RESEARCH ITEMS

New South African Stone Age Cultures

DR. E. G. N. VAN HOEPEN in his presidential address to Section E of the South African Association for the Advancement of Science on July 5, 1938 (*Argeologiese Navorsing Nas. Mus.*; 9, 10, 1939), in discussing certain aspects of South African archæology, adduced argument for the conclusion that there had been in the Stone Age in South Africa, as in Europe, two civilizations, existing side by side simultaneously, of which one was characterized by implements made on cores ('Fauresmith', Vaal, Stellenbosch), and one by implements made of flakes (Koning, including three industries, Wilton, Smithfield, Koning ; Mossel Bay ; and Pniel). Further research and exploration have since brought to light new cultures, confirming and extending the application of this view. A number of cleavers from Wellington made from river boulders, one side showing the original surface, are of more primitive form than the Vaal cleavers, and though Pniel in shape and technique, represent an earlier flake industry, which it is proposed to call the Wellington industry, to distinguish it from the Pniel industry, in conjunction with which it constitutes the Pniel culture. It is contemporary with Stellenbosch. A second new culture comes from the Brakfontein farm, and is a congeries of flakes and implements which cannot be placed in any of the known industries. The flakes are large, a breadth of twelve inches being not uncommon. More often the implements are broader than they are long. Flakes have been made into implements by secondary trimming of the edge opposite the bulb of percussion. They resemble flaying knives from the Koning industry, but are larger and cruder. Probably Koning is derived from them. Two other localities are known but not yet worked. The Brakfontein culture, as it is proposed to call it, may have been contemporary with earlier Mossel Bay, to which belong a number of long flakes recently found at Swartfontein with 175 hand-axes of the Vaal and Stellenbosch cultures. The Swartfontein flakes are distinct from the Mazelspoort, and it is proposed to differentiate the two as the Swartfontein and Mazelspoort industries, constituting together the Mossel Bay culture.

Chromosomes of the Pig

F. A. E. Crew and P. C. Koller (*Proc. Roy. Soc. Edin.*, 59, 163–175 ; 1939) show that the chromosome complement of the pig is $2n = 38$, with a range in chromosome size of $7 \cdot 5 \mu – 1 \cdot 5 \mu$. There is little, if any, terminalization between mid-diplotene and metaphase, and the chiasma frequency in some chromosomes appears to be proportional to the length of the chromosome. The five larger bivalents exhibit localization of chiasmata ; consequently, recombination of genes on these chromosomes is expected to be peculiar and limited. The Y, with a sub-terminal centromere, pairs with one arm of the medially attached X, while the other arm of the X chromosome appears to be the differential segment. Pre-reduction is obligatory in the XY bivalent. Evidence of at least one inversion is given.

Chromosome Rearrangements in Drosophila

B. P. KAUFMANN (*J. Hered.*, 30, 171–190 ; 1939) irradiated Drosophila males and studied the salivary gland chromosomes of the progeny. Deficiencies, duplications, translocations, transpositions (intra-chromosomal translocations) and multiple exchanges involving up to eight breaks were found. The author points out that chromatid and chromosome breaks caused by X-rays do not provide unequivocal evidence for the time of chromosome splitting.

Temperature Rhythm in an Ant-hill

THE temperature changes within the mound of a widely distributed species of Japanese ant, *Formica truncorum truncorum* var. *yessensis*, have been investigated by Mutsuo Katô (*Sci. Rep. Tôhoku Imp. Univ.*, 4 Ser., 14, 53 ; 1939). The diurnal temperature rhythm in the interior of the mound was remarkably different from that of the air temperature, for at a depth of 20 cm. or more below the surface it was almost constant, ranging only from $26 \cdot 1°$ to $28 \cdot 8°$ C. Even at a depth of 10 cm. the temperature was fairly constant ($24 \cdot 6° – 30 \cdot 9°$ C.), but at lesser depths the influence of the rhythm of solar radiant energy became more and more apparent as the surface was approached. The mounds are composed of masses of withered grass, bits of leaf-stalks and twigs loosely piled on bases of living trees or stumps ; they are thus partially insulated by the content of air interlaced in the material of the mound. Nevertheless artificial mounds showed, at corresponding depths, greater temperature fluctuations than the ant-hills, and this was due to temperature regulation within the latter. The main source of heat is undoubtedly the sun, and although during periods of activity the ants may add a little to the sum total, further regulation of the internal temperature is brought about by the opening and closing of the entrances to the mound. When the day is declining many ants carry material which is used in blocking the passages made for exit during the day-time, and thus the loss of heat which would take place during the night is reduced.

Market Economics of the Apple

AN interesting study of the complex relations between quality and price of McIntosh apples sold in the New York City markets has been made by John R. Raeburn (*Cornell Univ. Agr. Exp. Sta. Mem.* No. 220. Ithaca, U.S.A., March 1939). The average diameter, the amount of red-coloured skin, the practice of 'facing' or having the top layer of apples superior to the general sample, and serious and not-serious defects produced by insect attack, by fungal parasites or by bruising, all affect the price received. Their effects are interrelated, and a method of surface correlation involving the presentation of data in three dimensions has been used to reveal the joint effects of two variables upon the dependent variable, price. One important result of the study concerns the economic effects of high-quality grading. Separation of the highest quality fruit does not produce the greatest financial return ; the utilitarian needs of the ultimate consumer provide a surer basis for grading. Prices recorded in the

present investigation indicate the gastronomic, rather than the æsthetic, value of the fruit. Serious and not-serious defects affect prices jointly, for the influence of one type depends upon the proportion of the other. This finding vindicates the numerous recent studies of pests or parasites which have little effect upon their hosts. They predispose the market against even slight occurrences of more serious defects. The paper under review gives many other detailed correlations, several of which are crystallized into definite recommendations for the farmer or the market organizer.

Observation of Growing Roots

OBSERVATION trenches for the examination of roots in the field are described by W. S. Rogers (*J. Pom.*, 17, 99 ; 1939) in an account of four years' work on the growth of apple roots at East Malling. The trenches, which were 4 ft. 6 in. deep and 2 ft. 6 in. from the tree trunks, were provided with plate-glass windows held against the soil profile. They were enclosed to form wooden cabins and protected from light. 14 year-old Lane's Prince Albert apple trees were observed over four years and the time and rate of root growth, suberization and formation of laterals recorded. During active growth, the rate of root elongation approximated 3 mm. per day, while suberization occurred when the roots were a week to a month old. Small roots died and disappeared after suberization. Larger ones persisted, often with rapid secondary thickening, and produced laterals. Root growth was closely correlated with soil temperature, very little growth occurring in winter at soil temperatures from 35° F. to 45° F. Active growth began at about 45° F. and increased up to 69° F. (at 8 in. deep). It began before the leaves unfolded, and continued after shoot growth ceased. A fall in soil moisture checked root growth though the moisture content was still well above the wilting range. In spring, most root growth occurred in the warmer surface layers of soil and in winter in the lower layers. The greatest concentration of roots occurred at a depth between 5 and 30 inches. A comparison of trees on stocks I, IX and XVI showed that the amounts of root corresponded with the relative vigour of the stocks, but the mean growth-rate per root was similar for all stocks. It appeared that physiological differences between the rootstocks were relatively small.

Apparent Shape of Protein Molecules

IT has been recognized for some time that protein molecules are probably not spherical and the term dissymmetry constant was introduced by Svedberg for the ratio f/f_0, where f and f_0 are the measured molar frictional coefficient (derived from sedimentation and diffusion experiments) and the theoretical value for a spherical molecule of the same molecular weight, respectively. H. Neurath, (*J. Amer. Chem. Soc.*, 61, 1841) has applied Perrin's diffusion equation to the problem, this equation involving the long and short axes of a prolate ellipsoid of revolution. The results are subject to large limits of error but they show that, with a few exceptions, protein molecules are not spherical, and most exhibit high molecular dissymmetry. Proteins which belong to different groups as regards their molecular weight become members of the same group if arranged according to their molecular dimensions. Thus, cytochrome C, gliadin and erythrocruorin, with molecular weights of 15,600, 26,000 and 31,400, have a common short diameter of about 18 A. Comparison of the dimensions of proteins with those of their respective dissociation and aggregation products indicates that cleavage occurs only in directions parallel to either the major or minor molecular axis.

Diffusion Velocity and Molecular Weight

CONSIDERABLE interest has recently been shown in the use of diffusion velocity in determining molecular weights, calculations having usually been made by the Stokes-Einstein diffusion equation : $D = (RT/N) . 1/(6\pi\eta r)$. L. Friedman and P. G. Carpenter (*J. Amer. Chem. Soc.*, 61, 1745 ; 1939) point out that the diffusion coefficient to be used in this equation should be that at infinite dilution, and by plotting diffusion coefficients against the square root of the concentration and extrapolating the straight line to zero concentration for some sugars and salicin, they find reasonable values of the molecular weights. An experimental study of the diffusion velocity of glucose by this method gave the correct molecular weight. It is pointed out that the relationship holds for a substance of molecular weight as low as 180, whereas most investigators have felt that the Stokes-Einstein relation could not be applied to substances of such low molecular weight.

Detection of Carbon Disulphide Vapour

LEAFLET No. 6 of the series by the Department of Scientific and Industrial Research on methods for the detection of toxic gases in industry deals with carbon disulphide vapour (H.M. Stationery Office. 3d. net). It is stated that the permissible concentration of carbon disulphide vapour in the atmosphere of work-rooms should be kept well below one part in 30,000 of air and preferably below one part in 100,000. The method of detection of the vapour depends on its interaction with diphenylamine and copper acetate to produce a coloured compound, copper diethyldithiocarbamate, and full instructions for carrying out the tests are contained in the leaflet, which is bound in strong paper covers.

Impurities in Brass

FOR the last seven or eight years, on the recommendation of the American Society for Testing Materials, the Non-Ferrous Ingot Metal Institute has supported a research on the effects of impurities and heat treatment on the physical properties of brass which has been carried out by H. B. Gardner and C. M. Saeger at the National Bureau of Standards. Two papers on the effects of pouring temperature and of sulphur and iron impurities have already been published, and in the June issue of the *Journal of Research* of the Bureau a third on the effects of aluminium and of antimony appears. Cast red brass of composition 85 per cent copper, 5 per cent each tin, zinc and lead was remelted and up to 0·10 per cent aluminium or 0·23 per cent antimony added and specimen bars cast at temperatures from 1230° to 1065° C. in chilled or unchilled or sand moulds. The running properties were observed and tests of density, hardness, tensile strength, porosity under hydraulic pressure and electrical conductivity were made. Pouring temperature had little effect, but aluminium, while improving the running properties, lowered the ductility, hardness, tensile strength and electrical conductivity and raised the porosity of the brass. Antimony increased slightly the running and decreased slightly the conductivity, but its other effects were insignificant.