day with the maximum above the freezing point. Much snow also occurred with the cold in parts of France. The cold spell was due to a region of high barometer readings, which maintained a position between the British Isles, Denmark, and the north of Germany, and caused a flow of air over Germany and France from the colder regions of Russia. The Daily Weather Report on January 23 shows that at 7 a.m. the temperature was 50° at Seydisfjord in Iceland, which was the same as at Lisbon, and with this exception was warmer than any other station given for western Europe. Seydisfjord was 25° warmer than London, 36° warmer than Paris, and 14° warmer than Nice. The southerly current of air which caused the anomaly was doubtless associated with the same disturbance which occasioned the rapid rise of temperature and thaw over the British Isles.

THE IMPORTATION OF BIRDS' PLUMAGE.

AS is now well known, the United States Government has made the importation of birds' plumage penal, as well as prohibited the wearing of feathers. Austria and Germany are in accord with England as to the necessity of putting a stop to this nefarious traffic by similar laws. France and Belgium stand on the other side, for the plumassiers are so influential that it is hopeless for the Government of either of these countries even to propose such a protective Bill. The French plumassiers, however, now very uneasy at the trend of popular opinion in Europe and America, have attempted to ward off the severe blow which their trade would suffer if the Société d'Acclimatation were to sympathise with the movement, by securing their admission, in considerable numbers, to the membership of both that society and the Ligue Française pour la Protection des Oiseaux. Successful so far, they next brought forward a project before the former society for the appointment of a "comité d'ornithologie economique," similar to the one in England, with the avowed purpose of inquiring into the mass of evidence as to the destruction of birds brought before the English Parliament and the U.S. Congress, but the real object of which is the hope of checking the growing force of opinion against them on this question. It will be a matter of great satisfaction to all in sympathy with the movement in this country to learn that, at a meeting held in Paris on December 24, the ornithological section of the Acclimatisation Society of France, after giving careful and prolonged hearing to the plumassiers, were constrained to record that the arguments adduced before them were unable to modify the opinions hitherto held by bird protectors with regard to the plumage trade. Notwithstanding fierce opposition and grave discord raised by the plumassiers, the project for a committee was rejected, as no benefit from it could accrue to the protection of birds. The society declared also its conviction that the depositions which have led to the prohibition of the importation of birds' plumage to the United States are unimpeachable and trustworthy.

GEOLOGY IN NORTH AMERICA.

THE Geological Survey Branch of the Department of Mines of Canada continues to cover a wide field of research. Even its "Summary Report" for 1911 includes topographic and structural papers, in which coal-mining areas are dealt with, as well as notes on peat and clay, and (p. 316) on petroleum in New Brunswick. J. W. Goldthwait's paper (p. 296) on post-glacial changes of level in Quebec and New Brunswick continues work previously published (Mem. 10) on the shore-lines of the extinct lakes Algonquin and Nipissing in south-west Ontario. In this earlier memoir the author draws isobases across the Great Lake region, showing the warping of the beaches of Lake Algonquin and its successor, the greater uplift being in both cases in the north.

M. E. Wilson, in a publication numbered 1064, describes country on the east side of Lake Timiskaming, Quebec, where for the most part pre-Cambrian rocks prevail. The relations of the fragmental Huronians to the older granites are described. A large colour-printed map (18A), on the scale of one inch to one mile, has been issued of the mining region round the lake, and includes on the west the interesting basic igneous rocks and green schists of Cobalt.

M. E. Wilson, in Memoir 17E, shows how the geological surveyor is quickly following the extension of the railway into the gold-bearing region of northern Ontario.

G. S. Malloch, in Memoir 9E, describes the Bighorn Coal Basin of Alberta, where a large area of undeveloped coal exists in Upper Jurassic or Lower Cretaceous strata. The region lies near the United States border, and is so far only accessible by horse-trails.

Memoir 27 (1912) is concerned with a serious report on Turtle Mountain, which rises above the town of Frank, Alberta. This limestone mass is tunnelled into at the base for coal, and a destructive landslide occurred in 1903. R. A. Daly, W. G. Miller, and G. S. Rice, the commissioners appointed, now show that great fissures traverse the upper portion of the mountain, and that the modern forest growth is affected by their widening. The illustrations, especially plate viii., record impressive instances of the creep of massive rocks. It is recommended that the town of Frank, at the foot of the great scarp, should be moved to another site in the valley, since the mountain is structurally unsafe, irrespective of its possible weakening by the mines.

In Memoir 13 (1912), C. H. Clapp describes the mountainous region of southern Vancouver Island. A recent uplift of some 250 ft. has taken place (p. 13), whereby the coast-features have become rejuvenated, and the streams now fall from upraised coastal plains over rock-cliffs into the ocean. The prospects of copper-mining are discussed, but pyrite and pyrrhotine are the most prevalent ores. The metallic veins arose (p. 173) in connection with igneous intrusions of Upper Jurassic and Lower Cretaceous age.

W. H. Twenhofel, of Yale University (*Am. Journ. Sci.*, vol. xxxiii., 1912, p. 1), summarises the physiography of Newfoundland, in a paper that will interest geographers. Fault-scarp features remain prominent on the Long Range in the south-west of the island, and the faulting is later than the formation of a peneplain, which is tentatively correlated (p. 19) with the late Cretaceous peneplain of the Appalachians.

In Memoir 21 (1912) of the Canadian Geological Survey, on the geology and ore deposits of Phœnix, B.C., O. E. Le Roy makes some interesting observations on the silicification of large bodies of limestone, whereby nodular "jasperoids" are produced (p. 34).

Memoir 16E, on the clay and shale deposits of Nova Scotia and portions of New Brunswick, by H. Ries and J. Keele, and Memoir 24E, by the same authors, on the clay and shale deposits of the western provinces, both contain (pp. 115 and 177) a useful general essay on clay-rocks and their impurities. H. S. de Schmid has similarly incorporated a broad review of the mica industry throughout the world in his memoir on mica (Department of Mines, Mines Branch, 1912). The development of the "mica-board" trade now allows of the use of material that formerly was thrown aside.

In a monograph of 200 pages on pyrites in Canada (Mines Branch, 1912), A. W. G. Wilson describes the uses of iron sulphides, and the processes employed in roasting and in the manufacture of sulphuric acid.

The Mines Branch has also issued vol. i. (376 pp.) of a "Report on the Building and Ornamental Stones of Canada," by W. A. Parks, in which technical questions are prominent; and numerous papers on applied mineralogy appear in the "Summary Report" for the year 1911, including an account (p. 103) of the use of magnetic observations in tracing pyrrhotine. Pyrrhotine in Canada, of course, to the miner implies pentlandite and nickel.

L. M. Lambe, of the Geological Survey of Canada, has reviewed the past vertebrate life of Canada (Trans. R. Soc. Canada, vol. v., 1911, ser. 3, p. 3). Due prominence is given to the deinosaurs of the Judith River beds.

O. P. Hay, in a paper on the recognition of Pleistocene faunas (Smithsonian Miscell. Collections, vol. lix., No. 20, 1912), shows, in a series of maps, the distribution of a number of mammals in North America since the Pliocene period. The limit set by the fluctuating ice-margin in the north is clearly seen; but the author regards temperature-changes as of far less importance in promoting changes in the fauna than the mere element of time, whereby one type of mammalian fauna disappeared before another, which was itself already doomed to disappear. We presume that the doom thus referred to implies some cause other than the mere decay of specific energy during time; but this question trenches on physiology.

The work of the United States Geological Survey, equally with that of Canada, maintains a broad outlook, from topography to mineral research. The succession of severe earthquakes that occurred in the central Mississippi Valley in 1811–12, when the region was thinly populated, has been investigated by M. L. Fuller (Bull. 494, 1912). The possibilities of recurrence are considered (p. 110). Interesting surface-features due to the sudden extrusion of sand from fissures still indicate the earthquake-area, and a large region of sunken land is marked by stumps of trees standing in water, as was noted by Lyell in 1846 (p. 70).

The second edition of F. W. Clarke's "Data of Geochemistry" (Bull. 491, 1911) now takes the place of the copies of this manual that have been used with such advantage in scientific libraries. Its 731 pages form a summary of the chemistry of the earth, with abundant references to sources of information. The origins of minerals and rocks are steadily borne in mind, and the results of the evolution of gases from the earth, of processes of subaërial weathering, and of the multiplication of marine organisms in the ocean, are alike brought under review. The work, indeed, is for the general geologist quite as much as for the specialist in petrology. The passages on aragonite and calcite, on laterite, and on dolomitic limestone may serve as good examples. Nearly a hundred pages, moreover, are devoted to the origins of metallic ores.

T. N. Dale and H. E. Gregory (Bull. 484) describe the granites of Connecticut, with remarks (p. 17) on the composite origin of some of the associated gneisses. As is usual in such memoirs, examples are given of the monumental use of the quarried stones.

T. N. Dale also reports on the marbles of Vermont (Bull. 521), in which graphitic bands are ascribed to marine algæ of Ordovician age.

Bull. 492, by G. F. Loughlin (1912), contains some interesting examples of the effects of dynamic metamorphism upon gabbro in Connecticut, well illustrated in plates x. and xi.

C. W. Hayes and W. Lindgren edit the report on the developments in economic geology during 1910 (Bull. 470, 1911). Considerable attention is given (pp. 371–483) to the oolitic phosphate beds of Idaho, Montana, and Wyoming. R. W. Richards and G. R. Mansfield (p. 377) hope to show later that the Upper Carboniferous phosphatic deposits of Idaho were formed at a time of abnormal enrichment of the sea-water with phosphoric acid or its salts, and not by subsequent infiltration. In Bulletin 471, M. R. Campbell continues this report by an extensive review of mineral oils, coals, and lignites in many districts now under exploration. W. T. Lee (Bull. 510) has explored the area of Cretaceous coals in north-west Colorado. These coals have been improved in calorific value by the influence of quartz-monzonite laccolitic intrusions, which are clearly shown in the published sections.

H. S. Gale (Bull. 523) reviews the nitrate deposits of the United States, none of which seem at present to be of commercial value. The sketch of the origin of nitrates in soils (pp. 31–5) is just what teachers of mineralogy and agriculture require.

The demands of agriculturists are further considered in Bulletins 511 and 512. The former, by B. S. Butler and H. S. Gale, deals with a newly found deposit of alunite in Utah, which is believed (p. 36) to result from the uprising of solutions from below. The mineral occurs in veins in andesite, the main one being 20 ft. thick. The purity of the mass is shown by analyses which yield respectively 10·46 and 9·71 per cent. of potash. Alunite may be converted into a soluble sulphate by calcination, and a useful review is given of its commercial use in Australia and other places. In Bulletin 512, A. R. Schultz and Whitman Cross, with a somewhat prophetic outlook, consider the future of the potash-bearing rocks of the leucite hills in Wyoming. The percentage of potash in these lavas is about the same as that in alunite, and may reach even 12 per cent. The greater portion of the potash occurs in the two minerals leucite and phlogopite, and the authors look forward to the possibility of the separation of these minerals and the extraction of potash and alumina from them, or even from the lavas as a whole. The estimate of the alumina available in millions of tons (p. 35) seems premature, and any commercial process that may be devised will probably, so far as this substance is concerned, be applied also to common clay.

FIG. 1.—Rock-glacier on McCarthy Creek, Nizina district, Alaska. From Bull. 448, U.S. Geol. Survey.

Petrographers as well as miners will find much of interest in Professional Paper 77, on the Park City District, Utah, by J. M. Boutwell. A novel and effective feature is the illustration of the ores and

associated rocks by photographs taken in the tunnels of the mines.

Mining districts in a hitherto unmapped region in Elko County, Nevada, are described by F. C. Schrader in Bull. 497 (1912). The gold ores of Jarbridge, which are here beautifully illustrated, are attributed (p. 63) to the rise of waters at a high temperature, following on the eruption of Miocene rhyolites. The metallic ores are sometimes referred to as "mineral" and sometimes as "metal values," terms which seem out of place in a scientific treatise. A. Knopf (Bull. 504, 1912) describes briefly the Sitka mining district, Alaska, where gold in quartz reefs and gypsum are the valuable materials. The gold, as well as certain copper ores, is regarded (p. 17) as connected with the uprise of intrusive diorite.

F. H. Moffit and S. R. Capps (Bull. 448, 1911) show very interestingly how slowly moving rock-glaciers succeed true glaciers where warmer conditions now prevail in Alaska. Snow-slides, of course, assist in moving the material, but rock undoubtedly now predominates in the flow. The illustration here reproduced (Fig. 1) is one of several instructive plates. Gold is now the main product of the Nizina district, though chalcosine and native copper offer attractions.

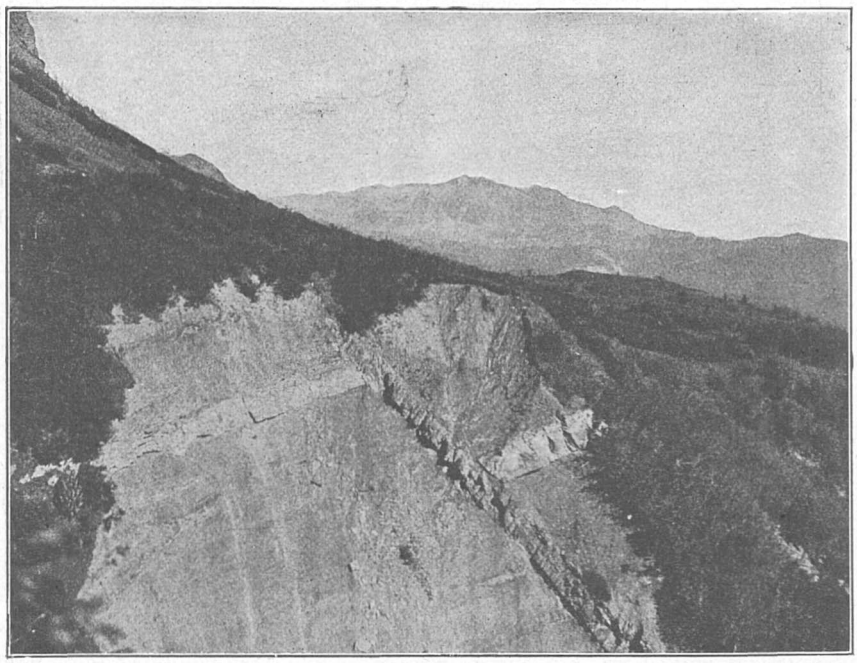

FIG. 2.—Diabase dyke in fault-plane in Cainozoic (Chickaloon Coal-measure) strata, Castle Mountain, Alaska. From Bull. 500, U.S. Geol. Survey.

Alaska claims continued notice. Bulletin 485, by G. C. Martin and F. J. Katz, describes the Iliamna region, where Triassic cherts are associated, as seems almost inevitable, with "green rocks" of volcanic origin. The same authors, in Bulletin 500, deal with the coal-bearing Lower Matanuska Valley, above Cook Inlet in lat. 62°. The coals are in Cainozoic strata, and are probably of Eocene age (p. 52). Basic lavas have intruded through these beds, and form conspicuous features on the bare hillsides (Fig. 2).

The development of Alaskan areas is also seen in Bulletins 449, 498, and 502. In Bulletin 467 (1911), W. W. Attwood deals with the coals and possible gold ores of the Alaska Peninsula, and furnishes several very interesting photographs of the coast. Bulletin 520, by a number of authors, brings our knowledge of the mineral resources of Alaska up to date. The review (pp. 45–88) of the possibilities of railway construction between the Pacific coast and the interior is of special interest, and the sketch-map provided, with "coal reported" marked on the seaboard of the north-east passage, is the sort of thing to captivate a Frobisher or a Cabot. The Cainozoic coal of the Bonnifield region is reported on in Bulletin 501, which also contains interesting notes on glaciation. Other economic papers on Alaska have been already noticed in NATURE (vol. xc., 1913, p. 659).

Professional Paper 71 (1912), constituting a large memoir on the stratigraphy of North America, by Bailey Willis, and accompanied by a coloured geological map of North America, on the scale of 1 : 5,000,000, is of such wide educational importance that it has already received special mention (NATURE, vol. xci., p. 93). Changes in nomenclature are somewhat rapid in the United States, and, since this great index was published, C. D. Walcott (Smithsonian Miscell. Collections, vol. lvii., No. 70, September, 1912) gives reasons for withdrawing his terms Georgian for Lower Cambrian and Saratogian for Upper Cambrian, and replacing them by Waucoban and St. Croixan respectively. Both these new names offer puzzles in pronunciation for the stranger. "St. Croixan" was first published by Walcott as a stratigraphical term in the preceding number of the Collections, p. 257, in which some very interesting tracks of Upper Cambrian trilobites are illustrated.

Four of the recent Professional Papers deal with western districts. No. 70, by A. H. Brooks, describes the difficult survey of the Mount McKinley region in Alaska in 1902, where almost all the geological systems are represented. From the historical summary on pp. 29–32, it seems doubtful if any explorers had reached the summit of Mount McKinley (20,300 ft.) by the close of 1910. The decay of the upland is shown by the immense areas of post-Pliocene detritus recorded on the preliminary geological map. The maps add considerably to our knowledge of the topography of the divide between Cook Inlet and the Yukon system.

In No. 73 W. Lindgren discusses the Tertiary gravels of the Sierra Nevada of California, well known as the scene of hydraulic gold-mining. The Great Valley of California has received detritus from the rising continental land ever since the opening of Cretaceous times, the shore-gravels becoming purely fluviatile during the Pliocene period (p. 28). J. M. Boutwell (p. 54) has had an opportunity of resifting the first-hand evidence as to the antiquity of the Calaveras skull, which at one time obtained a celebrity akin to that of the bones—also from Calaveras—which "were found within a tunnel near the tenement of Jones."

Professional Paper 74, by W. H. Weed, describes the Butte District, Montana, and is bound in cloth, a mode of presentation which makes it far more convenient than most of these large and

frequently consulted volumes. The Big Butte is a conspicuous rhyolitic hill rising above a somewhat dreary country of quartz-monzonite and andesite. The bare surface, however, allows the mineral veins to be traced over wide areas, and the district is now second only to the South African Rand as a producer of metals. The main ores are those of copper, containing 14 per cent. of silver. The volume includes a large number of vein-plans, and illustrations of the connection between separation-planes and ore-deposits in the crystalline igneous rocks. The ores were accumulated in these fundamental masses at some epoch prior to the eruption of the volcanic rocks at the close of the Cretaceous period. The conclusions as to their modes of origin may be compared with those of J. D. Irving and H. Bancroft for the district of Lake City, Colorado (Bulletin 478), where similar conditions occur.

Paper 75 is by F. L. Ransome, on the Breckenridge District, Colorado. Here gold is again the attraction, and the district has rapidly developed since 1909, when new dredges were introduced for dealing with the gravels. The glacial deposits show, as is so very general in America, two epochs of ice-advance and ice-retreat (p. 72). The fissures containing the sulphide ores and the gold from which the placer ores are derived were formed by earth-movements in early Cainozoic times.

It is impossible in a brief outline to do justice to the large volume (Monograph LII.) on the geology of the Lake Superior region, by C. R. van Hise and C. K. Leith. Much of the discussion on the pre-Cambrian series concerns the Dominion of Canada also, and miners will find a comprehensive account (pp. 460–596) of the ores of iron, copper, gold, and silver in the district. The ferruginous cherts, with hæmatite or limonite, are held to have arisen from the oxidation of cherty iron carbonates and of the green silicate greenalite, $(Fe,Mg)SiO_3.nH_2O$. The green oolitic ores with hæmatite of Dodge County, Wisconsin (pp. 567 and 536), which are regarded as having been deposited in a granular form in the sea, and the greenalite rocks of the Mesabi District (p. 165), invite comparison with the ironstones containing green oolitic grains in the Silurian rocks of North Wales (p. 509), concerning which the last word has by no means been said; while the red banded cherts remind us of similar stratified deposits in South Africa. The authors believe that the iron, whether hæmatite or magnetite, was largely introduced into the Lake Superior sediments from the adjacent basic igneous rocks, at a time when the latter were hot and capable of sending magmatic waters into the sea in which the sediments were accumulating (pp. 516 and 527).

In Bulletin 503, E. C. Harder indicates the development of the iron and steel industry on the Pacific coast of California.

Bulletin 505 (1911), by A. C. Veatch, is a summary of the mining laws of Australia and New Zealand, with testimony by practical miners as to their operation. The material of the bulletin was brought together for a report to Congress, to assist in framing regulations for granting leases of public coal-lands in the United States.

The Geological Survey of Alabama, working in cooperation with that of the United States, reports (Bulletin No. 10) on the Fayette Gas Field in the north-west of the State, where gas rises freely from small "gas-pools" in a coalfield of Upper Carboniferous age. Further explorations are recommended. The development of roads throughout Alabama by the use of selected material is discussed by W. F. Prouty in Bulletin No. 11, and there seems evidence that the lesson taught to Europe by the Romans, and long neglected by their successors, is at last spreading in the United States. It will be many years, however, before these civilised communities will possess the advantages given by French rule to the Berbers of North Africa.

The Wisconsin Geological and Natural History Survey issues (1912) a neat volume on the sandstones of Lake Superior, by F. T. Thwaites. The Bayfield group is the centre of interest, and is placed (p. 104) below the Cambrian, representing a sandy terminal phase of the Keweenawan sediments, in a region where a basin had been established which became choked by alluvial fans from the surrounding hills. The Survey also issues a large geological wall-map of the whole State, with a view to the requirements of public education.

In continuation of its handsome series of cloth-bound volumes, the Maryland Geological Survey publishes a work by W. B. Clark (State geologist), A. B. Bibbins, E. W. Berry, and R. Swann Lull, on the Lower Cretaceous deposits of the State. Mr. Berry (p. 99) takes the opportunity to summarise, with specific lists, the Lower Cretaceous floras of the world. As regards British deposits, he points out that we are not yet in possession of all that may be expected from the work of Dr. Stopes. Vol. ix. of the reports of the Survey treats largely of highway construction, but includes a history and description of the iron industry in the State. Prince George's County has been described in the latest of the interesting county monographs, with complete topographical and geological maps on the scale of one inch to one mile. We can imagine nothing better for the information of teachers in the local public schools.

The Iowa Geological Survey, in a massive volume issued at the close of 1912, includes its annual reports and papers for 1910 and 1911. More than 1100 pages are devoted to a thorough study of the underground waters of the State, including (p. 268) several mineral springs.

In *The American Journal of Science*, vol. xxxv. (1913), p. 1, J. W. Goldthwait, whose Canadian work has been already mentioned, describes cirques in New England, which, as seems natural, were occupied by small glaciers both before and after the great extension of continental ice. On p. 139, F. A. Perret carries us to "The Lava Fountains of Kilauea," which may now be fairly styled American. The mobility of the lava is ascribed (p. 143) to its being highly charged with an inflammable gas. The blue, and therefore highly actinic, cloud due to the combustion of this gas is here shown in photographs. It is well to learn, in view of the great interest aroused by Brun's researches, that the evolved gases are being carefully studied on the spot. The author regards those emerging from a lava-surface, that is, from a mass subject to oxidation, as quite distinct from the far purer gas of a great paroxysmal eruption. We must admit, in spite of all the work done on fumeroles, that we are still on the verge of this great question. In the same volume of the journal, p. 611, Mr. Perret directs attention to the evidences of occasional explosive action during the past history of Kilauea.

RÖMER'S "ADVERSARIA."

"ETUDES sur les notes astronomiques contenues dans les Adversaria d'Ole Römer," is the title of a paper by G. van Biesbroek and A. Tiberghien, published in the Bulletin of the Royal Danish Academy of Sciences (112 pp.). The "Adversaria" were published in 1910, and were reviewed in NATURE (vol. lxxxvi., p. 4). The authors of the present paper give a detailed analysis of most of

the astronomical notes contained in the volume. This analysis is especially valuable on account of the way in which the astronomical notes in the "Adversaria" are mixed up with others on hydraulics, statics, the construction of thermometers (the scale known as Fahrenheit's is due to Römer), numismatics, &c. These notes all date from the last eight years of Römer's life (1702–10), although several refer to investigations made during his stay in Paris (1672–81).

The authors dwell particularly on the various discussions of the work done from 1704 in Römer's private observatory a few miles west of Copenhagen, which show him as a great practical astronomer, to whom the principal modern instruments of precision and methods of observing are due. Thus it is shown that it was Römer, and not his pupil Horrebow, who invented the method of determining latitudes by altitudes observed north and south of the zenith and nearly at the same time, now known as the Horrebow-Talcott method. In this the result is independent of refraction, and a micrometric measure takes the place of the reading of graduated circles. Horrebow has certainly the merit of having recognised and published the advantages of the method, but there is now no longer any doubt that the idea was due to Römer.

At the beginning of the eighteenth century the method of determining time by observing equal altitudes of the sun east and west of the meridian was still in general use. Römer constructed an instrument for this purpose, in which the telescope was attached to a bar suspended vertically from a crook at the upper end, and he prepared tables and formulæ for reducing the observations. By degrees the use of the transit instrument, as regards which he was himself the pioneer, superseded the observations of equal altitudes in fixed observatories.

Römer also examined the problem of time-determination in the vertical of the pole-star; he did not arrive at a simple solution, but tried to get over the difficulty by constructing extensive tables for twenty-seven selected stars. How much he was in advance of his time is shown by his having employed the formula for correcting transit observations for instrumental errors proposed fifty years later by Tobias Mayer. The transit instrument in the prime vertical, introduced by Römer, was employed by him to determine the time of the equinoxes by a method which was a modification of one which he had described to the Paris Academy in 1675, but which, like most of his other investigations, never was published.

The authors give a detailed examination of his preparations for determining the vernal equinox of 1702 by this method. In the original method (described by Horrebow) the declination of the sun at its upper or lower meridian transit was deduced from the intervals of time between the transits over verticals near the prime vertical, employing an approximate value of the latitude of the place of observation. In the method of 1702 the declination of the sun does not enter, nor the latitude. The principal reason why Römer wished to eliminate the latitude, was, that he, like Picard, thought it was subject to an annual variation. Without knowing it, these two eminent practical astronomers had, in fact, perceived the effect both of aberration and of nutation on the apparent place of the pole star. Römer's method of determining the equinoxes is more ingenious than useful, since it not only assumes that the clock rate and instrumental errors do not change, but also requires that the sky should be clear for at least three consecutive approaches of the sun to the prime vertical as well as for time determinations.

It might have been expected that the man who had discovered the gradual propagation of light, and even foreseen the existence of aberration as its necessary consequence, would in his private notebook have left evidence that he continued to be interested in the discovery. There is, however, only an examination of the question, whether it would be possible to determine the velocity of light by means of lunar eclipses. He found, of course (as he had already done in 1677), that the velocity is far too great to become perceptible in observations of that kind.

Römer was the only observer who succeeded in seeing Mercury on the sun's disc on May 6, 1707, just after sunrise; the authors have computed the particulars of the transit by Newcomb's tables, and find that the observation agrees perfectly with modern theory. The doubts thrown on Römer's observation by Halley and Baily have thus been shown to be baseless, while Sharp's supposed observation must be rejected altogether. There are many other points of interest in this paper, which it is to be hoped will become widely known, as it gives a valuable survey of the varied activity of a man, who but for his reluctance to put his researches into shape and publish them would be reckoned among the greatest astronomers. J. L. E. D.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. D. G. Reid has been appointed junior demonstrator of human anatomy for five years in succession to Dr. Rogers, who has resigned the office.

The prize of 50*l.* from the Gordon Wigan Fund for a research in chemistry was awarded in the year 1913 to Mr. H. V. Thompson, for investigations on "Some Reactions of Diiodoacetylene," "Acetylenic Carbon," and "The Molecular Weight of Cellulose."

To the detailed report on the work of the score of men who have held John Lucas Walker studentships at Cambridge University, which occupies many pages in the present number of *The Cambridge Reporter*, the governors of the trust have added these words:—"During the twenty-seven years since the John Lucas Walker studentship, one of the earliest studentships in pathology, was established, the candidate who appeared most likely to carry out pathological investigations successfully, whether a Cambridge graduate or from some other school, British and Colonial, has always been appointed. While the work accomplished by the later holders of this studentship is perhaps too recent to be appraised, there has been ample time for that accomplished by the earlier students to manifest its worth and influence, not only upon the future careers of the students and upon the Cambridge Medical School, but upon the science of medicine. Moreover, it is now possible to form a fair estimate of the value of this foundation in particular and of graduate research studentships or fellowships in pathology in general. It would be difficult to cite any one position within the Empire which, in the same period, has been occupied by a succession of men so able, and who have attained such eminence in medical research."

LEEDS.—Mr. Henry Rutson, of Newby Wiske, Northallerton, has made a donation of 500*l.* to the funds of the University. It is only a short time since Mr. Rutson made a similar donation to the fund for new agricultural buildings.

Mr. Godfrey Bingley, an accomplished photographer, who has been connected for many years with the Leeds and Yorkshire Geological Association, has presented a collection of lantern slides, illustrating architecture, archæology, geology, and scenery in all parts of England, but especially in Yorkshire. There are about ten thousand slides of exquisite workmanship, and the collection is admirably arranged and cata-

logued. The section which deals with the geological and geographical aspects of Yorkshire is believed to be unequalled.

An anonymous donor has presented the sum of 20*l.* to be used for the purchase of a unique collection of fossils from the Marine Bands of the Coal Measures of Yorkshire, made by the late Mr. Henry Culpin, of Doncaster. The University has also received the conchological collections and library of the late Mr. William Nelson. Mr. Nelson was a working man who accumulated a collection of land and fresh-water shells of extraordinary variety and great interest. On his death a memorial committee was formed to acquire his collection and library, which will now be handed to the zoological department of the University, where they will be a valuable addition to the resources for zoological research.

OXFORD.—On Tuesday, January 27, Convocation passed a decree giving the consent of the University to the establishment of three professorships, in anatomy, chemistry, and experimental philosophy. These will be styled Lee's professorships, and the provisions relating to them "will not come into effect until there is a vacancy in the existing Lee's readerships in the three subjects respectively." The readership in chemistry is now vacant. The holder of each of the first two professorships will receive 900*l.* from Christ Church annually; the holder of the last-named will receive the same amount, provided mainly by Christ Church, but partly from other sources, including a grant from Wadham College. The Lee's professorship in chemistry will be an actual addition to the present staff; the other two will be ultimately merged in the existing professorships of human anatomy and experimental philosophy. Christ Church will retain the power of appointing Lee's readers in anatomy, chemistry, and physics, in addition to finding nearly the whole emolument of the Lee's professorships. It is to be hoped that the University funds set free by the action of Christ Church will continue to be applied to scientific objects.

Congregation has made some progress in the amendment stage of the statute proposing extensive changes in Responsions, but it is doubtful whether the statute will reach a final reading.

THE December number of *The Central*, the journal of the old students of the Central Technical College, South Kensington, continues to display those features which make it one of the best of the old students' magazines. Of the scientific article and the technical articles on chemical and electrical subjects respectively, little need be said, as they do not differ materially from corresponding articles which might be found in the technical Press. The article on "Ambitions—Commercial v. Technical," by a young sales manager, is well worth the careful consideration of technical students. It puts very clearly the advantages of a commercial career for those who have any doubts as to their capabilities as constructional engineers. The problems which confront a commercial engineer are as interesting, and may often be solved by the same methods as those a technical engineer encounters, while the rewards of success are both larger and come more swiftly. The rest of the number is devoted to the events of the past session, including changes in the staff, with photographs and views of the new buildings, and to the changes of positions of a large number of old students. It is the last characteristic which makes the journal so invaluable to all old Centralians.

A SHORT account of the work and objects of the Sutherland Technical School, built several years ago by the late Duke of Sutherland and Mr. Andrew Carnegie, near Golspie, in Sutherland, is given in the issue of *The Times* for January 23. In a letter to *The Times* of January 26, the Duchess of Sutherland makes an appeal for 20,000*l.* as a partial endowment for the school, and points out that 10,000*l.* has been raised among a few of her friends, and that it should not be difficult to secure the remainder. The aim of the school is to give boys from the small farms and fishing villages of the Highlands an opportunity to continue their school life in conditions which shall enable them to develop their special aptitudes and to learn the essentials of appropriate industries. The pupils are drawn from primary schools, and begin the course at the age of thirteen. The boarding-house attached to the school has room for forty-eight boys, and bursaries are provided to the number of forty. The secretary of the Scotch Education Department has spoken of the school as one of the most interesting educational experiments in recent times in Scotland. This successful attempt to provide a much-needed link between schooldays and the years of wage-earning is, in fact, worth the study of those education authorities now contemplating the inauguration of junior technical schools in rural districts.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 22.—Sir William Crookes, O.M., president, in the chair.—Dr. R. T. **Glazebrook** and D. W. **Dye**: The heat production associated with muscular work: a note on Prof. J. S. Macdonald's paper, Proc. R.S., B, vol. lxxxvii. Prof. Macdonald's results are analysed graphically by plotting, equations being obtained from curves connecting the various quantities—heat produced, work done, mass of individual.—M. **Wheldale** and H. L. **Bassett**: The chemical interpretation of some Mendelian factors for flower colour. These researches deal with the Mendelian factors for flower-colour in varieties of *Antirrhinum majus*. Two varieties, ivory and yellow, are chiefly considered. Ivory is a simple Mendelian dominant to yellow and contains a factor "I," which is absent from yellow. The authors have previously identified the pale yellow pigment of the ivory variety with a flavone, *i.e.* apigenin. In the present paper it is shown that the yellow variety contains, in addition to apigenin, another flavone pigment, *i.e.*, luteolin, which is present in the epidermis and accounts for the deeper yellow colour of the flower. Hence the dominant ivory factor may be expressed as the power to inhibit the formation of luteolin in the epidermis.—Prof. G. **Dreyer** and Dr. E. W. A. **Walker**: The determination of the minimum lethal dose of various toxic substances and its relationship to the body weight in warm-blooded animals, together with considerations bearing on the dosage of drugs. In warm-blooded animals of some species but different weights, dosage must be calculated in relation to body surface.—Prof. R. **Kennedy**: Experiments on the restoration of paralysed muscles by means of nerve anastomosis. Part ii., Anastomosis of the nerves supplying limb muscles.—Dr. F. Norman **White**: Variations in the sex ratio of *Mus Rattus* following an unusual mortality of adult females.

Geological Society, January 7.—Dr. Aubrey Strahan, president, in the chair.—C. I. **Gardiner** and Prof. S. H. **Reynolds**: The Ordovician and Silurian rocks of the Lough Nafooey area (county Galway). The Lough Nafooey area forms a ridge about four miles long and slopes steeply down to Lough Nafooey on the north. The rocks are of Arenig, Llandeilo, and Silurian age, together with intrusive felsites, bostonites, labradorite-

porphyrites, and dolerite. The Llandeilo rocks are mainly confined to the low-lying ground along the shore of Lough Nafooey, and have yielded no fossils. They dip at a high angle off the Arenig rocks, which extend in a band from a third to half a mile wide from end to end of the area. The Arenig rocks consist of spilite-lavas associated with coarse breccias, and with bands and patches of chert in which at two points radiolaria were found. Unfortunately, no graptolites were found in the Arenig rocks. Silurian rocks form the whole southern half of the area. They are highly inclined. They include representatives of the Llandovery, Tarannon, and Wenlock formations. The occurrence of *Monograptus galaensis* confirms the field evidence as to the Tarannon age of certain grey flags. The Wenlock beds are represented by thick grits. The paper concludes with a table comparing the rocks of the Lough Nafooey area, with those of Kilbride and those of the Killary district.—T. C. **Nicholas**: The geology of the St. Tudwal's Peninsula (Carnarvonshire). The St. Tudwal's Peninsula is situated at the S.E. extremity of S.W. Carnarvonshire, and forms the N.W. limit of Cardigan Bay; it is underlain by Cambrian and Ordovician rocks. In the southern part of the peninsula the structure is simple, and the succession plainly displayed in cliff-sections; Cambrian rocks similar in character to those of Merionethshire form most of the coast, but the interior is occupied by Arenig beds, which rest with a marked unconformity on every local member of the Cambrian in turn. The latter have escaped cleavage, and mudstones in the midst of the series have yielded fossils belonging to the zone of *Paradoxides hicksi*. The *P. davidis* zone appears to be absent. This southern area is separated by an overthrust from a more northern area in which members of the Tremadoc, Arenig, and Llandeilo series have been recognised, but in which the rocks are crushed, faulted, and disturbed, and the relations between the beds are far from clear. Pisolitic iron-ore is well developed in the district, and occurs chiefly in the Llandeilo beds along the line of the overthrust. Evidence is presented to show that, during the last phase of glaciation, the ice was moving across the peninsula in a westerly direction out of Cardigan Bay.

Linnean Society January 15.—Prof. E. B. Poulton, president, in the chair.—H. A. **Baylis**: Some observations on the tentacles of *Blennius gattorugine*. A study of sections of the branched tentacles shows an abundant supply of nerves in the centre of the organs, sending off branches to their smaller twigs. The function of the tentacles is still doubtful, but so far as the evidence goes, it only proves that they are sensitive to tactile stimuli, and probably the fusiform cells are concerned in the perception of such stimuli.—G. Claridge **Druce**: A new marsh Orchis. The author proposed the name *Orchis praetermissa* for the plant which he contrasted with the true flesh-coloured *O. incarnata* of Linnæus, as described by C. B. Clarke in Journ. Linn. Soc., vol. xix. (1881), p. 206, showing how it differed in the shape of the flowers and in other characters from that plant. He has as yet been unable to see any description or figure of his plant in British or European works.

Royal Anthropological Institute, January 20.—Annual general meeting.—Prof. A. Keith, president, in the chair.—Prof. A. **Keith**: Reconstruction of human fossil skulls (presidential address). The ordinary anthropological methods employed for the examination and description of complete skulls are not applicable to fragmentary fossil skulls. During the last six years the president had endeavoured to discover and perfect methods which might be employed in the reconstruction of skulls from fragments. Recently fragments of a human skull, representative of the pieces of a fossil human skull found at Piltdown, had been submitted to him for reconstruction. A cast of the original skull was kept by those who submitted the fragments to him. There was no apparent trace on the fragments of the middle line along the vault. The reconstructed skull with a cast of the original was submitted to the meeting. Tracings of the reconstructed skull were exhibited side by side with similar tracings from the lecturer's reconstruction of the Piltdown skull to show that the problem of reconstruction was the same in each case, and that in all dimensions the cranial cavity of the Piltdown skull was larger than the test skull submitted to him.

Royal Meteorological Society, January 21.—Annual general meeting.—Mr. C. J. P. Cave, president, in the chair.—C. J. P. **Cave**: Presidential address: Upper air research. Research in the upper air may be by means of manned balloon with observer and instrument, or by self-registering instruments sent up in kite, captive balloon, or free balloon. Kites were first used for this purpose by Dr. Wilson, of Glasgow, 1749, and also in Arctic expeditions in 1821 and 1836. The box-kite and the use of steel piano wire instead of line enabled greater heights to be obtained, and both were adopted by the Blue Hill Observatory in 1895. The use of kites was not taken up in England until 1902, when Mr. Dines flew them from a steamer. After referring to the use of balloons and the ascents made by Glaisher and others, the president said that danger to life in high ascents caused MM. Hermite and Besançon to use a registering balloon in 1893; a free balloon carried a recording instrument, the recovery of the instrument being dependent on the balloon being found after its descent; a height of nine miles was reached in France and thirteen miles in Germany soon after. The International Commission for Scientific Aëronautics directs the studies for upper air research, and special days are arranged for international ascents of balloons and kites, stations in various parts of the world taking part in the work. The first great result of these researches has been the discovery that the atmosphere is divided into the troposphere, where the air is in constant movement horizontal and vertical, and the stratosphere, where turbulent motion seems to cease. The stratosphere begins at about 7·5 miles in these latitudes.

Mathematical Society, January 22.—Prof. A. E. H. Love, F.R.S., president, in the chair.—S. T. **Shovelton**: (i) A generalisation of the Euler-Maclaurin sum formulæ. (ii) The deduction of the formulæ of mechanical quadrature from the generalised Euler-Maclaurin sum formulæ.—(iii) A generalisation of certain sum formulæ in the calculus of finite difference.—Prof. A. E. H. **Love**: The potential of an electrified circular disc.—Dr. A. **Young**: Binary forms.—J. R. **Wilton**: Darboux's method of solution of partial differential equations of the second order.

DUBLIN.

Royal Irish Academy, December 8, 1913.—Count Plunkett, vice-president, in the chair.—R. **Southern**: Polychæta. Part ii., in connection with Clare Island Survey. This paper dealt with the second part of the Polychæta from the Clare Island district, and comprised the *Polychaeta sedentaria*. The number of species in this section is 105, bringing the total number of Polychæta from Clew Bay and the adjacent waters to 250. One new genus, Thelepides, is described, and eight new species, belonging to the genera Nerinides, Aonides, Chætozone (2), Protothelepus, Armandia, Chone, and Euchone.

January 12, 1914.—Rev. Dr. Mahaffy, president, in the chair.—W. J. **Lyons**: Climatology, in connection

with Clare Island Survey. This report contained tables giving the annual and monthly means and extremes of barometric pressure, temperature, and rainfall for the district, together with summaries dealing with humidity and sunshine. An exhaustive analysis of the wind records kept at Clare Island Lighthouse was made, with some interesting results.

PARIS.

Academy of Sciences, January 19.—M. P. Appell in the chair.—H. **Deslandres** and L. **d'Azambuja**: The exact study of the second group of nitrogen bands in the magnetic field. Recognition of the nature of the displacements. The experiments were carried out in a magnetic field of 35,000 Gauss. The deviations, for λ about 400, corresponded to a maximum of 1·40 mm. for one Angström. Four diagrams are given showing the changes observed in different portions of the band N 25,009.—Armand **Gautier**: The function and state of fluorine in the animal economy. A discussion of the relations existing between phosphorus and fluorine in animal tissues.—M. Charles **Richet** was elected a member in the section of medicine and surgery in succession to the late M. Lucas-Championnière.—Charles **Arnaud**: Astronomical refraction. A simplification of some approximate formulæ given in a preceding communication.—Victor **Vâlcovici**: Fluid movements with constant vortex.—G. **Lumet**: Testing lubricating oils for internal-combustion motors. An attempt to test the viscosity of oils under conditions approximating to those actually existing in the cylinder of an explosion motor.—Georges A. Le **Roy**: Magnification or reduction of phonograms. A gelatine cast is taken of the original phonogram, and this is enlarged by hydration and reduced by drying, with fixation in each case by aqueous solutions of formaldehyde.—M. de **Broglie**: The spectroscopy of the Röntgen rays. Five photographic reproductions accompany the paper.—M. de **Broglie** and F. A. **Lindemann**: Fluoroscopic observation by direct vision of the spectra of the Röntgen rays.—Victor **Henri** and Marc **Landau**: The application of spectroscopy to the study of chemical equilibria. The systems formed by oxalic acid and uranyl salts. A mixture of uranyl salts with oxalic acid absorbs the ultra-violet rays much more strongly than the sum of the constituents. Details of the quantitative study of the absorption are given.—Mme. **Demassieux**: Study of the equilibrium between lead chloride and potassium chloride in aqueous solution. The experimental results for three temperatures, 14°, 50°, and 100° C., are given in the form of a diagram.—Pierre **Jolibois**: Remarks on the note of R. Goubau on the melting point of arsenic. Reclamation of priority.—E. **Léger**: The constitution of homonataloin and of nataloin.—M. **Balland**: The return to wholemeal bread.—Jivoin **Georgévitch**: The evolutive cycle in the myxosporidia.—Edouard **Chatton**: The evolutive and cyclic transformations of the peridinian structures in certain parasitic Dinoflagellæ.—E. **Voisenet**: A ferment present in waters causing the dehydration of glycerol. An organism has been extracted from Dijon water identical in its morphological and biochemical characters with *Bacillus amaracrylus* from bitter wines. It can form acrolein from glycerol in aqueous solution.—Auguste **Lumière** and Jean **Chevrotier**: Antityphoid vaccination by the gastro-intestinal way. The preparation of the dried bacilli and the mode of introduction into the body are given in detail. Immunity is obtained without any objectionable secondary symptoms.—J. **Danysz**: Compounds of chlorine, bromine, and iodine of dioxydiamidoarsenobenzene and silver. To a solution of Ehrlich's compound 606 a solution of silver bromide in potassium cyanide is added; a compound of arsenobenzene with silver bromide is formed, which can be removed as an insoluble sulphate. The therapeutic and antiseptic properties of this and the analogous chlorine and iodine compounds have been studied.—Gabriel **Bertrand** and H. **Agulhon**: The rapid estimation of boric acid in food substances, normal or added. Utilising the colorimetric method of estimation described in an earlier communication, figures are given for the amounts of boric acid present in a large number of animal and vegetable foods.—H. **Hérissey** and A. **Aubry**: The biochemical synthesis of α-methylgalactoside. The α-galactodidase used in this work was obtained from low beer yeast dried in the air.—Em. **Bourquelot** and M. **Bridel**: The equilibria of ferments. Production of hydrolysis or synthesis according to the changes of composition of the mixtures.—J. **Deprat**: The layers with Fusulinideæ of Akasaka, Japan, compared with the similar horizons of China and Indo-China.—J. **Repelin**: The modifications brought about in the Provençal sheets by Alpine movements.

BOOKS RECEIVED.

Introduction to Modern Inorganic Chemistry. By Dr. J. W. Mellor. Pp. xvi+684. (London: Longmans and Co.) 4*s.* 6*d.*

The Banana: its Cultivation, Distribution, and Commercial Uses. By W. Fawcett. Pp. xi+287+plates. (London: Duckworth and Co.) 7*s.* 6*d.* net.

A School Course in Geometry. By W. J. Dobbs. Pp. xxii+427. (London: Longmans and Co.) 3*s.* 6*d.*

Slide-rule Notes. By Col. H. C. Dunlop and C. S. Jackson. Pp. 127. (London: Longmans and Co.) 2*s.* 6*d.* net.

A Pocket-Book for Miners and Metallurgists. Compiled by F. D. Power. Third edition. Pp. xiv+371. (London: Crosby Lockwood and Son.) 6*s.* net.

Bücher der Naturwissenschaft. 18 and 19 Band. Der Wirbeltierkörper. By Dr. F. Hempelmann. Erster Teil. Pp. 185. 20 Band. Meereskunde. By Prof. A. Pahde. Pp. 190. (Leipzig: P. Reclam, jun.) 1.50 marks and 1 mark respectively.

Memoirs of the Queensland Museum. Vol. ii. Pp. 339+xxiii plates. (Brisbane: Government Printer.)

Pflanzenphysiologie. By R. Kolkwitz. Pp. 258+xii plates. (Jena: G. Fischer.) 9 marks.

Die realistische Weltansicht und die Lehre vom Raume. By Prof. E. Study. Pp. ix+145. (Braunschweig: F. Vieweg und Sohn.) 4.50 marks.

Models to Illustrate the Foundations of Mathematics. By C. Elliott. Pp. viii+116. (Edinburgh: Lindsay and Co.) 2*s.* 6*d.* net.

Astronomy: A Popular Handbook. By Prof. H. Jacoby. Pp. xiii+435+32 plates. (London: Macmillan and Co., Ltd.) 10*s.* 6*d.* net.

A List of the Birds of Australia. By G. M. Mathews. Pp. xxvii+453+map. (London: Witherby and Co.) 10*s.* net.

Exercises in Mathematics. By D. B. Mair. Pp. xi+469. (London: Macmillan and Co., Ltd.) 4*s.* 6*d.*

Analytic Geometry and Principles of Algebra. By Prof. A. Ziwet and L. A. Hopkins. Pp. viii+369. (London: Macmillan and Co., Ltd.) 7*s.* net.

Plane and Solid Geometry. By Prof. W. B. Ford and C. Ammerman. Edited by E. R. Hedrick. Pp. ix+321+xxxiii. (London: Macmillan and Co., Ltd.) 5*s.* 6*d.* net.

Handbuch der Entomologie. Edited by Prof. C. Schröder. 4 Lief. (Jena: G. Fischer.) 5 marks.

Handwörterbuch der Naturwissenschaften. Edited by E. Korschelt and others. 71 Lief. (Jena: G. Fischer.) 2.50 marks.

The Petrology of the Igneous Rocks. By Dr. F. H.

Hatch. Seventh edition. Pp. xxix+454. (London: G. Allen and Co., Ltd.) 7s. 6d. net.

Biological-Statistical Report on the Produce of the Danish Sea-Fishery in 1910. By A. C. Johansen and E. Neergaard-Moller. Pp. 179. (Copenhagen: C. A. Reitzel.)

Gypsy Lore Society Monographs. No. 1. A Gypsy Bibliography. By Dr. G. F. Black. Pp. vii+226. (London: B. Quaritch.) 15s.

Iowa Geological Survey. Vol. xxii. Annotated Bibliography of Iowa Geology and Mining. By C. Keyes. Pp. 908. (Des Moines.)

Department of Commerce. Technologic Papers of the Bureau of Standards. No. 18. Electrolysis in Concrete. By E. B. Rosa, B. McCollum, and O. S. Peters. Pp. 137+plates. (Washington: Government Printing Office.)

A Course of Practical Work in the Chemistry of the Garden. By D. R. Edwardes-Ker. Pp. 40. (London: J. Murray.) 1s. 6d. net.

Tables for Facilitating the Use of Harmonic Analysis, as arranged by Prof. H. H. Turner. Pp. 46. (London: Oxford University Press.) 1s. net.

Tierische Immunität. By Dr. W. Rosenthal. Pp. x+329. (Braunschweig: F. Vieweg und Sohn.) 6.50 marks.

From the Letter-Files of S. W. Johnson. Edited by his Daughter, E. A. Osborne. Pp. v+292. (New Haven: Yale University Press; London: Oxford University Press.) 10s. 6d. net.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 29.

ROYAL SOCIETY, at 4.30.—The Origin of Thermal Ionisation from Carbon: Prof. O. W. Richardson.—The X-ray Spectra given by Crystals of Sulphur and Quartz: Prof. W. H. Bragg.—The Temperature Variation of the Photo-elastic Effect in Strained Glass: Prof. L. N. G. Filon.—Studies in Brownian Movement. I. The Brownian Movement of the Spores of Bacteria: J. H. Shaxby and Dr. Emrys Roberts.—The Transmission of Kathode Rays through Matter: Dr. R. Whiddington.—The Variation with Temperature of the Specific Heat of Sodium in the Solid and the Liquid State; also a Determination of its Latent Heat of Fusion: Ezer Griffiths.—Radiation from a Gas: Dr. G. Green.—Similarity of Motion in Relation to the Surface Friction of Fluids: Dr. T. E. Stanton and J. R. Pannell.—The Influence of Molecular Constitution and Temperature on Magnetic Susceptibility: A. E. Oxley.—The Boiling Point of Sulphur on the Thermo-dynamic Scale: N. Eumorfopoulos.

ROYAL INSTITUTION, at 3.—The Mind of Savage Man: His Moral and Religious Life: W. McDougall.

CONCRETE INSTITUTE, at 7.30.—Discussion on "A Standard Method of Measurement for Reinforced Concrete."

SOCIETY OF DYERS AND COLOURISTS, at 8.—(1) The Effects of Mineral Loading upon the Physical Qualities of Hedychium Paper; (2) Tests to Determine the Relative Strength and Elasticity of Some Natural Fibres: Clayton Beadle and Dr. Henry P. Stevens.

FRIDAY, JANUARY 30.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Testing of Materials for Use in Engineering Construction: E. W. Monkhouse.

SATURDAY, JANUARY 31.

ESSEX FIELD CLUB (at the Essex Museum of Natural History, Stratford), at 6.—Notes on a Trip to Swedish Lapland, with Remarks on the Lichens Collected: D. J. Scourfield and R. Paulson.—British Oysters, Pliocene to Recent: A. Bell.—Scientific Surveys: Rev. C. H. Grinling.

MONDAY, FEBRUARY 2.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Oxygen and Metallic Antimony in Crude Antimony: W. R. Schoeller.—Estimation of Zinc in Coinage Bronzes by Volatilisation: T. K. Rose.—Nickel Tannates: Puran Singh.

ARISTOTELIAN SOCIETY, at 8.—Intuitionism Translated from the Russian of Prof. Losskij: Mrs. Duddington.

SOCIETY OF ENGINEERS, at 7.30.—Presidential Address: H. C. H. Shenton.

ROYAL SOCIETY OF ARTS, at 8.—The Relation of Industry to Art: Sir Charles Waldstein.

TUESDAY, FEBRUARY 3.

ROYAL INSTITUTION, at 3.—Animals and Plants under Domestication: Prof. W. Bateson.

ZOOLOGICAL SOCIETY, at 8.30.—An Annotated List of the Reptiles and Batrachians collected by the British Ornithologists' Union Expedition and the Wollaston Expedition in Dutch New Guinea: G. A. Boulenger.—Contributions to the Anatomy and Systematic Arrangement of the Cestoidea. XII. Further Observations upon the Genus Urocystidium Beddard: Dr. F. E. Beddard.—Report on the Deaths which occurred in the Zoological Gardens during 1913: H. G. Plimmer.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Problem of the Thrust Bearing: H. T. Newbigin.

ROYAL SOCIETY OF ARTS, at 4.30.—The Montreal, Ottawa, and Georgian Bay Canal: Sir R. W. Perks, Bart.

RÖNTGEN SOCIETY, at 8.15.

WEDNESDAY, FEBRUARY 4

AËRONAUTICAL SOCIETY, at 8.30.—Further Developments of Military Aviation: Lieut.-Col. F. H. Sykes.

GEOLOGICAL SOCIETY, at 8.—The Lithology and Composition of Durham Magnesian Limestones: C. T. Trechmann.—The Occurrence of a Giant Dragon-fly in the Radstock Coal-measures: H. Bolton.

SOCIETY OF PUBLIC ANALYSTS, at 8.—Iodimetry of Arsenic, Copper and Iron: Dr. G. D. Lander and J. J. Geake.—The Composition and Analysis of Compound Liquorice Powder: A. E. Parkes and F. Major.—The Composition of the Saline Matter adhering to certain Wet Salted Skins: M. C. Lamb.

ENTOMOLOGICAL SOCIETY, at 8.—The Myrmecophilous Aphides of Great Britain: Prof. F. V. Theobald.

ROYAL SOCIETY OF ARTS, at 8.—Motor Fuels, with Special Reference to Alcohol: Dr. W. R. Ormandy.

THURSDAY, FEBRUARY 5.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Conduction of the Pulse Wave and the Measurement of Arterial Pressure: Prof. F. Hill, J. McQueen and M. Flack.—Report of the Monte Rosa Expedition of 1911: J. Barcroft, M. Camis, C. G. Mathison, F. Roberts and J. H. Ryffel.—Some Notes on Soil Protozoa. I: C. H. Martin and K. Lewin.—The Development of the Starfish *Asterias rubens* L.: J. F. Gemmill.—The Floral Mechanism of *Welwitschia mirabilis* (Hook): Dr. A. H. Church.

ROYAL INSTITUTION, at 3.—Types and Causes of Earth Crust Folds: Sir Thomas H. Holland, K.C.I.E.

LINNEAN SOCIETY, at 8.—The Vegetation of White Island, New Zealand: W. R. B. Oliver.—Lantern-slides of Cape Plants, mostly in their Native Habitats: W. C. Worsdell.—The Range of Variation of the Oral Appendages in some Terrestrial Isopoda: W. E. Collinge.

FRIDAY, FEBRUARY 6.

ROYAL INSTITUTION, at 9.—The Mechanics of Muscular Effort: Dr. H. S. Hele Shaw.

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