

Research Items.

PREHISTORIC IVORY FIGURINE FROM EGYPT.—Among the more important objects discovered by the British School of Archaeology at Qau in Egypt during the excavations of last season was a female figure rudely carved in ivory. It differs from any of the prehistoric ivories hitherto known. On the same site were found ripple pottery and a number of objects—a globular vase with four small handles, a long narrow palette, a flint dagger, and a small oval vase with cylindrical neck, all of types not previously known. It would appear that these finds represent a culture apart from the usual prehistoric Egyptian, though on much the same level and using the same materials but in a different way. The ivory figure is not of the steatopygous type. The arrow heads and other flint work point to a connexion with the makers of the Fayum desert flints, which are of Solutrean style. Sir Flinders Petrie in describing these finds in *Ancient Egypt*, 1924, Pt. ii., suggests that the culture may have originated in Central Asia, whence the Solutrean workers are supposed to have come. This civilisation, for which the name Badarian is suggested provisionally, from Badari, the district around Qau, would thus be the earliest of any known in Egypt, though not necessarily contemporary with the European Solutrean period.

CURRENCY OF THE GUPTA DYNASTY IN EASTERN INDIA.—In the course of some notes on the Gupta and later Gupta coinage in the *Journal of the Asiatic Society of Bengal*, N.S., xix., Pt. 6, Mr. N. H. Bhattasali discusses the origin of the so-called "Imitation Gupta coins." These coins are of base gold and approximate to a standard of 95 grains, considerably less than the Gupta standard. They were in circulation in Eastern India only. Although they cannot be attributed to the Gupta imperial dynasty, it is evident that they were issued by a family which had a veneration for Gupta traditions. It is also evident that the king who was responsible for their issue claimed paramount power in virtue of the performance of the horse sacrifice. This would point to the first king of the Gupta dynasty of Magadha, Aditya Sana Deva, who rose to power after the death of the last sovereign of the imperial line, with which he was connected, and is known to have celebrated the horse sacrifice. The fall of the Magadha dynasty was followed by a period of anarchy in which all knowledge of arts and crafts was lost, so that when the Mohammedans first entered Bengal they found that the only currency in use consisted of cowrie shells, no minted money having been struck for four centuries.

PRAKRIT AND SANSKRIT LINGUISTICS.—Sir George Grierson has won for himself a world-wide reputation by a long series of masterly works upon the languages of Hindustan, culminating in the magnificent "Linguistic Survey of India" published by him for Government, and now happily almost completed. His latest contribution to these studies is "The Prakrit Dhātvy-ādeśas according to the Western and the Eastern Schools of Prakrit Grammarians," published in vol. viii., No. 2, of the *Memoirs of the Asiatic Society of Bengal*. As is generally known, the modern Aryan languages of India are all derived from the ancient dialects represented in literature by the Vedic and Sanskrit. The intermediate links were the Prakrits or ancient forms of popular speech, which in their turn were cultivated for literary purposes and studied by many grammarians, whose surviving works, so far as they are known, fall into two classes,

an Eastern school, deriving from Vararuci and his successors, and a Western school, based upon Hēmacandra. The present work deals with the verbal roots which are specifically recognised by the grammarians as used in Prakrit and as differing from the corresponding Sanskrit roots. It consists of two indexes: the first of these contains the Prakrit roots arranged alphabetically, in the order of their Sanskrit forms, in parallel columns showing the respective paradigms quoted by five leading native grammarians, while the second presents the roots arranged in their own alphabetical order with parallel columns showing the various meanings assigned to them by the same grammarians. It is rounded off by an introduction and an appendix containing the text of a chapter on the same subject from the *Prākṛita-kalpataru*, a Sanskrit grammar by Rāma Śarman, and altogether will be of the greatest utility to students of the ancient literary Prakrits and the modern vernaculars of India.

CONTROL OF PESTS IN GLASS-HOUSES.—The Annual Report for 1923 of the Experimental and Research Station at Cheshunt gives a record of steady progress and widening scope of activity. The variety and manurial trials with tomatoes have been revised to bring them more into line with present-day requirements, and valuable results are anticipated. A definite relation has been determined between manurial treatment and blotchy ripening of fruit, the proportion of blotchy fruit being heavy when the soil is deficient in both nitrogen and potash, and reduced when these substances are added to such soil. Experiments on the destruction of red spider by fumigation indicate that the action of gases and volatile liquids is ineffective owing to their rapid escape from the atmosphere in glass-houses and owing to the difficulty of keeping up a comparatively high concentration of the vapour sufficiently long to kill the spider. As recorded by Messrs. E. R. Speyer and O. Owen in *NATURE* of June 7, p. 820, naphthalene, when heated, seems to be the type of fumigant best suited to the purpose, provided that, within broad limits, the amount of its vapour in the atmosphere can be controlled so that no injury is caused to the plant. Other tests show wood-lice can be controlled by the introduction of small quantities of phenol into the soil, but unless commercial phenol can be utilised, the method is too expensive for ordinary use. In view of the suggested fertilising value of increased quantities of carbon-dioxide in the air of glass-houses, continued experiments have been made to overcome the technical difficulties involved in the control of the concentration of the gas, and increased yields of tomatoes have been obtained in certain cases, encouraging further research on the subject.

SURFACE TENSION OF SPRAY LIQUIDS.—In the control of insects by poisonous sprays, the power of the liquid used to wet and spread over the surface to which it is applied is as important a factor as its toxicity to the organism against which it is directed. Woodman (*Journ. of Pomology and Horticultural Science*, iv., No. 1) has now shown by carefully devised physical experiments that the surface tension of a spray liquid may be reduced to a certain critical value by the addition of small quantities of soap, under which conditions the surfaces of leaves are easily wetted and the maximum amount of spray liquid retained by them. Further reduction of surface tension increases the "spreading power" of the spray though not its "wetting power." Increases of viscosity by the

addition of gelatine at about 0.3 per cent. concentration causes the retention of much more of the spray fluid on account of the adsorption of gelatine by the leaves. Forcible spraying, when the drops pass rapidly through the foliage, also augments retention. By measuring the areas of spread of lenses of liquids on wax surfaces, it has been determined that the reduction of surface tension of the spray fluid below 32 dynes/cm. greatly increases the area of spread. This indicates the economic advantage of soap as a "spreader," owing to the very low surface tension of dilute soap solutions. The greatest spread is obtained with small drops applied with considerable force, which supports the advocated practice of mist-like spraying, though it is pointed out that reduction in the size of drops would lead to decreased "force" in passing the leaves and so to a lessened retention of the spray liquid.

WATER ABSORPTION BY COCO-PALMS.—The *Philippine Journal of Science* for July 1924 contains a paper by Messrs. R. B. Espino and J. B. Juliano dealing with the rate at which roots of *Cocos nucifera* (*in situ*) absorb three- or four-salt culture solutions. The solutions absorbed most rapidly are characterised by a rather high proportion of magnesium sulphate. In this respect the results resemble those previously obtained for rice, except that the latter apparently requires less concentrated culture media. Maximum absorption in the coco-palm takes place between one and two o'clock in the afternoon, and it is shown that variations in the rate of absorption correspond quite closely to variations in the rate of transpiration. The apparent width of the leaf pinnae is inversely proportional to the rate of absorption. The fact that water absorption depends upon the evaporating power of the air leads the authors to suggest that successful cultivation of this palm is possible even in climates usually regarded as too dry, if soil moisture is supplied in sufficient quantity.

THE GENETICS OF TOBACCO.—While parthenogenesis has been known to occur in two varieties of *Nicotiana Tabacum* grown in England, various tests have shown that this process is almost unknown in North America. The question has been re-examined at Pusa by Messrs. G. L. C. Howard and Kashi Ram (Mem. Dep. Agric. in India, Bot. Ser. 13, No. 1), who were unable to obtain evidence of parthenogenesis in either of the varieties tested. Parthenocarpy, however, occurred in *N. Tabacum*, var. *Cuba*, this always being associated with white flowers and also with especially vigorous growth of the parent plant. The inheritance of characters in Indian varieties of *N. rustica* has also been studied by G. L. C. Howard, and the results are described in the same number of these memoirs. Neither parthenogenesis nor parthenocarpy were observed. The characters of the F_1 plants were intermediate between those of the parents, except that the average height was always greater than that of the taller parent. The difference between short and tall types appears to be due to a single factor which causes elongation of the internodes both of the stem and of the inflorescence. A frilled leaf margin is dominant to a smooth edge and is apparently associated with the presence of a single factor.

RAINFALL MAP OF SWEDEN.—Owing to the widespread distribution of rainfall stations in Sweden which has grown since the start of the Hydrographic Service in 1907, it has been found possible to produce a rainfall map of the country with much greater accuracy than of old. *Nederbördskartor över Sverige* by Axel Wallen appears as Band 2, No. 3

of *Meddelanden från Statens Meteorologisk-hydrografiska Anstalt*. It contains a map of the annual rainfall based on the figures from 1881 to 1920 and twelve maps of monthly rainfall. In the north, where stations are few, the records probably do not express the full value of the fall and they have been adjusted by data derived from the flow of rivers. In the north-east, such corrections should probably also be made, but the figures do not appear to be available. The paper contains a summary of the data employed and a discussion of the cartographic methods employed. The Swedish rainfall figures for 1923 are published by the same department in *Aarsbok*. 5. The volume includes rainfall maps for each month of the year 1923.

EXPERIMENTS ON A MERCURY ARC RECTIFIER.—In the *Zeitschrift für Physik* for August 8, Messrs. W. Schottky and J. von Issendorff describe experiments designed to elucidate the peculiar effect produced when different voltages are applied to the wall of a mercury arc rectifier. The current curve obtained with a probe electrode was quite similar to that with the rectifier; when the electrode was 12.2 volts above the cathode voltage, the current, I , flowing from the discharge into the electrode was zero; but it very rapidly increased, as the voltage diminished, towards a saturation value. The greater part of the rise of current took place between +12.2 and zero volts, after which down to -100 volts it rose very slowly indeed. To determine the nature of this current, the authors measured the heating effect produced by it in the probe electrode, by means of an auxiliary heating coil, insulated in such a way that the whole of the heat produced by it went into the electrode. In this way the watts required to give the temperature rises produced by the current I at different voltages were determined, and it was shown that, with constant current through the electrode, the connexion between the heat produced and the voltage was a linear one. The relation was such that, within the limits of accuracy of the measurements (about 20 per cent.), it can be stated that the subsidiary current is due entirely to the flow of positive ions into the electrode. There is therefore no secondary production of cathode rays in the region examined. There is a distinct dark space round the probe, which only vanishes when it is made the anode. The suggestion previously made, that measurements of potential in the mercury arc with a probe are several volts too low, is confirmed.

THE EMISSION OF ELECTRONS CAUSED BY α -RAYS.—Dr. A. Becker has carried out a very comprehensive investigation on this subject, in which the phenomena were studied in high vacua. The α -rays were sent through foils of different thicknesses of aluminium, silver, and gold, and the movements of the electrons were controlled by fields of different signs and different intensities, produced between an electrode consisting of the preparation holder and foil and a surrounding electrode, or a parallel plate (*Annalen der Physik*, September). About ten electrons were produced per α -particle, when this had the velocity 1.5×10^9 cm. per sec., and about twenty with half this velocity, using any of the three metals. It was shown that the emission requires no essential outside acceleration, so that the electrical method employed in determining the velocities of the electrons, or δ -rays, is good in principle. Using a central field (an outer spherical electrode with the preparation holder at the centre) the curve of velocity distribution is very similar to that of the electrons from an incandescent solid, but varies from this at high velocities, which are more

frequent in the first curve than in the second. Within the limits of experimental accuracy, the first curve agrees with the Maxwell law of velocity distribution. These results were confirmed by experiments using homogeneous fields between two parallel condenser plates. It is probable that the distribution of velocity is independent of the direction of emission, and that the distribution in different directions follows the cosine law. The distribution of velocity, and its absolute value, are independent of the nature of the metal employed and of the velocity of the α -rays. The "most probable" velocity corresponds to a potential drop of about two volts; higher velocities than those corresponding to about twenty volts cannot with certainty be shown to exist. The results make it uncertain whether the two kinds of electron emission mentioned can be regarded as due to the same fundamental mechanism.

SINTERED GLASS FILTERS.—The *Chemiker Zeitung* (1924, vol. 48, p. 693) contains an account of the tests carried out by Moser and Maxymowicz at the Technische Hochschule, Vienna, of the new glass-filters made by the well-known Jena firm of Schott und Gen. These filters are an improvement upon the asbestos pads of the Gooch crucible, since the glass filtering layer is fused into the glass crucible, the lower rim of which projects beyond it for protection. Various grades are made according to the fineness of the precipitates to be collected. Successful quantitative tests were carried out with silver chloride, lead sulphate, lead chromate, mercuric sulphide, cuprous thiocyanate, nickeldimethyl glyoxime, barium sulphate, calcium oxalate, etc. The calcium oxalate can be weighed as $(\text{COO Ca})_2 \cdot \text{H}_2\text{O}$ and attempts are being made to estimate various metallic ammonium phosphates as such. The filters were found to resist the action of dilute and concentrated acids, including aqua regia, but are readily attacked by alkalis. Aqueous ammonia can, however, be used. The main disadvantage lies in the fact that variations of as much as 0.4 mgm. were found in the weighings unless the crucibles were allowed to stand for several hours in the desiccator.

CHEMICAL CONSTANTS.—In the April-July volume of the *Compte rendu des Séances de la Société de Physique*, of Geneva, the question of the calculation of the entropy of a gas from the point of view of the quantum theory is discussed by A. Schidlof. It is pointed out that the problem involves the quantification of the energy of translation of the gas molecules, and the difficulties arising out of this are mentioned. In the case of a gas consisting of N molecules in a volume V , the volume V/N may be taken as that in which the quantified motion takes place (Sackur), or, alternatively, the cube of the mean free path (Schrödinger). There is only one case free from ambiguity, namely, when the volume V contains only one molecule which can assume all the states of motion compatible with the conditions imposed. With this case, an expression for the entropy is found containing an additive constant, and it is claimed that neither Nernst's theorem nor the quantum theory allows of this constant being neglected. In the calculation of the chemical constant of a monatomic gas, the number N does not appear in the result, and the author shows that it is also unnecessary to introduce it into the deduction. The formula is that of Sackur, and differs from that found by Tetrode and by Planck.

THE COMPOSITION OF CHROMIC ACID.—The hydration product present in an aqueous solution of chro-

mium trioxide has usually been supposed to be dichromic acid, $\text{H}_2\text{Cr}_2\text{O}_7$, on the basis of the colour of the solution and conductivity measurements combined with cryoscopy. In the August number of the *Journal of the Chemical Society*, Mr. H. T. S. Britton describes some measurements with the hydrogen and oxygen electrodes in solutions of chromic acid which lead to the result that the acid is H_2CrO_4 , dissociating in two stages: $\text{H}_2\text{CrO}_4 \rightleftharpoons \text{H}^+ + \text{HCrO}_4^- \rightleftharpoons 2\text{H}^+ + \text{CrO}_4^{2-}$. The first stage is almost complete in dilute solutions; the second dissociation constant is very small, 4.4×10^{-7} at 18° . The use of the oxygen electrode as an indicator of both hydrogen ion concentrations and as end-points in titrations was made possible by comparison with the hydrogen electrode, and the method used appears to offer possibilities of application in other fields.

ATOMIC WEIGHT OF ALUMINIUM.—The June issue of the *Journal of the American Chemical Society* contains a description of the analysis of aluminium chloride by H. Krepelka, of the University of Prague. In a previous determination, with Prof. T. W. Richards, the value 26.963 was found as a mean of four analyses of aluminium bromide, the value given in the International Tables being 27.0. In the present research, pure aluminium chloride was synthesised from very pure chlorine and the purest obtainable aluminium. Eleven different fractions of the chloride, digested and repeatedly sublimed in nitrogen and in a vacuum, were analysed. The ratio $\text{AlCl}_3 : 3\text{Ag}$ was determined, with three different samples of standard silver. The mean of the eleven determinations is $\text{Al} = 26.972 \pm 0.001$, with $\text{Ag} = 107.88$ and $\text{Cl} = 35.458$. The most probable figure is considered to be the mean value of 26.963 and 26.972, namely, 26.97. It is remarked that, according to Aston, aluminium is a pure element, of mass 27, its nucleus being composed according to the scheme $4n+3$. The new result confirms the previously accepted value of slightly less than the sum of the nuclear masses of helium (4.00) and hydrogen (1.008), and although the three hydrogen nuclei are satellites, the new value suggests a slight loss of mass due to the disturbing effect of electromagnetic forces within the nuclear system.

PSEUDO-EPIBERBERINE.—In the August number of the *Journal of the Chemical Society*, Buck and Perkin describe experiments which involve at one step the condensation of 1-homopiperonyl-6 : 7-dimethyltetrahydroisoquinoline with methylal, under conditions the same as those previously used by Pictet and Gams. Crystalline products, however, could not be isolated. When the methyl alcoholic solution was treated with formaldehyde, the formyl derivative separates as a gum, and on warming with hydrochloric acid, this is at once converted into the sparingly soluble salt of what was anticipated would prove to be tetrahydro-epiberberine. It was proved conclusively that this was not the case, and that the mode of condensation assumed by Pictet was incorrect. The isomeric alkaloid produced is called tetrahydro-pseudoepiberberine. For example, when treated with sodium hydroxide, the substance decomposes into oxy-pseudoepiberberine and dihydro-pseudoepiberberine, a reaction exactly analogous to one previously investigated in which epiberberinium chloride is converted into oxy-epiberberine and dihydro-epiberberine. In the same journal, Haworth, Perkin, and Rankin show that a similar state of affairs exists with respect to berberine, and that the tetrahydroberberine described by Pictet and Gams is probably not that substance, but an isomeride.