

Research Items

Antiquity of Man in Rhodesia

WITH the view of determining the disputed question of the age of the stone implements of the Zambezi gravels, first described in 1905, the Rhodesian Archaeological Expedition of 1929 undertook to investigate the antiquity of man in Rhodesia as demonstrated by the implements occurring in the gravels south of the Falls, their cultural sequence and the relation, if any, of the gravels and their contents to the stages in the recession of the Falls and the excavation of the Zambezi gorge. The results of the archaeological investigation have now been reported by Mr. A. Leslie Armstrong and the Rev. Neville Jones, while the necessary geological preliminary considerations are embodied in notes on the geology of the area by H. B. Maufe, director of the Geological Survey of Southern Rhodesia (*J. Roy. Anthropol. Inst.*, 66, 2). The conclusions are summarized as follows: Over the area examined south of the Falls, the Zambezi formerly flowed over the site of the existing gorge at a level comparable with that of the river to-day north of the Falls, and more than 400 ft. above its present level. The terrace gravel and the old river-bed gravel are true residual Zambezi gravels, deposited when the river flowed over the site of the present gorge. The contained implements of Lower and Middle Palæolithic type are at least as old as the gravels in which they occur. The implements belong to a definite sequence of seven cultural groups from Pre-Chellean to Bambata (Aurignacian). With the exceptions of groups (1) and (7) the cultures represented are South African equivalents of the recognized European series, occurring in the same order of succession, at least as ancient in time, and showing close parallels in type and technique thereto. The Pre-Chellean implements are the earliest recognizable traces of man's occupation of the valley, and antedate the erosion of Gorge 5, the Falls then being to the south. The successive stages in the recession of the Falls and erosion of the Gorge since Pre-Chellean times can be related to the successive stages of culture. Since Pre-Chellean times, two arid and two pluvial periods have supervened. Man in Rhodesia is of an immense antiquity, at least equal to man in Europe.

Colour Changes in Elasmobranch Fishes

THE question of the control of the colour changes that occur in the elasmobranch fishes is a vexed one, and indeed the method may not be the same in different members of the group. Light has been thrown on the subject by G. H. Parker (*Proc. Amer. Phil. Soc.*, March 1937). The animals were anaesthetized by immersion in very cold water, a method that has advantages over anaesthetizing by drugs. The dark phase is induced by a neurohumour produced by the posterior lobe of the pituitary gland. The pale phase in *Raja erinacea* is due to the absence of a dispersing factor and in *Mustelus canis* and *Squalus acanthias* in part to nervous action. The concentrating neurohumour in the last two species is in the nature of a lipohumour soluble in olive oil but not in water, and a stable substance possibly a sterol.

Feeding Mechanism of *Apseudes*

THE Crustacean *Apseudes* is of special interest to the morphologist since it links the Isopoda with the primitive Mysidacea, which are presumed to form the starting point of the Peracaridan series. Very little, however, is known of its habits and mode of life. This deficiency is in part supplied by R. Dennell in a finely illustrated memoir (*Trans. Roy. Soc. Edin.*, 59, Pt. 1, No. 2, 1937) in which the method of feeding is discussed in relation to the evolution of the feeding mechanisms in the Peracarida. The exact relations of mouth-parts, carapace and associated structures are described in greater detail than has hitherto been done, and the mode of action partly described from observations on the living animal and partly inferred from a study of anatomical relations. It is concluded that the essential features of the primitive Peracaridan filter-feeding mechanisms are represented, but that this method of obtaining food is of little importance and is in process of replacement by raptatory feeding, which is the method followed by most Isopoda. Modifications in the carapace and particularly in the organs concerned in maintaining the respiratory current are adaptations to life in a muddy habitat.

Egg-Killing Washes

IT has been shown that the ovicidal properties of tar oils to *Cheimatobia brumata* L., *Lygus pabulinus* L., *Plesiocoris rugicollis* Fall. and *Psylla mali* Schm. increase with increase in boiling range. Petroleum oils, however, although their general insecticidal properties are known to increase with boiling range, fail to inhibit the hatching of aphid and psyllid eggs, which has led to the suggestion that ovicidal action to such eggs is associated with a chemical toxicity possessed by tar oils but not, in general, by petroleum oils. Moreover, some diversity of evidence exists regarding the relative toxicity of high- and low-boiling tar oils to *Aphis pomi* De Geer. Kearns, Martin and Wilkins (*J. Pom. and Hort. Sci.*, 15, 1, 56; 1937) have investigated this discordance in an examination of the comparative ovicidal efficiencies of high- and low-boiling oils, the validity of solubility in dimethyl sulphate as a criterion of toxicity and the importance of chemical composition. A wide range of tar and petroleum oils was tested and parallel chemical analyses carried out together with determinations of boiling ranges and solubilities in dimethyl sulphate. Ovicidal efficiency showed no relation to the total content of hydrocarbon oil in the emulsions, but was highly correlated with the content of neutral oils soluble in dimethyl sulphate. The toxicity of oil from which certain oxygenated derivatives were removed by fractionation with hydroferrichloric acid was not significantly different from untreated oil, and an examination of a number of individual compounds for possible toxic properties gave no indication of any specificity of this kind. In the absence of any large differences in the ovicidal properties of high-boiling neutral oils soluble in dimethyl sulphate derived from various sources, the solubility test is regarded as an adequate practical method of assessing the toxicity of hydrocarbon oils to *A. pomi*.

Run-off after Rainstorms

A PAPER by Mr. J. R. Daymond, an abstract of which is published in the *Journal of the Institution of Civil Engineers* (No. 7, 1936-37; June 1937), discusses the estimation of run-off from areas subjected to rainstorms in connexion with a law first proposed by Mr. Emil Kuichling in a paper contributed to the American Society of Civil Engineers (*Trans. Amer. Soc. Civ. Eng.*, 20; 1889) that "... in drainage areas of moderate size the heaviest discharge always occurs when the rain lasts long enough at its maximum intensity to enable all portions of the area to contribute to the flow. For large areas, on the other hand, a more elaborate analysis becomes necessary in order to find under what conditions the absolute maximum discharge will occur, . . ." As the law is often misquoted to the extent of ignoring the provisos and is thus misinterpreted, the object of Mr. Daymond's paper is to show that the reservation regarding large area is valid and important. In addition, an important general conclusion is arrived at, applicable to all areas, namely, that provided the rain falls at a constant intensity, the storm that gives the maximum run-off is one which lasts for a time less than, or equal to, the time of flow from the farthest point of the drainage area to the point of outfall from the area.

Precursors of a Volcanic Eruption

THE tilting of the flanks of the volcano Asama (Japan) in 1936 is described by R. Takahasi and T. Minakami in a recent *Bulletin of the Earthquake Research Institute* (15, 463-491; 1937), while the changes in depth of the crater in 1934-36 are recorded by Minakami (*ibid.*, 15, 492-496; 1937). Tiltmeters were erected at three stations, 4 km. east, 5 km. north, and 12 km. south-west of the crater. In 1936, explosions were frequent in February-March and July-August, and, during intervals of 7-30 days before then, marked changes of tilt were recorded almost simultaneously at the three stations, the variations being about five times as large as those observed during intervals of quiescence and being clearly independent of changes in air temperature. The tilts were accompanied by remarkable uplifts of the crater floor as a whole. The depths of several points on the floor were determined by triangulation from stations on the crater rim. After a pause of inactivity in July-October 1934, the floor began to rise, the uplift being about 70 m. by the time of the violent explosions on April 20, 1935.

Surface Layers on Glass and Silica

LORD RAYLEIGH (*Proc. Roy. Soc., A.*, 160, 514) observed that there was always some reflection from the boundary when polished glass surfaces were put in optical contact. Further investigations were made by immersing plates of glass or silica in a liquid adjusted to have the same refractive index as the bulk material. The reflection from fire-polished surfaces was found to be very low, but the reflection from surfaces which had been polished was quite appreciable, indicating the existence of a surface film of refractive index different from the bulk material. The refractive index of the film could be determined by finding a liquid mixture which gave minimum reflection. The index rises with the violence of the polishing treatment. In the case of fused quartz ($\mu = 1.46$) the index of the surface film could be brought up to 1.6 by polishing. The modified

surface film could be removed by hydrofluoric acid. It appears to be in fact a modified form of silica, probably with a depth of about 300 Å. Similar but much less marked effects were observed with glasses, and a very small effect with crystalline quartz. Crystalline quartz surfaces can therefore be optically contacted without much reflection at the interface, due to the skin effect. It is shown that most of the reflection observed in this case is due to the distance between the contacted surfaces, which is found to be about seven times the crystal spacing of the silicon atoms.

Built-up Molecular Films

K. B. BLODGETT and I. LANGMUIR (*Phys. Rev.*, 51, 964) have been able to build up films of various stearates on glass or metal surfaces by dipping the plates through a monomolecular layer of stearic acid spread on water containing salts of barium or other metals. The monolayer is kept under two-dimensional pressure. The first layer attaches itself to the surface by its carboxyl groups as the plate is raised from the water, the second layer attaches with its molecules reversed when the plate is dipped again, and so on. The layer is thus folded back on itself at each dipping. The presence of a little copper facilitates the production of thick films, and films containing 3000 layers have been built. The films are uniaxial crystals with the optic axis perpendicular to the surface. The optical properties of the film have been studied and the ordinary and extraordinary refractive indexes are 1.491 and 1.551 respectively. If a film which has been built up on a barium solution at pH 6.5 is treated with benzene, stearic acid is dissolved out and the resulting skeleton film has a nearly unaltered thickness but a much lower refractive index.

Double Stars and Relativity

In a paper delivered at the Tercentenary Conference of Arts and Sciences at Harvard on September 4, 1936, Prof. T. Levi-Civita shows that the relativistic equations of motion of two bodies of comparable size can be integrated by treating relativistic effects as perturbations (*Amer. J. Maths.*, 59, 225; 1937). Two results are obtained, which, it is hoped, may be tested by observation of double stars. The first gives a formula for the angular precession of the periastron of the satellite star. The second is more striking. It predicts that the acceleration of the centre of mass of a double star lies entirely in the plane of the relative orbit. This acceleration may be divided into a fluctuating periodic part, and the secular part, the effects of which accumulate during the successive revolutions. The secular acceleration of the centre of mass is directed along the major axis towards the periastron of the principal star. A formula is obtained for the increase of the velocity of the centre of mass during a century, which ought to be detectable eventually by spectroscopic observation. Prof. Levi-Civita has also considered the general case of n bodies (*ibid.*, 59, 9; 1937), but in this case no definite results capable of observational test have been reached. In a discussion on this paper at Princeton (October 7, 1936), Prof. A. Einstein suggested that an extra term, corresponding to the stresses keeping a body together, was needed in the equations. Prof. Levi-Civita adopted this suggestion, but found that it did not affect the conclusions previously reached.