Research Items

Polychrome Jewellery in Kent. A new view of the origin and dating of the garnet-inlaid jewellery from Teutonic graves in Kent is put forward by Mr. T. D. Kendrick in *Antiquity* for December. According to the generally accepted view of the two groups into which this jewellery falls, one (Style *A*) characterised by closonné and filigree, in which there is no chip-carving and niello is rare, is regarded as later than the class (Style *B*) in which chip-carving and cast settings are the rule, niello is common, and there is no filigree and no closonné. The earlier, Style *B*, is dated as from the early sixth century, while Style *A* is assigned to late sixth or early seventh century, one view holding that the latter represents Jutish supremacy under Ethelbert. It is here suggested, however, that a substantial part of the polychrome jewellery belongs to an earlier Kentish population than the Jutes of Ethelbert, and that the two groups are contemporary and belong to the archæology of the Jutish invasion, with a central date at about A.D. 500. It is clear that Style *A* had a cultural background of its own, remarkable for its 'luxury' or foreign aspect, being associated with Coptic bronze bowls, amethyst beads and cowries. It is also associated with 'British' hanging bowls. Its distribution in the main is along Watling Street, while Style *B* is found chiefly in Thanet and the Sandwich country. While Style *B* may well be Jutish, it is suggested that Style *A*, which exhibits unrivalled workmanship and is clearly a distinct culture, was of British origin. The distribution of the two cultures is explicable on the supposition that for a time the Dover road continued to be held by British when all other lines of communication had been blocked by the Jutes and that the Teutonic settlements along the Watling Street are those not of Jutes but of miscellaneous Teutonic mercenaries called in to help keep open communications with the Continent.

Rain-making in Neolithic Times. Prof. L. Joleaud (*Revue Scientifique*, Nov. 25) constructs a pedigree for certain rites connected with rain and the supply of water in rivers, lakes and wells in north-west Africa, which extends back to neolithic times, through references in classical authors, analogies from Ancient Egypt and the rock drawings of North Africa, more particularly in Morocco and the Sahara. The essential feature in the modern rites is a procession of domestic animals, especially rams and oxen, accompanied by men bearing ladles and spades and sometimes playing ball with sticks, hand or foot. The beasts are decked with various ornaments and trappings, feathers, leaves, amulets, etc. Both animals and men participating should urinate in the course of the ceremony: and special honour is paid to the genital organs of both men and beasts. The rock-drawings of Oran, and to a less extent of the Sahara, bear witness to the neolithic origin of these rites. Rams and oxen, similarly caparisoned, are shown in the drawings taking a prominent part in invocation rites. In some instances, what would appear to be intended for rain is falling on the animals. Sometimes men or beasts are shown urinating or preparing to perform that act. In a cave at Cape Spartel in northern Morocco a large number of terra-cotta models of neolithic date of the genital organ of rams and bucks have been found, which, apparently, had served as idols or *ex-votos*. The place of the ram, which is the most prominent animal in the neolithic rites, is taken later, at about the period of the æneolithic age in Egypt, by the bull. Prof. Joleaud traces the connexion of these early animal figures with animal-headed gods such as Ammon and their development into anthropomorphs.

Mammals of California. Dr. Joseph Grinnell has compiled a catalogue of the recent mammal fauna of California in which he indicates the place of the original description, the type locality and the range of 460 species and sub-species, including four sub-species of man (Univ. California Pub. Zool., **40**, No. 2, 71–234; 1933). This number of distinct forms, which includes 220 full species, has greatly increased since the first Californian list, of 1868, with its 115 kinds, or even the 1906 list of Frank Stephens, with 276 kinds. The list includes several species of non-native mammals such as the black and Norway rats, the Alexandrine rat and the house-mouse, only the first of which is relatively scarce and is confined to coast-wise cities. Equally successful in its powers of colonisation has been the Virginian opossum, first introduced by man probably about the beginning of the present century and now present in nearly all the counties of San Francisco Bay region and of the Pacific slope of Southern California.

Territory in the Life of Birds. The theory of territory in bird life, enunciated by Eliot Howard some twenty-five years ago and supported by the field observations of himself and others, has never gained complete acceptance; and now David and Dr. Lambert Lack have formulated a reasoned argument against the wholesale application of the theory (*British Birds*, 179; Dec. 1933). Were territory a primary requirement for success in reproduction, it might be expected to be universal amongst birds. It is not universal, and many of the most successful amongst birds are colonial breeders. Moreover, according to the authors, there is no good evidence that territory is important in conserving a food supply for the young. Many territorial birds, like colonial birds, obtain their food, not from their own 'territory', but from a common feeding ground; they allow other members of the same species to feed in their territory; and, on occasion, even their own selected females may ignore the territory of their mate and build in that of another male. Indeed 'territory' is really nothing more than a male bird's song centre, in which he can sing and display in prominence, and since these activities are at their highest at the beginning of the breeding season, it is only at that period that territory is strictly maintained.

Russian Spiders. A list of the spiders of the U.S.S.R., prepared by Prof. D. Charitonov, has just been published by the Leningrad Academy of Sciences (Katalog Russkich Paulov, *Ann. Mus. Zool.*, **32**, 1–206). The classification adopted is that of Petrunkevitch (1928) and the list includes the names of 1,068 spiders found in Russia, with the localities and captors of each species. The introduction and notes are printed in Russian and German. All records to

1930 are included, but many districts are still unsearched and a large increase may be expected. Of the 222 genera mentioned, 163 are also British, so that the work supplies a welcome addition to our knowledge of the range of many British species. It appears that more than half the Russian spider fauna belongs to four families—Linyphiidæ 261, Lycosidæ 145, Attidæ 127 and Thomisidæ 110 species, the corresponding British figures being approximately 240, 36, 33 and 34. Before long, Great Britain will be the only European country in which a recent list of the native Araneæ is not existent, a fact which should be remedied.

Biology of *Calanus*. In a contribution to the literature of *Calanus*, Dr. Sydney G. Gibbons gives an account of material collected in a restricted part of the North Sea ("A Study of the Biology of *Calanus finmarchicus* in the North-Western North Sea". Fishery Board for Scotland. Scientific Investigations. 1933. No. 1) Of all the copepods caught in the nets, *Calanus* predominates to a large extent in almost every haul; at certain times (May–August) the mean percentage abundance reaching 70 or more. Special attention is given to the separate stages picked out from the plankton, from nauplius to adult—eleven stages in all. The author is able to show that from the last larval stage (fifth copepodid stage), which shows no trace of external sexual characters, the perfect male or female arises. Besides this he has found a sixth nauplius stage, not before noticed, coming between the fifth nauplius and the first copepodid stages. The area investigated is difficult to compare with other regions where *Calanus* has been specially worked out. There is a very small winter population which in November consists of slowly developing late copepodid stages. By February many have grown into adults which breed, and nauplii appear. A rapid rise in numbers in April is due in the north to additions from outside, in the south from breeding of adults already there. Soon the southern section is inundated with 3rd and 4th copepodid stages from outside. The influx first affects the north, then the south, and the *Calanus* population is due both to movement from north to south and to development within the area.

Polyhedral Cells. F. T. Lewis has recently discussed the shapes of cells (*Proc. Amer. Acad. Arts and Sci.*, **68**, June 1933), in the investigation of which he has employed the wax-plate reconstruction method. He states that tissues are not composed of rhombic dodecahedral cells, truncated or otherwise, for these shapes have characteristic tetrahedral angles which cells avoid. In a mass of cells of approximately uniform size, the average cell has fourteen faces of contact with its neighbours; it is a tetrakaidecahedron. Data in support of this are given for 100 cells in elder pith and in fat tissue and for 50 cells in precartilage in the tadpole of *Bufo*. In the elder pith the cells tend to be in orderly arrangement in columns, but in fat and precartilage the cells, with the same number of facets, seem piled in lawless confusion. A reconstruction shows 16 cartilage cells, with an average of 14·1 facets, which had 12–21 facets each. The author adds a surmise concerning nerve cells and neuroglia, pointing out that these two types of branching cells arise out of the primitively uniform cells of the medullary tube. Since cells formed around nuclei distributed at random are on the average 14-hedral, it may be assumed that the primitive cells of the medullary tube are of this character. He suggests that the nerve cells imbibe, grow and send out processes; the neuroglia cells become relatively shrunken. The processes of the nerve cells, one axone and the dendrites, would grow out along the lines of least resistance, extending from the corners of the cells as shown in a model, but with the regression of the neuroglia the intracellular spaces would become large and the dendrites would not preserve their angular kinks.

Primulas in Bhutan. A very interesting account of a botanical tour in Bhutan, a State between India and Tibet, appears in No. 87 (vol. 18) of *Notes from the Royal Botanic Garden, Edinburgh* ("Botanical Tours in Bhutan, with Special Reference to the Occurrence of the Genus *Primula*", by Roland Edgar Cooper, pp. 67–118, Nov. 1933). The author visited Bhutan in 1914–15, touring the country extensively. Notes of the general distribution of vegetation are given, but the various members of the genus *Primula* received special attention. Several new species or forms are described in the paper under review, and seventeen out of the thirty-two sections of the botanical genus occur in Bhutan. The species are all described according to the classification of Smith and Forrest (1928), and are extremely useful in providing information about the natural habitats of many garden primulas.

Fungi causing Sooty Moulds. Several European mycologists have, in time past, described various fungi which produce a black, powdery mould upon the leaves of various plants. The idea that this condition was due to infection by two or more fungi had been growing, but proof is now forthcoming ("The 'Sooty Moulds' of some Australian Plants", by Miss E. E. Fisher, *Proc. Roy. Soc. Victoria*, **45**, N.S., Pt. 2, 1933, pp. 171–203). Sooty moulds on plants of *Bursaria spinosa*, *Leptospermum* spp., *Myroporum insulare* and *Melaleuca* sp. have been investigated. On some hosts the mould consists of two fungi, but usually there are three types: a perithecial stage, which is often a species of the genus *Teichospora*, a pycnidial stage, and an open conidial stage. The fungi of each stage which appear upon the hosts mentioned above are described in minute detail, both as they occur in Nature and as they behave upon culture media.

Observations on a Tropical Cyclone. The *Marine Observer* of October 1933 contains an account of a particularly violent hurricane through which the S.S. *Phemius* passed on November 5–9, 1932, when on a voyage from Savannah to Colon. The description is by the observing officer, Mr. H. Nicholas. It does much to correct the impression of symmetry and simplicity sometimes conveyed by accounts of tropical cyclones in meteorological textbooks. Four barometric minima were experienced, and on one day—November 6—two lulls with phenomena characteristic of the calm 'eye' of a storm were experienced at about 2 a.m. and 4 p.m., each of which lasted about an hour. The *Phemius* lost her funnel and had derricks, lifeboats and bridges wrecked by the force of the wind, the speed of which was estimated as two hundred miles an hour, and for a long time the ship was carried by the storm in an unmanageable state. The lowest barometric minimum occurred at

8 p.m. on November 5, this being the first of the four minima, which followed a continuous and very rapid fall of pressure. The reading fell to 914·6 millibars (27·01 in.), which is 4·3 millibars (0·13 in.) lower than the previous lowest verified barometer reading recorded in a tropical cyclone, namely, in the hurricane of September 19, 1885, which passed over False Point, River Hooghly. The ship's barometer, it may be noted, had only recently been supplied by the Meteorological Office, and had been certified by the National Physical Laboratory during the previous year. On emerging into fair weather, the *Phemius* was taken in tow by a salvage steamer, and the hurricane continued northwards to cause much damage on Grand Cayman Island.

Pipe Heaters and Coolers. The report by Dr. Ezer Griffiths and Mr. J. H. Awbery on the measurements they have made at the National Physical Laboratory under the auspices of the Engineering Committee of the Food Investigation Board on the heat transfer between metal pipes and a stream of air was read by the authors before the Institution of Mechanical Engineers on December 15. It supplies more definite information than has been available hitherto on the effects of the speed and temperature of the air, the size and temperature of the pipe and its position with respect to neighbouring pipes, on the interchange of heat between air and pipe. For dry pipes the interchange is the same for the same two temperatures whether the pipe is hotter or colder than the air. If ice or snow form on a cold pipe but remain dry, the abstraction of heat from the air is the same as from a bare pipe of the diameter and temperature of the outer surface of the covering, but if water is dripping from the ice or snow the heat abstracted is increased 30 per cent. In all cases turbulence in the air stream increases the heat interchange.

Background Noise in Amplifiers. It has long been recognised that some of the background noise in valve amplifiers is due to the inherent properties of materials as they exist. In a paper read to the Institution of Electrical Engineers on December 6 by E. B. Moullin and H. D. M. Ellis, the causes that give rise to the noise are divided into two classes. There is first the spontaneous voltage in the circuit called 'thermal agitation', and there is secondly the inherent mechanism of thermionic conduction within a valve which is called the Schrott effect. The experimental work described in this paper is a continuation and amplification of the pioneer work done by other scientific workers. All the component portions of an amplifier produce spontaneous fluctuations of voltage and those harmonic components which are inside the acoustic range disclose themselves by making background noise. This noise is always a scratchy hissing noise, but the general level of the pitch rises with the frequency of the circuit. The experimental results given verify the theory. It is shown that bare wire is unsuitable for use in the early stages of a high magnification amplifier as it exhibits curious effects when it carries a current. The electric current passing from the filament to the anode of a thermionic valve is now considered to be a stream of individual electrons. The pattering of these electrons on the anode maintain it at a fluctuating potential. Since these electrons come to rest in the space charge at random intervals of time, they arrive at irregular times and so participate in the general Schrott effect. According to the authors' view, the Schrott voltage is due essentially to the anode circuit receiving current by discrete charges, and must always occur.

Collisions of Neutrons with Atomic Nuclei. Feather (*Proc. Roy. Soc.*, A, Nov.) has carried out further cloud-chamber investigations on the collisions of neutrons with light atomic nuclei. The neutrons were derived from a polonium-beryllium source and the tracks were studied in oxygen, an oxygen-hydrogen mixture and a mixture of acetylene and helium chosen to have suitable properties for the working of the expansion chamber. A frequency curve of the ranges of the oxygen recoil atoms is similar to the curve for nitrogen collisions, obtained from previous work and presented here in a revised form. Few oxygen recoil atoms have a range greater than about 2·8 mm. of air. Using data of Blackett and Lees to correlate range of recoil atom with velocity and assuming that the collisions of the neutron are elastic, most of the neutrons are found to have an upper energy limit of about $4{\cdot}5 \times 10^6$ volts. It is not clear whether the neutrons form a homogeneous group or a continuous distribution, since the distribution curves of the recoil atom energies are in any case continuous. The interpretation of the tracks obtained in the mixtures is complicated. The distribution curve for the acetylene-helium mixture shows a pronounced change in slope at 46 mm. range; this may be ascribed to helium or to carbon. In the former case, it would indicate the appearance of a group of neutrons of energy about 1·1 million volts—presumably produced by resonance disintegration, and in the latter case it would indicate the presence of neutrons of more than 10 million volts. The study of the brightness variation of several individual tracks indicates that they ought to be ascribed to carbon nuclei, and gives some evidence in favour of the existence of high velocity neutrons. In addition to the elastic collisions, disintegrations were observed in oxygen, and ascribed to the capture process $O^{16} + n \rightarrow C^{13} + He$, the energy relations requiring the production of a high energy γ-ray. The disintegration of carbon is very rare, if existent, only one case being found in more than two thousand photographs.

Temperature Data of Metals. Sir Robert Hadfield and the Research Department of his firm, Messrs. Hadfields, Ltd., Sheffield, have recently published a new edition of a temperature chart extending from −273·05° C. up to the temperature of the electric arc, which they give as 3,700° C. (T.6165. 1*s*.). The melting and boiling points of various materials are tabulated, the greatest care having been taken to ascertain the latest and most reliable data. An interesting, and unusual, feature of this chart is that the degree of accuracy with which the temperature is known in any particular case is indicated by the manner of its presentation. Thus, up to a temperature corresponding with the melting point of copper, 1083·0° C., the temperature is regarded as being reliable to within ±0·1° C., whilst at the melting point of molybdenum, 2615° C., the degree of accuracy is regarded as ± 5° C. In addition to the data for the pure results, the melting points of various refractory materials, the temper colours of steel and other industrial temperatures of importance, are recorded. The purpose of the chart is stated to be: "To present to those concerned, in convenient form, various temperature data of general interest", and in this the producers are singularly successful.