Research Items.

CHINESE FRESCOES FROM HONAN. — Frescoes described as "the most important works of art that have ever come out of China" have recently been acquired by the Museum of the University of Philadelphia and are figured and discussed by Miss Helen E. Fernald in the *Museum Journal* (Philadelphia), vol. 17, No. 3. Up till a few years ago it was thought that the great frescoes of the temples and palaces of the T'ang dynasty extolled in Chinese literature had long perished. Various expeditions to Turfan and the borders of western China had, however, discovered fragments of paintings unquestionably of this period, but showing signs of provincial workmanship. In 1925 the Museum acquired five mural paintings from a cave temple in Honan; but these, and others which appeared in America and Europe at the same time, were merely single figures cut from the walls and without definite data. They did no more than prove that early frescoes did still exist in China. Three panels have now been acquired which belong together and form part of an enormous picture which must have been at least forty feet long and twenty-five feet high, and of which the composition can be reconstructed with some probability. Of the three panels, the central represents Sakyamuni seated on a dais in the *pâdmasana* position, with legs crossed and each foot resting on the opposite leg, sole uppermost. The left panel represents Avalokiteśvara, the Bhodhisattva of Mercy, seated in European fashion. The right-hand panel shows an important personage in robes befitting an emperor approaching the Buddha throne accompanied by a delicate female figure and followed by an official-looking individual. Two demon kings in fantastic armour are in the background. The three frescoes evidently represent three of the most important sections of a Paradise scene, such as appears again and again on the walls of caves of the Thousand Buddhas. Stylistic and other considerations assign the paintings to the latter part of the T'ang dynasty, about 845 A.D. or possibly thirty years later, and suggest as their possible source a mountain monastery of Honan.

THE ARCHÆOLOGY OF THE VALLEY OF MEXICO.— The interesting problem of the evidence for the pre-Aztec culture found beneath the lava bed of the Valley of Mexico is discussed by Mrs. Zelia Nuttal in a contribution to the *Proceedings of the American Philosophical Society*, vol. 65, No. 4. So long ago as 1861, attention was directed to fragments of pottery from beneath the lava bed, and clay heads of an archaic type have been on exhibit in the Trocadero Museum, Paris, since 1881; but their significance was not realised until investigations and excavations under the lava bed and the discovery of similar archaic heads and pottery elsewhere had revealed the existence in Mexico Valley of an archaic culture, of which an extension has since been discovered in Guatemala. It would appear from the results of recent investigation that Mexico Valley in remote antiquity was inhabited for a long period by a race which made pottery, modelled figurines, used flaked obsidian knives, and built a truncated structure faced with unworked stones. This structure was surrounded by lava flow at a period variously estimated at from 2000 to 5000 years ago. This area was the home of the *teozintl*, from which maize developed. The survivors of the catastrophe due to flood and the volcanic eruption seem to have drifted southward and to have established themselves in Guatemala, where they remained for a long period, developing the Maya and Mexican calendar. From this site they would appear to have been driven out by a catastrophe, possibly volcanic, possibly a famine due to a plague of grasshoppers, and migrated northward, carrying maize to Central America, and settled again in Mexico Valley. This hypothetical reconstruction would serve to confirm the legends and throw light on the connexion between the Maya and Aztec people, establishing the unity of their culture and their common origin.

NORWEGIAN PLANKTON INVESTIGATIONS.—The first food eaten by many young fish immediately after the absorption of the yolk consists of pelagic diatoms, and it has been suggested that the fluctuations in the supply of cod from year to year may depend on the amount of plankton food available for the young when they start to feed. Accordingly, in 1922-1925, investigations were carried out in Norway to ascertain the yearly variations in the quantity of plankton. In a preliminary report on the "Quantitative Investigations of Plankton at Lofoten, March-April 1922-1924" (*Rep. Norweg. Fish. Mar. Invest.*, vol. 3, No. 7, 1926), Birgithe Ruud traces the spring outbursts of the coastal diatoms and their connexion with the transport of dissolved nutrient matter in the snow water from the land. It is shown that the date of the spring flowering of the plankton at Lofoten depends upon the melting of the snow, for each year it follows immediately after the snow has begun to melt. The increase in the number of diatoms starts near the land and gradually spreads to offshore waters, the flowering being heralded from place to place by a lowering of the temperature and decrease in salinity, both of which are due to the increasing amount of fresh water from the snow melting on the land, on which the quantity of the developing plankton depends.

THE GROWTH OF HORNS.—The Swiss Society of Natural Sciences has published as part of its sixty-third volume (1926, pp. 1-180) an elaborate monograph by Dr. J. Ulrich Duerst on the horns of the Bovidæ (*Denkschriften der Schweizerischen Naturforschenden Gesellschaft*, Band 63. "Das Horn der Cavicornia. Seine Entstehungsursache, seine Entwicklung, Gestaltung und Einwirkung auf den Schädel der horntragenden Wiederkäuer." Zürich). Dr. Duerst holds that horn formation is primary, and that this has secondarily determined the development of a bone-core; evidence in support of this view is drawn from several examples of cutaneous horns containing a bony nodule (true os cornu). On the other hand, he denies the presence of a separate os cornu as a normal condition, but nevertheless is of opinion, from developmental evidence, that the bone-core is not a true outgrowth or apophysis but an epiphysis, which is from the beginning joined to the frontal bone. In this connexion Dr. Duerst refers at some length to the views of Gadow (*Proc. Zool. Soc.*, 1902), and although he does not consider in any detail the general problem of the relation of horns to the antlers of the Cervidæ, he appears to believe that the latter have been independently evolved. Variations in the form and structure of horns are explained in terms of their growth; of special interest are the account of the phenomenon of the shedding of juvenile horns in different species of the Bovidæ with numerous illustrated examples, and the discussion of the special case of the American prongbuck (Antilocapra), which periodically sheds its horns. An important concluding section of the monograph deals with the influence of horns on the form of the skull, a subject which

Dr. Duerst treats largely from the mechanical point of view. There are eighty figures and a full bibliography.

INSECT CONTROL IN THE UNITED STATES.—The United States Bureau of Entomology represents the largest organisation in existence for the control of injurious insects. Under the direction of its chief, Dr. L. O. Howard, it has reached a high standard of efficiency and scientific attainment. Dr. Howard's report for the year ending June 30, 1926, has recently come to hand, and forms a record of a very wide range of activities. Among the many problems in hand, the Japanese beetle comes in for a big share of attention, and its investigation now forms a separate section of the Bureau. The perennial campaign against the Gipsy and Brown-tail moths has not been relaxed, and more than three and a half million parasites of the former insect have been liberated during the period under review. The extreme drought of 1924 extended through the cotton-growing season of 1925 and resulted in but a light infestation of the boll weevil, which has, in consequence, restricted the experimental work. The practicability of aeroplane dusting for controlling this insect has been fully borne out, and there are now several companies operating aeroplane dusting on a very extensive scale. Malaria investigations by the Bureau, and also in co-operation with other bodies, have been actively pursued. The identification of the blood imbibed by mosquitoes has led to the determination of the host relationships and preferences of various species, while a considerable amount of research has been carried out with reference to arsenical and other compounds as larvicides. Among other problems, those relating to forest insects, apiculture, and a general insect-pest survey are also reported on.

POLYCHÆTA FROM THE PHILIPPINES.—Most of the Polychæta collected by the *Albatross* in the neighbourhood of the Philippine Islands during 1907–1909 have already been described, but in an additional paper recently published (*Bull. U.S. Nat. Mus.*, vol. 6, part 2) A. L. Treadwell makes some further records, including descriptions of one new genus and three new species. Monorchos, the new genus, is of the family Sabellariidæ, and is distinguished from allied genera by possessing only a single row of paleæ, internal to which is a series of hooks arranged in a V-shaped manner. The genotype, *M. philippinensis* n.s., is known only from a number of anterior portions brought up from 805 fathoms between Siquijor and Bohol Islands. Of the other new species, *Lœtmonice nitida* n.s. is separated from *L. producta* Grube, as described by M'Intosh from the *Challenger* collections, chiefly by the form of the chætæ and by the absence of a felt covering. Two partially complete specimens are also regarded as a new species, which has been named *Eupanthalis evanida*. Some heteronereids obtained at Mindanao are thought to be *Nereis masalacensis* Grube, and a description of them is given.

LINKAGE IN GARDEN PEAS.—The inheritance of fifteen characters in the garden pea—the classical material of Mendel's experiments—has been studied by Miss Sverdrup (*Jour. of Genetics*, vol. 17, No. 3) on a large scale. A new mutation appeared in the experiments, having narrow leaflets frequently alternate and various flower-changes, including a narrow, pointed standard and sterile carpels. It is recessive in inheritance when the pollen is used in crosses. The main purpose of the experiments was to determine the linkages between factors. In certain cases it was found that the backcross involving two pairs of characters gave different linkage values from the F_2; or, in other words, when the cross is of the form $DR \times DR$, the crossing-over frequency is different from that of the cross $DD \times RR$. Such discrepancies in the coupling and repulsion values have been observed by other investigators in Primula, maize, and morning glories, but the explanation is not apparent. The fifteen factors of Pisum are found to fall into four linkage groups and five other independent factors, thus making nine independently assorting groups, whereas there are only seven pairs of chromosomes. One pair of the chromosomes is found to have attached satellites, which Nawaschin has shown in Crepis to be independent in the prophase of mitosis. It is suggested that possibly the structure of the chromosomes may be more flexible in Pisum than in Drosophila, where an exact correspondence has been shown between the linkage groups and the chromosome number.

IRRAWADDY DELTA AIR SURVEY.—On the Burma Forest Department needing large-scale maps of the forest areas of the Irrawaddy delta, arrangements were made to undertake an air survey, since the district, which consists of densely wooded alluvial plains, did not lend itself to any other form of mapping. Progress by land is laborious, especially during high spring tides, when much of the country is submerged. The sandy sea beaches and the banks of creeks at low water afford the only lines of communication except by water. An account of the survey is given by Major C. G. Lewis in *Records of the Survey of India*, 21, 1. The area originally surveyed was about one thousand square miles, to which another 440 square miles was afterwards added. Ground control for the air survey was difficult to obtain owing to the height of the trees, which rendered useless even masts of 100 feet in length. The procedure eventually adopted was traversing along the sea beaches and triangulation along the main streams. The country was then cut up into five or six sections, each enclosed by a circuit of fixed points. The photography was begun in February and finished early in April 1924, when a total of 3795 plates had been exposed at an average elevation of 9400 feet. It is estimated that a ground survey of the delta would have occupied a party of thirty surveyors at least three years, at double the cost. The disadvantages of the air survey are that minor creeks are often obscured by overhanging trees and cannot be traced in detail on the photographs, and that it was seldom possible to photograph the coast-line at low tide, with a result that the low-tide line and many sandbanks were not surveyed.

THE ECHELON STRUCTURE OF JAPANESE VOLCANOES.—Under this title Sakuhei Fujiwhara presents a remarkable analysis of the distribution of volcanoes in Japan (*Gerlands Beiträge z. Geophysik*, 1927, p. 1). He defines a shear as positive when the stresses applied make a right-handed system, and as negative when they make a left-handed system, and shows by experiment that a positive shear gives a series of compression cracks in positive echelon and a complementary series of tension cracks in negative echelon. Applying this principle, it is clear that the sense of shear that has been applied to a region can be determined if the echelon cracks can be interpreted as due to tension or compression. A survey of all the Japanese volcanic lines shows that with one minor exception they are arranged in positive echelons, and that the volcanoes themselves have developed mainly along the axes of anticlines, that is, along lines controlled by compression. Thus it is deduced that the Japanese Islands are affected by a positive regional shear acting to the south-west on the Pacific side and to the north-east on the Asiatic side. The San Francisco earthquake revealed a corresponding movement on

the other side of the Pacific, namely, a north-west movement of the ocean floor relative to North America. As a result of a recent study of the volcanoes of Central America, Sapper has shown that they too form a good positive echelon. It thus appears that the bed of the North Pacific is making a counter-clockwise rotation relative to the surrounding lands, and that the seismic generating force in California and Japan may be due to this rotation. No suggestion is given as to the possible origin of such a movement, but the recognition of the latter is itself a contribution to tectonic geology and geophysics of fundamental importance. The paper should be carefully studied by all who are interested in these subjects.

THE MAGNETIC MOMENT OF HYDROGEN.—On the older quantum theory, atomic hydrogen should be paramagnetic, and the moment of the atom should be the unit Bohr magneton. Any large departure from this value might have an important bearing on the new undulatory mechanics and on the idea of a spinning electron, and its experimental determination is thus a matter of considerable importance. This has now been done by T. E. Phipps and J. B. Taylor (*Phys. Rev.*, **29**, p. 309; 1927), using a modified form of the well-known apparatus of Stern and Gerlach. A pencil of hydrogen atoms was allowed to diffuse from a discharge tube through a series of narrow glass slits into a highly evacuated chamber. It was there passed through an intense inhomogeneous magnetic field, in which the atoms were orientated and deflected. They were finally registered as a simple pattern of blue lines when they impinged on and reduced a white film of molybdenum trioxide. Within the experimental error of 10 per cent., which arises largely from uncertainty as to the velocity of the atomic rays, the moment of the atom is one Bohr magneton. Active hydrogen from a tungsten filament proved to be less satisfactory, and no result could be obtained with the product of the action of ultra-violet light on a mixture of mercury vapour with hydrogen.

HIGH VOLTAGE OVERHEAD TRANSMISSION.—In the January issue of *AEG Progress*, the journal of the Allgemeine Elektricitäts Gesellschaft of Berlin, there is a timely article on high tension overhead lines. One of the troubles which electrical engineers have to overcome when using very high electrical pressures is to avoid the production of brush discharges from the line—the so-called corona discharge—as when these discharges appear there is a sudden increase in the power lost in the line and a consequent lowering of efficiency. It is known that the larger the conductors the higher is the limiting voltage at which the corona appears. This has been taken advantage of by using aluminium instead of copper for the conductors, as the larger sizes of these conductors make higher voltages possible. The A. E. G. manufactures special hollow conductors for very high voltage cables. It is pointed out that it is advisable when erecting overhead lines to make them of such size that they can, if necessary, be used for considerably higher voltages. At 220 kilovolts the diameter of the conductors must be at least 2·5 cm. if corona losses are to be avoided. It is stated that the manufacture of hollow conductors presents little difficulty. For the erection of these large wires, special tackling equipment is described. Caterpillar tractors are used to haul the necessary heavy loads over uneven ground. In the front page a photograph is given of part of a polyphase transmission line as it crosses the Main between Neuenahr and Rheinau. It is described as being for 380 kilovolt working.

THE SCATTERING OF X-RAYS.—In a recent number of the *Physikalische Zeitschrift* (No. 3, 1927) Prof. P. Debye has reprinted an important article on the scattering of X-rays by amorphous bodies, originally published by him in the *Journal of the Massachusetts Institute*. Both he and Prof. W. H. Keesom have pointed out that the interference rings obtained with liquids—similar to those produced in the powder method of crystal analysis—cannot be due entirely to the individual molecules acting as small crystals, since the patterns are very similar for different substances, and are also obtained with a liquefied monatomic gas, where the existence of a polyatomic molecule is unlikely. The principal maximum in the interference pattern has consequently been attributed to superposition of radiation scattered from molecules acting as units. If this part of the intensity of the scattered rays could be predicted as a function of the angle made with the primary ray, the residual effect, which would arise from radiation scattered by the component atoms, might give, for example, very direct information about the distance apart of the latter. Prof. Debye has given an elegant theoretical treatment for the simple case of a gas the molecule of which is a uniform sphere, and has shown that although even then the unknown Laue scattering factor has to be introduced, interference phenomena are to be expected. To a first approximation, the gross action of the molecules is proportional to the ratio of their total volume to that of the vessel in which they are contained, and so can be allowed for ideally by experimenting at different pressures. The interference pattern for a simple diatomic molecule has been worked out on similar lines, and a graphical illustration given of how it would be expected to vary with the density of the gas, the internal atomic contribution and aggregate molecular contribution being readily distinguished.

THE FORMATION OF GOLD FROM MERCURY.—A detailed account of the experiments by which the authors claim to have demonstrated the conversion of mercury into gold is given by Miethe and Stammreich in a recent issue of the *Zeitschrift für anorganische Chemie* (vol. 158, p. 185, 1926). They describe the method used in the purification of the mercury, but without detail, stating that this is unnecessary when tests show the absence of gold in the product. The mercury is distilled to a small residue, which is then treated with nitric acid and the residual gold melted with borax in a small porcelain dish. The treatment of the mercury in various ways is then described. Several types of mercury lamps are represented, although not in exact detail. The yield of gold in various experiments was very variable. In some cases no gold was found. The discharge in mercury vapour gave no gold. In a mercury turbine interrupter gold was produced and the copper electrodes after the experiments contained more gold in the outer layers than was present at the beginning. In other types of interrupters no gold was formed. Discharges between electrodes and mercury in a gas yielded negative results. Discharges between mercury and solid electrodes under paraffin oil yielded gold. The majority of the experiments gave negative results, but a connexion between positive results and the particular kind of discharge used is found. The results of other experimenters are discussed, and the conclusion is drawn that these are really in favour of the views of Miethe and Stammreich. Theoretical criticisms of their work are not regarded seriously by the latter, since they start from assumptions different from those which they themselves consider possible. They emphasise that the matter is purely an experimental problem.