

Research Items.

POPULATION AND ENVIRONMENT.—Dr. S. M. Shirokogoroff has published, through Messrs. Edward Evans and Sons of Shanghai, under the title "Ethnical Unit and Milieu," a valuable study of population problems, in which he lays down a number of propositions supported by examples drawn mainly from his studies of the peoples of north-eastern Asia. In a community, if an increase of population exceeds the possibility of nourishment, the excess of population must perish or the natality must be regulated by some means, medical, artificial, social, etc. Increase of population is regulated by the extent of territory and by the growth of culture; the more intensive the exploitation of territory, the larger the population it may nourish, as, for example, in an agricultural as contrasted with a hunting community. Maintenance of the level of numerical value must be understood relatively to the variation of culture and territory, a conclusion which has a direct bearing upon the question of degeneracy and decline of any given people. Variation of some aspects of the cultural complex is followed by variation in the whole complex and entails a period of cultural disequilibrium. Physical degeneracy may be either a process of extinction or a substitution of one anthropological type for another; in both cases there is an ethnical disequilibrium. Limitations being imposed upon the possibility of variation in the factors of culture, territory and density of population, which are interdependent, the general conclusion follows that there will be a degeneration or decline and an end of the present species of man. It is probable that the greater part of the way to absolute density of population is already covered, and that mankind is at present near its culmination.

THE MOTHER GODDESS IN EGYPT.—In No. 11 of the Journal of the Manchester Egyptian and Oriental Society, Mr. John Lewis analyses certain forms of Egyptian belief with the view of showing that they point to conceptions associated with the cult of a Great Mother Goddess such as Prof. Elliot Smith has postulated to lie at the root of primitive and early religion. Mr. Lewis compares the graffiti of the rocks at Gebel Hetematt, Wady Hammanat, and Selsileh, and the paintings of the prehistoric tomb near Hierakonpolis, with the cave drawings of France and Spain, and from their similarity deduces that they are based upon identical magical ideas connected with food and protection. The statues of the god Min, at one time a female deity, link up the ideas of water, the life-giving element, the shell, which is the life-giving female deity, procreation, the mother-deity and the father-deity. The girdle of Hathor-heads on the slate palette of Narmer is a development of the shell-girdle, the strength of Hathor-Isis, which connects the shell-deity with Hathor.

ORIENTAL PREHISTORY.—M. J. de Morgan contributes to *l'Anthropologie*, t. xxxiv. 1-2, the first of a series of articles on the prehistory of Western Asia and Egypt. In neolithic times, possibly from late quaternary times, it is suggested as a working hypothesis that the areas under consideration were inhabited by four races—in the north a white Caucasian race, of which traces may perhaps still be found in the remote mountain districts of the Caucasus; in the south, stretching from Elam to the Mediterranean, a negro race related possibly on one side to peoples living in the Indian Peninsula, on the other to the inhabitants of the European caves; in Egypt and North Africa, Berbers; and

Semites in Arabia. This multiplicity of races at this stage throws no light upon the question of origins. That part of Western Asia, of which the country of the Euphrates and Tigris—the cradle of civilisation—is the centre, is cut off from the rest of the world. It contains three types of geographical areas, a mountain region, plateaus, and plains. An examination of the geological conditions from early quaternary times indicates that Chaldæa, lying between mountains and plateaus with their cold and humid climates and the hot dry desert area, alone afforded conditions suited to man in early times, and this owing to the fact that it was watered by two rivers. The plateaus did not become habitable by man until he possessed domesticated animals capable of subsisting on pasture land.

ANIMAL LIFE IN DESERTS.—In the Proceedings of the Royal Society, B, vol. 96, 1924, pp. 123-131, Mr. P. A. Buxton records the results of some investigations made in Palestine on the relations of temperature and moisture to animal life in deserts. This observer finds that the soil surface commonly reaches 60° C. at mid-day, and certain insects are active upon it even at that temperature. Their body temperature is lower than might be expected, probably owing to loss of water during respiration. An interesting point is that the black form of a dimorphic grasshopper has a body-temperature 4-5° higher than the buff form, when exposed to the sun. If the loss of water hypothesis be correct the insect's need for water is greater than is commonly believed. Deserts have a great diurnal range of temperature and of relative humidity. The night air is often almost or quite saturated with moisture, while by day the humidity may drop to 20 per cent. It appears that the desiccated fragments of the annual vegetation are hygroscopic: that they take up a considerable proportion of water from the moist night air and hold it for several hours after the sun has risen. The author believes that this property of the dried pieces of grass and herbage is one of the foundations which support all animal life in deserts during summer. These fragments, with the moisture absorbed over night, are eaten by certain insects which in turn become a source not only of food but also of water, for the birds, lizards, predaceous insects, and other carnivorous animals.

SYMBIOSIS BETWEEN TERMITES AND THEIR INTESTINAL PROTOZOA.—L. R. Cleveland has given further details of his work on the symbiotic relationships between the intestinal protozoa of termites and their host (*Biol. Bull.*, vol. 46, pp. 177-225, 1924). The protozoa principally concerned are flagellates—Trichonympha and related forms. By incubating termites at 36° C. for 24 hours (a method due to Grassi) the flagellates are killed, but the termites are uninjured. If such "defaunated" termites are given their normal diet of wood, they eat quantities of it, but they become less active and die within three or four weeks. If "defaunated" termites are placed with ordinary ones, the former—by feeding on the fæces of the latter—become reinfected with protozoa, and after about ten days regain the ability to utilise wood and can live indefinitely. When termites were starved, the wood-ingesting protozoa in their intestine died within eight days, and the termites when returned to a wood diet lived only a few weeks. These and other examples emphasise the close correlation between the wood-feeding habit and the presence of protozoa. That the latter use the wood as food and not the intestinal fluids of their host is

proved by direct observation—numerous wood particles are present in the posterior portion of *Trichonympha*—and by the fact that these protozoa die ten to twenty days before their host when wood is withheld. In normal-feeding termites a large percentage of the wood which they have eaten may be found in the protozoa, and in termites starved for a few hours it is almost impossible to find any wood particles in the intestine; they have all been ingested by the protozoa and the particles gradually disappear. A large amount of glycogen is present in these protozoa produced by digestion of the wood. The termites furnish food and lodging to the protozoa, and the latter provide products formed by digestion of the wood—a clear case of symbiosis. The young termites feed on excreta loaded with flagellates, so that they are practically certain to become infected, and then they begin to eat wood.

MASS RELATIONS OF CYTOPLASM AND NUCLEUS.—Prof. R. W. Hegner brings together (*Scientia*, June 1924) evidence from his observations on *Arcella* and *Opalina* and from those of other investigators on protozoa, in regard to the mass relations existing between cytoplasm and chromatin, and concludes that the following generalisations are reasonably established: At each stage in the life cycle of these organisms there is a fairly definite amount of cytoplasm associated with each nucleus. The size of the nucleus is an indication of the amount of chromatin contained within it; the amount of chromatin is the real factor involved in the ratio of nucleus to cytoplasm. Nuclear division is initiated by an increase in the amount of cytoplasm as compared with that of the nucleus.

VITALITY OF POLLEN GRAINS.—Mr. S. Nohara (*Japanese Journ. of Botany*, vol. 2, No. 1) has made an experimental study of the pollen in several species and hybrids of *Salix*. Germination of the pollen was most successful in 2-5 per cent. sugar solution, beginning very quickly, and the pollen tubes attaining a length of 4-8 μ in half an hour. Tests of the longevity of pollen showed that it was much affected by temperature, humidity, and light, and that its germinating power could be maintained for seventy days in a dry, cool, dark place. Temperatures so low as 21° below zero for 8 hours do not lessen the germinating and fertilising power, while a temperature so high as 37° kills the pollen. Chloroform vapour terminates the germinating power of pollen in 4-5 hours, and ether vapour in 20 hours. In certain hybrids between *Salix viminalis* and *S. multineervis* the pollen and seeds were nearly normal, but the catkins showed various intersexual conditions.

BOTANICAL NOTES FROM CEYLON.—The Annals of the Royal Botanic Gardens, Peradeniya, vol. viii., May 1924, is mainly contributed by Mr. I. Petch, Government Botanist and Mycologist, Ceylon. A long paper upon the insect catching proclivities of the flowers of species of *Aristolochia* cultivated in Ceylon includes a record of their insect visitors so far as identification of the tropical insects had proved possible. Mr. Petch concludes that the flies are attracted to the flowers by their odour, which is offensive in *A. gigas*, but in some species, such as *A. ridicula* and *A. elegans*, is not detected by man's senses. The flies then seem to enter the tube of the flower by accident, and are prevented from crawling out by the inwardly and downwardly directed hairs, until later these hairs wither. One interesting conclusion from the record of insect visitors is that the hooded type of flower, which is regarded as primitive, is the most effective in attracting and trapping insects; the striking bizarre forms, such as *A. ringens*, attract

few flies, so that "the advantage of a further evolution in the direction taken by these extraordinary forms is not obvious." Mr. Petch also describes the species of Xylariaceæ recorded for Ceylon up to the present date (pp. 119-166), and has a note upon extraordinary forms of fructification extending the range of variation recorded for *Diplodiella*. Mr. C. Ragnathan confirms the occurrence of teleutospores in *Hemileia vastatrix* B. and Br., the coffee leaf disease; they were previously recorded by the late Prof. Marshall Ward, but have not been seen by subsequent investigators.

ORIGIN OF TINSTONE.—Bulletin No. 5 of the Geological Survey of Nigeria, by Mr. C. Raeburn, deals with the tinfields of Nassarawa and Ilorin Provinces (London: Crown Agents for the Colonies, 1924. 10s. net.) It describes two separate areas in considerable detail and discusses the origin of the tinstone, which it says "is due to pneumatolytic action on the granite and gneisses near their contact. This gives rise to greisen, usually containing topaz and tin, and carrying networks of quartz veins with tinstone, and at times to a complete replacement of the rock in the direction of topazisation or micatisation. As regards that part of the tinstone which is related to the pegmatites, it must be emphasised that it, both in point of time and manner of origin, is quite different from the other. On the one hand we have tinstone as an original constituent which had already commenced to crystallise before the intrusion of the rock; on the other we have tinstone as a later mineral formed by pneumatolysis after the intrusion and solidification of the granite."

ZIRCONIUM AND HAFNIUM ORES.—The results of some analyses of zirconium ores by G. Hevesy and V. T. Jantzen are published in the *Chemical News* for May 30. Malacon from Madagascar and from Hitterö is particularly rich in hafnium, the former containing so much as 7 per cent. and the latter 5 per cent. of hafnium oxide. Three out of four specimens of thortveitite showed a higher hafnium than zirconium content. The superior radioactivity of ores with a high hafnium-zirconium ratio over that of the more abundant zirconium ores is due to the presence of uranium and thorium oxides.

METEOROLOGICAL DATA OVER THE OCEANS.—From various sources the Royal Netherlands Meteorological Institute has produced some useful tables of monthly meteorological data over the oceans for the year 1921 (Bulletins 6¹ and 6²). The computations are for ten-degree squares and give the mean force and direction of the wind, the atmospheric pressure, air and water temperature, and cloudiness. In the Atlantic Ocean the data are given between 5° to 25° N. and 25° to 45° W. and between 0° to 20° S. and 10° E. to 10° W.; in the Indian Ocean between 10° and 20° N. from 70° to 90° E. and between 10° and 30° S. from 90° to 110° E.; while in the Pacific Ocean the limits are 10° to 30° N. and 140° to 160° W., and 10° to 20° S. and 90° to 110° W. The observations thus leave out of account large areas of the oceans especially in high latitudes, and are not complete in many parts of the Pacific Ocean within the limits given. But they can of course be obtained only on frequented trade routes. The number of observations in each month varies in different squares from one to more than a hundred. The corresponding data for 1917-1920 consisting only of Dutch observations are promised shortly.

FREE-AIR TEMPERATURES AND WIND DIRECTIONS.—The *Monthly Weather Review* for January, published by the U.S. Weather Bureau, has an article by Mr. W. R. Gregg showing the relations between the above.

The purpose of the discussion is to utilise, for the advancement of the subject, the available free-air observations made in the United States from 1915 to the present time. All observations made with kites are considered, but the discussion is chiefly confined to data from Drexel, Nebr., and Ellendale, N. Dak. Observations of wind and temperature are grouped for 16 points of the compass for the surface, and for one, two, three, and four thousand metres above sea-level for each station, also for spring, summer, autumn, winter, and the year. The observations with N.N.W. to N.N.E. and S.S.E. to S.S.W., with distinctly north and south components, are separately combined for each elevation. At all levels to at least 4 kilometres much higher temperatures prevail with south component than with north component surface winds. Differences are smallest in summer, averaging about 5° C. The differences are greatest at 1 and 2 kilometres, but at 4 kilometres they average 7° to 8° C. It is pointed out that the free-air position of a low barometrical centre is usually to the north-west of the sea-level position, and that of a high to the south-west, so that winds are south-westerly above the sea-level positions of lows and north-westerly above the sea-level positions of highs, and consequently the air above lows is warmer than that above highs. Taking the lowest and highest pressures at different heights as the basis of comparison, it is found that the lowest pressures are accompanied by the lowest temperatures, the pressure itself at any level being largely a function of the mean temperature of the air column beneath. Numerous examples and charts are given, showing the influence of the source of air supply on the changes of temperature experienced during the passage of areas of low and high barometer. The discussion is of great value to experimental meteorology.

ADSORPTION.—Since Gibbs deduced an equation for the change of concentration of a dissolved substance at the surface of separation of its solution from another material, in terms of the rate of change of surface energy with concentration, attempts have been made to test its validity by experiment. The most successful experiments up to the present were those of Donnan and Barker in 1911. J. H. Mathews and A. J. Stamm, in the May number of the *Journal of the American Chemical Society*, describe experiments at a liquid-liquid interface, using a drop-weight method. Solutions of dimethylaniline in heptane and in benzene were used. The qualitative results confirmed Gibbs' formula, and by calculation from the quantitative results Langmuir's theory of adsorption was found to be verified, namely, the adsorption is one molecule thick up to concentrations where a complete surface layer is formed. The molecular thicknesses and cross-sections agree with those of other investigators.

APPARENT SELECTIVE REFLECTION OF X-RAYS BY CRYSTALS.—Dr. W. Kossel, in the *Zeitschrift für Physik* for May, deals with the observations of Clark and Duane, which these authors have interpreted as indicating selective reflection. Kossel points out that, according to the ideas of the mechanism of radiation held up to the present, a coherence between the radiation of separate atoms, such as is required to explain selective reflection, is not to be expected, since the times during which they are excited are supposed to be irregularly distributed. He finds it possible to explain a good deal of the experimental material of Clark and Duane, in part quantitatively, by considering the variations of the absorption coefficient of the crystal. X-rays of wave lengths for which the coefficient of absorption is

small penetrate to a greater depth into the crystal than those for which it is large, and stronger interference effects are produced by the crystal lattice with the first than with the second. It seems doubtful whether any new phenomenon, which can be described as selective reflection, is involved.

MAGNETON NUMBERS AND ATOMIC STRUCTURE.—It is interesting to note that a certain amount of scientific work is still being carried out in Russia. Dr. J. Dorfmann contributes a paper, dated from Leningrad, to the May issue of the *Zeitschrift für Physik*, in which he puts forward a series of hypotheses as to the relation between the electron orbits of the elements, and their magnetic properties. Bohr has shown that atoms with a closed electronic configuration, where the orbit groups contain 2, 4, 6, 8 similar n_k orbits, are diamagnetic; and that paramagnetism appears when they contain 1, 3, 5, 7 orbits. If there is only one electron in an orbit group, the magnetic moment due to it is given in Bohr units, by the k number of the orbit; the author assumes that, with a group having 3, 5, 7 or $2p + 1$ orbits, $2p$ of them form a symmetrical diamagnetic complex, while one of them takes part in the paramagnetism, and contributes a moment of k units to the atom. The moments due to different asymmetrical orbit groups are supposed to add, when the principal quantum number n is the same for all the groups concerned; while for different values of n they are regarded as combining vectorially. Orbit configurations have been worked out for different ions of the elements between scandium and zinc; and values of the magnetic moments have been calculated, on the above assumptions, which agree quite well with the observed values. A similar table is given for the elements from lanthanum to hafnium, for which, however, the observational data are not quite complete.

STEAM-NOZZLES.—The third report of the Steam-Nozzles Research Committee has now been presented to the Institution of Mechanical Engineers, and comprises (a) tests on convergent impulse nozzles, 20° nominal angle, with thick partition plates; (b) a series of tests to determine the effect of chamfer on the exit edges of comparatively thick plates; (c) work on the $\frac{3}{8}$ -inch Parsons standard 430 B blades, which emphasises the effect of entry on nozzle efficiency; (d) the first test results of a set of straight elementary nozzles designed by Prof. A. L. Mellanby. The general shape of the curves obtained for the velocity coefficients of steam-nozzles (given in the second report) has been corroborated, and in one or two cases the curve has been carried sufficiently far into the low velocity region to indicate that it "turns over" as predicted by Mr. Martin. The effect of chamfering thick plates of convergent nozzles is clearly shown in the present report; it would appear that a thick plate nozzle with a chamfered exit can be made as efficient, over a considerable working range, as a nozzle with very thin plates. A straight elementary nozzle is in general 5 per cent. more efficient than the practical types of nozzles which have been tested. A review of both second and third reports goes to show that the condition of entry or of exit is important; the steam should approach the nozzle as smoothly and as slowly as possible, and no flat surfaces should be left on the exit side of any nozzle. There are other interesting conclusions on the effect of superheat, for which reference should be made to the report. The work of the committee is proceeding without interruption, and has been greatly assisted by contributions from the British Electrical and Allied Industries Research Association.