

## Research Items

### The Marriage of Osiris

In a study of the origins and character of the Osirian ritual in Egyptian religion, Mr. G. D. Hornblower (*Man*, Oct. 1937) figures a sculptured scene from the inner chamber attached to the Hall of Sukkur (Sokkaris) in the temple of Seti I at Abydos, which depicts the culminating scene of the great rite of the latter half of the month of Hathor, which in the Egyptian calendar is the last of the four months of the Nile flood. In the process of synthesizing the various local cults of Egypt, Osiris came to be identified with the Nile flood (but not with the river), while Isis became Mother-Earth, the flood appearing as a kind of hierogamy or sacred marriage. The sculptured relief at Abydos puts Seti, the king, in special relation with the god at the supreme moment of the adventures in the myth of Osiris. Osiris is here seen lying as a mummy in the "House of Sukkur", that is, the tomb. At his head is his sister-wife Isis, the Great Lady of Magic, who is engaged in calling her dead husband back to life, temporarily, for the purpose here revealed. For Isis, in accordance with the principle of early art, which depicts succeeding events in the same plane, is also shown in the form of a falcon, with her name inscribed by her, hovering over the body of Osiris, who, now resuscitated, is seen in the act of fecundating her. The rite is thus revealed as the solemnization of a sacred marriage. At the feet of Osiris, Horus, the falcon-god, stands protectively, and a falcon also shelters the head of Osiris. This is undoubtedly the outstanding rite of the Egyptian year. Other sacred marriages are known—of Amūn-re at Thebes, in the "Festival of Opet", and of Horus and Hathor at Edfou. It appears that a sacred marriage was a very early general institution which was adapted to Osiris on the establishment of his cult, the festival being observed concurrently in various Egyptian towns.

### Early Indian Sites in Virginia, U.S.A.

AN examination has been made of a number of ancient Indian sites in the State of Virginia, U.S.A., by Mr. David I. Bushnell, jun. (*Smithsonian Miscell. Collect.*, 96, 4). These sites have been discovered on the banks of the Rappahannock, beginning at Leedstown, an early colonial settlement some forty miles below the falls, and continuing up the valley. The finds—stone implements, potsherds, beads and clay pipes—are from the surface, and probably represent the midden material from village sites, which have been scattered by the plough. Further research by excavation is eminently desirable. When the English first explored the Rappahannock, they found many Algonquian (Nandtaughtacund) villages in this district, extending up to the large island below the falls near the present city of Fredericksburg. From this point, the territory extending westward belonged to the Manahoac, a Siouan group constantly at enmity with the Algonquians. The finds of the present investigation vary in form and material, and obviously belong to several distinct periods of occupation. They prove that the tribes encountered by the settlers were not the first to

inhabit the country; and indeed it is evident not only that this area was occupied and re-occupied for centuries, but also that a part of the valley below the falls had been abandoned by the Algonquian tribes in 1608 when it was first visited by the English. The occurrence of a beautiful Folsom point of the eastern type near the Millbank creek on the left bank represents an interesting problem, which requires further investigation in order that the evidence of stratification may be made available for the consideration of the antiquity of man in the eastern States. Next in importance to the Folsom point are two axes found above Lamb Creek, which resemble a specimen found some years ago on the Rapidan. These may be earlier than the Algonquian occupation. Argillite points and scrapers resemble those from the Delaware Valley, and may also be pre-Algonquian.

### Breeding of Oysters in Tanks

MR. H. A. COLE has gone a long way towards solving the problem of oyster breeding in captivity for the improvement of the oyster industry ("Experiments in the Breeding of Oysters (*Ostrea edulis*) in Tanks, with special reference to the Food of the Larva and Spat. Min. Agric. Fish. Fish. Invest. Series 2, 15, No. 4; 1936). His own experiments during 1936 are particularly described, but these are a continuation of the work of Dodgson and Sherwood from 1919 onwards. It was found in 1918 that a large amount of spat from oysters which had remained in the tanks following some purification experiments had settled. The same occurred during the next two years, and in 1921 an attempt was made to repeat the spat collection on a much larger scale with the view of possibly re-stocking the natural beds. The results showed that food for the young oysters, especially in the free-swimming stage, was all important, and laboratory experiments were specially made to find a good micro-organism on which the free-swimming larva could be fed. These experiments show that the only food which the oyster in its free-swimming existence is able to use is the naked flagellate, and that only the settled spat can feed on green cells surrounded by a cellulose or hemi-cellulose cell wall. The explanation put forward is that the slow penetration of enzymes through such a cell wall during the passage of food through the gut is possible in the spat, but in the larva where the passage is very rapid the cells pass through undigested. In the large-scale experiments where two tanks were used, one was provided with finely divided organic material and the second was used as a control, the result showing a much larger number of larvæ which settled in the tank so manured whilst the flagellates were also much more numerous. It is now possible to anticipate with some confidence a spat-fall of commercial value in the tanks, the rapid growth of such spat transferred to cages in the open water showing that the methods employed are effective. Good results are anticipated from further experiments in culturing on a large scale the naked flagellates for the food of the larvæ.

### Climatic Cycles and Tree Growth

PUBLICATION No. 486 (1937) by the Carnegie Institution of Washington contains a description by W. S. Glock of the principles and methods of tree-ring analysis developed by Dr. A. E. Douglass, which enters very fully into the methods of sampling trees and of reading and correlating the numbers and breadths of the annual rings. A survey of ring breadths at different heights on the trunk of *Pinus ponderosa*, which extended even to observations on branches and roots, supplies convincing evidence of the validity of these ring measurements, and the analysis of the correlation between these observations and examination of their value as climatic indicators show how carefully and conservatively the new technique is being developed. Mr. G. A. Pearson, senior sylviculturist in the United States Forest Service, discusses the factors influencing the growth of trees, but these have received more adequate treatment in many forestry publications; this volume will rather be consulted for its very full account of the technique developed in reading the ring breadths of trees and in applying such data to the discovery and analysis of climatic cycles.

### Fjord Formation

THE coastal mountain belt of North-East Greenland affords ample evidence of a former considerable ice-cover, and the extensive system of fjords in that region provides scope for the study of the origin and development of fjords in relation to erosion processes. Mr. N. E. Odell discusses this problem in a paper on the Franz Josef fjord region of North-East Greenland in the *Geographical Journal* of August and September. J. H. Bretz, in a former study of these fjords, considered them to be stream-eroded valleys modified and deepened by ice action, which would, he believes, be accentuated, during ice submergence, on a previously eroded valley. This was also the view of F. Nansen. Mr. Odell, on the other hand, considering in detail the possibilities of subglacial plucking, doubts the ability of the ice to do the work suggested. An ice-sheet covering a steep preglacial valley might possibly have the motion necessary for abrading, but would be unlikely to acquire moraine matter, without which the scouring action would not occur. Mr. Odell also shows that the disintegrating effects of basal freeze and thaw would probably be absent. On this and other evidence he inclines to the belief that the greater part of the fjord formation of North-East Greenland must be attributed to a period of partial and complete emergence of the land surface rather than to a time of entire submergence by continental ice.

### Basalts from the Carlsberg Ridge

AN important contribution to the petrology of the floor of the Indian Ocean has appeared (*Sci. Rep. John Murray Exped., 1933-34*, 3, No. 1, 1-30, British Museum, 1937). Dr. J. D. H. Wiseman gives petrographic descriptions and chemical analyses of four Carlsberg Ridge rocks dredged from a depth of 3,385 metres. While mostly angular, some of the specimens are rounded and have a coating of manganese nodule material. Three of the analysed rocks are oligoclase-basalts; the other is hornblende-augite-dolerite. Chemically, all are characterized by low total iron, relatively high soda and very low potash, and thus show spilitic affinities. The possibility that the unique alkali relations may depend

on the action of sea-water is discussed, but it is concluded that they are much more probably an index to the nature of the parental magma. The rocks are chemically different from the Deccan traps and other Gondwanaland basalts, and there is strong evidence that they are of submarine origin and do not represent sunken remnants of any former land area. Apart from the very low potash contents, the Carlsberg Ridge specimens are comparable with average basalts from the Atlantic and Pacific Oceans, all of which differ from the Plateau basaltic types of the world in their lower iron contents. Dr. J. H. J. Poole has determined radium in the described specimens and finds the amounts present to be uniformly low, in which respect the rocks also differ systematically from the Deccan basalts.

### Deep-Focus Earthquakes in the South-West Pacific

MR. R. C. HAYES has recently made an interesting study of the distribution of normal and deep-focus earthquakes in the south-west Pacific (*Bull. N.Z. Dom. Obs. Wellington*, No. 109, 691-701; 1937). The area considered is bounded by the parallels 0° and 50° S. and the meridians 140° E. and 160° W., and, during the years 1918-34, contains the epicentres of 87 deep-focus earthquakes, of which Mr. Hayes gives a valuable catalogue. These form 11 per cent of the total number of earthquakes recorded in the district. As a rule, the focal depths lie between 100 km. and 200 km.; but, in an area of which the centre is in lat. 25° S., long. 176° E., depths of 500 km. or more were common, while normal earthquakes were almost absent. In the zone between 10° and 30° S., in which the deep-focus earthquakes were most numerous, the maximum monthly number occurred in August.

### Atmospheric Pressure at Mauritius

PUBLICATION No. 18 of the Royal Alfred Observatory, Mauritius, by M. Herchenroder, is entitled "The Atmospheric Pressure at Mauritius". It is a discussion of fifty-six years' continuous record of that variable at the observatory at Pamplemousses made with a Kew barograph recording photographically. Mean yearly values for each year from 1875 until 1930 range from 1,008.70 mb. in 1916 to 1,010.82 mb. in 1880, the mean for the whole period being 1,009.69 mb., and show a secular drift. If this drift is a cyclical variation, the period of 56 years is too short to determine its value directly, but it is held to be connected if not identical with a long-period rainfall oscillation that seems to have completed one cycle between 1872 and 1928. Short-period oscillations are superposed on the long-period oscillation, notably periods of nine and seventeen years. The annual variation is shown by plotting the means for each day of each month, and is composed mainly of a very well marked annual wave of 10 mb. amplitude with a minimum on February 9-10, which falls very nearly at the time of the maximum of the annual temperature wave. The diurnal variation is studied by means of harmonic analysis, and this shows that by far the largest component is the 12-hour cycle, the phase of which shifts slightly in the course of the year; that the next in importance is the 24-hour term (mean amplitude 0.394 mb. compared with 0.953 mb. for the 12 hour); that the 8-hour term, although its amplitude is not more than a quarter of that of the 12-hour term even at the seasonal maximum of the 8-hour term in July, shows a large and remarkably systematic double annual

variation both of amplitude and of phase; and lastly, that the small 6-hour term also shows a double seasonal variation but with phase reversed. The lunar daily variation is not determined here, having already been investigated for the forty years 1876-1915 by Chapman.

#### Synthesis of Vitamin B<sub>1</sub>

THE structure previously proposed for vitamin B<sub>1</sub>, based on the identification and synthesis of several disintegration products (notably 4-methyl-5-beta-hydroxyethylthiazole, 2,5-dimethyl-6-aminopyrimidine, 2-methyl-6-oxo-pyrimidine-5-methylene sulphonic acid) and the establishment of the mode of linkage of the two nuclei indicated by the presence of quaternary nitrogen in the molecule, has been completed by J. K. Cline, R. R. Williams and J. Finkelstein (*J. Amer. Chem. Soc.*, **59**, 1052; 1937) by a synthesis of the vitamin by a method depending on the conversion of a 5-ethoxy-methyl-pyrimidine into the corresponding 5-halo-methyl derivative. Difficulties in obtaining crystalline material were encountered. Ethyl sodioformyl-β-ethoxypropionate was condensed with acetamide hydrochloride in alcohol with sodium, and the resulting 2-methyl-5-ethoxymethyl-6-oxypyrimidine liberated and sublimed in high vacuum. This was converted into the corresponding chloropyrimidine with phosphorus oxychloride, and this into the corresponding aminopyrimidine by heating under pressure with alcoholic ammonia. By heating this with a solution of hydrobromic acid in glacial acetic acid, 2-methyl-5-bromomethyl-6-aminopyrimidine hydrobromide was obtained, and by heating this with 4-methyl-5-β-hydroxyethylthiazole in butanol and diluting with boiling ethanol, needles of vitamin B<sub>1</sub> bromide hydrobromide were obtained. The physiological activity of this compound, C<sub>12</sub>H<sub>17</sub>ON<sub>4</sub>SBr.HBr. 0.5 H<sub>2</sub>O, was found to be equal to that of the natural vitamin. The corresponding chloride hydrochloride was prepared, and its physiological activity established.

#### Structure of Carbon Suboxide

ABOUT four years ago the structure of carbon suboxide (C<sub>3</sub>O<sub>2</sub>) was shown by the methods of electron diffraction to be most probably linear and symmetrical. Evidence supporting this view was also derived from investigation of its ultra-violet spectrum and, more recently, from its Raman spectrum. For a molecule possessing a centre of symmetry, spectroscopic selection rules forbid the appearance of Raman-active fundamental frequencies in the infra-red spectrum and vice versa. A paper of Drs. R. C. Lord and A. Wright (*J. Chem. Phys.*, **5**, 642; 1937) on the infra-red spectrum is therefore full of interest. They find that Raman-active frequencies are not present in their spectrum and the linearity and symmetry of the molecule are now convincingly proved. The modes of vibration of such a model consist of 4 non-degenerate (2 Raman-active, 2 infra-red active) and 3 doubly degenerate (only one of which is Raman-active) frequencies. By assuming the type of molecular force field, values of the frequencies can be calculated, and it is found that one of the infra-red active degenerate fundamental frequencies lies beyond the limits of their spectrograph at about 50 μ (200 cm.<sup>-1</sup>). The other degenerate infra-red fundamental (ν<sub>6</sub>) cannot at present be assigned with certainty. From a consideration of the allowed binary and ternary com-

bination tones, there is strong indication that its value is 550 cm.<sup>-1</sup>, although another possible value at 900 cm.<sup>-1</sup> cannot be completely excluded. It is interesting to note that all the observed bands can be satisfactorily interpreted on the basis of ν<sub>6</sub> = 550 cm.<sup>-1</sup>, but further and more detailed experimental data on the infra-red spectrum, especially between 2 μ and 7 μ, between 11 μ and 18 μ, and around 50 μ, must be forthcoming before the final assignments can be made.

#### Atomic Weight of Phosphorus

ASTON has shown that phosphorus is a pure element, in the sense that it is composed of one type of atom only, of mass number 31. It has a negative packing-fraction amounting to  $-5 \times 10^{-4}$ . Hence the atomic weight of phosphorus should be less than 31, especially as the factor for converting physical atomic weights to chemical atomic weights on the scale O = 16 (1.00022) also acts in the same direction. Yet the internationally accepted value for the atomic weight of phosphorus is 31.02 (O = 16). The value calculated by Aston from mass-spectrographic data is 30.978. Hönigschmid (*Naturwiss.*, **25**, 670; 1937) has recently carried out a careful chemical determination of the atomic weight of phosphorus using phosphorus oxychloride, POCl<sub>3</sub>. The ratio POCl<sub>3</sub>:3Ag was determined by a nephelometric method, and the value obtained for the atomic weight was 30.978, in exact agreement with Aston's result.

#### Effect of Surface Treatment on Magnetic Permeability

IN a letter in NATURE of May 29, Dr. T. F. Wall gave particulars of results obtained in an investigation on the permeability of nickel wire as affected by a coating of 0.003 inch of electro-deposited copper. These showed that, as compared with the bare wire, a value about 60 per cent higher could be obtained under the conditions described. The results of further tests on similar lines are now available (*Engineer*, Aug. 13), and bear out the idea which gave rise to the experiments. The dissymmetry of the molecular forces at and near the surface of the bare wire suggested to Dr. Wall a corresponding dissymmetry of the magnetic forces, and his idea was that by coating the surface with a thin skin of non-magnetic metal this condition might, to some extent, be eliminated and that interesting information might be forthcoming as to changes in magnetic properties. The later tests have been made on wire of bright drawn Armeo iron with coatings of copper, nickel, and aluminium. While the uncoated wire gave a maximum permeability of 3,500, the figures reached with the coated wires were: copper coating 3,600, nickel 4,050, and aluminium 4,300. The effects are thus not as striking as in the first tests, but from the very marked increase obtained when nickel is coated with copper—two metals standing next to each other in the atomic number series—it is inferred that iron with a coating of manganese—two similarly placed metals—may be expected to show an equally pronounced increase. This is now under investigation by the methods described and with the aid of X-ray spectrograms of the boundary surface of the wire and the applied skin, and it is anticipated that in the results some light may be thrown on the behaviour of manganese in the Heusler series of alloys and its influence in Hadfield's non-magnetic manganese steel.