

Research Items.

THE BIRTHPLACE OF HUMANITY.—Prof. Henry Fairfield Osborn returns to his attack against the generally accepted theory of man's ancestry, in a short article in *Science* (June 8, 1928, p. 570). Darwin thought that "our progenitors, no doubt, were arboreal in their habits, and frequented some warm, forest-clad land," and, as was pointed out in a recent leading article in our columns, this is the view still widely held. From considerations of a general kind, however, Osborn argues that a warm, forest-clad area was not the sort of place to stimulate the great progressive development which led to the human stock. Recent ethnographical and physiographical evidence indicates that intelligent progressive and self-adaptive types of mankind arise in elevated upland or semi-arid environments, where the struggle for food is intense and where reliance is made on the invention of implements as well as weapons. Again, the first modernisation of the entire mammalian kingdom, geology indicates, occurred in Oligocene times and was seemingly due to a wave of aridity concurrent with the complete elevation of great continental plateaux. This geological change caused a branching of the ways of mammalian evolution, for pre-existing mammals were compelled to choose between the warm, enervating, forest-clad regions, or the temperate, stimulating plateaux. Is it likely that the forerunners of mankind were exempt from this compelling and fateful decision? Is it not more likely that the stimulus seen in the development of so many mammalian groups was also that which gave the urge to the primate ancestors of man? If Osborn's speculation is right, he looks to the uplands of Mongolia or Tibet, the top of the world, as the most favourable geographical centres for such development, the final proof of which must rest upon the efforts of the fossil hunter and explorer.

THE DYING GOD IN EGYPT.—Miss Murray has directed attention in Part I of *Ancient Egypt* for 1928 to passages in the Pyramid texts of Pepy and Merenra which appear to point to the sacrifice of the king as a fertility victim. Though the text is corrupt and the meaning of the religious ideas obscure, these passages seem to recite a demand of the people and the gods for the death of the king because he "has not eaten the Eye of Horus" and the "Limb of Osiris." The former expression usually means food. It is suggested that this may mean that if the king does not eat, perhaps owing to scarcity, he must die. The death, however, is ritual only, for he "lives on the bread of his father Atum" and his escape from death is compared with that of the god Setesh, this escape apparently being effected by ploughing the earth. The sacrifice takes place at a moon period, the new or the full, and presumably after a period of time, though the year is not given. Perhaps, as suggested by the tradition of Mykerinus, the length of his life was limited to seven years. The two lunar festivals of the month at new and full moon, it may be noted, were specially connected with the commemoration of the dead. The mention of the king as "a star opening the waters of heaven" would be a reference to his rain-making powers. The position of Setesh as the sacrificial victim whose example is to be followed by the king instead of, as usually, the principle of evil, may be due to the fact that Setesh was the god of the barren south. As the northern cult of Osiris advanced south, Setesh became the great enemy. The conflict of the Horus-people of the north and the people of the south was translated into the theory which made the son of Osiris the

avenger against the murderer of his father, and the more noble Osiris became, the more evil was Setesh.

SEAL LICE FROM NORTHERN REGIONS.—Lieferung XI, XII, of "Die Tierwelt der Nord- und Ostsee," contains an account of the body lice of the Pinnipedes by Ludwig Freund (*Anoplura Pinnipediorum*). It perhaps comes somewhat as a surprise to the uninitiated to find that such mammals as seals should harbour true lice, but these have been known for well over half a century, and they are here recorded from more than a dozen different species of seals. These lice belong exclusively to one family, the Echinophthiridae, and only three genera are known from the area described, with ten species. The *Antarctophthirinae*, with five-jointed feelers, are provided with body scales, the *Echinophthirinae*, with four-jointed feelers, with specialised spines only. The function of these special scales and spines is to entangle air and so form an air sheath which surrounds the insects when under water. Those without scales occur chiefly on the head of the host and receive more air, whilst those with scales may occur on the body and survive a long immersion in water. Thus special respiratory facilities are provided for these marine lice. The author has illustrated his monograph with many careful original drawings in addition to those from other works. The original figures are chiefly of *Echinophthirus horridus*, which is common on several different seals, and has a wide range of distribution. The eggs of all those known are very firmly fixed to the hairs of the host.

INTESTINAL FLORA OF THE MOLE.—The microflora of the intestinal tract of the common mole, according to recent investigations of W. A. Kutejschikow (*Journal de biologie et de médecine expérimentales*, Moscow, 9; 1928), is extremely poor, the stomach content being practically sterile; only a few organisms of the *Bacillus coli* type were isolated, and these proved to be closely allied to the similar organisms from man, but different from them serologically. This poverty of the intestinal flora is the more remarkable because the mole lives in the upper layers of soil, which are very rich in micro-organisms; it may be explained by the very rapid course of the digestive processes in the mole, and perhaps by some special properties of its gastric juice. The mole presents in this respect a marked contrast with the shrew, which has a very rich and varied intestinal microflora.

CONTROL OF THE PEACH-BORER BY PARADICHLOR-BENZENE.—The peach-borer moth (*Agria exitiosa*) is widely spread in North America, where its larvæ burrow into the tree-trunks just below the surface of the soil. In addition to peach the insect also affects apricot, nectarine, and plum. The use of paradichlorbenzene is becoming increasingly favoured as a means of control ever since Blakeslee discovered its value in 1919. A great deal of experimental work has been carried out with reference to the application of this substance in different parts of the United States, and the most recent contribution to the subject will be found in *Technical Bulletin, U.S. Dept. of Agriculture* (No. 58, March 1928), by Messrs. O. I. Snapp and C. H. Alden. These workers report that paradichlorbenzene has been used on the same trees in one orchard for five consecutive years with no discernible tree injury and almost complete eradication of the borers. In the south it should not be used on trees less than four years old. Before applying it all grass, stones, and refuse are cleared away for a foot radius from the trunk, and $\frac{3}{4}$ oz. to 1 oz. of paradichlorbenzene crystals are distributed

in a continuous ring about $1\frac{1}{2}$ inches from the trunk. The crystals are then covered with soil, which is packed around the tree to form a mound. An exposure of from four to six weeks was found to give excellent control, the borers having been killed by the gas given off.

WING DIMORPHISM IN WEEVILS.—The inheritance of long and short wings in the weevil, *Sitona hispidula*, is the subject of a study by Miss Dorothy J. Jackson (*Trans. Roy. Soc. Edin.*, vol. 55, part 3, No. 27). The two forms are carefully described and figured. In the form with short, truncate wings, the structure of the metanotum and metapleura is greatly altered, especially the parts serving for attachment of wing muscles. Some of the long-winged weevils differed from normal in having the wing muscles greatly reduced and modified, but in the brachypterous weevils these muscles were further reduced and difficult to find, their place being taken by body fat. Breeding experiments involving more than 600 weevils showed that the brachypterous type behaved as a simple Mendelian dominant to long wings. There were also indications that the short-winged type was more viable, perhaps owing to the presence of the reserve fat. Reduction in the wing muscles was unaccompanied by any change in the muscles that lift the elytra. Both forms of the weevil are found to be common in Europe, where the two forms frequently occur together; but hitherto only the long-winged type has been found in America. Evidence from breeding indicates that the abnormal condition of the wing muscles in long-winged weevils is inherited, probably as a Mendelian recessive. Interbreeding occurs between the long- and short-winged types, and about half of the wild short-winged insects were found to be heterozygous. Of 34 species of *Sitona* examined, ten were found to show wing dimorphism, and this number will probably be increased. In 12 species only long wings were found, and in 12 others only short wings. Other families of Coleoptera frequently contain species in which the wings are reduced or absent, and wing dimorphism is recorded in several. The origin of the wingless condition in flying insects is discussed, and it is pointed out that the facts in *Sitona* are not in accord with any theory of disuse. The conclusion is drawn that wing reduction has arisen through abrupt mutations, and is a very ancient phenomenon in Coleoptera. It may form the basis of selection under certain conditions, but since apterous species occur in the most diverse situations, the flightless condition is probably in many cases of little importance in determining the survival of a species.

ANTARCTIC PLANT LIFE.—Some interesting facts regarding Antarctic and sub-Antarctic vegetation are recorded by R. N. Rudmose Brown, the polar geographer and naturalist ("Problems of Polar Research," *Amer. Geog. Soc.*, Special Publ. No. 7). Antarctic plant life is necessarily confined to the edges of the Continent, the mountain ranges, and islands near the coast. The great ice sheet is completely devoid of any form of life. The poverty of the flora compared with that of the same latitudes in the North Polar regions is striking. The Arctic regions support some four hundred species of flowering plants as against only two species in the Antarctic. This may be ascribed to the shortness of the Antarctic summer and the remarkably low temperatures, for no month has a mean temperature above freezing point. As a rule, December is well advanced before the rays of the sun lay bare what little soil occurs in a few places. Only for a month or six weeks is the vegetation, except lichens on cliff faces, exposed to sunlight. The ground thaws to a depth of only a

few inches on a few cloudless days, and even then is saturated with ice-cold water in which root hairs are physiologically inactive. Mosses are numerous, and form one of the chief constituents of the vegetation, and more than fifty species have been recorded, mostly from Graham Land. Fruiting specimens are rare, and only six species have been found showing this mode of reproduction. About seventy species of freshwater algae have been found in the South Orkneys, the most interesting being species of *Sphaerella*, which colours snow red. Marine algae are very abundant in Antarctic Seas, and grow at times in pools which are frozen solid all winter. Luxuriant genera like *Laminaria* and *Macrocystis* flourish only on sub-Antarctic coasts which remain open throughout the year. Most remarkable of all, however, is the wealth of diatom life, in strong contrast to its scarcity in warm seas. The important factors operating in this case are probably decreased activity of denitrifying bacteria at low temperatures, the tendency for the surface layers of water to sink and be replaced by deeper layers richer in nitrates, and the abundance of silica in polar seas owing to the low temperature of the water and the great quantities of glacier-swept debris from the land.

PERMIAN FOSSIL INSECTS OF NORTHERN RUSSIA.—Mr. A. V. Martynov has published some very interesting results of his extensive studies on the fossil insects found in several localities in northern European Russia in the Permian strata (*Travaux du Musée Géologique près l'Académie des Sciences*, Leningrad, vol. 4; 1928). A very large number of new species, genera, and some new families are described in the paper (written in English), and fully illustrated on the 19 plates. An analysis of the fauna found shows that the greater portion of the Permian fauna of northern Russia, about three-fourths of the species, was not related either to the Carboniferous or to the Permian faunas of western Europe; about one-half of these species showed some more or less definite relations to the Lower Permian fauna of Kansas and partly also to the Upper Permian fauna of Australia. The forms of the 'Kansas type' are all characterised by their rather small dimensions, while the Permian forms of Europe are mostly large; this suggests that the fauna of the 'Kansas type' developed under less favourable climatic conditions than the European fauna of the same period, probably in some land north or north-west from Kansas during the Lower Permian period; then it migrated by the North Pacific bridge to the Angara continent and penetrated farther westwards, reaching European Russia in the Upper Permian period. A meridional sea which extended at that time right across the present European Russia from north to south, stopped the fauna from reaching western Europe, where a distinct Permian fauna consisting of large forms developed under very different and more favourable climatic conditions. Certain affinities between the Permian faunas of northern Russia and of Australia are difficult to explain in the present state of our knowledge.

EARTH-TILTINGS PRECEDING EARTHQUAKES.—Two interesting papers on this subject are published in the *Proceedings* of the Imperial Academy, Tokyo (vol. 4, pp. 148-153). Mr. S. Haeno has examined the records of two horizontal pendulums at Tokyo specially designed for the purpose. He notices the existence of two regular variations, one diurnal, the locus of the vector end being an elliptic curve with a major axis of $0.57''$ in the direction N. 80° W.: the other annual, the locus of the vector end being roughly elliptical, with a major axis of $10''$ in the direction N. 50° E. These regular variations agree

closely with variations of the earth's temperature at a depth of 10 cm. In addition, the records sometimes indicate variations of an irregular type, one of which occurred just before the Haneda earthquake of Aug. 3, 1926. In the other paper, Prof. A. Imamura describes the tilting of the earth for forty days before the great earthquake of Sept. 1, 1923. From July 18 until July 30 the tilting southwestwards may be regarded as a normal variation of land-level caused by the gradual increase of air temperature. Then came a very conspicuous and abnormal tilting of nearly 1.7" downwards towards W. by N., which continued until Aug. 17. During the succeeding fortnight the changes were normal until the morning of Sept. 1, when a sharp tilting of 0.3" occurred in eight hours, ended abruptly by the great shock.

NATURAL GAS-AIR EXPLOSIONS.—Since for testing purposes, and for the study of gas explosions on a large scale, British investigators use methane, whilst in the United States of America natural gas—a mixture of the simpler hydrocarbons, and variable in its composition—is employed, a comparison of the two methods became desirable. The work, which was carried out at Pittsburgh under a scheme of co-operation between the Safety in Mines Research Board of Great Britain and the Bureau of Mines, U.S.A., is described in *Technical Paper of the U.S. Bureau of Mines*, No. 427, by H. F. Coward and H. P. Greenwald. The results amply confirm provisional conclusions that the use of natural gas (composed of paraffin hydrocarbons with not more than 2 or 3 per cent of nitrogen) instead of methane for testing the safety underground of electrical equipment, flame lamps, and explosives is justified, any slight difference being, in fact, on the safe side. The lower limit of inflammability of a natural gas in air may be calculated almost exactly, and the higher limit approximately, from the limits of its constituent hydrocarbons. From the results of a combustion analysis giving the ratio between the contraction on explosion and the volume of carbon dioxide thereby formed, and reference to a curve, the lower limit may be found with equal accuracy in the absence of knowledge of the exact composition of the natural gas. It is interesting to find that the speed of uniform movement of flame, that is, the initial stage in the propagation of flame from the open end of a tube towards the closed end, can be calculated for mixtures of various samples of natural gas and air from data for the individual hydrocarbons on the basis of the so-called "law of flame speeds." Many of the experiments were carried out with a tube 100 ft. long and 12 in. in diameter, in order that the conditions should approach those obtaining in industry.

A NEW PERIODIC TABLE.—Prof. Yamamoto, of the Kyoto University Observatory, has recently revised a form of periodic table of the elements which he first published in January 1927 in a Japanese journal of astronomy entitled *The Heavens*. In this table the elements are arranged in families and series in much the usual way, but fall into two main groups. One of these groups contains elements almost all of which do not appear to be present in the stars or in the sun, while the other includes most of the elements so far observed in stellar spectra.

THE REACTION BETWEEN METHANE AND STEAM.—The reaction: $\text{CH}_4 + 2\text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + 4\text{H}_2$ has been investigated at 500° C. and 1 atm. pressure by R. N. Pease and P. R. Chesebro, who describe their results in the May issue of the *Journal of the American Chemical Society*. The equilibrium was approached from both sides, the gas mixtures being passed at measured rates of flow over a supported nickel-thoria catalyst at 505° C.

and then analysed. The average value of the equilibrium constant at this temperature was found to be 0.037, while that calculated from the free energy equations of Lewis and Randall is 0.0387, thus showing that the expression used for the free energy of methane at 500° C. is satisfactory. The presence of about 1 per cent of carbon monoxide in the effluent gas indicates that the reactions $\text{CH}_4 + \text{H}_2\text{O} \rightleftharpoons \text{CO} + 3\text{H}_2$ and $\text{CO}_2 + \text{H}_2 \rightleftharpoons \text{CO} + \text{H}_2\text{O}$ also take place to some extent. The reactions between methane and steam at high temperatures form a possible source of hydrogen and hydrogen-carbon monoxide mixtures, the concentration of the carbon monoxide being decreased if required by the use of excess of steam.

PURIFICATION OF INVERTASE.—The problem of obtaining a pure preparation of the enzyme invertase has been partially solved by some recent work of Sastri and Norris (*Jour. of Indian Inst. of Science*, vol. 2A, Part 1). Several methods in use for the purification of invertase have not so far succeeded in producing the enzyme free from both protein and yeast gum. The most difficult part of the problem, however, is the removal of substances closely allied to the enzyme itself, and probably consisting of inactivated enzymes, zymogens, and decomposition products of invertase. The method of Sastri and Norris consists essentially in the autolysis of the yeast in the presence of toluene, after which the liquor is concentrated by freezing. Various impurities are then absorbed by kaolin, which is centrifuged out and the clear liquor siphoned off. The enzyme is then precipitated by ammonium sulphate (which does not inactivate the invertase), and the precipitate is washed with water. Removal of the sulphate by dialysis follows, and the enzyme is absorbed by aluminium hydroxide, which is later filtered off by a bed of previously ignited kieselguhr. The preparation is white and free from yeast gum. It is odourless and gives neither the Molische test for carbohydrates nor the Millon test for proteins. It gives, however, a very faint biuret reaction and the xanthoprotein reaction. The nitrogen content and ash content are both very low. It is free from maltase, oxidase, reductase, and all other enzymes known to be contained in yeast. The activity of the preparation is expressed by the 'time value' defined by Willstätter and Kuhn, and changes during the process of purification from $\pm 0^\circ = 430$ minutes in the original yeast liquor to $\pm 0^\circ = 0.91$ minutes in the purified enzyme.

THE CARBONISATION PROCESS.—The eighteenth Report of the Joint Research Committee of the Institution of Gas Engineers and the University of Leeds records a continuation of the study of the carbonisation process carried out in the Corbet Woodall Experimental Plant at the University of Leeds. It deals with the effect of size of coal treated and with the effect of admixture of ferric oxide (2.2 per cent), calcium carbonate (3.4 per cent), sodium carbonate (3.3 per cent), with the Nottinghamshire coal distilled. The retorting temperature was reduced to 915° C., and the results were largely parallel with those obtained in previous tests at 980°. Experiments with blends of coal and coke did not promise great advantage. Striking effects were observed with the mixtures of coal and inorganic compounds. The yield of gas in therms was always increased—with the soda by 12 per cent—and this was ascribed partly to the more far-reaching decomposition of steam by the reactive coke. It was only the mixture with calcium carbonate which gave a much greater yield of ammonia. The reactivities of the cokes were increased by the presence of the inorganic compounds, but abnormalities require further investigation.