

Research Items

Early Man in Uganda. Mr. E. J. Wayland, as a preliminary to a Geological Survey Memoir to be published in the course of the current year, has summarised in chronological order the main features of his studies in Uganda since 1919 with reference to its prehistory (*J. Roy. Anthropol. Inst.*, 64, Pt. 2). The prehistory of a country is no longer merely a question of culture sequences and human types, but has now been enlarged to include the physical conditions, their changes and the effects of these on human activities. In Uganda there were not only great changes of climate during Pleistocene days, but also of topography and hydrography, consequent upon powerful earth-movements, of which the Rift Valley and Victoria Nyanza are two visible expressions. Two pluvials are claimed in the Pleistocene and in each of them is an intrapluvial period, while the post-pluvial period is punctuated by two spells of moister climate. They are separated by a relatively dry break and preceded by a more pronounced swing towards aridity. Earth movements are recorded at three points, to the most recent of which the present configuration of the Rift Valley and the lake and the flow-direction of the river-system are due. Equated with these events of the Pleistocene are Stone Age cultures. With Pluvial I are associated Early and Later Kafuan. In the following interpluvial, lakes dry up. The early part of Pluvial II is associated with Pre-Chellean and Protosangoan, followed by Chelleo-Acheulean and Early Sangoan. It is correlated tentatively with Riss. An intrapluvial follows associated with Acheulean, a valley culture, and Full Sangoan, a hill culture. Pluvial II, correlated with Wurm, is associated with Mousterian and Lower Aurignacian, followed by Still Bay and Upper Aurignacian, respectively. The Aurignacian has the appearance of a foreign origin, presumably from the north or north-east. From the Aurignacian arise microlithic industries, such as Magosian and Wilton, a dying Still Bay influence being discernible in the former. These are post-pluvial and are correlated tentatively with the Achen retreat and Bühl stadium. In Uganda, pottery appears first with Wilton.

Polynesian Mythology. A number of legends concerning Maui and Tahaki, the former the central figure of Polynesian mythology, from the island of Fagatau of the Tiamotu Archipelago, are published with a translation by J. F. Stimson (*Bull.* 127, Bernice P. Bishop Museum, Honolulu). The legends of Maui and Tahaki are found throughout Polynesia, the well-known legend of Maui being one of the most widespread of the pre-distribution myths. The principal Tahaki theme, the voyage to the underworld to avenge Hema, is fairly consistent throughout Polynesia, but the incidents composing the plot differ markedly in different localities. The material now published is derived from the narration of Fariua-a-Makitua, a former chief of Fagatau and inheritor of the esoteric lore of Kamake, the greatest of all Tuamotuan sages. His wife Reva refused to receive the ancient teaching of Kamake as being "heathenish nonsense" and her version of the legends is not included as probably being affected by Christian influence. Chants are interspersed throughout the narrative. These are mostly of an erotic character,

and have been included only when they form an integral element in the progression of the myth. The music of these chants, as sung by Reva, has been analysed by E. G. Burrows. Verbal rhythm dominates the musical rhythm (the contrary of European song) and a further irregularity is due to the pauses. The accent corresponds to $\frac{2}{3}$ time in European notation. The simple irregular rhythm of the chants, their narrow tonal range and prevailing monotone, and the quavering endings are widespread, and presumably ancient, in Polynesia.

Hair-Tracks of Australian Aborigines. A detailed account of the lie of hair upon the bodies of Australian aborigines, made by Dr. J. H. Gray, suggests that the hair-tracks are highly characteristic of the race, and that they constitute a striking departure from the human hair-pattern hitherto accepted as normal (*J. Anat.*, 69, 206; 1935). The differences are connected with the presence of centripetal hair-whorls on jaw and back, and reversals of the normal hair trend on the posterior of the thigh and on the back. Dr. Gray is inclined to correlate the peculiar reversals with characteristic habits peculiar to the aborigines. The dorsal reversal he associates with gravitational and other forces involved in the maternal carriage of children upon the left hip, and the anti-clockwise spiral with the support given by the mother's left arm while the child is being carried. The disturbances of pattern upon the posterior aspect of the thigh he thinks may be brought about by the squatting habits of the aborigines. In the foetus, the descriptions so far made have indicated no departure from the normal in the hair-tracks. But before the idea can be accepted that habits alone can produce in each generation uniform and characteristic hair-patterns, more would have to be known regarding the hair-tracks in other primitive races.

Spines of a Spinous Rat. Specimens of the spinous rat of Amami (*Rattus jerdoni osimensis*, Abe) have been examined by Yosio Abe, particularly as regards the curious spines which project beyond the normal fur (*J. Sci. Hiroshima Univ.*, 3, 107, Dec. 1934). Contrary to what has been suggested as regards the spines of other species, these do not appear to be shed in winter, nor are they noticeably fewer in younger animals. Their arrangement in the skin shows that they correspond in a hair group to a *Mittelhaare*, and this indeed may be a spine in some groups, and in others an ordinary overhair. A tendency in one direction or the other means the difference between a richly-spined and a poorly-spined individual. In transverse section the spines are flattened and strongly curved in at the sides, and although at their place of origin they contain a well-developed medulla, the subsequent constriction has the effect of restricting the medulla to the thickened edges.

Some Laurentian Copepods. Prof. Arthur Willey has recently discussed the variations of certain copepods which are of much interest (*Trans. Roy. Canad. Inst.*, 20, Part 1, 1934). In a letter to *NATURE* of August 8, 1925, he briefly described a new copepod *Canthocamptus hiatus* from a swamp beside the Nikaban

River. This species has now been found again in water accumulating in the funnel-shaped leaves of the pitcher plant, *Sarracenia purpurea*, in Quebec. The fifth foot is peculiar in having only five marginal bristles instead of the usual six and is distinguished as the *forma uzeolicola*, the more northerly form being the *forma paludicola*. It is made the type of the new sub-genus *Pentacamptus*. Each form is found associated with a different species of *Cyclops*. Several more species of *Canthacamptus* are re-described and variations noted. There is a general similarity in the nature of the variation, and at the same time some parallelism as well as mere identity between European and trans-Atlantic species and races. In *Cyclops vernalis* and *C. venustus* the variations are of different kinds, although the species are fairly closely allied and live together in a small space under identical conditions. They were found in a small spring in almost pure culture when the rest of the countryside was covered with a thick mantle of snow and ice in the foothills of the Laurentians. A single ovigerous female of the rare *Cyclops modestus* was found in water poured from the submerged introrse leaves of the yellow water lily.

Penæidæ of Louisiana. Mr. Martin D. Burkenrood has continued his studies on penæids (*Bull. Amer. Mus. Nat. Hist.*, 68; 1934), a companion paper having appeared a few months ago (Bingham Oceanographic Collection, 4, 7; 1934). The present investigation is mainly confined to the eastern portion of Louisiana, and the material is estuarine and littoral. It is very satisfactory that the importance of the larval history is realised. The classification is thus based on the structure of both adult and larva. Four sub-families of the Penæidæ are recognised and these are discussed particularly in the light of larval history. The Aristæinæ and Solenocerinæ show close affinities and are contrasted with a second group composed of Penæinæ and Eusicyoninæ. All the descriptions are detailed, and great care has been taken in the examination of all essential characters. It is interesting that the author is of the opinion that in all Penæidæ the pleurobranches are the last gills to appear in larval development. He finds that "postmysis larvæ of Penæinæ completely lack pleurobranches and are indistinguishable in this from larval Eusicyoninæ; in the further course of development, the Penæinæ add pleurobranches to somites behind VIII and IX, as well as to these somites, while the Eusicyoninæ do not develop them behind IX".

Bryozoan Fauna of the Faroes. Until the present, records of Bryozoa from the Faroe Islands have been extremely few. This gap in our faunistic knowledge of this region has now been filled by the publication of a hand list of the Bryozoa of these islands ("Zoology of the Faroes". Section 58. Bryozoa) compiled by P. L. Kramp. The list comprises 82 species all from the Faroe plateau proper—that is, within the 200 metre line and the Faroe Bank. The list is followed by a brief discussion of the bryozoan fauna of the Faroes from a zoo-geographical point of view.

Diagnostic Characters of Woods. In various countries now, attention is being paid to the possibility of distinguishing between the woods of different tree species with a much greater appreciation of the difficulties created by the range of diversity in structure

within a species. The difficulty is greater with softwoods where the structural element composing the wood is so uniform, and Mlle. M. Brem (*Bull. Internat. de l'Acad. Polonaise Sci. Nat.*, 1934) has recently tested, on larch and spruce, the method suggested by Dr. J. A. Stamm (*Bot. Gaz.*, 92; 1931). Dr. Stamm counted the number of intersections of double tracheid walls, compared with tracheid ray walls met with along a series of horizontal planes in tangential longitudinal sections of the wood. The ratio thus obtained expresses the average length of a tracheid in contact with a ray compared with the total tracheid length, and ratios ranged in American trees from 0.072 to 0.288. Mlle. Brem finds that, if the earliest rings on lateral branches are neglected, this ratio proves a good diagnostic character to distinguish between spruce (0.1–0.2) and larch (0.2–0.3). Obviously, from the range given, this character could not safely be used alone.

Petroleum Geology of Western Canada. On February 12 Mr. A. J. Goodman read a paper before the Institution of Petroleum Technologists entitled "Notes on the Petroleum Geology of Western Canada", which includes an account of the author's conception of geological conditions obtaining in the Rocky Mountains and foothill regions respectively and of oil and gas reservoir rocks in these regions. The views expressed are founded on detailed practical work and on the collected data of numerous oil wells, as is evidenced by the number of sections, sketch maps and photomicrographs included in the report. Briefly, it is contended that in post-Cretaceous times the whole of the Rocky Mountains was compressed by the advent of geosynclinal strata between the Canadian Shield and the Jurassic Mountains; hence their wedge-shaped profile with flat overthrusts on the borders and steeper thrust faults within. Surface structures in the foothills are predominantly imbrications in Mesozoic rocks caused by the shortening of underlying Palæozoic limestone by overthrusts. Oil and gas source rocks are claimed to be primarily Palæozoic, though some may be Mesozoic. The presence of oil and gas in Mesozoic strata may be ascribed to upward migration, preservation in pores and cavities and final sealing off by secondary calcite and silica; it may be attributed in part to compression of Palæozoic limestone by the Mesozoic load and later, in Laramide times, by tectonic compression; these factors caused collapse of cavernous zones of Palæozoic limestone and consequent upward expulsion of oil and gas into the Mesozoic strata. Throughout this process the lighter constituents were retained in such small voids as escaped collapse in the reservoir rock. This separation of lighter constituents may also have been furthered by selective adsorption of secondary silica and silicates.

The Movement of Desert Sand. In a study of the movements of sand particles in a sand storm or sand cloud, Major R. A. Bagnold has criticised the view that the particles are kept aloft by upward components of the turbulence of the wind. Discussing the physics of a desert storm in a paper in the *Geographical Journal* for April, he shows that the supporting air currents, due to eddies in the wind, are not strong enough to support the average sand grain. Moreover, in open desert country where sandstorms frequently occur, the wind currents are unusually steady. Major Bagnold finds the chief cause of the flying sand grain is a bouncing action. A particle of sand gains a

horizontal velocity equal to that of the wind as it is lifted off the ground. It strikes the nearest hard surface and is deflected upwards to a height determined by velocity and size. Smaller grains at rest on the ground will also be disturbed and made to splash upward into the moving air currents. The bombardment of large grains or pebbles, too heavy to be lifted by air currents, will help to move these larger grains along the surface before the wind. Furthermore, when the sand cloud reaches an area where the grains are equal in size to those in the cloud, there will be little bouncing and the grains will tend to lie on the surface. Thus, in short, sand will collect and tend to form a dune in those areas where the size of the surface grains is the same as that of the moving sand.

Lightning Photographs. The Smithsonian Institution, Washington, has accounts of two remarkable photographs of lightning taken in 1908, and now published at the suggestion of Dr. B. F. J. Schonland, of the University of Cape Town. The first was taken with a camera revolving once in five seconds. It was a very bright flash and the thunder it caused was very sharp and sudden, like the sound of a cannon. If it is assumed that the distance of the flash is 1,000 ft. which, according to Mr. Larsen, of Chicago, who observed and photographed it, is a conservative estimate, then the diameter of the flash is more than 18 ft. He describes it as a flash, between two clouds, having the appearance of a flexible tube of very large diameter, appearing instantaneously during a very heavy rainfall. The second flash photographed looks as if there were four separate rushes following one another in the path opened by the first discharge. It shows a meandering and very complicated flash. Mr. Larsen suggests that the path was a partial vacuum of low resistance, which the beaded (or striated) appearance of the flash tends to confirm. The whole flash seems to be made up of striated alternate light and dark spaces not unlike the striæ produced in a vacuum tube.

Theory of Adsorbed Films on Metals. It is well known that a sparse adsorbed layer of alkali metal atoms on a metal surface will greatly reduce the work function of the latter, and this is attributed to an electrical double layer formed by atoms which have each lost a valence electron to the underlying metal. A similar reduction of the work function is, however, obtained with a thin layer of barium, strontium or calcium on a tungsten surface; the first ionisation potentials of these elements are all higher than the work function of tungsten, and the ordinary view of the ionisation of the adsorbed atom does not apply. R. W. Gurney (*Phys. Rev.*, March 15) has examined this problem by quantum mechanics. A simplified picture shows the adsorbed atom core as a potential well separated from the potential box of the interior of the metal by a barrier. A solution of the Schrodinger equation for this system gives a set of allowed energy levels which belong jointly to the metal and the core. In practice, the $|\psi|^2$ function, corresponding to the electron density, shows a blurred energy level corresponding approximately to the ionisation potential of the adsorbed atom and filled with electrons to an extent depending on the relative positions of this level and the critical Fermi level for the metal. This model shows how an alkaline-earth atom may behave very like an alkali metal in forming a double layer. It also explains the observed variations of the strength

of the double layer with the number of atoms adsorbed, and the probability of ionisation of the atoms when these are evaporated from the surface.

The Quinhydrone Electrode. The so-called quinhydrone electrode has come into extensive use since its investigation by Billmann in 1921 and is known to be affected by salt errors, due to the change in the activity ratio of quinone and hydroquinone, the dissociation products of quinhydrone, in presence of salts. F. Hovorka and W. C. Dearing (*J. Amer. Chem. Soc.*, **57**, 446; 1935) have now carried out a systematic investigation on this matter, and their paper includes some useful practical details of the electrode. They made the comparison against a hydrogen electrode and determined the salt error for fourteen solutes at concentrations up to 2*N*. A nearly linear relation between salt error and concentration of solute was found and constants to be used in the correction of *pH* values were derived. The salt errors were found to be additive for many mixtures, which simplifies matters, but some anomalies were found with mixtures of sulphates and hydrochloric acid. The normal electrode potential of the system quinone-hydroquinone was found to be 0.69938 at 25°, and the standard quinhydrone electrode was found to have a potential, with respect to the hydrogen electrode, of 0.69915 at 25°.

Constitution of Coal. Although it has long been known that coal results from the slow transformation of vegetation, the exact course of this change is still a matter for investigation and dispute. Much discussion has ranged round the question whether coal substance is the survivor of either or both the cellulosic or lignin constituents of the original vegetable matter. One method used for studying this question has been to subject coal—after extraction of resinous or oily matter by solvents—to a process of controlled mild oxidation, for example, with alkaline potassium permanganate. From the nature of the products, inferences could be made as to the constitution of the 'coal' substance from which they were derived. Since 1920 it has been known, following the work of Fischer and Schrader, confirmed by Francis and Wheeler, that benzene carboxylic acids were present in the oxidation products, pointing to the existence of ready formed benzene rings in the original coal. Prof. W. A. Bone and his collaborators have carried out such oxidations quantitatively so as to account for all the carbon in the raw material, and in a recent paper (*Proc. Roy. Soc., A*, **148**, 492; 1935) they give the results for a complete range of materials, cellulose, lignin, peat, lignite, bituminous coal and anthracite. The products got from cellulose were almost entirely carbon dioxide and oxalic acid, with no benzenoid acids. In all the others benzene carboxylic acids were important constituents, representing up to 50 per cent of the original carbon in the case of anthracite. Small proportions of acetic and oxalic acids were also measured. From these results it is concluded that lignins have been the chief progenitors of coal substance, the cellulose having mainly disappeared during its formation. All the benzene carboxylic acids—except benzoic acid—have been isolated in the products, but the penta- and hexa-carboxylic acids predominate. The results also support the view that lignin has an aromatic structure, and favours some such constitution as indicated by the formulæ of Fuchs or Schrauth.