

## Research Items.

**Early Man in India.**—In a report by Col. Seymour Sewell and Dr. B. S. Guna (*Memoirs, Archaeol. Survey*, No. 35, App. 5), the bones excavated at Nal, in Baluchistan, by Mr. H. Hargreaves of the Archaeological Survey and attributed by Sir John Marshall to the chalcolithic age, are described and their possible affinities discussed. Of two crania described by Sir Arthur Keith, one, the 'Sialkot' skull, probably belongs to much the same period as the bones from Nal. These consist of fragments representing thirteen individuals, of whom some were children. With the human remains were bones of birds and mammals, part of a large and remarkable bone pin, and some fragments of pottery. Part of an adult skull was found. The greater part of the left side of the skull is missing, as is the lower jaw. It is markedly dolichocephalic, having the low index of 70. This may be due to a slight posthumous flattening. A crescentic piece of flatly ground limestone was wedged at the back of the hard palate. It is suggested that this is an early form of the Indian custom of placing a gold coin in the mouth and of other methods of occluding the mouth and nostrils to prevent the escape of the soul. The teeth are large and well formed, but very much worn down by a hard diet. The long bones show the flattening usually attributed to life in a mountainous region. Owing to the scarcity of types of this early period, it is difficult to suggest physical affinities. The closest resemblance is to the dolichocephalic type from Kish, except that the Nal skull has a much higher vault. Of the two types found at Mohenjo-Daro, the dolichocephalic also resembles the Kish type, but the brachycephalic appears to be Mongoloid rather than Armenoid, as has been suggested for the Kish brachycephalic.

**Skull of Ornithorhynchus.**—Dr. Kesteven and Mr. Furst (*Jour. Anat.*, vol. 63, pt. 4, pp. 447-472, July 1929) give the first complete description, in the English language, of the skull of the platypus, based on a series of nine skulls, from a foetal skull measuring 25 mm., to the skull of an old adult. Such a complete series has enabled the authors to work out the development of the skull, and to correlate features of the early skull with those of the adult. They show, among other features, the extent and situation of the presphenoid and ethmoid ossifications, and have discovered that the squamosal bone is excluded from sharing in the formation of the inner wall of the cranial cavity. They believe that an independent lachrymal bone is present as a separate entity in the youngest skull, and is still recognisable up to a skull measuring 65 mm. A discussion on the significance of the alisphenoid lamina of the petrotic bone is added by the senior author.

**Migration of Sea Animals to Land.**—Mr. A. S. Pearse ("Observations on Certain Littoral and Terrestrial Animals at Tortugas, Florida, with special reference to Migrations from Marine to Terrestrial Habits." Papers from the Tortugas Laboratory of Carnegie Institution of Washington, vol. 26, No. 6) makes some interesting experiments and observations on the ability of certain littoral animals to live in fresh water and on land. In their natural surroundings the sea animals of the Dry Tortugas have little or no opportunity to migrate to fresh water, but there are several crabs and hermits which are adapted for living in more or less dry situations. These form a series which inhabit all grades from sea to land, culminating in the land hermit, *Cenobita diogenes*, which lives far from the shore and can do without gills at all, as the

author has shown by experiment. Crabs that have migrated landwards show a progressive lessening of gill volume, sometimes developing respiratory tufts on the lining of the branchial cavity. As is stated, "An ideal animal is air-breathing, water conserving, swift, and internally stable". As an example of such an animal that has migrated from the sea, the crab *Ocypode* is instanced, which is swift, aggressive, more or less diurnal, and spends most of its time on land. It is omnivorous and a scavenger, and has lost a third of its gills and developed branchial tufts. An interesting point about this crab is the absence from its gills of parasitic mites which occur on some of the other land crabs. The habit which *Ocypode* has of bathing at intervals in the sea is given as the reason. A separate paper by the author in the same publication (No. 6) describes two of these mites which are new to science.

**Experimental Research on Freshwater Plankton.**—An important summary of research methods in freshwater plankton laboratories is given in Band 6, 1929, of Dr. August Thienemann's "Die Binnengewässer", which is wholly occupied by Dr. Einar Naumann, Director of the Swedish Limnological Laboratory of Aneboda, in his "Grundlinien der experimentellen Plankton-forschung". The author explains the aims of these laboratories, giving particulars of all researches in every aspect. Throughout, the importance of ecological work is emphasised, and details of methods both in field and laboratory are fully discussed. The laboratory at Aneboda is first briefly described as an example; all terms which have to do with limnological study are defined, and figures of apparatus and tables of reagents for analysis of the plankton, both living and dead, are given. Further sections discuss suitable waters for the laboratory, testing methods, and the regulation of the chemical constituents of water, including the estimation of pH, lighting and heating, plankton as food, and the feeding of the plankton organisms; finally, details of plankton culture both in the laboratory and in the open, and problems of plankton research. The cladoceran *Daphnia magna* is very much used in these researches, besides copepods, rotifers, and unicellular organisms, both plant and animal. The whole work is extremely useful to all those who have anything to do with limnological studies.

**Japanese Bryozoa.**—Mr. Yaichurô, Okada, in his "Report of the Biological Survey of Mutsu Bay, 12. Cheilostomatous Bryozoa of Mutsu Bay" (*Science Reports of the Tôhoku Imperial University*, 4th Series (Biology) Sendai, Japan, vol. 4, No. 1, Fasc. 1, February 1929), continues his survey of the Bryozoa. This is one of the contributions from the marine biological station at Asamushi, Aomori-Ken, and is the second paper on this group by the same author. In the present instalment only the Cheilostomata are described, twenty-seven species in all, six of which are apparently new. These latter include one species of *Ellisina*, two of *Caberea*, one of *Lepralia*, and two of *Micronella*. In *Costazia costazi* Audouin, which was very common, it was noticed that the zoecium exhibits a variable outer configuration, forming frequently a cubical mass, infrequently a discoidal convex thickened mass, and occasionally an encrusting mass. So far as these outer characters are concerned they might be regarded as distinct species, but from the characters of the zoecium they are found to agree and are therefore all included under one species.

**Appearance of *Phormia* in *Calliphora* Cultures.**—Prof. E. A. Bogdanov (*Nautchno-Agron. Zhurnal*, Moscow, No. 7-8, 1929) records some very interesting observations on the appearance on six separate occasions of the fly *Phormia coerulea* in the pure cultures of the *Calliphora erythrocephala*. The conditions of breeding of the latter (for genetic studies) were such that a contamination of the culture by the eggs of *Phormia* is considered exceedingly improbable. Moreover, the *Phormia* flies obtained in the laboratory differed physiologically from the wild flies of the same species, which could not have happened if they were their direct descendants. The main feature of the laboratory-bred *Phormia* is their inability to propagate further, while the wild fly is extremely prolific; other characters of the laboratory flies indicate also a considerable degree of degeneration, generally in the same direction as in the case of other mutants of *Calliphora*. Very remarkable is the fact that some females of the laboratory *Phormia*, though unable to propagate with their own males, produced fertile progeny with the males of *Calliphora*, and the hybrids of the first generation were indistinguishable from the normal *Calliphora*; thus the laboratory *Phormia* proved to be completely recessive to *Calliphora*. This can only occur in a case of a true mutation. In the following generations there was no uniformity, and most of the flies were pathological, but clearly belonging to *Calliphora*; in one case, however, a *Phormia* was obtained in the second generation. The author does not insist that the transmutation of one genus into another has actually taken place and is prepared for some other explanation. His main object in publishing the observations is to attract the attention of other workers on *Calliphora*, since it is probable that when similar cases are observed, they are attributed to an accidental contamination and not investigated in detail.

**Newer Tertiary Fossils from the Dutch East Indies.**—Collections of Newer Tertiary fossils from the Dutch East Indies are described by F. Siemon (*Ber. Naturf. Gesell. Freiburg i. Br.*, Bd. 29). One series was obtained on two expeditions, in 1907 and 1909-10, from the south-west of Dutch New Guinea in the regions drained by the North River, the Bibis River, and the North-west River. Twenty-two species of mollusca, two being new, with a few corals and foraminifera, as well as a selachian (*Carcharias gangeticus*, Müll.) are recorded and tabulated from Miocene and Pliocene deposits. Two text maps and half-tone figures from photographs of the new species accompany this part. Another series of fossils was collected by Prof. G. G. L. Kimmerling in the neighbourhood of Cheribon in Java, and these are dealt with station by station. In age they range from the Eocene upwards.

**Observing Sea Temperature.**—In discussing the reliability of various methods of taking the surface temperature of the sea (*Journal of Washington Academy of Sciences*, vol. 18, No. 20), Mr. E. F. Brooks notes that, with all its faults, the bucket method affords the only practical method for general use. It is useful, therefore, to note some of the sources of error that are likely to occur. The first source of error is that the bucket is unlikely to have the same initial temperature as the water: this may mean an error of 0.1° C. Then, again, the water sample may be cooled by evaporation and conduction. The conduction cooling can be prevented by a rubber covering two to four millimetres in thickness. Evaporation is less easy to check and may account for a fall in temperature of 0.5° C. The thermometer generally used has a metal case which may have an appreciable effect, but the case can be removed and

this error thus obviated. A quick responding thermometer is advisable to prevent the likelihood of a false reading, and for the same reason the thermometer should be read while in the water. A few other minor sources of error are noted. Mr. Brooks also shows that experiments have proved that in calm weather the temperatures at the surface and at a depth of 5-8 metres vary within 1.5° C. In rough water, however, there is little difference, and a thermograph attached to the condenser intake should give reliable surface temperatures.

**Afforestation and Stabilisation in Granada.**—The publication of the *Instituto Nacional de Investigaciones y Esperiencias Agronómicas y Forestales* (Año 2, Núm. 3, Madrid, 1929) contains several articles of interest. To a country possessing so little forest as is the case in Spain, one of the most important is a project for the correction and stabilisation of certain tracts of land in the Province of Granada, by J. M. Garcia Nájera, a mountain engineer. The author, after briefly discussing points justifying the scheme, proceeds to describe the geology of the area and the causes of instability. The primary cause, probably dating back several centuries, was the ruthless disafforestation practised, accompanied by and completed by fire and the pasturage of animals—especially goats. The engineer of course regards the matter from the point of view of the conditions actually existing, and they demonstrate the necessity of governments considering this question of erosion and denudation in mountain regions due to the absence of protection by existing forests. For present neglect will not only prove directly injurious to the descendants of the existing populations practising wasteful methods of utilisation, but will also result in heavy expenditure, which Spain is now undertaking in the stabilising work herein dealt with. The author discusses the various possible means for dealing with the instability and his proposed solution. This involves the construction of a main dyke, channels for intercepting water, embankments and trenching work and general drainage schemes. Lastly, plans of afforestation are dealt with and the establishment of rain gauges on the area. The article is illustrated with some excellent photographs and several plans depicting the works to be undertaken.

**Repulsion of Atomic Kernels.**—In the November number of the *Journal of the American Chemical Society*, W. M. Latimer has considered organic rearrangements from the point of view of the change in the repulsion of the atomic kernels which results from the chemical change and has arrived at the following conclusions. The great majority of rearrangements take place with a decrease in the interkernel repulsion energy; a few occur with no change in repulsion energy and are then regarded as resulting from a state of high activation of the molecule, and the product is a mixture of the two forms. Rearrangements with an increase in repulsion energy are rare and invariably accompanied by complex redistributions of electrons in the molecule. The observations are in accordance with the following premise: if there are several possible arrangements of the atoms in a molecule which have the same number of electrons per atom and satisfy equally well the tendencies of the more electro-negative elements to complete their octets of electrons, that form will be the most stable which gives a minimum of repulsion between the atomic kernels.

**Permeameters, Rods and Strips.**—The general principles of permeameters for testing rods and strips of iron by the use of a yoke to provide a return path for the magnetic flux are well known. The main diffi-

culty of such apparatus is to approximate sufficiently closely to the condition of uniform magnetisation which is assumed in the formulæ. To effect this, various means for compensating for lack of uniformity have been devised. With a uniform specimen, complete uniformity of magnetisation involves equality of magnetic potential and absence of magnetic leakage. The Ilivici permeameter tests the first condition and the modified form of Picou permeameter the second. In the November issue of the *Journal of the Institution of Electrical Engineers*, C. E. Webb and L. H. Ford describe precision permeability measurements on straight bars and strips in the region of high permeability. The construction of a yoke apparatus to give magnetising forces up to  $H = 3000$  on straight samples 25 cm. long and up to  $H = 5000$  on straight samples 10 cm. long is described. Search coils are used to measure the magnetising force and the conditions for satisfactory compensation for leakage are determined. It was found that solid bars were less liable to the effects of stress than sheet samples, but slightly bent or twisted specimens clamped between flat blocks give rise to serious errors. When search coils are wound directly on the sample, sheet material rings are very liable to be stressed. The errors due to variation in the reluctance of the path of the magnetic flux can be avoided by limiting the number of strips in the sample to ten, provided that they be accurately cut to a uniform width. For values of  $H$  greater than 15, the effects of stress and variation of reluctance become negligible.

**Reactions of Atomic Hydrogen.**—The action of atomic hydrogen prepared by Wood's method on a number of organic compounds has been studied by Urey and Lavin, whose results are published in the November number of the *Journal of the American Chemical Society*. Atomic hydrogen is, on the whole, a rather mild reducing agent. It reduces azoxybenzene at least partly to azobenzene and azobenzene partly to hydrazobenzene, with aniline as a final product. Certain solid dyes are reduced to colourless compounds which are partly oxidised again to the coloured form on exposure to air. Benzoic acid and acetamide catalyse the recombination but are not noticeably reduced. Atomic hydrogen recombines in the presence of formic acid. A small amount of formaldehyde is produced, probably due to the decomposition of the acid by heat into water and carbon monoxide and the subsequent formation of the aldehyde from carbon monoxide and atomic hydrogen. Acetaldehyde is polymerised to paraldehyde.

**Vapour Pressure of Rubber Jellies.**—In the October number of the *Journal of the Chemical Society*, P. Stamberger describes experiments on the vapour pressures of rubber jellies in three solvents; benzene, chloroform, and carbon disulphide. Up to a certain concentration the rubber causes no appreciable vapour pressure lowering, but beyond this the lowering increases rapidly with concentration. This result is quite different from that with 'true solutions' (molecular dispersions), for which a linear relation with concentration holds up to high concentrations. The results with different samples of rubber agreed, thus suggesting that rubber is probably a definite hydrocarbon and not a mixture of hydrocarbons of different degrees of polymerisation. The results are interpreted on the lines of the formation of solvated layers and not swelling by capillary forces. During the first stage of the process it is assumed a layer of solvent molecules is formed around the rubber particle, leaving free solvent to exert the normal vapour pressure. In the solvated layer solvent molecules exhibit vapour pressure lowering. The results

are shown to favour the assumption that the rubber molecules are long chains, and this type of molecule seems to be characteristic of substances which show swelling.

**Liquid Crystals and Chemical Constitution.**—The property possessed by certain chemical compounds of forming liquid crystals has been studied by D. Vorländer, who attempts in two papers in the November issue of the *Berichte der Deutschen Chemischen Gesellschaft* to correlate this property with certain deductions as to the relative orientations of two or more long chains of atoms to one another. It is shown that the non-appearance of liquid crystals in such derivatives of urea and thio-urea as are obtained by introducing two *p*-amino-*p'*-ethoxyazobenzene groupings into the molecule may be due to the angular divergence of these two long groups, which are linked together by the carbonyl or thio-carbonyl group at an angle of  $109^\circ$ . When, however, these compounds are converted to the corresponding di-imide by removing water (or hydrogen sulphide), this divergence disappears, since the double linking of each nitrogen atom to the central carbon atom results in a linear configuration  $-N=C=N-$  and the compound can exist in the liquid crystalline condition. This evidence is confirmed from a study of the esters which trimesic acid and the three phthalic acids produce with such lengthy chain compounds as *p*-phenetoleazophenol. The star-shaped orientation of the trimesic esters and the angular divergence ( $60^\circ$ ) of the chains in the ortho-esters seem to preclude the possibility of liquid crystal formation. The meta-esters with a divergence of  $120^\circ$  melt to liquid crystals which persist only over a short temperature-range, whilst the para-esters, in which the two chains are said to lie in a straight line, are described as supra-crystalline, that is to say, the liquid crystalline condition is so stable that the amorphous liquid state is not even attained.

**Voltage Control of Large Alternators.**—One of the difficulties which electrical engineers have to overcome is to maintain the voltage constant at an alternator's terminals when large loads are suddenly thrown on or off. An alternator requires direct current excitation, and its voltage is regulated by varying the current given by a direct current machine. The magnetic circuit of the alternator does not respond instantaneously to a change in the exciting current. The magnetic circuits of large machines store a large amount of energy, and consequently there may be a lag of a second or two in responding to the changes of the exciting current made necessary by sudden changes in the load. H. W. Taylor discussed the voltage control of large alternators in a paper read to the Institution of Electrical Engineers on Nov. 23. Voltage control is now required to be automatic within one or two per cent of its normal value. The author discussed the action and reaction of the two machines. In certain cases the alternator voltage is unstable, as, for example, when the load consists of a large overhead network on a light load or unloaded underground cables. In these cases the voltage can rise to a high value. Methods are given in the paper for computing the curve of falling voltage when a sudden load is thrown on the circuit. Modern voltage regulators act only on the field circuit of the exciting dynamo. The alternators have such large exciting currents that it would be impracticable to operate the very heavy contact pieces that would be required to vary their magnitude. An interesting oscillograph record is given of the transient variation in the field current when a change in the nature of the load changes the magnetic flux of the machine.