

This is an important conclusion. If we are to judge by the reservoir, the early Minoan palace was probably a great architectural work. The "Early Minoan III." architects were perhaps almost as capable as their contemporaries, the Egyptian pyramid-builders of the fifth and sixth dynasties.

In the small "palace" on the hillside west of Knossos further discoveries have been made, including a paved way with the rut-marks of ancient Minoan chariots. In this part of the site more recent remains, of classical and Roman date, constantly are found above the Minoan level; whereas in the main palace, "whether owing to a superstitious awe or to other causes, the hilltop . . . was never invaded by later habitations." A fine metope of a Doric temple, contemporary with the Parthenon sculptures, was found over the western palace.

Mr. Doll has proceeded with the work of conserving the palace buildings, and has run the great staircase another flight higher. Also the nature and composition of the frescoes have been studied by Mr. Noel Heaton.

In the tomb-field of Isopata further important discoveries have been made, owing to the *flair* of Gregori, Dr. Evans's Cypriote foreman,

"the most expert tomb-hunter of the Levant. . . The wild, long-rooted fennel, which seeks out by preference the spots above ancient cuttings, served him, as often before, as a guide, and the result was the discovery of six chamber-tombs, some of which for their size and the interest attaching to their contents and arrangement surpass any hitherto known of this class."

The date of the tombs is the second late Minoan period, about 1450 B.C., contemporary with the eighteenth dynasty of Egypt. The most remarkable point about these tombs is the information as to Minoan religion which they give us. In one tomb, where "the religious interest culminated," was found an arrangement wholly new, which "rather recalled the domestic Etruscan ideas of the after-life than anything yet known of the Minoan age." The tomb was made to resemble a house of the living, with stone-cut benches, as if for family gatherings. And at the head of the sepulchral cist were found the remains of a double-axe shrine, with an offering-vessel, in the shape of a bull's head, lying close by. These tomb-chambers seem not to have been kept open regularly, but were opened for solemn service on the anniversary of the death probably. They were rifled of their more valuable contents by robbers of the early Iron age (geometrical period), who left behind them traces by which we can identify their date.

"It will be seen that the 'Tomb of the Double Axes' has produced more definite evidence regarding the sepulchral cult and religious ideas as to the after-world than any grave yet opened in Crete or prehistoric Greece."

Dr. Evans's comparison of the interior of the tomb with that of an Etruscan grave is very apposite and suggestive. This Etruscan impression has already been given by the great painted sarcophagus found by the Italians at Agia Triada, and it is most interesting to see how a relationship between the Etruscan, Minoan, and Anatolian (Hittite) cultures in matters of religious cult is gradually becoming clearer to us.

H. R. HALL.

#### NOTES.

THE following is a list of those who have been recommended by the president and council of the Royal Society for election into the council for the year 1911 at the anniversary meeting on November 30:—*President*, Sir Archibald Geikie, K.C.B.; *treasurer*, Mr. Alfred Bray Kempe; *secretaries*, Sir Joseph Larmor and Dr. John Rose

Bradford; *foreign secretary*, Sir William Crookes; *other members of the council*, Mr. L. Fletcher, Dr. W. H. Gaskell, Sir David Gill, K.C.B., Dr. E. H. Griffiths, Prof. W. M. Hicks, Prof. F. S. Kipping, Major P. A. MacMahon, Mr. H. R. A. Mallock, Dr. C. J. Martin, the Duke of Northumberland, K.G., Prof. W. J. Pope, Prof. J. H. Poynting, Prof. E. Rutherford, Mr. A. E. Shipley, Mr. M. R. Oldfield Thomas, and Mr. Harold W. T. Wager.

THE Royal Society's medals have this year been adjudicated by the president and council as follows:—The Copley medal to Sir Francis Galton, F.R.S., for his researches on heredity; the Rumford medal to Prof. Heinrich Rubens, for his researches on radiation, especially of long wave-length; a Royal medal to Prof. Frederick O. Bower, F.R.S., for his treatise on the origin of a land flora; a Royal medal to Prof. John Joly, F.R.S., for his researches in physics and geology; the Davy medal to Prof. Theodore W. Richards, for his researches on the determination of atomic weights; the Darwin medal to Mr. Roland Trimen, F.R.S., for his South African bionomic researches, in large part undertaken as the outcome of correspondence with Charles Darwin; the Sylvester medal to Dr. Henry F. Baker, F.R.S., for his researches in the theory of Abelian functions and for his edition of Sylvester's "Collected Works"; the Hughes medal to Prof. John A. Fleming, F.R.S., for his researches in electricity and electrical measurements. The King has been graciously pleased to approve of the award of the Royal medals.

At the meeting of the Royal Society of Edinburgh held on November 7, the following honorary fellows were elected:—*British*: Prof. J. G. Frazer, Sir Joseph Larmor, F.R.S., Dr. Alfred Russel Wallace, O.M., F.R.S. *Foreign*: Prof. Hugo de Vries, Amsterdam; Mr. F. A. Forel, Morges; Prof. Karl F. von Goebel, Munich; Prof. J. C. Kepteyn, Gröningen; Prof. Elie Metchnikoff, Paris; Prof. A. A. Michelson, F.R.S., Chicago; Prof. W. Ostwald, Leipzig; Prof. F. W. Putnam, Harvard University; and Prof. A. F. L. Weismann, Freiburg (Baden).

It is reported from Stockholm that the Academy of Sciences has decided to award this year's Nobel prize for physics to Prof. J. D. van der Waals, of Amsterdam, for his work on gases and liquids.

WE regret to see the announcement of the death of Mr. Theodore Cooke, for many years principal of the Poona College of Science, at seventy-four years of age.

A REUTER telegram from Wellington, New Zealand, states that Mr. Priestly, who accompanied Sir Ernest Shackleton, as geologist, on his Antarctic expedition, is going out with Captain Scott in the place of Mr. Thompson, who is ill.

THE date of the annual exhibition held by the Physical Society of London, which was fixed some time ago for December 13, has been altered to Tuesday, December 20. The exhibition will be open in the afternoon as well as in the evening.

THE annual Huxley memorial lecture of the Royal Anthropological Institute will be delivered on Tuesday, November 22, at the theatre of the Civil Service Commission, Burlington Gardens, W., by Prof. W. Boyd Dawkins, F.R.S., whose subject will be "The Arrival of Man in Britain in the Pleistocene Age."

MRS. TYNDALL has presented to the Royal Institution two Nicol's prisms, constructed for the lectures on light given by Dr. Tyndall in America in 1872, and used by him sub-

sequently in his researches and lectures; also two pieces of rocksalt, the remains of a large block given to Dr. Tyndall by the King of Württemberg in 1867.

THE eighty-fifth Christmas course of juvenile lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Prof. Silvanus P. Thompson, F.R.S., his subject being "Sound, Musical and Non-musical: a Course of Experimental Acoustics."

THE General Purposes Committee of the Birmingham City Council has recommended to the council that an invitation be given to the British Association to meet in that city in 1913. The council will cooperate with the University and other public institutions in making the necessary arrangements.

THE death is announced of Dr. Carl S. N. Hallberg, professor of pharmacy in the Chicago College of Pharmacy in connection with the University of Illinois. He was born in Sweden in 1856, and emigrated to America when a lad. He organised in 1885, and subsequently directed, the National Institute of Pharmacy. Since 1906 he had edited the *Bulletin of the American Pharmaceutical Association*.

THE Simon Newcomb library, which has been presented to the New York City College by Mr. John Claffin, has just been classified and catalogued. It is a collection of 4000 volumes and 6000 pamphlets, and includes many mathematical and astronomical publications of unusual interest. Among them may be mentioned an early edition of Euclid's *Elements*, a Pacioli of 1494, the 1515 edition of the *Almagest* of Ptolemy, and the first book ever published on sun-spots.

MR. G. M. MEYER sends us an extract from the Madrid weekly periodical *Nuevo Mundo* of October 6 in which a Spanish case of eugenic policy is described. It appears that an illustrious Salamancan, Don Federico Gómez-Arias, founded an annual prize of 1000 pesetas, which is awarded every year to a young woman of Salamanca from fifteen to twenty-three years of age, of good physical constitution, attractive, and well conducted, who must have received at least an elementary education and be on the point of being married to a man of similar physical and moral condition and of suitable age.

By the generosity of Sir Julius Wernher, who recently placed a sum of 10,000*l.* at the disposal of the committee for the purpose, a much needed extension of the department of metallurgy of the National Physical Laboratory has now been commenced. The department has been accommodated in scattered rooms in Bushy House, which, in consequence of the increase and importance of the work, have become quite inadequate. Plans have been prepared in consultation with Dr. Rosenhain, the superintendent of the department, and the contract has been let to Messrs. Dick, Kerr and Co., who have already made good progress with the foundations.

THE programme for the 157th session of the Royal Society of Arts is being issued to the members. There will be five ordinary meetings before Christmas, at the first of which the usual address will be given by the chairman of the council, Sir John Cameron Lamb. The papers announced for the other four meetings are by Sir Henry H. Cunyngame, K.C.B., "Detecting Fire-damp"; Mr. C. P. Ogilvie, "Argentina"; Dr. Vaughan Cornish, "The Panama Canal"; and Mr. Reginald Smith, "Roman London." There will also be a meeting of the Colonial Section, at which Mr. A. Montgomery will read a paper on "Mining in Western Australia,"

and one of the Indian Section to be occupied by a paper by Mr. R. F. Chisholm, on "The Taj Mahal." On the four Mondays before Christmas Mr. C. R. Darling is to give a course of Cantor lectures on "Industrial Pyrometry." There is also a very full list of papers and lectures for the part of the session after Christmas.

A QUARTERLY periodical entitled the *Botanical Journal* is issued as the official organ of the Royal Botanic Society of London. The first number contains an account of the history of the society since 1839, the date of the Royal Charter, in which are set forth the objects which have been served in that period. In recent years progress has been impeded by a lack of sufficient financial support, and consequent increase of debt, but the latest report shows that in some measure, at least, this condition is being remedied. The number of Fellows now is 1834, as compared with 1570 last year. The debenture debt is 14,714*l.*, as compared with 24,248*l.*, and the current liabilities 572*l.* instead of 3050*l.* Prof. A. J. Ewart, of Melbourne University, has an article on "The Flora of Victoria," and other subjects treated upon include "Our Native Lawns," "The Melbourne Botanic Gardens," "Fruit-growing in Queensland," and "Art in the Garden." There are notes upon botanical questions of interest and recently issued books. Two plates in colour from paintings by Miss Bertha Maguire prettily illustrate chrysanthemums, but their value is purely decorative, for they shed no light on the evolution of the flower, as would appear to be the case from the title. Mr. Butler's colour photographs are welcome, because they illustrate interesting plants in the society's collection. The number is not entirely free from the blemishes common to first issues; especially is this the case in the awkwardness of some of the titles to the subject-matter. The journal is issued by Messrs. Page and Pratt, and the price is one shilling.

THE *Bulletin of the Johns Hopkins Hospital* for October (xxi., No. 235) contains an appreciation of the life and work of Lord Lister, by Mr. Charles Judd, with bibliography; an historical inquiry on the decussation of the pyramids (nerve tracts in the brain), by Dr. Thomas; and an historical sketch of the practice of blood-letting, by Dr. Joseph Smith. Dr. Thomas ascribes the first definite observation of the crossing in the medulla of the great motor tracts passing from the brain to the spinal cord to Francois Pourfour du Petit (1664-1741). The practice of blood-letting or "bleeding" is at least two thousand years old, and is mentioned by the earliest medical writers.

UNDER the provisions of the Indian Museum Act of 1910, the ethnological and art collections have been separated from those of economic products, and in his last report of the museum as originally constituted, the curator, Mr. I. H. Burkill, has given a useful account of its past history and present condition. The museum was first started by the Asiatic Society in 1814, the first donor being the Countess of Loudoun. The collections have passed through many vicissitudes, due to the absence of suitable accommodation. Under the present scheme of reorganisation they have at last been placed upon a satisfactory footing. The ethnological gallery now contains about 11,000 exhibits, but it still lacks a proper descriptive catalogue, which can be prepared only by a competent ethnologist. The progress of the art series has been stimulated by the patronage of Lord Curzon, who provided an annual State grant of about 400*l.* for the purchase of specimens. Most of the older economical exhibits have perished, but these are being gradually replaced. It is satisfactory to learn that these important

collections are now being arranged in suitable galleries, and it only remains for the Government of India to provide a series of descriptive catalogues prepared by competent experts, which will render the exhibits available for study by students of art, anthropology, and the economic sciences in Europe.

PART 8 of vol. v. of the *Annals of the South African Museum* contains five articles on the entomology of the country. Among these, Mr. E. Meyrick continues his description of new Microlepidoptera, while Messrs. A. Raffray and L. B. Billecoq treat, in separate communications, of two groups of Coleoptera.

To the *Journal of Economic Biology* for October Messrs. Collinge and Shoebottom contribute a long article on the Apterygota (Thysanura and Collembola) of Hertfordshire, to which they have devoted special study. Before they commenced there appear to have been no records of these minute insects from the "county of Hertfordshire," but the authors are now enabled to enumerate four species of Thysanura and sixty-nine of Collembola.

To the *Inales* of the National Museum of Buenos Aires, ser. 3, vol. xiii., p. 317, Dr. F. Ameghino contributes a note on certain teeth from a cavern in Cuba, which are referred to a large monkey the dental formula of which is identical with that of the Cebidæ, but the cheek-teeth of which are stated to approximate to those of Old World monkeys and man. For this monkey the new generic and specific name of *Montaneia antropomorpha* is proposed. It is noteworthy that no wild monkeys are found in Cuba at the present day.

In the October issue of the *Journal of Economic Biology* Prof. Hickson discusses the place of economic zoology in a modern university, and the best way of training students in that branch of science. After pointing out that there is a growing demand for the services of men capable of dealing with the problems of economic biology in a practical manner, the author observes that the qualifications usually associated with what is termed "a good field-entomologist" will not suffice, and that a man who aspires to a post of this nature must have a working acquaintance with parasitism, parthenogenesis, heredity, and embryology; while he should possess special knowledge of the Protozoa, parasitic worms, land and fresh-water snails, and, particularly, tracheate arthropods. Such a course of study "could be given in the zoological departments of the principal universities of our country without very much additional equipment or a very material addition to the numbers of the teaching staff. But in order that the student may have the opportunity of getting some training in the recognition of insect pests in the field, the work of the laboratory should be supplemented by some systematic teaching in connection with an institution of the nature of an agricultural college, in which access to growing crops may be facilitated."

THE question of the systematic position and feeding-habits of the African Jurassic genus *Tritylodon*, and its northern allies *Plagiaulax* and *Ptilodus*, is reopened by Dr. R. Broom in the October issue of the *Proceedings of the Zoological Society*. In the first place, the author has no doubt as to *Tritylodon* being a mammal, while as the only known specimen is from the Stormberg beds, it must be regarded as of Lower Jurassic, and not Triassic, age. As regards the affinities of the three genera, Dr. Broom refuses to admit that Mr. Gidley is justified in including them among the diprotodont marsupials, remarking that

the dentition, both structurally and numerically, is of a different type, while the presence of a well-developed septo-maxillary in the African genus suggests monotreme rather than marsupial affinities. It is also pointed out that there is a considerable probability of diprotodonts having originated in Australia. "In the present state of our knowledge it seems wisest to leave the *Multituberculata* as a distinct independent group with no very near affinities with the living monotremes, marsupials, or eutherians." As regards the food of these mammals, the author points out that fruits were non-existent in Jurassic times, while if, as he considers probable, *Tritylodon* and its relatives were carnivorous, they must have fed mainly on reptiles, which would require a type of dentition different from that of mammal-eating species.

A NOTE on a fungal disease of the blue pine, *Pinus excelsa*, reported from the Simla forestry division, is contributed to the *Indian Forester* (October) by the assistant to the imperial mycologist at Pusa. The chief object of the note is to establish the observation of infection proceeding from diseased to healthy roots, for which good evidence is adduced. The fungus is reported to be *Trametes pini*, for which such marked fungal development in the root, and infection from root to root, has apparently not been previously recorded.

MESSRS. FLATTERS, MILBORNE AND MCKECHNIE, of Longsight, Manchester, are issuing a quarterly publication of fifteen pages entitled the *Micrologist*. Part ii., issued October 1, contains two excellent articles, one on mounting microscopical objects in fluid media in cells, the other (by Mr. H. E. Hurrell) on the polyzoa and the methods of collecting and mounting them. It is well printed and illustrated, and contains a beautiful plate of five reproductions of photomicrographs of starch, volvox, hydra, &c.

A USEFUL list of pteridophyta for the Transvaal province is communicated by Mr. J. Burt-Davy to the *South African Journal of Science* (October) on behalf of the late Mr. V. G. Crawley and himself. To make the list serviceable to teachers and students, brief diagnoses are supplied for the classes and genera, while analytical keys and localities are given for the species. Among the true ferns, *Cyathea Dregei* and *Mohria caffrorum* are two remarkable common species; *Oleandra articulata*, *Todea barbara*, and *Marattia fraxinea* are said to be rare. With respect to the number of species, *Asplenium*, *Pellaea*, and *Gymnogramme* are conspicuous genera.

MR. W. N. LUBIMENKO publishes in the botanical section (series iii., parts i.-ii.) of *Travaux de la Société des Naturalistes de St. Pétersbourg* a long paper (in Russian) in which he presents the results of experiments directed towards ascertaining the relationship that exists between the amount of chlorophyll present in a leaf and the energy of photosynthesis. In the summary it is stated that the minimum intensity of light required to start photosynthesis depends on the amount of chlorophyll, being less as the amount of chlorophyll is greater; also that as the amount of chlorophyll increases the energy of photosynthesis increases up to a maximum, and then decreases. It is further suggested that certain experiments indicate that photosynthesis proceeds in two stages; first, CO<sub>2</sub> is decomposed and O is liberated, then certain photochemical reactions lead to the transport and incorporation of organic material.

A CORRESPONDENT sends us examples of a monstrous carnation in which the inflorescences have produced no true flowers, but a superabundance of bracts. This

peculiarity in carnations and certain species of *Dianthus* was observed many years ago (see "Vegetable Teratology," p. 371, by M. T. Masters). An example is illustrated in the *Botanical Magazine*, Tab. 1622, in which one bud has developed into a perfect double flower, and several others are exactly similar to those sent by our correspondent. Earlier than this, Linnæus had met with a similar malformation, and given it the name of *imbricatus*. The distorted flower buds so nearly resemble ears of wheat that they are known as "wheat ear" carnations. It is not known what causes the suppression of the other parts of the flower and the increase in the number of bracts, but Masters pointed out that the condition is met with frequently in a species of *Mæsa*, in *Plantago major*, and in *Gentiana Amarella*.

HITHERTO agricultural chemists have concentrated attention mainly on those constituents of the soil that are essential to the production of plant food, but recently attempts have been made to ascertain the effect of the non-essential or the rarer constituents. The investigations at Woburn are well known. Mr. Failyer, of the United States Department of Agriculture Bureau of Soils, has published (Bulletin 72) a number of analyses showing that barium is present in most soils in the United States, especially in soils derived from rocks containing barite deposits or from the Rocky Mountains. The quantity sometimes rose near to 0.1 per cent. Felspar is also a source of barium. It appears probable that the soil moisture, which plays a part in the nutrition of plants, contains barium salts, and cases are on record where barium has occurred in the plant ash. Its presence there would be injurious to animals, and may perhaps be the cause of some of the unexpected results occasionally produced by vegetation.

M. AUG. CHEVALIER, in a letter on his explorations in Upper Dahomey, published in the last number of *La Géographie* (October 15), mentions a curious phenomenon which he observed with respect to the Ouémé River. In its middle course, last May, he found during his stay of fifteen days that the stream ran continuously in a reversed direction, toward the head of the river. The gradient of its bed in this part is very small, and the upper reaches are completely dry during several months of the year, as is the case with most of the rivers of the central African plateau. The rainy season sets in earlier in the downstream part of the country and fills the empty channel, which then runs for a time both ways until equilibrium is established, after which the normal direction of flow is maintained. Similar abnormalities have been previously observed in some of the water-channels of the Kalahari desert in south-central Africa.

IN NATURE of October 20 (p. 503) reference was made to an article in the *Times* on the Norwegian expedition to Spitsbergen, which contained a somewhat detailed account of the discovery of a volcano of recent age in a branch of Wood Bay. It appears, however, that there is still some doubt about the age of the volcanic phenomena. The latest number of *La Géographie* (xxii., No. 4, October 15) includes a note on the results of the expedition by M. Charles Rabot, based on an article in the *Christiania Aftenpost*, sent to him by Captain Isachsen, the leader of the expedition, as the only official communication which has yet been published. On this authority the following reference is made in *La Géographie* to the discovery:—"Finally, round a branch of Wood Bay, Mr. Hoel [one of the geologists] has made the very unexpected discovery of an ancient volcanic development (*appareil*). Contrary to what has been announced from Spitsbergen correspondence

published in Christiania journals, it does not date the actual epoch, and for a long time has not been the seat of manifestations. At present, upon the shores of Bock Bay the internal activity manifests itself only by the presence of thermal springs, of which the temperature does not exceed 28.5°." The scepticism respecting the earlier newspaper accounts of the volcano, alluded to in our previous note, was therefore not altogether unjustified. The full particulars of the discovery will be examined with keen interest by geologists and geographers.

THE Bureau of Science, Department of the Interior, Manila, has issued the annual report on the mineral resources of the Philippine Islands for the year 1909. It is thoroughly characteristic of American methods that the United States Government should have straightway set about fostering the development of the mineral industry of their first colony. The success that has attended this attempt is clearly enough indicated in the present report. The main product up to the present has been gold, the output of which for the year 1909 is valued at about 49,600*l.*; it shows an increase of 14 per cent. over that of 1908, in which year the output was about three times that of the year previous. Even more important from the point of view of general industrial development and civilisation is the increase in the production of coal; the total quantity raised in 1909 was 30,336 tons, an increase of 155 per cent. over the previous year, and more than seven times as great as the production in 1907. The entire production now comes from two mines on the island of Batan, one at the extreme east and the other at the extreme west of the island. The seams now worked are from 3 feet 4 inches to 5 feet 8 inches in thickness. The coal appears to be of Tertiary age; it is classed as sub-bituminous, is low in ash, and has given satisfactory results in raising steam. From the scientific point of view the chief interest of the report centres in a very brief sketch of the geology and geological history of the Philippine Islands.

THE Meteorological Committee has issued a useful contribution to the study of the north-east and south-east trade winds of the Atlantic Ocean (Publication No. 203), comprising (1) an investigation by Commander Hepworth with the view of tracing any effect of the variations of those winds upon the temperature of the water in the North Atlantic; (2) a *résumé* of the meteorological data available for St. Helena, by Mr. J. S. Dines; and (3) a calculation, by Mr. E. Gold, of the relation between the periodic variations of wind velocity and of atmospheric pressure, with the application of the general theorem to the case of St. Helena. In NATURE of December 21, 1905, Dr. Shaw directed attention to an apparent connection between the circulation of the atmosphere, as represented by the south-east trade wind, and the meteorological consequences in other parts of the world, and the present work may be considered as an attempt to identify that connection, to trace the links in the chain of cause and effect, and also to supply information available for meteorologists interested in the subject. In a very lucid preface summarising some of the results Dr. Shaw points out that the marine discussion of the south-east trade wind shows hardly any seasonal variation (possibly due to the peculiarities of the Beaufort wind-scale), while the results for the north-east trade show a marked variation very nearly complementary to that at St. Helena, where the anemometer record exhibits a regular mean variation (irrespective of direction) between about 14 miles per hour in May and 21 miles per hour in September. Dr. Shaw points out that Mr. Gold's solution, on dynamical prin-

-iples, of the origin of the diurnal variations of the trade wind over the South Atlantic gives results which are hopeful, but not final.

THE well-known observatory on Mount Vesuvius was founded in the days of the Kingdom of Two Sicilies, and was taken over by the Government at the time of the unification of Italy. The work that it has done under the direction of Prof. Palmieri, and latterly Matteucci, is well known; but in a plea put forward in the *Atti dei Lincei*, xix., 3, Dr. Carlo dei Stefani states that the institution has been hampered by the want of a more substantial subsidy from the State, and he further directs attention to the desirability of establishing a much more extensive institution for the study of Vesuvius in all its aspects. It is pointed out that since the observatory was founded every branch of science has advanced enormously, that the study of volcanoes plays an important part in geology and geophysics, and that Vesuvius, from its situation as well as from our intimate knowledge of its past history, offers exceptional facilities for systematic study. In such an institution the departments of geology, mineralogy, chemistry, and physics should all be represented on the staff.

THE geometry of the triangle occupies a somewhat unique position in mathematics, leading as it does to a large number of results which appear to be capable of being added to almost without limit, which do not require the employment of advanced methods for their study, and have the further interesting peculiarity—perhaps not altogether a disadvantage—that they can be studied without afterthoughts as to probable utilitarian applications. We have received two papers on this subject. One is by Mr. W. Gallatly (London: Francis Hodgson, price 2s. 6d.), dealing with Lemoine and Brocard points, angular and tripolar coordinates, pedal and antipedal triangles, the medial triangle, Simson's line, the orthopole, and orthogonal projection. The second, by Mr. W. H. Salmon, is a note reprinted from the *Quarterly Journal of Pure and Applied Mathematics*, dealing with the Omega and Omega-prime lines and the  $\gamma$  line. These lines are defined by the property that if O be any point in the plane of a triangle, and the lines OA, OB, OC be rotated through a constant angle, they will, for certain angles of rotation, meet the sides taken in order in three points lying on a straight line, these lines being the lines in question.

PROF. L. PALAZZO has sent us a copy of his "Misure Magnetiche fatte in Sardegna nel 1892," extracted from vol. xxiv. of the *Annali* of the Italian Meteorological Service. This volume belongs to the year 1902, but the chronological order has not been observed in the publications of the Italian Meteorological Service—some of which are much in arrears—so that an account is only now published of the magnetic survey of Sardinia made by Prof. Palazzo in 1892. Sixteen stations were occupied, the observations at which are described in minute detail, the results being embodied in a chart. No really large local disturbances were detected, but some minor disturbances were noticed, especially towards the north-west of the island. Besides a full description of the observational methods and reductions, there are descriptions, with plates, of apparatus for determining the temperature and induction coefficients of collimator magnets, with which very consistent results seem to have been obtained.

In the May number of the *International Bulletin of the Academy of Sciences of Cracow* Prof. Smoluchowski, of the University of Lemberg, gives an account of some

measurements he has recently made of the heat conductivities of fine powders, and the influence of the size of the grains and the state of the gas between them on the conductivity. His apparatus is in principle identical with that used by Kundt and Warburg in their measurements of the heat conductivities of gases. It consists of a thermometer the bulb of which is surrounded by a tube nearly concentric with it, the space between the bulb and tube being filled with the powder and connected to a Gaede pump, so that it can be filled with a gas or evacuated. Whatever the nature of the powder, the conductivity through the gas between the grains is found to diminish rapidly as the pressure of the gas is reduced, and for granular, as distinguished from spongy, powders its dependence on the pressure may be calculated by the aid of the kinetic theory of gases if the surface resistance, which depends on the mean free path of the molecules of the gas, is taken into account at the low pressures.

COPIES have reached us of the volumes of magnetic data recorded during 1905 and 1906 at the observatories of the U.S. Coast and Geodetic Survey. There are five of these observatories, viz. at Cheltenham, Baldwin, Sitka, Honolulu, and Vieques (Porto Rico). The Cheltenham volume is dated 1909, the others 1910. Thus the delay in publication seems hardly accounted for by the inclusion of two years' data in the same volume. The procedure followed and the mode of presenting the data are closely alike at all the stations. Full particulars are given of all the hourly readings and of the daily maxima and minima, but only the ten quietest days of each month are employed for deducing the diurnal inequalities. Each volume contains a table of the principal magnetic disturbances, and some of the curves showing them are reproduced on a reduced scale. Except at Cheltenham, the times shown on the curves are G.M.T., thus facilitating intercomparison, but the times of commencement, &c., given in the text are in local mean time. The stations are now all provided with a complete outfit of Eschenhagen magnetographs, including vertical force instruments. The troubles experienced—discontinuities in the trace, changes of scale value, drift of trace across the sheet, and general instability—are described in some detail, and though most prominent in the vertical force instruments, seem by no means confined to them. Even the declination instrument gave serious trouble at Baldwin, leading to considerable loss of trace. One cannot but experience a doubt whether a more stable and less sensitive type of instrument would not have been preferable, especially at the less accessible stations. In addition to other troubles, Sitka suffered from an outbreak of dry rot, which necessitated a large amount of internal structural alteration in the magnetograph room. This led, however, practically to no loss of trace, the magnetographs being accommodated during the alterations in a temporary building. In addition to magnetic data, there are particulars of the seismic movements recorded by seismographs, mostly of the Bosch-Omori pattern.

A LIST of observing stations and particulars of the apparatus employed in connection with the *Michael Sars* North Atlantic Deep Sea Expedition, 1910, has just been received. An article by Dr. Johan Hjort describing the work of the expedition is given in another part of the present issue.

MESSRS. HENRY SOTHERAN AND CO., 140 Strand and 43 Piccadilly, London, have issued a new classified catalogue (No. 709) of second-hand books on geology,

mineralogy, mining, and metallurgy, including the library of the late Prof. Hilary Bauerman, with a supplement of sets of periodicals and publications of the learned societies.

The Cambridge University Press has undertaken the publication of a work entitled "*Principia Mathematica*," by Dr. A. N. Whitehead, F.R.S., and the Hon. B. Russell, F.R.S.; the aim of the work is to show the dependence of mathematics upon logic by deducing from purely logical premises the elementary propositions of various branches of mathematics. The first volume, on mathematical logic and prolegomena to cardinal arithmetic, will be published very shortly. The second volume, concerning the principles of arithmetic, is in the press. In the third volume the authors have dealt with measurement and the principles of geometry.

We have received the first part of vol. xviii. of the *Journal of the Royal Institution of Cornwall*. The proceedings at the annual and spring meetings of 1909 are given at length. The annual excursion of 1909 is described, and the address of the president, Dr. Richard Pearce, at the spring meeting in 1909 is printed *in extenso*. Among papers read at the meetings during 1909 may be mentioned:—King Arthur's Hall on Bodmin Moor and some Irish circles, by Mr. A. L. Lewis; the fauna of St. Ives Bay for 1908, by Mr. R. Vallentin; and the invertebrate fauna of Cornwall—Hymenoptera Entomophaga and Hymenoptera Aculeata, by Mr. W. A. Rollaston. The volume also contains meteorological tables for Cornwall for 1909.

#### OUR ASTRONOMICAL COLUMN.

**FIREBALL ON NOVEMBER 2.**—A brilliant fireball was observed on Wednesday, November 2, 7.46 p.m. It passed from east to west over the English Channel, and fell from heights of 84 to 26 miles. As seen from Cornwall and from the north of France, as well as from ships in the Channel, the meteor was a splendid object, yielding a brilliant light, as though the moon had broken out from clouds. The stream of aërolites from which the phenomenon was directed has its radiant point in Aries, and further observations are desirable.

**ROTATION OF THE MOON.**—A correspondent has been puzzled by the perennial perplexity of non-mathematicians as to how the moon can be said to rotate when she always presents the same face to the earth. The answer, of course, is that as we prove the rotation of the earth by the fact that any meridian, such as that of Greenwich, completes its circuit with respect to any fixed star in the course of a *sidereal* day, so also the similar consideration shows that the moon rotates on her axis in  $27\frac{3}{4}$  days, during which time she also completes her circuit about the earth with respect to the stars.

The moon's equator is not quite circular, since her figure may be considered as possessing a solidified tidal inequality of shape. Laplace examined the mechanical results of this condition of affairs, and showed that the moon would oscillate slightly about a mean position relatively to the earth. This is called the physical libration of the moon, and in consequence of its existence we see slightly more than half of the moon's surface.

It is probable that the moon once rotated more rapidly on her axis, and that her rotation was reduced by tidal friction to its present magnitude. The transition from a slow rotation to a libration would present a problem of considerable mathematical difficulty. We can, however, see what would be the several stages through which the changes would pass. There would first be unequal speed in the several parts of the rotation; this inequality would increase until at two moments in one rotation that rotation would nearly cease; then there would occur an actual

stoppage, and the direction of motion would reverse itself for half a rotation, constituting a very large libration; finally, the amplitude of libration would diminish to its actual insignificant magnitude.

**EPHEMERIS FOR HALLEY'S COMET.**—Dr. Ebell publishes a continuation of his ephemeris for Halley's comet in No. 4450 of the *Astronomische Nachrichten*. The ephemeris covers, in four-day steps, the period November 5 to December 31, and shows that the comet is now travelling in a south-westerly direction through Corvus; its magnitude is about 15.5.

**SELENIUM PHOTOMETER MEASURES OF THE BRIGHTNESS OF HALLEY'S COMET.**—Observing at the Illinois University Observatory, Mr. Joel Stebbins measured the brightness of Halley's comet with his selenium photometer on fifteen occasions during May, and now publishes the results in No. 2, vol. xxxii., of the *Astrophysical Journal*. The selenium cell was attached to the 12-inch refractor, and, through a diaphragm, light from a circle 7 minutes of arc in diameter was admitted to it; Mr. Stebbins suggests that eye-estimates of the comet's brightness never included a larger area. The cell is known to be especially sensitive near the red end of the spectrum, and it is supposed that, unless the spectrum of the comet was very peculiar, the systematic error of these observations would be less than visual comparisons of a luminous surface with a point source of light, such as a star; extra-focal images of stars were used in the comparison, and in the morning observations the brightness of the sky was measured and taken into account in adopting final values for the comet's brightness. The range of the latter is shown by the following values, given in magnitudes:—May 3, 2.0; May 11, 0.6; June 1, 3.6. The second value, 0.6, is vitiated by bad observing conditions, but Mr. Stebbins states that the comet became brighter than the first magnitude, although it never reached magnitude 0.0.

**THE APPARENT DIAMETER OF JUPITER.**—An earlier discussion of the observations of an occultation by Jupiter, made at the Z6-sè Observatory on May 21, 1908, led to the conclusion that the apparent diameter of the planet, as generally adopted, should be diminished; the occulted star was BD, +19° 2095.

In No. 4450 of the *Astronomische Nachrichten* Father Chevalier, director of the Z6-sè Observatory, suggests that the observational results were not sufficiently certain to have such an important conclusion based upon them.

Attempting to determine more trustworthy data, he measured a photograph of the planet taken on May 19, and determined the corrections to the tabular place. Then applying these differences he found the position for May 21. This gave the position-angle of the star as  $149^{\circ} 23'$  and its distance from the centre of Jupiter as  $18.7''$ , a value greater than the semi-diameter of the planet. It is difficult to reconcile this result with the data for the occultation, and Father Chevalier urges that the observations made at other observatories should be closely examined and discussed from this point of view. A number of discussions such as he now publishes would possibly elucidate the matter.

**CURVED PHOTOGRAPHIC PLATES.**—In No. 161 of the Harvard College Observatory Circulars Prof. E. C. Pickering describes some interesting experiments made for ascertaining the practical efficiency of curved plates in celestial photography.

With the 16-inch Metcalf telescope employed, the difference in focus between the edge and the centre of the plate is only 0.8 mm., but the experiments show that the bending of the plates to the focal curve is advantageous, while there is little likelihood of counterbalancing disadvantages.

Several methods were tried, such as holding the ordinary photographic plate against a properly curved concave surface by means of mucilage, &c., but it was found that the most successful method was to have the space between the plate air-tight, and then to exhaust it by means of a pump. Reproductions of actual photographs illustrate the gain in definition over the whole plate.