Research Items

Giant Hand-Axe from Sheringham, Norfolk. An altogether remarkable and gigantic hand-axe, discovered embedded in the beach below Beeston Hill, Sheringham, by Mr. J. P. T. Burchell, has been figured and described by Mr. J. Reid Moir (*Proc. Prehistoric Soc. East Anglia*, **7**, Pt. 3). The implement measures in its greatest length 15½ inches, in greatest width 6¼ inches, in greatest thickness 5¼ inches. Its weight is approximately 14½ lb. It was derived originally from the base of the Cromer Forest bed, which rests upon the surface of the chalk. The implementiferous bed runs in beneath the Forest Bed strata and the glacial deposits which form the cliff, some 200 ft. in height. The material of the axe is of flint, the colour of the flaked surfaces being jet black. The ridges and outstanding parts are abraded, and it is striated in places. There is a small area of the cortex remaining, which shows a ferruginous staining. It is a specimen of the 'platessiform' type, that is, rhomboidal in section in the anterior portion and showing the remains of both the dorsal and ventral planes or platforms of the rostro-carinate stage. In two other specimens cited for purposes of comparison, coming from East and West Runton, one is clearly of the 'platessiform' type, but the ventral plane is partly transformed into a cutting edge, while the second is equally clearly of the 'batiform' type, in which the section through the anterior portion is triangular in section, the lower angles of the triangle representing the cutting edges. Hand-axes showing these characteristics have been discovered not only in England but also widely distributed over the earth's surface. The numerous specimens discovered in the basement bed, belonging to the early Pleistocene epoch, are as highly specialised as are those of any later prehistoric period and represent a very definite and necessary stage in implemental development. No adequate explanation of the purpose which the gigantic size of the Sheringham axe could serve has been offered.

Racial History in Scandinavia. Dr. Stanislas Zejmzejmis has constructed an anthropological map of Scandinavia, and from this has reconstructed the racial history of the peninsula in the light of archæological and historical material. He has drawn his anthropological data mainly from military statistics and other published material, which he has analysed in accordance with the anthropological methods of Czekanowski (*L'Anthropologie*, **45**, 1–2). The existence of four physical types is established as 'fundamental' in the sense of Czekanowski: Mediterranean, Nordic, Lapoid and Armenoid. The Mediterranean provinces, which play an important part in the peninsula, are centrally situated at Dalecarlia in Sweden, and Hedmark and Oppland in Norway. They are surrounded by provinces of transition in which the Mediterranean type diminishes in favour of the Nordic or Lapoid. The essentially Nordic provinces form not one, but two zones, the first in southern Sweden (Skaraborgs, Jänköpings, Oestergötlands, Göteborgs, Aelvsborgs), the second in Norway (North and South Tröndelag), lying on each side of the lenticular centre. Outside these provinces are territories in which is found a strong proportion of the Lapoid element. In the north of Norway (Tromsø and Finmark) this reaches as high as 33 per cent. In Sweden the proportion is not so great; in the south, Scania and the adjacent regions correspond to the Norwegian Rogaland. The Armenoid does not play an important part, and nowhere does it exceed 3–5 per cent. The most ancient stratum of the prehistoric population (for example, Stägenäs of the Ancylus period) is Mediterranean, possibly Cro-Magnon. It is followed by the Lapoids of the south, who possibly are to be related to Ofnet. The northern Lapoids are distinct and later, being Laps. The Nordics appear with the last great neolithic migration into Scandinavia. The brachycephals of southern Scandinavia are to be closely associated with Maglemose and the Danish kitchen-middens. The Nordics belong to the following Littorina period when the climate of Europe, becoming drier, was favourable to their nomadic habits. The Norwegian Nordics are of secondary origin. The Armenoids appear to have arrived at the end of the neolithic or beginning of the bronze age.

Spearman's General Factor in Mental Activity. *Character and Personality*, **3**, No. 2, contains an article, "On the Nature of Spearman's General Factor", by Prof. Wm. McDougall. He presents Prof. Spearman's case for the existence of a general factor, usually represented by the letter *G*, which enters into all mental activity and is revealed in mental testing, and he considers the problem of determining the nature of *G*. Two questions arise. First, in what kind of operation does *G* most clearly manifest itself? Secondly, what is the underlying cause or condition which thus manifests itself? To the first question a satisfactory answer can be given, but the second presents a number of problems. Spearman favours "a quantity of intellective energy" as the answer. McDougall criticises this view, and suggests that both the supply and the direction of energy should be considered, and that a definition of *G* as "power of effective concentration of energy" is nearer the truth. The study of the effect of emotional excitement on cognitive activity, and the lack of any common factor so far from tests on animals, leads to the conclusion that 'integration' is the answer to the problem. "In proportion to the degree of integration achieved the whole mind works as one system which dominates and controls all its parts." Prof. McDougall does not claim that his solution is final, but his arguments are stimulating and convincing.

Chinese Fishes. In the *Journal of the Shanghai Science Institute* (Section 3, vol. 1, 1934), Mr. Shigeru Kimura publishes a "Description of the Fishes collected from the Yangtze-kiang, China, by late Dr. K. Kishinouye and his Party in 1927–1929". The collection is very large and of considerable interest, coming from the tributaries of Yangtze-kiang, from Szechwan Province, and consisting of fishes belonging to 63 genera and 28 families. There are among them 11 new species, one of which is a handsome member of the Salmonidæ, *Hucho bleekeri*, represented by one specimen only from a mountain stream. The name *Hucho* is from *Hu-yu*, meaning tiger-fish, a name given by the natives to various different forms. Seven new species belong to the Cyprinidæ, and one each to the Cobitidæ, Siluridæ and Bagridæ. The paper is well illustrated by plates in black and white, and there is a map showing the localities from which the material was collected.

Crustacea of the Vanderbilt Expeditions. The fifth volume of the "Scientific Results of the World Cruise of the Yacht *Alva*", 1931, with William K. Vanderbilt commanding, deals with Crustacea (*Stomatopoda* and *Brachyura*. By Lee Boone. *Bull. Vanderbilt Marine Mus.*, **5**; 1934. Huntington, L. I., New York, U.S.A. Printed Privately). It describes the zoological material personally collected by Mr. Vanderbilt during a series of cruises in his yachts, and deposited in his marine museum. The latest collections were made by the yacht *Alva*, and the present work is as beautifully printed and illustrated as were the former volumes. Miss Lee Boone describes every species in detail, many of them being very rare, citing the type of each and where it is to be found, its distribution and reference to previous descriptions. There are three new species of crabs: *Actæomorpha alvæ*, an interesting form representative of a little-known genus of the family Leucosiidæ and resembling in appearance the cancroid genus *Actæa*: *Lissocarcinus elegans*, a new swimming crab connecting the sub-family Caphyrinæ with the Lupinæ: and *Actæa aphrodita*, a pretty little crab from the coral reefs of Bali. Colour plates and notes of several forms were made at the time of collecting by Mr. W. E. Belanske, staff artist of the expedition, under the direction of Mr. Vanderbilt, and are deposited in the Vanderbilt Marine Museum.

Storage of Avocado Pears. As Memoir No. 1, the Low Temperature Research Station of the Imperial College of Tropical Agriculture publishes a study of storage possibilities with Avocado pears, which includes points of both scientific and commercial interest. The authors, Dr. C. W. Wardlaw and Mr. E. R. Leonard, point out that most of the orchards of this plant in the West Indies are stocked with plants grown from seed so that there is great variety in the produce, a diversity which extends to their behaviour in storage conditions and makes their behaviour quite impossible to predict in relation to an export trade. They emphasise, therefore, that the first step, if an export trade is to be built up, is to select certain definite varieties, which these preliminary tests show to possess possibilities, to use these only for purposes of propagation, and to study the behaviour of experimental consignments of these varieties under export conditions. It is suggested that these preliminary exports should be kept at a steady temperature of 45° F. At this temperature many of the local varieties manifest phenomena of 'chilling' which have considerable interest. Maturation processes still continue in the internal tissues in these chilled fruits, but the biochemical processes take an abnormal trend. The onset of chilling is shown to be closely associated with a phase of the process of ripening in the fruit.

Taxonomy of Wild Hybrids. In his presidential address to the Botanical Section of the American Association for the Advancement of Science (*Science*, **81**, 161), Prof. K. M. Wiegand discussed the subject of wild hybrids from the taxonomic point of view. He cited his experience with the genus *Amelanchier* in eastern North America, in which, after many sortings of herbarium specimens, he finally reduced them to six piles (species) and a seventh pile including heterogeneous forms with intermediate or combination characters, local distribution and other features of hybrids. In Newfoundland, where the conditions had been disturbed by forest cutting, a mixture of hybrids was found, but in less disturbed areas the plants were more uniform. The conditions of hybridity in various other genera, such as *Crataegus*, *Rubus* and *Quercus*, are discussed, and it is concluded that hybridisation has probably played little part in evolution. The eastern American species are regarded as nearly all going back to the Glacial period or much earlier, and species formation as a very slow process. While this doubtless contains much truth, it is possible that the evolutionary importance of polyploidy, and particularly amphidiploidy, has been underestimated.

Life-History of *Endophyllum sempervivi*. A very full account of the life-history of a rust fungus on houseleek plants has recently been published by Dorothy Ashworth (*Trans. Brit. Mycol. Soc.*, **19**, Part 3, 240–258, February 1935). Investigations have been made into almost all the phases of activity of the fungus. Binucleate sporidia germinate to form germ tubes, which penetrate the epidermal walls of the host. Uninucleate mycelium is produced, and spermagonia appear in spring. Masses of æcidial primordia occur at the base of each spermagonium, and after the production of secondary primordia, the hyphæ become binucleate by nuclear migration. Æcidiospores formed from these mycelial threads have four nuclei, and give rise to a tri-septate promycelium from which four sporidia or basidiospores are abstricted. It is interesting to note that æcidia can be formed without the intervention of the spermatia; diploid mycelium can be produced as a result of hyphal fusions. *Endophyllum sempervivi* is a perennial fungus, and the mycelium appears to be always uninucleate until æcidia begin to develop. It is not typical of the rust fungi in that æcidiospores produce basidia directly, without the intervention of uredo- or teleuto-spores.

Ship Waves. T. H. Havelock (*Proc. Roy. Soc.*, A, April 10) has made some calculations on the wave-making resistance of simplified ship forms, taking into account fluid friction. In the absence of fluid friction, the energy absorbed in making waves is the same whether the model is moving bow first or stern first, even when the model is not symmetrical fore and aft. The main effect of fluid friction is to lower the relative wave-making effects of the after parts of the surface, and in some cases calculated the effectiveness of the stern is lowered by about 40 per cent. This reduction introduces a difference between the wave resistances for ahead and astern motion. Calculations are also made of the wave profile using the corrections for fluid friction, and these agree well with observation.

Rotation of Molecules in Liquids. X-ray studies have shown that the molecules of a liquid possess a spatial distribution comparable with that occurring in a crystalline solid. The centre of gravity of a liquid molecule can be imagined as oscillating about a point which is itself slowly moving. Furthermore, there exists a coupling between neighbouring molecules, and hence the latter cannot be considered as completely free to rotate. Instead, they are constrained to perform rotatory oscillations about an axis the orientation of which varies slowly. The effect of this constraint on the molecular polarisation and the Kerr effect of a liquid substance has been examined by P. Debye (*Bull. Classe Sci., Acad. roy. Belg.*, **31**, 166; 1935). The calculation shows that the coupling, measured by the energy required to rotate a molecule through 90°, is quite large, being as much as 10 kT for water. The fact that the

molecular polarisation and the Kerr effect of a substance in solution are both less than for the same substance in the vapour state also follows from the theory. Thus the effect of dissolving monochlorobenzene in hexane is completely explicable on the basis of a coupling energy equal to $0 \cdot 75\ kT$.

Negative Ions in the Glow Discharge. Little work has been done on negative ions in the glow discharge, and they are commonly neglected in theories of the discharge. J. L. Spencer Smith has carried out careful work on the glow discharge in iodine (*Phil. Mag.*, April and May, 1935), and he finds that in this vapour negative ions are present in large numbers and exert a strong influence. In one series of experiments various regions of the discharge were investigated by the Langmuir probe method, and an analysis of the probe currents showed that negative ions are present in numbers about equal to the positive ions. In further work, negative ions from the discharge were drawn through a perforated probe electrode into an independently exhausted space and analysed by a magnetic field. I^-, I_2^- and I_3^- ions were found. The beams of negative ions obtained in this way were used for some approximate measurements of the collision probability between negative ions and neutral iodine molecules by measuring the absorption of the beams in iodine vapour.

New Method of Distinguishing Amylases. Basing himself upon the observations of Wijsman (*Rev. Trav. Chim.*, **9**, 1; 1890), K. Venkata Giri has recently suggested a simple qualitative method of characterising different amylases which may prove to have a wide range of usefulness (*J. Indian Inst. Sci.*, **17A**, 11, 127–129). A small drop of the enzyme is added to an agar gel carrying a suspension of starch and allowed to diffuse for 24–28 hours at laboratory temperature. The gel is in a Petri dish, and at the end of this period a dilute solution of iodine is poured on for a few minutes, until the diffusion zones show clearly. In the case of β-amylase the central diffusion zone is coloured violet; in the case of α-amylase it is colourless. The results of its use with taka-diastase, salivary amylase and pancreatic amylase are described.

Standard Methods for Testing Wood Preservatives. In 1930, a conference was held in Berlin to discuss the possibility of arriving at a standard method for testing the toxicity of wood preservatives in the laboratory. At this conference there was general agreement as to the form which the tests should take, and a report of the decisions taken was published in NATURE (**126**, 921; 1930). A committee was set up at the meeting to organise a series of co-operative tests to determine how far the suggested method could give consistent results when carried out in different laboratories by different workers, and to settle details of technique. The results of the committee's work have been published in *Angewandte Chemie* (**48**, 21; 1935) in which is given an account of the experiments made in order to compare the activity of various isolations of the different test fungi chosen, and of the results obtained in different laboratories in comparative tests on identical samples of sodium fluoride and creosote. A detailed description of the standard method adopted for carrying out the recommended wood block test (*Klötzchenmethode*) is also included, together with a note on the 'agar' method (*Rohrchenmethode*). It is to be hoped that, in future, laboratory tests upon the toxicity of wood preservatives will be carried out, so far as possible, by this standard method, so that results obtained in different laboratories may be directly comparable.

Boundary Friction of Oxidised Lubricating Oils. Dr. Redgrove's paper on the "Boundary Friction of Oxidised Lubricating Oils", read before the Institution of Petroleum Technologists on April 9, is in fact an account of experiments conducted during the period 1927–31. Conclusions then reached agree substantially with those obtained as a result of more recent research, even though the particular problems under consideration were attacked from an entirely different angle. Since small percentages of the higher fatty acids improve lubricating qualities of mineral oils under boundary conditions, experiments were made to ascertain whether the less volatile petroleum acids exerted a like beneficial effect. Preliminary investigations with blends of a mixed base distillate oil and 1 per cent of fatty acids showed that there was a definite variation of coefficient of friction with temperature. A special apparatus was, therefore, designed in which temperature could be rigidly controlled, and results proved that the lower molecular weight fatty acids do not reduce the coefficient of static friction of mineral lubricating oils under boundary conditions. Moreover, they showed that the true criterion of lubricating values is rather the effective length of the hydrocarbon chain, normal to the bearing surfaces, attached to the adsorbed polar group, than the volume of the molecule. The greater the length of this hydrocarbon chain, the greater the flexibility of adsorbed molecules. Such a theory in conjunction with thermal vibration explains the low coefficient of friction of mixtures containing the higher molecular weight saturated fatty acids. Certain oxidation products of mineral lubricating oils are believed to be multipolar, and to them is due the elimination of the friction/temperature rise normally characteristic of non-oxidised mineral lubricating oils. If, however, asphalt is formed and deposited on the bearing surfaces as a result of the oxidisation, then an increase in the coefficient of static friction is likely to occur.

Systematic Displacements of Lines in Stellar Spectra. The radial velocity of a star as determined from the line displacements in its spectrum is found to depend slightly on the lines chosen for measurement. The lines of different elements give different results, though in general these differential effects are only very small. They may be caused by the influence of interstellar matter or by conditions in the stars themselves. The latter cause of the effect has been studied by Adams and McCormack (*Astrophys. J.*, **81**, 119; 1935) in the case of nine stars of different types, all of which are sufficiently near to eliminate the effect of interstellar absorption. The chief lines affected are the *H* and *K* lines of calcium, the sodium *D* lines and a pair of Al I lines, all of which give systematic differences of the order of -5 km./sec. from the normal stellar lines. It is suggested that the hypothesis of a gradually expanding envelope surrounding the star affords the best explanation of these results. Three of the stars (including γ Cygni) are exceptionally interesting. The neutral Fe lines give larger results than those from ionised Fe, and Ce II gives larger values still. In such cases the hypothesis of radial convection currents affecting lines of different levels differently seems to be the only adequate explanation.