

## Research Items

### Vaulted Tombs of Knossos and Ras Shamra

SIR ARTHUR EVANS in *Man* of December reviews the evidence bearing on the dating of the vaulted tombs of Knossos in relation to those of Ras Shamra, Syria. In the second report on the tombs of Knossos (1914), the smaller built tomb at Isopata was assigned to the last Palace Age on account of the Late Minoan II ceramic content and a gold signet ring. The chronological succession of Minoan engraved gems now established counteracts this evidence. A chalcidony bead seal from the covered part of the cist belongs to a class now shown to be characteristic of the second and third phases of the Middle Minoan, barely surviving into Late Minoan I a. The sepulchral relics thrown out at the opening of the dromos undoubtedly belong to Middle Minoan III. The 'Royal Tomb' itself supplied a very fine series of Late Palace vases (L. M. II); but here, too, conflicting data were apparent in the early character of stone vessels of the Eighteenth Dynasty, Middle Kingdom and even a strong tradition of Fourth Dynasty influence. Ritual signs on the blocks themselves correspond, it had already been noted, with those on the earliest structures of the Late Palace at Knossos. It is now known that the practice of incising such signs on Palace blocks was not followed in Late Minoan II. The makeshift character of the concluding palatial phase does not fit in with the fine architectural construction and massive masonry of the Royal Tomb. A viaduct and bridge on the east slope of the Palace site have now afforded a parallel in splayed blocks like the Isopata vaulting. These structures belong to an even earlier phase than the Isopata tombs, and centre rather in Middle Minoan II. The use of the horizontal arch and vault, in fact, go back to the earliest Palace period, or approximately the twentieth century B.C. As a result of the last campaign at Ras Shamra, it may be taken as demonstrated that there was an actual Minoan colonization there so early as the second Middle Minoan period, which was already reacting on north Syrian culture. It will be seen from the Knossian evidence that the parallel between the vaulted tombs and those of Ras Shamra (Ugarit) ought to be carried back to that epoch.

### Otomi of Central America

THAT important, but little-known, group of Indians of Central America, the Otomi and their affinities, are the subject of a study by Dr. Jacques Soustelle ('La Famille Otomi-Pame de Mexique centrale'. *Tr. et Mém. de l'Inst. d'Ethnol. Univ. de Paris*, 26; 1937). This study embodies the results of investigations, undertaken at the suggestion of Dr. Paul Rivet, lasting over a period of two years and some months. Conclusions are based mainly on the linguistic evidence, as culture has been affected profoundly by European contacts, while language to a large extent has retained its original characteristics. At the same time the evidence of history and of the geographical distribution of the tribes supports the findings from linguistic evidence, and the data of physical anthropology, ethnography and recorded history have therefore also been taken into account. The Otomi—the name is Aztec or Nahuatl—were

regarded by the early Spaniards as a typical mountain-dwelling tribe; and this still holds good. Of seven divisions here recognized, four are in the *terras frias*, the cold lands of high altitude, and three in the *terras templadas*, the temperate lands, while no Otomi are found in the *terras calientes*, the low-lying hot lands of the coastal area. In 1921, the Otomi numbered 210,873 and the four related tribal groups in all just over 67,000. Briefly, it would appear that in the pre-Cortesian era the members of this linguistic family belonged to two groups of very different cultural level, the first being sedentary agriculturists, the second, to which belonged the Chichimecs, nomad or semi-nomad hunters. According to Sahagun the Otomi cultivated maize and agave and were makers of the drink *pulqué*. They lived in villages. The standard of living of the food-gathering hunting tribes was poor. They lacked salt and the Chichimecs lived in caves. The Otomi originally were without pottery. It was natural that to the Aztecs, who conquered and drove them to the hills, excluding them from the stream of cultural development, the culture of these tribes should appear low.

### Osteology of *Varanus*

*Varanus monitor* is a large and well-known lizard; but in spite of this, the accounts of the skull given in many of the ordinary text-books are often incomplete or actually incorrect. This deficiency is made good by K. N. Bahl (*Rec. Indian Museum*, July 1937), who has provided a very full and well-illustrated account of the skull. It is well ossified, but important cartilaginous structures still remain. It is truly streptostylic, that is, the quadrate bone is freely movable at all its articulations. It is metakinetic, and the occipital segment is movable on the maxillary segment at four places, not three as is sometimes stated. The foramen internum is present, but it transmits the sixth cranial nerve and not a branch of the internal carotid artery as was supposed by Siebenrock, its discoverer. The soft parts, nerves and blood vessels related to the skull have been fully taken into account in the description.

### Insects Affecting Stored Products

IN the *Annals of Applied Biology* of November, 1937, Mr. H. Hayhurst gives an annotated survey of the species of insects, etc., found by him on the L.M.S. Railway during the past ten years. They were found infesting commodities stored in warehouses and in transit, etc. He mentions that all imported commodities and those liable to infestation were examined prior to transit and to being warehoused. The great majority of insects commented upon are Coleoptera (beetles), with some seven species of moths and a few mites, etc., and the greater number of them are cosmopolitan pests, well known to economic entomologists. An enormous variety of different substances may be infested by a single species of insect; this is especially noticeable in the case of the beetles *Ptinus tectus*, *Tribolium confusum* and *castaneum*; the moths *Borkenhausenia pseudo-spretella* and *Endrosis lactella* and the mite *Tyroglyphus farinæ*. An article of this kind serves to emphasize the fact that too little attention is paid

to pests of stored products in Great Britain. Furthermore, in the event of any large accumulation of such products becoming necessary as a reserve in the event of war, heavy losses from pests are certain to supervene unless proper measures are adequately formulated beforehand. Among the various means of protection one of the most important is the construction of properly built granaries and stores which readily admit of the sterilization of the contained products when necessary.

#### Rock-Burrowing Organisms and Coral Reefs

MR. G. W. OTTER describes many interesting facts with regard to rock-borers in his monograph "Rock-Destroying Organisms in Relation to Coral Reefs" (Great Barrier Reef Expedition 1928-29, 1, No. 12; 1937. British Museum (Natural History)). Most of these are molluscs, but Crustacea, worms, sponges, and to a certain extent echinoderms and some plants burrow more or less into the corals; but molluscs are by far the most important in actual destruction. The mode of life is varied and the different forms may bore by mechanical means as in *Petricola*, *Gastrochaena*, *Tridacna* and *Arca*, or may use some form of acid as in *Lithophaga*. The barnacle *Lithotrypa valentiana* is also a mechanical borer. The formation of the burrows is described in detail for many forms, feeding and rate of growth in relation to rock-boring is discussed and also the distribution and ecology of rock-burrowing organisms including geological nature of the rocks available for attack. Finally the author describes the effects of rock-burrowers in relation to coral reefs. There is no doubt that these various factors of destruction affect the reefs to such an extent that it is often difficult for them to hold their own against them; many are completely destroyed and few, if any, are appreciably growing. Mr. Otter's work gives us a good summary of all the causes of such destruction.

#### Trout-marking in Massachusetts

ON the populous Atlantic seaboard of the United States the streams are so intensively fished that a stock sufficient to meet the needs of anglers can be kept up only by the frequent and extensive introduction of trout of legal size. These may be placed in the river in autumn or in spring, and doubt has existed as to which is the more satisfactory time. To settle the question, if possible, 2887 rainbow trout and 4830 brown trout, 6-10 inches long, were marked by the internal tagging method, and released, some in November and some in the last week of March. The trout season opened on April 15 (R. A. Nesbit and J. A. Kitson in *Copeia*, 168; 1937). The recoveries indicate that if fish are planted in the autumn, the over-winter losses are so great that five times as many fish are required to provide a given catch as are needed if the fish are held in the hatchery until spring. Against this advantage must be reckoned the cost of keeping the fish in a hatchery over winter, and the less easily reckoned consideration that autumn fish are said to yield better sport. In the course of their experiments, the authors discovered that the method of internal tagging with a celluloid belly tag, or with a soft rubber tag which they later substituted for the celluloid tag, was not satisfactory for trout, and they recommend that in future experiments the jaw method of marking described by Shetter in 1936 and 1937 should be adopted.

#### Effect of Bio-azotized Peat on Plants

BIO-AZOTIZED peat differs from ordinary organic manures, such as farmyard manure, in that the microflora is mostly aerobic, cellulose and nitrogen-fixing bacteria being especially prominent. Again, the latter build up nitrogen compounds from free nitrogen, while, in most organic manures, complex nitrogenous compounds are broken down. The activity of the microflora, in bio-azotized peat, results in a multiplication of nitrogen-fixing organisms, an accumulation of nitrogen, and a conversion of the unavailable portion of the peat into more readily assimilable compounds. Experiments have recently been carried out by Makinov, both in pots and in the field, to test the effect on yield and nitrogen content of crops; in order to reduce the number of unknown factors, a 'synthetic' soil was used in one series of pot trials ("Effect of Bio-azotized Peat on the Growth and Nitrogen Content of Plants. *Nature* (translated title), 140, 51-57, August 1937. Leningrad). The bio-azotized peat proved as effective in small doses as mineral nitrate in raising yield, and, in larger application, proved more effective than the latter; applications representing less than 2 per cent of the weight of soil did not yield satisfactorily because of the insufficiency of energy-providing material for the activities of the cellulose and nitrogen-fixing bacteria. The bio-azotized peat raised the nitrogen content of the crop by an unexpectedly large amount, as compared with unactivated peat; thus, with equal quantities of both, the percentage of nitrogen in the dry matter of oat plants amounted to 1.537 in the former and 1.061 in the latter. This large increase, of the order of 50 per cent, may be contrasted with the increments of the order of 5-10 per cent noted in Great Britain in grasses manured with nitrogen.

#### Control of Insect-Transmitted Virus Diseases

Two virus diseases attack the henbane plant, *Hyoscyamus niger*, which is grown for the preparation of pharmaceutical compounds. Both viruses are transmitted from diseased to healthy plants by the aphid *Myzus persicae*. Dr. Marion A. Watson (Hamilton) (*Ann. App. Biol.*, 24, No. 3, 557-573, Aug. 1937) has experimented upon the possibility of controlling the spread of the maladies by eradicating the insect vector. The aphid can be controlled by treatment with nicotine sprays, and its removal substantially reduced the incidence of the virus. There was, moreover, an increase of 30 per cent in the third crop of leaves, harvested in the second year of growth.

#### Take-All Disease of Wheat

'TAKE-ALL' is the expressive name given to a disease of wheat and other grasses, caused by the fungus *Ophiobolus graminis*. The attacks of this organism are often very severe, and result in the production of grainless heads of corn. Mr. Geoffrey Samuel has lately summarized our knowledge of this disease (*J. Minis. Agr.*, 44, 3, 231-241, June 1937). He describes the symptoms and life-history of the fungus in detail, and discusses the persistence of mycelium in the soil, after the removal of a diseased crop. It has been shown that soil conditions affect the longevity of the fungus to a considerable degree. The disease is more to be feared on light soils than on heavier ground; it is favoured by soils with alkaline reaction, and flourishes where organic matter

is abundant. Many wild grasses are also attacked, but oats and rye-grass are resistant crops which may follow wheat in the rotation. Other methods of control are set forth in the paper.

#### Formation of Large Hailstones

At the meeting of the Royal Meteorological Society held on November 17, Mr. T. E. W. Schumann gave a mathematical analysis of the generally accepted theory that the formation of large hailstones is due to the constant collection by the stone of supercooled water drops that lie in its path. The problems that received particular attention were, first, how it is possible for a hailstone to remain suspended long enough in the clouds to collect enough drops to enable it to reach the very large size sometimes attained, 10 cm. and more in diameter, and, secondly, how the hailstone gets rid of the latent heat of condensation of the supercooled water that freezes on it. It was shown that the main factors that determine the size to which a hailstone grows are its average density (which will depend on the amount of air entrapped in it), the height at which the nucleus is formed, the average upward velocity of the air and the amount of liquid water present in unit volume of air in the regions with temperature below 0° C. The connexion between these various factors was shown by a series of graphs. It was found that the probable values of the water content and of vertical velocity are sufficient to account for hailstones at least 8 cm. in diameter. The disposal of the latent heat was examined in considerable detail, and it was demonstrated that this heat can be disposed of partly by the absorption of heat from evaporation from the surface of the hailstone and partly by conduction to the surrounding air, although in the neighbourhood of 0° C. the mechanism of heat disposal is reduced in efficiency to such an extent that the rate of growth and therefore the final size of the stones is more restricted than at lower temperatures.

#### Higher Oxides of Lead

As is well known, the preparation of pure lead dioxide,  $PbO_2$ , is very difficult. This oxide is present in the positive plate of the accumulator, and X-ray examination has given evidence of highly characteristic distortion in the lattice under certain conditions. It has been shown that the tetragonal lattice persists from  $PbO_2$  down to  $PbO_{1.66}$ . G. L. Clark, N. C. Schieltz and T. T. Quirke (*J. Amer. Chem. Soc.*, 59, 2305; 1937) have examined the formation of  $PbO_2$ . By heating lead dioxide, sodium hydroxide, water and a trace of manganese dioxide in a bomb, crystals of  $Pb_2O_3$ ,  $Pb_3O_4$  and a new oxide  $Pb_5O_8$  have been prepared at the temperatures of 260–275°, 355–375° and 295–310°, respectively, the compounds being identified by microscopic examination and X-ray diffraction patterns. The crystals supposed to be  $PbO_2$  obtained by this process were shown to be  $Pb_2O_3$  mixed with  $PbO_2$ . It appears, therefore, that this process does not give pure lead dioxide.

#### Stereochemistry of Cobalt and Manganese

THE ion  $CoCl_4$  in  $Cs_2CoCl_6$  has been shown to possess tetrahedral configuration, whilst the existence of two forms of  $Co(NH_3)_2Cl_2$  suggests that they are *cis*- and *trans*-isomers of plane configuration. Stereochemical studies of the two forms of  $CoPy_2Cl_2$  (Py = pyridine), which are monomolecular, have been

made by E. G. Cox, A. J. Shorter, W. Wardlaw and W. J. R. Way (*J. Chem. Soc.*, 1557; 1937). The X-ray measurements show that in the  $\alpha$ -compound the four groups linked to the central cobalt atom have a *trans*-planar configuration. The corresponding compound with manganous chloride is isomorphous with the  $\alpha$ -dipyridino-cobaltous chloride, and in this compound the four covalencies of bivalent manganese also have a planar configuration. The  $\beta$ -dipyridino-cobaltous chloride is isomorphous with the only known forms of dipyridinocobaltous bromide and iodide, and their stereochemistry is still uncertain. These results are of interest in providing a definite example of a metal, cobalt, in the same valency state which has both planar and tetrahedral quadri-covalent derivatives.

#### Artificial Radioactivity Produced by $\alpha$ -Particles

THE cyclotron method of accelerating particles makes possible the production of energetic  $\alpha$ -particles in numbers equivalent to the particles from many grams of radium, and the energy of the cyclotron particles may be considerably higher than those from radioactive elements. L. N. Ridenour and W. J. Henderson (*Phys. Rev.*, 52, 889) have used a beam of 9 Mev.  $\alpha$ -particles to produce artificial radioactive elements by bombarding B, N, Mg, Al, P, Cl, Cr, Ni, Co, Cu, As, Br. The majority of the radioactive nuclear species produced are already known, having been produced by other nuclear reactions with neutrons. In most cases, the radio-elements were identified by chemical methods, and the nuclear reactions were found to involve the absorption of an  $\alpha$ -particle with emission of a proton or more commonly a neutron.

#### Meteors at Great Heights

MR. J. G. PORTER has written a paper (*J. Brit. Astro. Assoc.*, 48, 2, December 1937) which is a continuation of others previously published, in which the true paths of meteors doubly observed at Stowmarket and Peterborough are given. A large number still remain to be computed, and up to the present Mr. Porter has only been able to deal with those observed up to the end of October 1934. Among the 30 observed in that month at the two stations referred to, there is one of great interest observed on Oct. 15<sup>d</sup> 23<sup>h</sup> 31<sup>m</sup>, of magnitude about 5.5. Its heights at the beginning and end are 257 and 248 kilometres, respectively. As there was a very close agreement between the figures for the two observers, the results must be accepted as accurate. The Rev. Dr. M. Davidson pointed out at a discussion of the paper that occasionally such great heights had been found previously, but had always been considered inaccurate. Meteors in the higher regions should throw some light on the conditions of the atmosphere in those parts.

#### Protection for Telescopes

MR. F. R. CLARK describes (*J. Brit. Astro. Assoc.*, 48, 2, December 1937) how he made and utilized a movable roof to cover an observatory for a 3½-inch refractor, and in the same journal Mr. F. O. Smith describes how he made a garden hut for a 6-in. Wray equatorial for the small sum of £10 10s. It is impossible in the limited space to give a summary of these two papers; amateur astronomers are recommended to read them carefully if they contemplate erecting simple and inexpensive observatories.