Research Items.

THE BULL ACROBATS AT KNOSSUS.—In the Journal of Hellenic Studies (vol. xli. part 2) Sir Arthur Evans describes a remarkable bronze group from Knossus in Crete, representing an acrobat jumping over a galloping bull in the arena. The high action and skilful modelling of this animal are altogether unique among the relics of Minoan metallurgic craft, and for vigour and beauty this far exceeds two representations of such feats discovered by Schliemann and others. The full stretch of the bull's legs conforms to what is known as the "flying gallop" scheme, and the small figure of the acrobat, apart from the conventional attenuation of the waist, is finely executed, and even his features, though abnormally diminutive and incompletely brought out by the casting, with the sinewy development of form, due to athletic training, are well indicated. In other examples of feats of this kind the performer is usually a girl, but there can be no doubt that this figure is a male. In a representation of the same class on the bull *rhyton* it is clear that at the epoch to which it belongs, that is, about 2000 B.C., the long-horned Urus breed of cattle had been already introduced into Crete. The earlier indigenous variety, a form of shorthorn, *Bos Creticus* of Boyd Dawkins, was not well adapted for such a form of sport.

THE PALÆOLITHIC AGE IN INDIA.—The discovery of stone implements in India began with an implement found by Mr. Le Mesurier in 1861, and since that time many specimens have been found. But only two cases are known in India where stone implements have been found associated with the remains of extinct animals, in the Nerbudda and Godavari valleys, and further evidence of their occurrence in strata, the date of which can be established, is much to be desired. In the March issue of *Man* Mr. T. H. Vines reports the discovery of flint workshops in hills overhanging the North Indus valley. These consist of cores and broken chips, with a yellowish-brown fabrication and lustre. In the ravines of these hills flint knives and other tools of a white or whitish colour are found in considerable numbers. Mr. Vines suggests that the strata in which these implements are found correspond with the area in Egypt where implements of the same type have been discovered by Prof. Seligman (Journal Royal Anthropological Institute, vol. li. p. 115). The area to which Mr. Vines refers well deserves examination, as its geological character may form the basis of fixing an approximate age for manufacture of these implements.

MAN IN THE PACIFIC.—At the meeting of the British Association held in Australia in 1914 the desirability of fuller knowledge of the Pacific was advocated. In response to this appeal the Legislature of Hawaii appropriated funds to be used by the Pan-Pacific Union in defraying the cost of a Pan-Pacific Commercial and Educational Congress to be held at Honolulu in 1920. The Bernice P. Bishop Museum has now issued, as No. 7, Part I., of its publications, a full report of the Proceedings of the Congress, which are of peculiar interest. The papers now published are devoted to the question of Race Relations. In a valuable paper on "Man in the Pacific," Dr. Clark Wissler remarked on the need for such investigations as "the old Polynesian is passing the last mile-post of his career." "First, we need a geological survey of the several island groups; for the backbone of man's chronology is geological chronology. Further, we need data upon the fauna and flora of the respective islands. It is the realisation of this inter-relation of problems that underlies the conception of this congress and is its only excuse for being. You tell us the history—a relative chronology—of such plants as taro, bread-fruit, the paper mulberry, etc., and the story of such mammals as the pig and dog, and of the chicken, in the islands of the Pacific, and we will soon fill in the gaps in the chronological scheme for the Polynesians."

THE AMERICAN INDIANS' KNOWLEDGE OF THE MASTODON.—In *Natural History*, the Journal of the American Museum of Natural History (vol. xxi. No. 6), Mr. J. L. B. Taylor, under the heading: "Did the Indian know the Mastodon?" describes a bone bearing an incised elephant-like figure, found in the Jacobs Cavern, Ozark Country, near Pineville, Missouri. Dr. Clark Wissler, who has examined this bone, regards the work as what might have been expected from the hand of an American native; three attempts to represent living forms, apparently by the same artist, are identified—"Two have the distinctive lines of elk and deer, while the lines of the third characterise elephant kind, and this favours the interpretation that an elephant, mastodon, or mammoth was intended. At once the objection will be raised that the bone is recent. Though the mastodon and the mammoth are characteristic of Pleistocene time, it is not known when they became extinct: for all that is known to the contrary these great mammals may have held out within 3000 years ago. . . . No one in authority seems now prepared to deny that man was in America 3000 years ago." Dr. Wissler regards this discovery in Jacobs Cavern as of great importance; "it is to be hoped that at last we are on the trail of early man in America."

BEHAVIOUR OF STOMATA.—In a significant paper on the behaviour of stomata (Carnegie Institution of Washington, Publ. No. 314) Mr. J. V. G. Loftfield has made important additions to our knowledge of the action of stomata in relation to the environmental and physiological conditions of the plant. He used the method of fixing strips of the epidermis in alcohol, supplemented by direct microscopic observation of the living, attached leaf. Many of the observations were continued every hour throughout the day and night, microphotographs showing the condition of the stomata on the upper and lower epidermis of leaves being ingeniously arranged in circles for comparison with the corresponding continuous circular records of light, temperature and humidity. Many plants were studied under different climatic conditions, and it was found that while illumination affects the action of stomata, as has long been known, yet weather conditions also control the size of the openings, and with varying water supply the stomata may change their behaviour from day to day. Some of the movements were quite rapid, from fully open to closed in less than an hour. Low morning temperatures caused the stomata to open very gradually, and even moonlight affected the size of aperture. The great majority of the stomata on a leaf behaved alike, but about 2 per cent. were functionless and 3 per cent. superfunctional, opening to twice the normal maximum. The plants studied fell into three groups. In cereals the stomata are very sensitive and never open at night. In another group, as conditions become less favourable the stomata open at night and close for a time about midday. In the potato and other plants the stomata are normally open at night and close only under conditions of high evaporation or low water-content. Light induces the opening of stomata by causing the conversion of starch in the guard-cells into sugar and so increasing their osmotic pressure. This work

shows that stomata are regulatory in their action, a fact on which earlier investigations had thrown some doubt. It indicates that there are considerable fluctuations in the water-content of a normal leaf, and that the regulation of water-loss by the stomata is very effective when they are nearly closed.

SILK WEAVERS AND THEIR OUTPUT.—In Report No. 17 of the Industrial Fatigue Research Board, Mr. P. M. Elton analyses the differences in the output of individual silk weavers. Silk weaving is a highly skilled occupation, and it takes at least two years to teach a girl to weave quickly and well. Hence it is very important that unsuitable girls should not waste their own time, and that of their employers, in undergoing training. Training has often been faulty in the past, and in consequence bad methods of work are acquired which are never eradicated. So important is the human factor for success in silk-weaving that the quickest operatives consistently produce about twice as great an output as the slowest. Mr. Elton analyses the causes of these wide variations in detail, and his report should be of great value to those engaged in teaching young weavers. A weaver has to have good eyesight, be dexterous with both hands (for in weaving both hands are simultaneously employed on very different operations), and have a delicate sense of touch. Mr. Elton has not endeavoured to determine the most suitable tests for would-be apprentices to the weaving industry, but there should be no difficulty in the choice of some of the necessary tests. A thoroughly adequate selection can only be made gradually, after much experiment, but few more fertile fields for the application of the principles of "vocational selection" can offer themselves than that of weaving.

ELECTRICAL PRECIPITATION IN INDUSTRY.—In the Journal of the Society of Chemical Industry for February 15, Dr. H. J. Bush gives an account of the industrial applications of electrical precipitation. In 1884–86 Sir Oliver Lodge carried out experiments on the electrical deposition of fog and smoke, and patents were taken out in England and other countries during those years. In 1884 Dr. Karl Moeller, in Germany, obtained an independent patent. In 1906, Dr. F. G. Cottrell, Director of the United States Bureau of Mines, then professor of physical chemistry in the University of California, repeated Lodge's experiments in connection with the removal of acid mists, and in his hands the process has been largely developed. During the war a very large Cottrell plant was in operation at the Queen's Ferry works, and an installation was designed by the Lodge Fume Co. for cleaning blast-furnace gases. Dr. Bush gives an account of these and other plants. The principle is very simple. An insulated wire hangs inside a metal tube, both being connected with a high voltage transformer, or special electrodes are hung between metal plates. The fume passes through the apparatus, and the electric discharge brings about its precipitation. The mechanism of the process appears to be somewhat obscure, and the account given by Dr. Bush is very empirical. Further scientific work will probably throw light on this interesting process. Electrical precipitation has a large field of possible applications.

SEPARATION OF ISOTOPES OF MERCURY.—In the January number of the Journal of the American Chemical Society, Prof. W. D. Harkins and R. S. Mulliken describe the experimental separation of mercury into isotopic fractions by evaporation in a vacuum. A difference in density of 133 parts in a million was obtained. A theoretical discussion of the resolution of isotopic mixtures by diffusion and similar processes is given, and equations are obtained showing the rate of separation to be expected in such processes. This work supplements previous results by other workers given in NATURE, vol. cvi. p. 144; vol. cviii. p. 209.

AMMONIA OXIDATION.—During the war the oxidation of ammonia was studied in England with a view to its application in the State factory for the fixation of nitrogen. Although the other parts of the chain of operations leading from atmospheric nitrogen to nitric acid never materialised, the process of ammonia oxidation was brought to the stage of technical application, and was taken up by different firms in connection with the supply of oxides of nitrogen to sulphuric acid chamber plants. In the Journal of the Society of Chemical Industry for February 28, Messrs. C. S. Imison and W. Russell, of the United Alkali Company, give a very interesting and detailed account of the improved process now in operation. They remark that, so far as their experience goes, there is little difference in cost between this and the old retort processes for making strong nitric acid with nitre and ammonia at present prices, but if the published estimates for the cost of synthetic ammonia are realised in this country, the balance will turn strongly in favour of the oxidation process. They also point out that the oxidation process is an integral part of the process for the fixation of atmospheric nitrogen, which, in conjunction with a fixation process for ammonia, would render this country independent of overseas supplies of nitre in the event of another war. It seems strange that, among so much legislation for "key industries," the absolutely vital problem of nitrogen fixation has never been mentioned.

RADIUM MINING.—In a circular issued by the Colorado School of Mines, entitled "A World Storehouse of Rare Metals, Radium, Uranium and Vanadium, the Paradox Field of South-western Colorado," interesting information is given of the present conditions prevailing in what is undoubtedly the richest radium region of the world. The ore mined is carnotite, a potassium uranyl vanadate of the composition $K_2O,2UO_3,V_2O_5,3H_2O$, occurring in sandstone in the San Miguel, Dolores, Mesa, and Montrose counties of S.W. Colorado. The ore, as mined, contains usually from 1·4 to 1·8 per cent. of uranium oxide, averaging some 4 milligrams of radium to the ton and 4 or 5 per cent. of vanadium oxide. Of a total of 52,000 tons produced in the U.S.A., Colorado has produced 48,700 tons, of which 38,000 tons were mined by one company, the Standard Chemical Co. of Pittsburgh. Smaller quantities have been produced also in Wyoming and Utah. The ore is prospected for by diamond drilling to a depth of some 40 feet and mined by inclined shafts and gravity tunnels. The deposits occur in sedimentary rocks, and so far are confined practically to what is known as the M'Elmo formation. Though easily recognised as outcrops, the deposits of carnotite are exceedingly variable and obey no law of deposition. They are often associated with fossil wood as "logs," in which the mineral has replaced the trunks of trees embedded in the rocks. It is concentrated *in situ*, if of less than 2 per cent. U_3O_8 content, and furnishes not only the largest present source of radium but also an important source of the vanadium, now so largely employed in the manufacture of special steels. The Colorado School of Mines maintains a special well-equipped radioactivity laboratory for the estimation and evaluation of these ores.