

## Research Items.

MARGIDUNUM.—Dr. Felix Oswald reviews the results of his excavations on the Roman site of Margidunum in a paper published in the *Transactions of the Thoroton Society*, vol. 31. Margidunum was situated on the Fosse Way, half-way between Leicester and Lincoln, and in the early days of Roman occupation was of considerable strategic importance. When, however, the frontier was pushed north, it ceased to be of value in this respect, and, being off the trade routes, it became merely a posting station. It revived under Constantine, when in the then flourishing condition of Britain it became a seat of much activity. At the close of the occupation it suffered no violent end but sank into decay. It was never occupied by the Saxons. Owing to the long period of its continuous occupation, its history, as revealed by excavation, affords numerous illustrations of changes in Roman practice and culture. The name is probably a Romanised form of a Celtic denomination meaning 'the plain of the king,' and the adjacent eminence on which Belvoir Castle is situated may have been a hill-fort of the king of the Coritani. Sporadic relics of prehistoric times have been found—flint arrow heads, polished axes, and bronze socketed celts. That the Roman occupation was early is indicated by the rhomboidal form of the first camp. It was protected by a wooden palisade and a system of trenches or ditches, six in number. In later times, when the Romans abandoned this system of defence for a stone rampart with a single ditch, the marshy ground of the early site was filled in with stone and rubbish and gravelled over. In the early days the soldiers may have lived in leather tents or in the underground cellars which have been found. After the burning of the camp by Boudicca in A.D. 61, stone barracks were erected. There are other signs of this consequence of the disastrous defeat of the Ninth Legion, then stationed at Lincoln, by the British queen. Moulded stones much calcined by fire were found in the ditch. These, it is conjectured, are parts of the stone gateways which gave access to the original camp within the wooden palisade.

SEX OF EELS.—Grassi's presumption that the so-called 'male' freshwater eels, less than 30 cm. in length, are not sexually defined has been experimentally confirmed by J. J. Tesch (*Jour. du Conseil Perm. Int. pour l'Exploration de la Mer*, vol. 3, No. 1, April 1928). The remarkable fact that as a rule males are to be found in estuaries and river-mouths, whereas females are most numerous in the upper reaches, has long attracted attention. Further, females outnumber the males wholesale in samples of the larger eels, though they are almost absent in those of smaller individuals. This cannot be explained altogether by the supposition that females grow more rapidly than males, thus telescoping the earlier stages. Tesch took a large number of small eels (20-25 cm.) from the Zuiderzee and kept them for three years in concrete tanks. A sample of these when first taken consisted entirely of 'males.' After a year there was no change, but after another two years, three in all, the survivors, twelve in number, were all females, with numerous ova developing in their ovaries. This experiment is being repeated on a larger scale. Further investigations on age determination confirm the fact that males do not become silver eels, that is, ready for the spawning migration, until their sixth year, and the vast majority not until their seventh or later, when they are 30-42 cm. in length. Female silver eels are not found less than about ten years old, and reach a much greater size.

RESEARCHES ON EARTHWORMS.—Three papers in the *Science Reports of the Tohoku Imperial University* (Fourth Series (Biology) Sendai, Japan, Vol. 3, No. 3, Fasc. 3, May 1928) deal with the biology and anatomy of Japanese earthworms. Mr. Takeo Imai's work describing the nervous system of *Perichæta megucolidioides* Goto and Hatai is valuable; the large size, toughness of body wall, and peculiar behaviour of this worm when stimulated making it an exceedingly good object for various researches; and as it represents the commonest genus of earthworms in Japan, knowledge of its anatomy is eminently desirable. Although the general scheme of the nervous system agrees with that of other earthworms which have been described, there are certain differences, especially in the number of cerebral nerve trunks arising from the cerebral ganglion which supply the prostomian region and buccal cavity. "The Effect of Inorganic Salts on Phototaxis in *Allolobophora fetida* (Sav.) (3). Nitrates," is described by Mr. Ekitaro Nomura and Mr. Shinryo Ohfuchi, who have previously dealt similarly with chlorides and sulphates in earlier work in this same journal (No. 2 and 3, Vol. 3). *Allolobophora fetida* is also the subject of Mr. Sataro Kobyashi's paper on spectroscopic observations on porphyrin in the integument of this worm. The object of this research was to decide whether the pigment belongs to hæmoporphyrin, the conclusion being that it differs spectroscopically in certain important particulars.

FEEDING MECHANISM OF *CHIROCEPHALUS*.—Prof. H. Graham Cannon describes (*Trans. R. Soc. Edin.*, 55; 1928) the feeding mechanism of the fairy shrimp *Chirocephalus diaphanus*. This animal normally swims on its back and feeds on minute particles which it separates from water-currents produced by its trunk-limbs. Water is drawn into the mid-ventral space between the trunk-limbs mainly from in front and above, passes out laterally between the limbs and is swept backwards in two powerful lateral swimming currents. The rhythm of the limbs which produces the swimming stream and the food current is carefully described. The food-particles, drawn into the mid-ventral space by the suction produced during the forward stroke of the limbs, are carried towards the mouth and passed by the maxillules on to the mandibles and probably entangled by the secretion of the labral glands. The view that the phyllopodium represents the primitive crustacean limb is criticised, and it is suggested that a flat, biramous, paddle-like limb, such as occurs in the posterior trunk-segments of *Lepidocaris*, represents the constitution and arrangement of the primitive crustacean limb.

HUMUS-LIVING MILLIPEDES.—O. F. Cook and H. F. Loomis give an account (*Proc. U.S. Nat. Mus.*, vol. 72, Art. 18, 1928) of millipedes of the order Colobognatha from Arizona and California, with descriptions of six new genera. A special interest is claimed for millipedes of this order as examples of interrupted or residual distribution in widely separated regions which could not be reached by any method of transportation now at the disposal of these animals. The explanation of such facts of distribution is to be found in the vegetation and the surface conditions in former ages, which must have been very different from those of the present time. The Colobognatha are delicate, fragile, slow-moving millipedes, unable to burrow in the soil or to withstand surface exposure; the legs and other appendages are very short and unspecialised, and the mouth parts rudimentary. The outstanding requirements for these humus animals is a continuous

supply of moisture. A study of the distribution of the humus fauna may throw light on the natural conditions in the south-western area of the United States before the period of human activity, for there can be little doubt that the surface conditions have been greatly changed during the human period.

**A BACTERIAL DISEASE OF PINEAPPLES.**—F. B. Serano describes a brown-rot of pineapples in the *Philippine Journal of Science*, vol. 36, July 1928. On the basis of inoculation experiments, he decides that the causal organism is a primuline yellow bacterium, a new species *Erwinia ananas*, which is fully described with particulars of its behaviour in culture. Whilst the disease does relatively little damage to the native pines, 54 per cent of the fruits of the 'Smooth Cayenne' variety examined were attacked, and one-third of these were a total loss. As is so often the case with bacterial diseases, the flowering stage is the susceptible stage. The stigma, with its sugary surface ready for the pollen, provides an inviting opportunity for the pathogen, which also enters by natural lesions in the placenta and near the base of the stamens. As the fruit matures, inoculation experiments show that the tissues become more resistant to the organism, a fact which explains the important observation of the author that the disease does not seem to make headway upon fruits in storage.

**EARTHQUAKES DURING 1918-24.**—The catalogue of earthquakes for the seven years 1918-24 which has been prepared for the British Association by Prof. H. H. Turner, will be greatly valued by seismologists ("Catalogue of Earthquakes 1918-24: being a Digest of the International Seismological Survey (1918-24)". Pp. 64. London: British Association, 1928. 2s.). Based on the *International Seismological Summaries*, the catalogue gives for every important earthquake its date in Greenwich time, the position of its epicentre, the number of stations at which it was recorded, thus suggesting a rough measure of its intensity, and the previous dates at which the same origin was in action. Earthquakes in which the preliminary wave *P* was observed at distances of at least 80° from the epicentre are indicated, as well as those earthquakes with focal depths that differ much from the normal. As many as 29 earthquakes appear to have a focal depth of 0.05 or more of the earth's radius below the normal depth, which is taken to be about 0.008 of the radius or 30 miles. In two earthquakes the depth is given as 0.08 radius below the normal. It is worthy of notice that no day in the whole seven years is without a record, though on some days an earthquake was registered at only one or a few places.

**GEOLOGY OF ZANZIBAR.**—During the years 1925-26, Mr. G. M. Stockley made a detailed geological investigation of Zanzibar and Pemba, and his results are now handsomely published by the Government of Zanzibar (*Report on the Geology of the Zanzibar Protectorate*, March 1928, price 12s. 6d.). It is shown that the present East African coastline was determined in Neogene time, Pemba being separated from the mainland towards the end of the Miocene as a result of rift faulting. This severance is reflected in the difference between the living fauna of Pemba and those of Zanzibar and the mainland. Zanzibar became individualised very much later. Originally a sandbank fringed with corals, the advance of the Azanian Sea in early Pleistocene times converted it into a group of small islands. Retreat of the sea followed by recent encroachment produced the present outlines. Pemba has also been affected in recent times by a relative rise of sea-level. The Tertiary and Recent deposits are described in adequate

detail, and a particularly valuable chapter deals with the correlation of the Indo-Pacific Neogene. Water supply and other economic questions are naturally discussed fully, since they were among the primary considerations which led up to Mr. Stockley's appointment.

**FLOW OF WATER THROUGH THE STRAITS OF DOVER.**—Dr. J. N. Carruthers has written a memoir entitled "The Flow of Water through the Straits of Dover as gauged by Continuous Current Meter Observations at the Varne Lightvessel," Pt. I (Fishery Investigations Series 2, Vol. 11, No. 1. London: H.M. Stationery Office, 1928), dealing with the mechanism and the results obtained with a drift indicator which he has designed on the principle of the Ekman current meter, but which can be left working for 3 days or more, even in the roughest weather. The indicator is well adapted for the heavy service of obtaining continuous records, one instrument having been worked continuously for a year by the personnel of a light vessel. The run of the north-east going tidal stream through the Straits of Dover was usually found to exceed the return south-west going stream. During the course of a lunar day the excess flow amounted on an average to 2.7 miles, from the Channel into the North Sea. At times this was greatly exceeded, the extreme being 16.8 miles, associated with strong south-westerly winds driving the water up the English Channel, southerly winds in the North Sea and spring tides. In this case each 'flood' or north-east going tidal stream ran about 11 miles while the ebb stream only ran about 2½ miles. At other times the ebb or south-west going tidal streams exceed the 'flood' or north-east going streams, resulting in an over-all flow of water, or residual current, from the North Sea into the English Channel. The extreme so far recorded of this reversal of the usual current is 11.9 miles per lunar day from the North Sea into the Channel. These reversals are brought about by the tractive force of north-easterly winds in the Channel, usually in conjunction with northerly or north-westerly winds over the North Sea which tend to pile up the water towards the south. The author has estimated from records extending over a year that enough water comes through the Straits of Dover annually from the English Channel to form a layer 13½ feet deep over the whole superficial area of the North Sea.

**FIXATION OF SAND DUNES.**—Many countries are faced with the problem of controlling and reclaiming sandy wastes in order to check destruction of arable land. Some account of the successful work in Cyprus is given in the *Bulletin of the Imperial Institute* (vol. 26, No. 3) by Dr. A. H. Unwin. The areas of sandy waste in Cyprus are small—the largest is a little more than five square miles—and the meteorological conditions are favourable. Most of the year is moist, but August-September and December-January are dry periods. The sand consists mainly of silica, but there are sufficient mineral salts to allow a fair growth of trees. Water is provided from wells and is raised by an air motor to a tank from which irrigation channels lead. When the channels are ready, the seedlings are planted, and when the area is completely planted the air motor is moved to another site. In some cases ploughing and drilling is a sufficient preparation of the ground, but for at least the first five seasons the seedlings must be watered in the dry seasons by carts or gravitation channels. Under these conditions growth is quick. The wattle was mainly used, but other useful trees are the Aleppo and stone pines and the cypress. Several other trees, including the eucalyptus, carob, olive, false acacia, and juniper, have been tried.

**OSCILLATIONS IN IONISED GASES.**—During the last few years, several instances have been reported of the occurrence of electrical oscillations the origin of which could not be traced with certainty, in thermionic and other similar devices. These have been particularly noticeable in discharge tubes containing gas, which often possess an intrinsic natural period which is independent of the circuit connected to them. Dr. I. Langmuir has, however, now published in the August issue of the *Proceedings of the National Academy of Sciences* a theoretical analysis of the possible modes of vibration of what he refers to as a *plasma*, a highly ionised gaseous medium at low pressure which contains, when undisturbed, equal numbers of positive ions and of electrons, and appears to have accounted for the majority of these hitherto unexplained observations. Waves in the component electron gas should be of high frequency, with a zero group velocity, and so be incapable of transmitting energy; these appear to be identical with some oscillations of small amplitude first noticed at Eindhoven in discharges from a hot filament through a gas, and since obtained at Schenectady with a frequency as high as  $10^9$  cycles per second. Similar vibrations of lower frequency should theoretically also occur in a beam of electrons, and have in fact been detected, whilst the electrical analogue of sound waves has been found in a vibration of the heavier positive ions, and tentatively identified with the type of ionic oscillations which is supposed to be associated with moving striations. The question of amplitudes still presents some difficulties, but on the whole the agreement between theory and experiment is good, and may well lead to advances in the technical use of 'soft' thermionic valves and of gas-filled rectifiers.

**THE RAMAN OPTICAL EFFECT.**—The issue of the *Zeitschrift für Physik* for Sept. 19 contains several papers upon the changes in wave-length which occur when light is scattered by certain transparent media, one from Moscow, by G. Landsberg and L. Mandelstam, being of special interest in that it appears that a positive result had already been obtained with quartz before the appearance of Prof. Raman and K. S. Krishnan's first note on the subject in *NATURE* last March. The other researches which are described by C. E. Bleeker in Utrecht, and by Prof. Pringsheim and B. Rosen in Berlin, were undertaken primarily to test the reproducibility of the Indian results, and only the German workers have reported upon their observations in detail. They find that the fundamental vibration of the C-H group at  $3.3 \mu$  can be superposed on the incident light by all the compounds which they have used that possess it, but also that although all the modified scattered rays from organic liquids can be referred to known infra-red frequencies of these liquids, not all of the infra-red vibrations give rise to Raman lines. In this connexion they point out in a footnote that many of the conclusions that have been drawn from measurements in the infra-red are quite unwarranted, because of the small accuracy that can be attained in the spectroscopy of this region. Two further results that they have obtained are also somewhat unexpected, namely, that the light scattered from fused silica shows no trace of the strong satellites produced by the action of crystalline quartz, and that the Raman spectrum of silicon tetrachloride is very weak and quite unlike the well-developed spectrum of carbon tetrachloride. It is noticeable that all three groups of investigators are agreed that it is important to measure both the position and the intensity of the Raman satellites.

**RADIO TRANSMISSION AND SOLAR ECLIPSE EFFECTS.**—Advantage was taken by the Radio Research Board

of the opportunity provided by the solar eclipse of June 29, 1927, to investigate the influence of the eclipse on radio transmission. The experimental results have now been published by the Department of Scientific and Industrial Research (Special Radio Report, No. 7. London: H.M.S.O.). As exact quantitative results were desired, the experiments were limited to long waves the wave-length of which was about 13,000 metres and medium waves of about 400 metres. The observations show that the eclipse produced a definite effect on the properties of the ionised layer which deflects waves back to the ground. A striking effect was the large increase in the intensity of the down-coming ray. This was detected at both near and distant receiving stations. This effect is probably due to two causes: first, the increase in the height of the stratum responsible for bending the ray back to the earth; and secondly, the rapid removal of ionisation in the lower layers consequent on the removal of the solar ionising agents. The increase in the height of the stratum was so large that it could be detected without difficulty. The more southerly of the receiving stations experienced the maximum eclipse influence a little earlier than the northern stations. It is curious that the eclipse effects seem to have lasted only for periods of from 20 to 50 minutes, although the total time taken for the moon's shadow to pass across the sun was nearly two hours. This shows that quite an appreciable fraction of the sun's radiation can be cut off before the effect can be detected by ordinary radio methods. It is worth mentioning that the morning after the eclipse was exceptional, as night-time conditions persisted for an exceptionally long time after sunrise. The direction-finding observations carried out during the eclipse gave results which may be ascribed to changes in the effective height and reflection coefficient of the ionised layer.

**CRACKING HYDROCARBONS IN THE PRESENCE OF HYDROGEN.**—The North British Association of Gas Managers arranges annually a lecture in memory of William Young, prominent at one time in the coal gas industry and a pioneer in the distillation of oil. This year the lecture was given in Edinburgh by Mr. E. V. Evans, joint manager of the South Metropolitan Gas Company, who discussed what might be described as Young's discovery of the secret of carbonisation, namely, the carefully controlled cracking of hydrocarbons in the presence of hydrogen. Young had a remarkable intuition for the essentials of the problem, but was hampered by the necessity for evaluating his products according to their illuminating value. Mr. Evans stated that it has been found possible to bring into colloidal dispersion 90 per cent of a coal. The results of a special method of distilling coal in the laboratory were mentioned, whereby a primary tar, equivalent to 50 therms per ton of coal, was obtained, together with 25 therms of very rich gas. By heating the coke further to  $1000^\circ$ , 35 therms of gas could be obtained, or in all 110 therms in the volatile products—an unusually high result, not however to be anticipated in large-scale practice. The action of hydrogen in preserving from decomposition gaseous hydrocarbons is indicated by results of distilling low temperature primary tar at  $800^\circ$  in a stream of water gas. By this means as much as 106 therms of gas of calorific value 500 B.T.U. were obtained per ton of coal carbonised, together with a normal yield of low temperature coke and high temperature tar. This suggests a way in which low temperature processes might be fitted into the town's gas industry. The experiments emphasise the need for maintaining an adequate proportion of hydrogen during carbonisation, a need which Young himself realised many years ago.