

## Research Items

'Diminutive' Flint Implements. Diminutive flint implements—to be distinguished both by their form and their cultural associations from the microlith of upper palaeolithic and early neolithic age—have been found in pliocene and pleistocene deposits in Suffolk, Lincolnshire and the Thames Valley. In describing their characteristics, Messrs. J. Reid Moir and J. P. T. Burchell point out (*Antiquaries J.*, 15, 2) that on two previous occasions only, so far as they can ascertain, have similar implements been recorded, the first being by M. E. Pittard in 1908 in the valley of the Rebières, Dordogne, and the second in the account of the implements found with the relics of Peking man in the cave of Chou Kou Tien. These diminutive implements do not show the characteristic forms of the microlith, but are rather diminutive forms of the industries with which they have been found in association. As regards their age, the specimens now described belong to four different periods, of which the latest is much older than upper Aurignac. The earliest of the Suffolk implements are of pliocene age and pre-palaeolithic type, coming from the Suffolk bone bed beneath the Red Crag. Next comes St. Acheul and early Le Moustier series from the 'Middle Glacial Gravel' (held to be of second Interglacial age) underlying the upper chalky boulder clay. Next are implements from the Upper Chalky Boulder Clay; and lastly those from the Lower Floor of late Le Moustier or early Aurignac age in Bolton and Co.'s brickfield, Ipswich. The Lincolnshire implements come from the 100 ft. and 50 ft. raised beaches below the brown boulder clay, and are middle to upper Le Moustier; and those from the Thames Valley come from the base of the 50 ft. terrace of post-Combe rock age, while others may be derived from the Boyn Hill 100 ft. terrace and possibly from the 50 ft. terrace of pre-Combe rock age. The maximum length of these flints is two inches and the minimum is  $\frac{3}{8}$  in. Their purpose seems beyond conjecture.

Equatorial Islands of the Pacific. In 1924 the Whip-poorwill and Kaimiloa Expeditions of the Bernice P. Bishop Museum, Honolulu, visited the low coral islands lying within six degrees of the equator which, though uninhabited when discovered by Europeans, are supposed to have served as resting places for the Polynesian voyagers in their journeys. The results of the search for archaeological remains have been recorded by Mr. Kenneth P. Emory (*Bull.* 123, Bernice P. Bishop Museum). On Howland Island, previously recorded excavations and mounds were examined, the most important being an irregular crescent-shaped pile of coral and shells, 18 ft. long, and a low circular enclosure. On Washington Island no artefacts of local origin have been found; but ancient stone-wall enclosures appear on the south coast. On Fanning Island an enclosure of dressed stones and a tomb near the cable station were inspected, but no excavation was permitted. The enclosure agrees in structure with Tongan and Tongarevan marae, but, outside these, has no parallels in Polynesia. Similar stone vault burials are widely distributed in Polynesia and are especially characteristic of Tonga. In Christmas Island all the principal sites, except those on the east coast, were visited. They consist of house sites and platforms,

coconut groves and ruins, and graves. There is no definite evidence of Polynesian settlement, and two village sites have yielded no artefacts, indicating temporary occupation. Petroglyphs are too indefinite to be associated with any particular area. The traces of Polynesian visitors belong to different periods and come from various directions. Jarvis Island produced no Polynesian ruins or artefacts. Three well preserved marae were found on Malden with smaller marae and a number of ruins. They resemble strikingly those of Raivavae and suggest an occupation of several generations. No archaeological remains are reported from Starbuck Island.

The Termite Population of a Mound Colony. Termites of the species *Eutermes exitiosus*, Hill, form mound nests in parts of Australia, and an attempt has been made to ascertain the total number of individuals inhabiting such a colony. In carrying out such an estimation, there has to be taken into account the fact that all the termites living in a particular mound are never present within such a mound at any one time. Messrs. F. G. Holdaway, F. J. Gay and T. Greaves have recently published an article embodying the results of their investigations of this subject (*J. Coun. Sci. and Ind. Res.*, Australia, February, 1935). The observation that the number of individuals of the afore-mentioned species present in a given mound is greatest during the cooler months of the year led them to study the population of the mounds during such periods. Four mounds, not differing greatly in size, were dug up and their populations calculated by a method of weighing. It was estimated that 65–70 per cent of the termites in the mounds were encountered and, on this basis, the actual population was calculated to range from 747,000 to 1,806,500 individuals. The proportions of individuals in the most populous mound worked out as 1,561,400 workers, 201,000 soldiers and 44,100 nymphs. The size of the mound in question was 3 ft. 4 in.  $\times$  3 ft. 5 in.  $\times$  19 in. high.

Wing and Halter of *Tipula*. J. Zaéwilichowski (*Bull. Internat. Acad. Polonaise Sci. Lettres*, 2, Oct.–Dec. 1934) has investigated the innervation and the sense-organs of the wings of one of the daddy long-legs, *Tipula paludosa*, employing vital staining by rongalite white for the nerve elements. He describes the distribution of the sense-hairs, sense-bristles and sense-papillæ on the wing and the three chordotonal organs which are present near the base of the wing. He regards the innervation as more primitive than that of any other dipterous wing hitherto described and as indicating that *Tipula* is very nearly related to *Panorpa*, the nerves and sense organs of the wing of which he described in a paper in the same journal in 1933. In a further paper the author describes the results of corresponding investigations by similar methods on the halter of *Tipula paludosa*, on which are sense-hairs of two types, sense-papillæ arranged in five groups, and six chordotonal organs. After discussing the distribution of the nerves in the halter and the homologies of the parts of the wing and the halter, he concludes that the halter, in contradistinction to Buddenbrock's view (1919), is to be regarded as a rudimentary wing with a remarkable

accumulation of sense organs, in consequence of which it plays a notable part in the sensory life of the fly. On the basis of these morphological investigations the halter has assumed no new function, that is, none foreign to the wing, from which it has arisen. The halter is a transformed hind-wing.

**Water Requirements of Indian Crop Plants.** Following the methods of the American investigators, Briggs and Shantz, Prof. B. N. Singh and two research students, R. B. Singh and K. Singh, have examined the water requirements of fifty-seven species and varieties of cereals, cotton, sugar cane, etc., when grown at the experimental station of the Institute of Agricultural Research, Benares Hindu University (*Proc. Indian Acad. Sci.*, 1, No. 9, March 1935). The plants are grown in pots with carefully controlled water supply and, in the end, the total water transpired is divided by the dry weight produced, the roots being included in the yield, as was not done by the American experimenters. The amount of water available in these experiments seemed to control the yield of the varieties; the most efficient varieties, it is concluded, have a relatively short life-cycle when the use of water is reduced to a minimum. It is suggested that, under Indian conditions, these efficient varieties should be grown so that the number of irrigations might be controlled and thus the cost of production diminished. In their demand for water, sugar cane crops proved most greedy, and then in order came tobacco, cotton, rice, potato. Other cereals, wheat, oats, barley, as also linseed, pea and mustard, had a much lower water requirement.

**Gondwana Deposits of Brazil.** Many new observations on the Gondwana rocks of southern Brazil are recorded in a paper by V. Oppenheim entitled "Rochas Gondwanicas e Geologia do Petroleo do Brasil Meridional" (Min. Agric., Dept. Nac. Prod. Min. Bol., No. 5. Rio de Janeiro, 1934). The author gives a new stratigraphic scheme along the lines of those of White and Oliveira, recording for the first time the existence of several unconformities within the Santa Catarina System. Especially notable is the one between the Lower and Upper Strada Nova, the lower member considered to be Permian while the upper one, with the pelecypod fauna described by Cowper Reed, is of Upper Triassic age. There seems also to be an unconformity between the Upper Strada Nova and the Rio do Rasto group as well as a local one between the last named group and the Botucatu sandstone. The author regards the Bonito group (lower member of the Tubarao series) as partly glacial, stating that in several localities coal seams are known underlying glacial deposits that seem to be *in situ*. These observations are of great interest because until now all the glacial deposits of Southern Brazil were indiscriminately referred to the Itararé series. It is shown that the tectonic structure of the Paraná Basin corresponds in a general sense to a geo-synclinal with the character of a 'Graben' between Lat. S. 18° and 24°, and of a monoclinical between Lat. S. 24° and 33°. The internal structure is one of faults *en echelon* from east to west, intensively developed in successive degrees of small individual throw. The paper is illustrated with more than thirty geological profiles based on field observations and deep boring, and with a geological map to the scale of 1 : 2,750,000 comprising the Brazilian States of Rio Grande do Sul,

Santa Catarina, Parana, São Paulo and parts of Minas Geraes, Goiaz and Matto Grosso as well as the neighbouring Republic of Uruguay and parts of Paraguay.

**Extraction of Oil from Oil Shales and Torbanites.** Great Britain is at the present time importing most of its requirements of petroleum and petroleum products. Economically, this position may be sound since there are adequate resources of these commodities for some time to come. Politically, however, such dependency on foreign supplies is dangerous, as was demonstrated during the War. For this reason, attention is being constantly focused on the possibility of obtaining liquid fuel from domestic resources. Hydrogenation of coal, tar or creosote is being carefully investigated; also production of liquid fuels by synthesis from carbon monoxide and hydrogen, by fermentation to alcohol vegetable products, by polymerisation of certain hydrocarbons, and extraction of oil from oil shales, sands and torbanites. Messrs. Salermo, Ltd., of 14 Waterloo Place, S.W. 1, have done a considerable amount of research in connexion with the last possibility, and have recently issued a technical pamphlet on the subject. A brief account is given of the characteristics of oil shales and torbanites, their distribution and possible origin. From this it becomes apparent that oil-yielding products vary substantially in chemical and physical properties, and it is not possible to specify one plant as adequate for the extraction of oil from all types of material. The firm has, however, by dint of prolonged study of the 'primary variables', namely, rate of heating, temperature and carbonisation and rate of removal of oil vapours and gas, achieved a system of retorting which approximates closely to established principles. The Salermo retort and process are clearly described and illustrated in the pamphlet already referred to, and in addition carbonisation results are furnished of representative materials after treatment in this plant.

**Volumetric Determination of Copper.** The iodometric determination of copper depends on the addition of a soluble iodide which precipitates cuprous iodide and liberates iodine; the latter is titrated with thio-sulphate. It is well known that the method has certain difficulties. The reaction  $2\text{CuI}_2 = 2\text{CuI} + \text{I}_2$  does not go quite to completion when the iodine is titrated, and some iodine appears to be absorbed by the precipitated cuprous iodide, which is always coloured instead of white at the end point. The addition of potassium thiocyanate with the iodide, which precipitates cuprous thiocyanate instead of iodide, does not give good results, because both iodine and thiocyanogen are liberated simultaneously and react with each other. H. W. Foote and J. E. Vance (*J. Amer. Chem. Soc.*, 57, 845; 1935) obtain better results if the titration with thio-sulphate is first carried out to the point when starch is added. After adding starch, the titration is continued nearly to the end point usually observed, when about 2 gm. of ammonium thiocyanate is added for 50 c.c. of solution. The blue colour immediately deepens. When the thiocyanate has been dissolved by stirring, the titration is finished. The end point is exceedingly sharp and the precipitate is white instead of slightly brownish, probably because the cuprous iodide is transformed, at least on the surface of the particles, into thiocyanate and the small amount of adsorbed

iodine is liberated. Considerable changes in hydrogen ion concentration have no measurable effect on the accuracy. The reaction takes place in stoichiometric proportions within one part in 1,600.

#### Shock Wave of an Explosion and Rate of Detonation.

When an explosive is fired from a borehole with no filling above the charge, it not only emits flame and a considerable volume of gases, but there is also a 'shock' wave transmitted to the surrounding atmosphere. This produces the concussion effect felt in the ear to a varying extent when 'shots' are fired. D. B. Gawthrop has described experiments to show how the shock wave is affected by the rate of detonation (*J. Franklin Inst.*, April). It advances in the air ahead of any forward movement of the gases from the explosive. If in unconfined space it expands spherically in all directions, its velocity diminishing, and it ultimately degenerates into a normal sound wave. The paper describes a research made to determine the velocities of the shock waves sent out by the explosives at widely differing rates of detonation. Definite indications had been previously obtained that the rate of detonation is a factor which affects the safety of the explosives when fired in the presence of firedamp. It was found that with a certain charge the average speed of the shock wave at a distance of 15 cm. from the mouth of the borehole was 1,135 metres per second, but at 135 cm. it was only 350 m.p.s. Quadrupling the weight of the charges, the corresponding speeds were found to have increased to 1,670 and 450 m.p.s. respectively. The experiments made showed that the rate of detonation had no effect on the velocity of the shock wave sent out. As the weight of the charge increases there is a decrease in safety in firedamp, and we now know that there is also an increase in the velocity of the shock wave.

**Preservative Treatment of Wooden Sleepers.** As a result of the work and researches of Sir Ralph Pearson and others, carried on by successors, *Forest Bulletin No. 85* (Delhi: Manager of Publications, 1934) has recently appeared entitled "A Record of the Results obtained with Experimental Treated Sleepers laid in Indian Railways between 1911 and 1916", by S. Kamesam of the Wood Preservation Section of the Research Institute at Dehra Dun. Between 1911 and 1916 some thousands of wood sleepers of several species of Indian timbers were treated with different preservatives at Dehra Dun and then laid down by the railway authorities in the various railway systems of India. As a result of these experiments, the confidence of Indian railway engineers in wood preservation has been steadily and definitely strengthened. Coal-tar creosote, as in other parts of the world, has given excellent results. The Indian railways are thoroughly satisfied with a creosote-crude oil treatment for their sleepers, and it has become the standard treatment during the last decade. In reviewing, however, the results obtained in the present series of test sleepers, and considering that creosote costs in India more than twice as much as it does in Europe, Mr. Kamesam states that there are great potentialities for cheaper preservatives, such as arsenic, on the basis of wood preservative "efficiency for a unit of cost". Tabular statements record the number of the sleepers laid in different parts of India (except the south), and give data as to the method of treatment and their subsequent life-history.

**Pulsation in Electric Mains.** We have now throughout Britain hundreds of very powerful dynamos (alternating current generators) all working practically in step with one another although the frequency is 50 per second. In the early days of electricity supply, John Hopkinson found mathematically that two alternators could run in parallel with one another, a slight falling out of step being accompanied by powerful forces tending to make them fall into step again. Practical experience has shown that instability may arise from the nature of the load, and if we have many machines working in parallel and interconnected by long mains, serious pulsations of the current may be set up which may open the circuit breakers and interrupt the supply. In a paper by W. D. Horsley read to the Institution of Electrical Engineers on March 28 an investigation is made of different conditions of operation which may give rise to these pulsations. The value of automatic voltage regulation is discussed and it is shown that it is of considerable value in increasing the load limit and stability of an alternator. When it is used, the load of the system is only limited by the values of the constants of the transmitting line. In America the corresponding problem is more difficult because the power stations have to be interconnected by very long transmission lines. In addition, they have large hydro-electric plants linked together with steam generating plants. In designing the British grid full advantage was taken of experience gained abroad. Luckily the lightning problem is not a serious one in Great Britain. The most severe types of disturbance we suffer from are due to faults in the network, and so the quicker the speed of operation of protecting apparatus and switch gear the better.

**A Test Recorder for Electric Lamps.** The manufacturer of incandescent lamps is obliged, in order to control the quality of his product, to make a large number of life tests of individual samples. In order to get the maximum benefit from these tests, they have to be made on a large scale under expert supervision. The large consumption of electric energy during the 1,200-hour test is quite a serious addition to the cost of manufacture of the lamp. It has now been found that by increasing the voltage applied over the rated voltage of the lamps, the time necessary for the complete test can be considerably shortened. For example, the life-history of a batch of lamps which would normally average 1,200 hours burning could be found in twelve hours. In the *G.E.C. Journal* of May, G. Chelioti gives a full description of the test recorder used by the Osram-G.E.C. works. This works has had considerable experience of the shortened method of testing, but before the introduction of the recorder it was found that the necessary continuous supervision for the 12-hour test put a great strain on the supervisors, as unless the time at which each of a long row of lamps burns out was recorded with fair accuracy, large errors arose. Human frailty is a large factor as the work is extremely monotonous, and it is practically impossible to check the records. Hence an electrical recorder which would relieve the worker of this dreary task and give a permanent record of unimpeachable authority was welcomed. In the full-life test at the rated voltage, it is customary to make checks every 12 hours; in the abbreviated test they are made every six minutes.