

Research Items.

A REMARKABLE OBJECT FROM BENEATH THE RED CRAG.—In *Man* for April, Mr. J. Reid Moir describes a remarkable object obtained from beneath the Red Crag at a pit on the north bank of the River Gipping at Bramford, near Ipswich. It was obtained from the detritus-bed lying below loamy sand, which in turn was below glacial gravel. The bed lies at about 100 O.D. upon the surface of the London Clay. It is made up of typical sub-crag detrital material and does not exhibit any signs of glacial disturbance. The object was discovered in 1926, but beyond being labelled, was not specially noted until attention was directed to its remarkable character by the Abbé Breuil, who, on examining it, pronounced it shaped by the hand of man. In shape it is like an elongated egg with one end slightly blunter than the other. At each end is a small depression or punctuation, and similar marks are visible on other parts—in places four or five being grouped together as a rhomboid or as straight lines. It is possible that these may be due to decomposition of crystalline grains. The whole surface has been scraped with a flint, so that it is covered with a series of facets running fairly regularly from end to end. From each one is made up a number of longitudinal striations of unequal depth; a number of fine concentric incisions are visible at one of the poles. The specimen is of a greyish-brown colour, weighs approximately $\frac{1}{2}$ ounce, and measures at its greatest length $1\frac{1}{8}$ in., and at its greatest depth $\frac{1}{4}$ in. The exact nature of its material is in doubt. The Abbé Breuil compares it with the steatite sling stones of New Caledonia.

TLINGIT EMBLEMS.—In the *Museum Journal* (Philadelphia) for December last, Mr. Louis Shotridge describes a number of ancient clan emblems of the Tlingit of Alaska; these formed part of a collection of ancient objects representative of the traditional art of this people which he was able to collect solely in virtue of the fact that he himself was a Tlingit of noble birth. These objects, it is stated, had not seen the light since the introduction of the white man's religion and law. The emblems are in the form of ceremonial head-dresses, each of a once generally recognised grade in rank and importance. The Tlingit were divided into two nations, each of which was subdivided into clans. Each clan had its ceremonial head-dress, but its possession was often the subject of dispute and the cause of internecine war. On the side of the Thighnaedi nation, first in importance was the raven hat, which signified culture; next in order the whale hat, an emblem of greatness and the cult object of the greatest clan. The frog hat signified persistence and was the emblem of the Kiks-adi clan. On the side of the Shungookaedi nation were the eagle, the grizzly bear, the emblem of power, and the wolf, signifying courage. The hats are for the most part woven of roots of the spruce, with highly conventionalised representations of the head or other part of the animal simulated carved in wood and ornamented with locks of human hair. On most there was a 'top-stock' of spruce roots, woven to resemble a number of interlocking cylindrical boxes superimposed which could be made to expand or contract. The number of these boxes or divisions represents the number of ceremonies in which each hat was used.

LESSONS FROM THE HUMAN FOOT.—In the third lecture in memory of Hugh Owen Thomas, delivered before the Medical Institution at Liverpool on May 11, 1928, Sir Arthur Keith discussed some of the problems of the human foot (*Jour. Bone and Joint Surgery*,

January 1929). Helooked upon thesequence of postural functions as a more promising line of investigation than anatomical details, and took it as proved that the human foot had been evolved from a prehensile foot, the nearest representative of the primitive form being that of the chimpanzee. The chief changes which transformed the prehensile into plantigrade were due to growth—a recession of growth of the external or planar limb of the prehensile foot with a progressive growth in the hallucial limb. Three stages of this growth-development can be followed: the pronograde prehensile foot, the small orthograde foot (hylobatian), the massive orthograde foot (troglodytian) leading to the human plantigrade. The mass of the body has been the most important factor in bringing about the later changes, and it is inferred that it was the weight of the body which compelled man's anthropoid ancestors to assume terrestrial habits of life, and that man is the descendant not of a pigmy anthropoid but of one of massive body.

RURAL POPULATION OF NEW YORK STATE.—In a study of the movements of population in New York State from 1855 to 1925 (Cornell University Agricultural Experiment Station, *Memoir* 116) Mr. B. L. Melvin brings to light a number of interesting facts especially with regard to recent years. While the population of New York State increased 7.5 per cent from 1920 to 1925, the total city population, including New York City, grew less than did other classes, and the larger cities gained less than the smaller ones. Suburbanisation was the most marked phenomenon in the shifting of population in that period. As a result, rural population increased, especially in those counties where urban influences were most dominant. That this increase was due to urban influences, provided no doubt by improved transport, seems to be clear from the fact that farm population increased only in suburban counties but decreased in all others. Cities seem to maintain the farm population near them rather than to cause its decline. In such a study, of course, the use of terms is somewhat arbitrary. Mr. Melvin classes as rural population all persons living outside places of population 2500 and above. The pamphlet is well illustrated with distributional maps.

MIGRATIONS OF THE ARCTIC TERN.—A *Daily Science News Bulletin*, issued by Science Service, Washington, D.C., announces that an Arctic tern, ringed as a fledgling at Turnevik Bay, Labrador, on July 28, 1928, was found dead on the beach at Margate, Natal, South Africa, on Nov. 14, 1928. This is a remarkable record, not only for the distance covered, but also for the fact that the bird could have been only about three months old at the time of the flight. It suggests the possibility that the birds, which are rarely or never seen on the south Atlantic coast of the United States, may cross the ocean to Europe and then proceed south. The extensive migrations of the Arctic tern are well known, and owing to its habit of breeding in the northern portion of the northern hemisphere and of wintering in the far south, it enjoys more hours of sunlight than any other living creature. In the northern part of its breeding range and during its stay in the Antarctic regions, it lives practically in continuous daylight.

GENITALIA AND GENITAL DUCTS OF INSECTS.—C. J. George (*Quart. Jour. Micr. Sci.*, vol. 72, part 3) has examined the development and morphology of

the genitalia of Homoptera, as represented by the frog-hopper, *Philænus*, and of Zygoptera as represented by *Agriion* (one of the demoiselle flies) and sets down the homologies of the parts. As the result of studies on the development of the genital ducts, he concludes that the vaginal opening in Orthoptera, Hymenoptera, Homoptera, Diptera, and Lepidoptera is homologous, and that the vaginal opening in Coleoptera is homologous with the oviducal opening of Lepidoptera and with the opening of the accessory gland of Homoptera, Hymenoptera, Diptera, and Isoptera. The common oviduct, being formed differently in the different groups, is not homologous, and the accessory organs, for example, spermatheca, are not homologous. The author discusses the probable lines of evolution of the female ducts in Insecta, and points out that the Ephemeroptera with their double female openings on the seventh abdominal segment exhibit an ancient condition, and that many higher insects pass through this condition during their larval and nymphal stages. The existence of an ectodermal invagination behind the seventh abdominal segment in Homoptera and Orthoptera shows that the acquisition of a single gonopore was the next step. The later ontogenetic history shows that there has been a tendency to shift the gonopore to the terminal abdominal segments. The conclusion is that the Orthoptera, Homoptera, Lepidoptera, and Diptera are closely allied, but the Coleoptera have had a different line of evolution.

CHROMOSOME LINKAGE IN *ÆNOTHERA* HYBRIDS.—Prof. R. R. Gates and F. M. L. Sheffield, in *Phil. Trans. Royal Soc.*, B, vol. 217, 367 (1929), have published an account of important cytological researches on reciprocal hybrids obtained from *Ænothera ammophila* and *Æ. (biennis × rubricalyx)*. The reciprocal F_1 hybrids are very different and are patroclinous. The chromosome linkages were found to be unlike in the reciprocal hybrids. In *Æ. ammophila × (biennis × rubricalyx)* the spireme segments in diakinesis into three free pairs of chromosomes and a ring of eight. In the reciprocal cross there are, on the contrary, seven chromosome ring pairs. That the latter has all its chromosomes paired makes it clear that complete pairing is not necessarily a sign of the homozygous condition. The conclusion is reached that since the same two haploid sets of chromosomes are present in the reciprocal hybrids, the cytoplasm plays a part in determining what pairing shall take place; it influences the attractions between the chromosomes and the distribution of chromosomes in the reduction division. This leads in itself to a departure from usual Mendelian behaviour. The production in F_1 of true breeding hybrid types is to be explained through the occurrence of chromosome linkage, which prevents free assortment of the chromosome pairs, and hence of the differential characters. Linkage differences in *Ænothera* occur in wild species as in mutations arising in controlled experiments. It seems, therefore, that evolution can occur through germinal changes (mutations) of various kinds arising in a succession of species which are of natural hybrid origin, but, in the main, breed true because of their persistent chromosome linkages in meiosis. In this probable sequence we have suggested a new evolutionary phenomenon which may be of much significance for the student of the origin of species.

A NEW 'DEEP' IN THE PACIFIC.—A *Daily Science News Bulletin*, issued by Science Service, Washington, D.C., announces that the non-magnetic ship *Carnegie*, now cruising in the Pacific Ocean, has discovered a new deep some fifty miles west of Tahiti. The greatest depth was 5400 metres, and its area does not seem to

be extensive. The observations were made with the sonic depth-finder. Captain Ault named the depression the Bauer deep, after the director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. A further discovery was that of a submarine ridge in approximately lat. 23° S. and long. 80° W. This seems to be a northward extension of the ridge on which the San Felix Islands lie. It was named the Merriam ridge. Other oceanographical discoveries were made, but details are not yet given.

ICE IN THE ARCTIC SEA.—The Danish Meteorological Institute has published in the *Nautisk-Meteorologisk Aarbog*, 1928, its usual report on the state of the ice in Arctic Seas during the year. Most of the observations are naturally for the summer months, but off south-west Greenland, western Spitsbergen, and in the North Atlantic it is possible to give reports for all months. In the Barents and Kara Seas there was less ice than usual in the summer. Franz Josef Land could be reached in August, while in September there was even water between some of the islands of the archipelago. In Spitsbergen waters conditions were favourable except for unusually late streams of pack-ice on the south-west coast. In August and September Spitsbergen could be circumnavigated without difficulty. The east coast of Greenland had rather more ice than usual, and this state of affairs was found also in the east of Spitsbergen. On the other hand, there seems to be no evidence of an increased outflow of pack-ice by the other outlets of the Arctic Sea. Davis Strait and Baffin Bay had rather less ice than usual. Reports from the Bering Sea are few and vague. Iceland coasts were practically free throughout the year. On the Newfoundland Banks pack-ice was below the normal in every month, but icebergs were much above the normal in April, May, and June. The report is illustrated with the usual charts for the spring and summer months.

RAMAN EFFECT AND THE SPECTRUM OF HYDROGEN.—In *NATURE*, Jan. 26, p. 127, Prof. H. S. Allen suggested the view that many of the faint lines in the secondary spectrum of hydrogen may result from the bombardment of hydrogen molecules by light quanta of frequencies corresponding to the Balmer lines. A table was given for the first five Balmer lines showing a number of possible Raman lines having frequency differences with respect to the exciting line which were integral multiples of a particular wave number. Dr. D. B. Deodhar, Physics Department, University of Lucknow, in a letter to the Editor, states that he has made a further search in this direction, using the recently published wave-length tables of Finkelburg, and for ten members of the Balmer series has found a large number of lines, both of lower as well as of higher frequencies, which approximately occupy the positions of Raman lines. Finkelburg's experimental tube was energised with 2000 volts, giving a discharge current of 600 ma., while the current in Gale, Monk, and Lee's tube was only 20 ma. Finkelburg discovered about 2000 lines which were previously unknown in the spectrum of hydrogen. The intensity of the Balmer lines in his experiments was considerably greater than in those of Gale, Monk, and Lee. It is interesting to note that a majority of the Raman lines of increased frequency belong to the newly discovered lines, and that they are of very low intensity. Dr. Deodhar expresses the opinion that his results strongly corroborate the view put forward by Prof. Allen; but, in consideration of the high accuracy of recent measurements of wave-lengths in the hydrogen spectrum, it may be well to scrutinise such results very carefully.

MOLECULAR RAYS.—Some experiments performed with beams of molecules by Prof. O. Stern and F. Knauer (*Zeitschrift für Physik*, Mar. 7) furnish good qualitative evidence that particles of atomic dimensions, as well as electrons, behave as waves in certain circumstances. The de Broglie waves of a hydrogen molecule at room temperatures gave an average wave-length of about 1 Å., and should therefore be reflected specularly from a well-polished mirror if they are incident upon it at an angle of the order of a thousandth of a radian, as are X-rays of corresponding wave-length. This has been shown to be the case; the efficiency of reflection is greater the less the glancing angle, and the angle at which reflection first becomes marked is about that which would be expected from the size of the irregularities on the polished surface, whilst the amount of reflection increases as the temperature of the beam of molecular rays is lowered, that is, as the equivalent wave-length of the particles is increased. Prof. Stern was unable to obtain any positive results in an attempt to diffract molecules from a ruled grating, but his results with a crystal surface, although not quite definite, are compatible with the idea that diffraction takes place in this case.

LOAD AND TARIFF IN ELECTRIC SUPPLY.—The standard method of distributing electrical energy in Great Britain is by means of three wires carrying alternating currents, the phases of the currents in each wire being different. The consumer's load can either be connected in mesh (like a triangle) or in star (the three wires being joined together at one point). When the load is balanced, the measurement of the power taken presents no difficulty. When, however, the power expended in each of the three arms is different, the problem becomes complex and the ordinary methods of measurement give no useful or sufficient indication of the nature of the load taken by a consumer. In addition to the values of the three currents in the arms, we have to take into account the phase differences between these currents and the electromotive forces driving them. This problem, which is almost purely mathematical, was discussed in a paper by E. W. Hill, read to the Institution of Electrical Engineers on April 5. The solution arrived at, however, whilst possibly better than some of the methods at present in use, appears to us not to classify consumer's loads in a truly equitable way. If the assumption is made that all the waves follow the harmonic law, the solution given by Russell, which is referred to in the paper, seems to be a satisfactory one. The general case, however, yet remains to be solved, although a very large number of papers have been written on the subject, especially in America. There are few industrial applications where mathematics can be more usefully employed than in electrical engineering.

GEOGRAPHICAL INFLUENCES AND RADIO WAVES.—In the *Revue Scientifique* for Mar. 23, R. Bureau, of the French meteorological office, gives data which show that ordinary meteorological and geographical causes exert a very appreciable influence on the propagation of radio waves. In the early days the hypothesis of a conducting layer in the upper atmosphere was a great help in enabling us to picture how part of the radio energy flowed round the earth. With waves the frequency of which exceeds 6000 kilocycles (wave-length less than 50 metres) it gives a fairly satisfactory explanation of the 'zones of silence' observed in practice. It is now accepted, however, that the height of this layer is a quantity varying at different times of the day and that there are possibly several conducting layers at different

heights. Apart, however, from what happens in the upper atmosphere, important effects are produced in the troposphere, which is about six miles in height, and in the lower layers of the stratosphere. Contrary to expectation, direct experiment has shown that the surface which separates the stratosphere from the troposphere has little, if any, effect on the propagation of the waves. It is found that short waves, whether entering or leaving France, have very different properties, which depend on their direction of propagation. Waves coming from the Caribbean Sea, Panama, and the Gulf of Mexico suffer little attenuation. On the other hand it is, if not impossible, at least very difficult to get signals from the north-east of the United States and from Newfoundland. Signals given by a 200-watt emitter on the Atlantic coast of Morocco seem never to reach central or eastern Europe, although they can be heard in other directions for thousands of miles. The radio waves seem to have difficulty in passing through the surface of separation between a mass of cold air and a mass of warm air. The lines which separate the audible zones from the zones of silence often coincide very closely with the meteorological lines separating masses of cold and warm air.

CRYSTAL STRUCTURE OF β -THALLIUM.—At the ordinary temperatures, α -thallium has a hexagonal close-packed lattice. Drs. Nishikawa and Asahara have shown by X-ray methods that it has an inversion point at about 230° C. The change in crystal form consequent upon this has been investigated by Mr. Sinkiti Sekito, of the Research Institute for Iron, Steel, and other Metals, Sendai, Japan, who has sent us a short communication on the subject. The metal was retained in the form stable above the inversion temperature by quenching it in iced water. Photographs were then prepared, using a chromium anticathode and taking the wave-length as $\text{CrK}\alpha = 2.287$, $\text{CrK}\beta = 2.080$. It appears from these that β -thallium has a face-centred cubic lattice ($a = 4.841$). Calculating the specific gravity from this value, the figure 11.86 is obtained, which agrees well with the results obtained by other methods. A similar face-centred cubic structure was obtained with thallium alloys containing bismuth, lead, antimony, or tin in solid solution. Mr. Sekito concludes, therefore, that the face-centredness of thallium above 230° C. has been definitely established.

HYDRATES OF CADMIUM SULPHATE.—The hydration of cadmium sulphate was for long the subject of controversy, until Hauer and also Rammelsberg showed that, at ordinary temperatures and pressures, this salt crystallises from its solutions as the monoclinic hydrate, $\text{CdSO}_4 \cdot 2.67 \text{H}_2\text{O}$. This result was confirmed by later investigators and, as a consequence of vapour pressure measurements by Carpenter and Jette in 1923, the temperature of transformation into the monohydrate was given as 41.5°. A systematic study of the dehydration of this salt, carried out by Prof. Luca Coniglio, is recorded in the *Rendiconti* of the Academy of Physical and Mathematical Sciences of Naples for January–April 1928. The experimental data show that at 74°, $\text{CdSO}_4 \cdot \frac{3}{2} \text{H}_2\text{O}$ loses $\frac{1}{2} \text{H}_2\text{O}$, giving the monohydrate, which is stable until the temperature reaches about 120°, when further expulsion of water occurs, with formation of $3\text{CdSO}_4 \cdot 2\text{H}_2\text{O}$. The latter hydrate is stable at temperatures below about 138°, when another molecule of water is lost, giving $3\text{CdSO}_4 \cdot \text{H}_2\text{O}$, which is converted, but only comparatively slowly, into the anhydrous salt at 150°. It seems probable that the water of crystallisation of the original salt is combined, not with a single molecule, but with three molecules, of the cadmium sulphate, the formula being $3\text{CdSO}_4 \cdot 8\text{H}_2\text{O}$.