Research Items.

Medieval Indian Dress.—Mr. K. de B. Codrington contributes to the *Indian Antiquary* for August the first instalment of a study of medieval Indian culture as illustrated in the frescoes of the Ajanta Caves. The style of the frescoes, though mannered, is based on a minute observation of life; and there is no reason to doubt that the textiles, arms, and accoutrements are a faithful witness to vanished originals, except in the case of the frescoes of Buddha, of which the piled-up head-dresses and the jewelled necklaces never existed outside the tradition. With regard to chronology, four, or at most five, sequence styles can be detected, and the work is of the sixth and perhaps part of the seventh century, but certainly not later. Mr. Codrington here deals with costume and embroidery and textiles. It is usually said that cut and sewed garments were unknown in ancient India. Though this is borne out by the early sculpture at Bharhut and Sanchi, it does not apply to Ajanta. The indoor costume of the women consisted of a waist-cloth of varying length, usually supported by a beaded or jewelled belt. Occasionally a breast-cloth or scarf is worn. On other occasions a knee-length garment was worn, apparently slipped over the head, fitting tightly on the shoulders, and opening up on either side. With it was worn a long-sleeved waist-length bodice. The waist-cloth is the chief costume of the men, though the hunters and other forest people wear the small loin-cloth. A long-sleeved tunic to the knee is worn by soldiers and horsemen. Another type of jacket had short sleeves and ended at the waist. There are embroideries at the wrists, upper arm, and neck, and sometimes down the front. In some cases the dress seems to be a uniform. Here a waist-cloth is worn, but princes and heroes wear *paijamas* or tight-fitting 'jodhpurs'. With these one prince wears scarlet leather slippers.

Arterial System of Lemurs.—One of the most interesting results of the investigation of the anatomy of *Loris lyddekerianus* by Drs. A. Subba Rau and P. Krishna Rao (*Half-yearly Jour.*, Mysore University, vol. 4, p. 90, 1930) is the detailed description of a plexiform condition of the subclavian, external iliac, and middle sacral arteries. This leads to a general discussion of the purposes served by arterial plexuses, which, although most often found in aquatic air-breathing animals, are not confined to these and reveal no phylogenetic relationship or indeed at first sight any similarity of habit in their possessors. This is evident from their occurrence in creatures of such different modes of life as fishes, birds, and amongst mammals, ungulates, cetaceans, and lemurs. Various suggestions have been made as to the significance of the plexuses, such as that they merely represent a persistence of the embryonic phase of the arterial system, or that the minute branches diminished the velocity of the blood stream to the muscles, or that they served to maintain normal circulation during the period of contraction of the muscles. Judging from the structure and position of the plexuses in *Loris*, and from the association of venous with arterial plexuses, the authors "reaffirm the proposition already hinted at by Caralisle and add confirmative evidence in support of the view of Burne that these plexuses serve as storage tanks for arterial blood", and that they "regulate the supply of blood to the limbs in the same way as the spleen functions in regulating the blood supply to the viscera".

Aalborg Herring.—The Report of the Danish Biological Station to the Ministry of Shipping and Fisheries, **35**; 1929, by the Director, Dr. A. C. Johansen, contains some very interesting work. In the first part, "The Aalborg Herring and its Importance to the Danish Herring Fishery from the XVIth Century until the Present Day", Dr. Johansen deals with the history of the Limfjord herring fishery. In early years the Aalborg herring was the only one in the Limfjord, coming in from the Kattegat to spawn, but the breaking through of the Agger Isthmus in 1825 and the consequent inflow of salt water from the North Sea influenced the fishery profoundly. Not only was there an immigration of fish of different races from the west but also the altered conditions of salinity affected the spawning grounds of the original herring. There is distinct evidence to show that the eastern herring of the Limfjord of the present day is the descendant of the original Aalborg herring, having the same habits. Together with those of other races from different parts, it almost certainly spends part of its life in the Skagerrak feeding on the abundant and rich plankton to be found there, which fact accounts for its quality and its importance for centuries in the Danish fishery. The present day herring fishery, although proportionally not so large as in early years, is in a flourishing condition and the last decades show a decided increase, partly owing to the use made of the young, known as 'silding'.

Plankton of British Columbia.—Mr. G. H. Wailes has been occupying himself for some years with the marine plankton of British Columbia, publishing from time to time his very useful summaries of the various groups in the *Vancouver Museum and Art Notes*. The present paper, "Marine Zoo-Plankton of British Columbia" is reprinted from Vol. 4, 1929, of that publication, and embodies an address given to the Burrard Field Naturalists' Club on Oct. 25, 1929. The chief interest of this plankton lies in the fact that many forms are common to the Pacific and Atlantic and a plankton haul from Vancouver does not look very different from one from British seas. Some species are certainly different, but many may be closely related, such as *Calanus tonsus*, which to a large extent replaces *Calanus finmarchicus* in the Strait of Georgia. In the list of Copepoda are to be noted as abundant such common British species as *Calanus finmarchicus*, *Pseudocalanus elongatus*, *Metridia lucens*, and *Anomalocera pattersoni*, and similarly in other groups one meets many species which are familiar. A table is drawn up to show the food chains in the sea with special reference to *Clupea pallasi*, the Pacific herring, and the sock-eye salmon, *Oncorhynchus nerka*, including the various enemies of the latter fish.

Northern Echinoderms.—Two papers in *Bergens Museums Arbok* for 1929 deal with echinoderms. The first, by Mr. James A. Grieg, "Some Echinoderms from the South Shetlands" (Naturvidenskapelig rekke No. 3), describes some interesting collections from the Whaling Station in Admiralty Bay and from two of the whaling boats probably taken near the same locality. Among the sixteen species recorded there are some which are very little known and have only rarely been seen, and some which hitherto were only recorded from the Antarctic regions. In the second paper (No. 9) Mr. Sven Runnström describes a new spatangid larva from the west coast of Norway. These occurred between 50 and 100 metres, only four being found, representing a series of developing stages. The youngest larva still contained a good deal of yolk, showing that it must have come from a

yolk-laden egg. Red-gold yolky eggs were also collected which probably belonged to the same species. The author suggests that the eggs and larvæ are those of *Briaster fragilis*, the development of which was unknown but whose yolky eggs led Dr. Mortensen to predict direct development.

Mollusca from the Raised Beach at Portland Bill.—Collections have from time to time been made of the molluscan remains occurring in the raised beach at Portland Bill by such well-known observers as Pengelly, Prestwich, Damon, and Sykes, as well as by the Geological Survey, but so far no list has been given including the results of all their published observations. This has now been done by Mr. D. F. W. Baden-Powell (*Proc. Malac. Soc. Lond.*, Vol. 19), who has further added to the number of species found, which thus amounts to more than fifty, and supplied notes concerning each. With one possible exception, none of the forms is extinct, and the lower limit of age of the deposit may therefore be placed in the Pleistocene, and perhaps rather after the middle thereof, rather than in the Pliocene. The assemblage represents a more northern one than that now found at Portland, and the suggestion is that the sea at the time of the formation of this raised beach was colder than at present.

Temperature Gradients in the Permian of Texas.—W. B. Lang has discussed the depressed isogeothermal surfaces of the Permian Basin of Western Texas (*Jour. Wash. Acad. Sci.*, April 4, 1930). A well was recently drilled 4400 feet through Permian formations carrying anhydrite, into Carboniferous and Pre-Cambrian rocks. The subnormal gradient characteristic of the Basin was met with until the anhydrite beds were passed through, after which the gradient rapidly steepened. It therefore appears that internal heat is being conducted more rapidly by the anhydrite than by the underlying sediments. The thermal conductivities of anhydrite and rock salt are respectively 0·0123 and 0·0137, values twice as high as those characteristic of ordinary sediments. It is pointed out that our present data on the thermal conductivities of rocks as they exist under natural conditions are very meagre. The effects of compaction, porosity, bedding, mineral orientation, degree of cementation and water content have rarely been considered, although when cumulative they may be very great. There is urgent need for research on these lines, for until better data are forthcoming geothermal problems cannot be attacked with precision.

Copper Belt of Northern Rhodesia.—The new copper field of Northern Rhodesia gives promise of becoming the greatest copper-mining centre of the world, for already the ore-reserves have been estimated at between 500 and 1000 million tons of copper. A detailed account by Alan M. Bateman of the deposits and their geological setting and origin appears in *Economic Geology*, June–July, 1930, pp. 365-418. The rocks of the area consist of an old basal complex overlain unconformably by the ore-containing Roan Series. The latter are continental sediments cut and metamorphosed by granite intrusions that represent the magmatic source of the copper. The areal distribution of the granite along the copper belt suggests a slightly eroded batholith with pendants of sediments projecting deeply into the granite. The pitchblende of Katanga has been shown by its lead ratio to be of late Pre-Cambrian age, and since the copper sulphides of Rhodesia and Katanga evidently belong to one metallogenic epoch, the Roan Series must therefore almost certainly be of Pre-Cambrian age. The sediments have been folded into open pitching folds with a north-westerly trend, giving V-shaped outcrops. The ore-beds are disseminations of minute specks of copper sulphides with sparse but deep oxidation in all the mines. The paragenesis is pyrite, linnæite, chalcopyrite, chalcopyrite and bornite, bornite, bornite and hypogene chalcocite, hypogene chalcocite, supergene chalcocite, and oxidation products. The latter probably formed at great depths during a former period of desert climate.

Wireless Echoes.—The address given by Prof. Carl Størmer to the Royal Society of Edinburgh on Feb. 17 has now been published in the Society's *Proceedings* (vol. 50, p. 187). He discusses the problem of whether the 'wireless echoes of long delay' come from space outside the moon's orbit or not. In a communication to NATURE of Jan. 5, 1929, he said: "the mathematical theory of the motion of electric corpuscles around a magnetised sphere shows that the chances of obtaining a well-defined toroidal space round the earth are good when the direction to the sun lies near the magnetic equatorial plane (perpendicular to the magnetic axis)." He predicted that it was very improbable that echoes would recur before the middle of February. This prediction was duly verified by several physicists. In particular, two observers in Indo-China observed two thousand echoes from a relatively small emitter station. The echoes came about 30 sec. after the signal and their amplitude was sometimes as great as one-third of the signal. Some of the experiments recorded prove conclusively that they were echoes. It seems as if the space outside the earth's orbit was traversed intermittently by very unstable streams of electrons. This may explain the great variety of echo times observed. It is also possible that multiple echoes may be caused by reflection between the inner walls of the toroidal space. The great variety of echoes is similar to the great variations in aurora phenomena and magnetic perturbations. If this explanation is correct, these wireless echoes give a striking proof of the corpuscular theory of aurora and a valuable method for exploring electron currents in cosmic space.

X-ray Wave-lengths and the Electronic Charge.—The determination of an X-ray wave-length by means of a ruled grating, in correlating quantities of atomic and of macroscopic dimensions, leads indirectly to an evaluation of the charge (e) on an electron, and, as is well known, the value of e obtained by this method is slightly larger than that found by the oil-drop method of Prof. Millikan. Further evidence for the reality of this discrepancy is furnished by some measurements of the wave-lengths of the L lines of molybdenum, of which an account is given by J. M. Cork in the second June issue of the *Physical Review*. The gratings used were of glass, ruled with either 30,000 or 14,400 lines to the inch, and were mounted in a vacuum spectrograph in direct connexion with a hot-filament X-ray tube. The values obtained for the wave-lengths of the $L\alpha_1$ and $L\beta_1$ lines were 5·4116 A. and 5·1832 A. respectively, whereas it was calculated on the basis of Prof. Siegbahn's measurements with a gypsum crystal that if calcite had been employed and corrections made for refraction, the two numbers would have been 5·3960 A. and 5·1674 A. The corresponding value for e is $4{\cdot}8162 \times 10^{-10}$ e.s.u., which is slightly larger than the number given by J. A. Bearden as a result of similar measurements with the K radiation of copper.

Cleavage Tests of Timber.—One of the tests made in connexion with the anisotropic properties of timber is a determination of its resistance to cleavage by the

application of equal and opposite loads, up to fracture, along the diameters of incomplete holes bored in flat specimens cut so that the stress is normal to the direction of the grain. An investigation by the photo-elastic method of the stresses which are set up, with the obvious limitation that the models used are isotropic, is described by Prof. E. G. Coker and G. P. Coleman in the *Proceedings of the Royal Society* for August. It has been found that the stresses are decidedly complex, and, moreover, that each form of test piece gives rise to a stress distribution peculiar to itself, which is doubtless further complicated in practice by the anisotropy, so that fairly comparable results in actual tests can only be expected when one form is adhered to. It is suggested, however, that it would probably be better to rely on a simple tension test to define cleavage property, with an arrangement so that load is applied uniformly and normally to the grain of the timber; such a test would, in a short length, exert normal tension across a large number of cells, and its selective action would ensure fracture at the weakest place.

Earthing Resistances.—The necessity of earthing electrical supply networks at one or more points has led engineers to study very carefully the best method of securing a good earthing electrode. In some cases a network of water pipes, the lead sheath of a large sized cable, or the steel structure of a building is available, but in many cases pipes, plates, and strips buried in the earth have to be used and it is advisable to know their relative merits. In a paper in the June number of the *Journal of the Institution of Electrical Engineers*, P. J. Higgs, of the National Physical Laboratory, gives a helpful account, both theoretical and experimental, of various kinds of earthing resistances. He begins by investigating the phenomena of polarisation and endosmose which happen when electric currents flow through damp earth and points out that their effects are very appreciable. Pipes, plates, and strips were installed in a plot of ground near the laboratory and periodic tests of their earth resistance were made for a year. The results obtained are of practical utility, but it is difficult to deduce general conclusions from them as the ground was probably far from being homogeneous. The seasonal variations in resistance during the year were found to depend on moisture and temperature, the former being the more important. The possible differences between measurements made with alternating and direct currents were also investigated. It was found that the resistances with direct current were greater than with alternating current, the maximum difference being about twenty per cent. The experiments indicate that pipes are the best to use. It was found that two pipes spaced about five feet apart and connected in parallel make a much more efficient earth than one pipe of diameter equal to the sum of the two.

Reactivity of Hot Coke.—It is known that the 'reactivity' or readiness with which a red-hot coke will reduce carbon dioxide is much increased by the presence of compounds of iron, and this 'reactivity' is liable to curious fluctuations with varying conditions. A study of this influence of iron compounds on the reactivity of coke forms the subject of a report by J. H. Jones, J. G. King, and F. S. Sinnatt (Fuel Research Technical Paper No. 25, H.M.S.O., 9*d*. net.) They show that the activating effect of metallic iron is large, of ferrous oxide small, and the fluctuations in activity are determined by the presence of iron in the reduced or reducible form. Should the iron be converted into non-reducible forms such as silicate or sulphide, the coke becomes relatively inert, although in the latter case reactivation may be brought about by exposure to air. Although other inorganic ingredients are known to increase the reactivity of cokes, it is concluded that in metallurgical cokes the preponderating catalytic effect is to be ascribed to the iron present.

Evolution of Heat by Polonium.—An interesting paper on this subject is published in the current issue of *Roczniki Chemji*, the organ of the Polish Chemical Society (**10**, 304-313; 1930), by Mlle. Alicja Dorabialska. The investigation was carried out in the Curie Radium Institute, Paris. The evolution of heat was measured by means of the adiabatic microcalorimeter constructed by Prof. Swietoslawski and Mlle. Dorabialska, made of different metals (copper, aluminium, zinc, nickel) and weighing only 2-3·5 gm. The experiments were made with three extremely small quantities of polonium, possessing an energy of about 3000 e.s.u. and weighing about 0·0005 gm., which were deposited one on a silver leaf, another on a nickel leaf, while a third was sealed in a copper tube filled with nitrogen. The rise of temperature amounted to 0·150°-0·250° per hour. The mean value obtained in the three series of experiments (nine in number) was $1 \cdot 87 \times 10^{-5}$ ($\pm$ 0·9 p.c.) cal. per hour and per one electrostatic unit of polonium. From this number may be calculated the evolution of heat by one curie of polonium as 24·2 cal./hour. The number of α-particles calculated from this value would be equal to $3 \cdot 4 \times 10^{10}$ per second either by one curie of polonium or by one gram of radium (Geiger and Werner find for this value $3 \cdot 4 \times 10^{10}$). It is interesting to note that one gram of polonium would evolve $1 \cdot 1 \times 10^5$ cal./hour, and one gram-atom of polonium would evolve during its life-time (197 days) $1 \cdot 1 \times 10^{11}$ cal. (one hundred thousand million calories).

Sensitising and Desensitising Dyes of the Cyanine and Related Types.—A little more than two years ago (*Phot. Jour.*, 21; 1928) Mr. Olaf Bloch and Dr. Frances M. Hamer of the Research Laboratories of Ilford, Limited and of British Photographic Plates and Papers, Limited, published their first paper on the optical and photographic properties of these compounds, dealing with a complete series of typical, simple, cyanine dyes. They now (*Phot. Jour.*, 374; 1930) deal with 8 cyanine dyes, 12 styryl compounds, 2 cinnamylidene derivatives, and 10 anyls. Six of the cyanine dyes have recently been prepared for the first time by one of the authors. All were examined under the same conditions as described in the previous communication. Some of the compounds are sensitisers while others are desensitisers, but the change of structure which occasions this change of function is a comparatively slight one. The photographic action of dyes can show "enormous variations" with variations in the character and treatment of the emulsions employed in testing them, so that generalisations are at present impossible. The authors give the structural formulæ, names, spectrum absorption curves, sensitising curves, various physical properties, and certain analytical results of the dyes dealt with. During the discussion, Dr. Walter Clark suggested that it would be more reasonable to measure the absorption curve of the silver bromide dye complex rather than that of the dye itself, and Mr. Bloch said that it had been tried. He also asked if the authors had found any relation between the absorption spectrum of the desensitiser and the wave-length desensitisation due to it. Miss Hamer replied that there is no relation; there are numerous colourless desensitisers.