

Research Items

Metal Images from Southern India. Mr. T. B. Nayar has recently published (*J. Annamalai Univ.*, 3, No. 1) an account with illustrations of three metal images from a Śaivite shrine, called Pāsupetēśwarar Kovil, at Tiruvētkālam, South Arcot, Madras. The images are said to have been excavated from a mound a few yards southward of the present shrine within the memory of the great-grandmother of the present hereditary priest. Local tradition credits the place with Arjuna's penance, and an annual festival is celebrated here for two days in the month of May-June. The chief interest of the festival is a fight between men dressed as hunters and men dressed as Arjuna. The festival, however, is of recent growth and not more than twenty-seven years old. The first of the three metal images is that of Kirātārjunamūrti, that is, Siva as he appeared to Arjuna in the story of Arjuna's penance. Representations of the penance are rare in art and few images of Siva in this manifestation, either in stone or metal, are in existence. The image here described is 23.2 in. high and is made of copper, cast solid by thecire perdue process. The figure wears the sacred thread and a loin-cloth tightly wrapped and kept in position by a decorated belt or girdle. Its arrangement is unique in South Indian metal figures. The figure stands with the weight on the left leg, the right arm raised at right angles, holding the arrow, the left arm being raised vertically from the plane of the shoulder as if holding the top of a bow. An oval ring fringed with tongues of flame surrounds the image. When excavated, this figure had the figure of Arjuna on its left and a broken image of Indra on its right, both engaged in sockets. If this statement be correct, the image of Indra is difficult to explain. Verification is not possible, as the figure was destroyed for its metal. The arrangement is not known in any other South Indian examples. The figure of Arjuna wears no thread, and the loin-cloth is kept in position by three bands, below which is an arrangement of two sashes, characteristic in certain sculptures.

Shamanism in North America. In a study of shamanism in North American society by Mr. Leonard L. Leh (*Univ. Colorado Studies*, 21, No. 1), the position and functions of the shaman are surveyed in each of the regional areas of Amerindian culture in turn. The shaman in some form existed throughout North American society, notwithstanding the great variety of cultures. It was not, however, everywhere the same thing. The background is the supernatural world which the Indians believed to control their destinies. In some tribes, the guardian spirit concept was sufficient to explain all the powers of the shaman, as, for example, among the Eskimo, the Algonkin and the Plains Indians. Among the Eskimo, Tlingit and others the shaman might have a number of such guardian spirits. In part of the Californian area, however, this idea was poorly developed, or absent. In addition, the shaman might have to be trained by other shamans, or undergo a period of preparation as an additional qualification to the vision in which the spirit appeared to him. He might become a shaman by initiation—a method developed to a high degree among the Central Algonkin. In general, both men and women might become shamans, though in the south-west it was not often that a woman took on the full burden of shamanistic powers.

There was throughout a marked tendency for shamanism to run in families: but over a large part of the continent there was no restriction to prevent anyone becoming a shaman. The function of the shaman was to compel the supernatural powers to serve human needs, healing the sick being the most common. The shamans were also capable of causing sickness. Not all the various functions of a shaman were performed by all the shamans in a tribe. There were specialists—prophets, seers, rain-makers and so forth. Originally the shaman does not appear to have been a public functionary, but the tendency was for the shaman to become socialised, with a quasi-public position, and later for them to form an organisation.

Madras Fisheries. The administrative report for the year 1932-33 by the director, Dr. B. Sundara Raj, describes the activities of the Department, which include research in marine fisheries, minor marine and estuarine fisheries of prawns and edible oysters, inland fisheries, fish breeding, pearl and chank fisheries, with inspections, besides a large amount of miscellaneous work. There are three biological research stations, at West Hill, Krusadai and Ennur. Great possibilities for pond- and well-culture in rural areas are shown but there is a need for more research with regard to the fish for them. It is hoped that a fresh-water biological station and central fish farm for research will soon materialise. There is also a scheme for the establishment of a technical laboratory for research in fish manures, fish oil and fish meal. A specially important part of the report deals with the chank fishery. Little is known of the biology of the chank, *Turbinella pyrum*. Extensive marking experiments have been made which, it is hoped, will throw much light on the rate of growth, mortality and migrations; also researches on its breeding habits. Large egg capsules, measuring 7-10 in. and containing 30-33 chambers, are laid with one end fixed in the ground, where about the first nine chambers are empty; in the others, young chanks were found, two to each chamber. The veliger stage is passed within the chamber, the embryonic shell having a conical transparent shell of four to six whorls and the velum having four lobes. When ready to hatch, the shell has quite a different form, is 9-10 mm. long and has lost the velum.

Ciliates from Bermuda Sea Urchins. Miriam S. Lucas has recorded (*J. Roy. Micro. Soc.*, 54, 1934) observations on ciliates of the genus *Metopus* which occur in the intestinal caeca of sea urchins from Bermuda. Practically all the sea urchins (*Diadema setosum*) contained *Metopus circumlabens*, and a second and new species occurs sparingly in some of the urchins. The ciliates are commensals, feeding on diatoms, fragments of algae and cellular debris in the host's intestine. Particular attention was devoted to the neuromotor system, which consists of the peristomal membranelles of the lower lip, the motorium, the ventral and dorsal adoral fibres, the pharyngeal strand and the peripheral cilia. The motorium is a centre whence various peristomal fibres arise and lies deeply imbedded in the cytoplasm posterior to the cytostome. It is highly chromophilic, staining deeply with fuchsin in Mallory's triple stain. The pharyngeal strand appears to be very striking in this ciliate, arising from the

motorium and passing posteriorly to the right of the cytopharynx into the hinder part of the animal where it forms a large spiral coil. This strand is fibrillar and the author is disposed to regard the neuromotor system as bearing "a specialised relationship to the ingestatory cilia and to the cytoplasmic mass of the cell including the digestive, absorptive and excretory organelles". Observation of fission stages indicates that the neuromotor fibres arise as outgrowths from a clump of specialised posterior basal granules of the membranelle zone (the future motorium?).

Anthozoa of the North Sea and Baltic. Included in Part 26 of "Die Tierwelt der Nord- und Ostsee" (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1934. 17.60 gold marks) is the systematic account by Ferdinand Pax of the Anthozoa, namely, the Ceriantharia, Antipatharia, Zoantharia and Madreporaria. The last group is represented in these northern seas by five genera, three of which are solitary corals—*Flabellum*, *Caryophyllia* and *Paracyathus*, and two, *Lophohelia* and *Amphihelia*, are colonial. All are represented by single species except *Paracyathus*, of which three species occur in the area. The anatomy and biology are concisely described and notes are added on the habitat and geographical distribution of the species. In a postscript, we are informed that the names *Lophohelia* and *Amphihelia* (both due to Milne Edwards and Haime, 1857) should be replaced by *Lophelia* and *Amphelia* respectively as these have priority, having been used by Milne Edwards and Haime in 1849.

Fireblight of Pears and other Plants. Dr. K. M. Curtis, chief of the Mycology Department of the Cawthron Institute, has prepared a useful synopsis of present-day knowledge of the destructive disease known as fireblight (Mycology Pub., No. 10, Cawthron Institute, Nelson, New Zealand. Reprinted from *Orchardist of New Zealand*, June 1, 1934). Fireblight attacks apple, pear, hawthorn, quince, medlar, loquat and *Pyracantha angustifolia*. It is caused by *Bacillus amylovorus*. Symptoms of the malady are a brown discoloration of the affected parts, wilting and discoloration of the blossoms and leaves, and a slowly advancing canker of the main branches and trunk. The bacillus travels along the soft tissues of the plant, but overwinters in the cankered branches and larger twigs. Insects and birds transmit the organism from tree to tree, whilst pruning or grafting and even showers of rain can disseminate the disease. The bacillus gains entrance to the plant through wounds or through the stomata. Control measures are the removal of infected parts six inches below the lowest canker, and the treatment of the cut surface with acid mercuric chloride solution. A slight amount of control was obtained by spraying the open blossoms with weak Bordeaux fungicide.

Treatment of Lawns. The North of Scotland College of Agriculture has recently published a booklet entitled "Experiments on Lawns" by Mr. W. M. Findlay (reprinted from the *Scottish Journal of Agriculture*, 17, No. 2, April 1934). The suitability of various mixtures of lawn grasses is discussed, and a seeding of $\frac{1}{4}$ — $\frac{1}{2}$ oz. per square yard of New Zealand bent grass, or a mixture of $\frac{3}{4}$ oz. of New Zealand bent and $\frac{1}{4}$ oz. of chewing's fescue per square yard is recommended. Manurial trials have also been carried out, and sulphate of ammonia has been found to

be the best form of nitrogen. It stimulates the turf, and kills most weeds. Superphosphate and sulphate of iron have also a beneficial effect in eradicating weeds. It is suggested that two dressings of sulphate of ammonia be given in spring, and two in autumn, both at the rate of 1 oz. per square yard. Half an ounce of sulphate of iron may be applied in spring, and 1 oz. superphosphate per square yard in the autumn. There is general agreement of these results with others on the manuring of lawns, notably with those obtained by the Golf Green Research Station, Bingley, Yorks.

Dhubri Earthquake of July 3, 1930. A valuable report on this earthquake has been written by Mr. E. R. Gee (*Mem. India Geol. Surv.*, 65, pt. 1, 1–106, 1934). The earthquake is interesting from its possible connexion with the great Assam earthquake of June 12, 1897. From observations in the field, it appears that the earthquake originated in the strata that underlie the alluvium of the Brahmaputra River, a few miles to the south of Dhubri, in lat. 25° 57' N., long. 90° 0' E. This point, the position of which agrees closely with that indicated by the seismographic records, lies close to the north-west boundary of the epicentral area of the Assam earthquake, as laid down by Mr. Oldham. The intensity of the shock was far less than that of the Assam earthquake, for in no place did it exceed degree 9 of the Rossi-Forel scale. At Dhubri, however, a single determination of the maximum horizontal acceleration showed that it was not less than 2,200 mm. per sec., or about the same as that at Messina in 1908 and San Francisco in 1906. The area disturbed was probably about 322,000 sq. miles, or about the same as that of the Mino-Owari earthquake of 1891, and about double that of the Kwanto earthquake of 1923. The number of after-shocks, though large, was by no means unusual, and they declined in frequency very rapidly, the numbers felt in July, August and September 1930 being 223, 35 and 17, and, in the three years succeeding the earthquake, 294, 35 and 68, or altogether 397.

Cold-Working of Copper. A recent paper by W. A. Wood, of the National Physical Laboratory, deals with the lattice distortion due to cold-working of copper (*Phil. Mag.*, Sept.). Copper strip was annealed and then rolled, specimens being examined at various stages in a specially constructed X-ray diffraction camera. The negatives were measured on a microphotometer. The lines due to reflection by the (420) lattice phases of the crystal were broadened and also displaced in a way corresponding to an increase in the average spacing of the planes. This increase in the lattice spacing corresponds to an increase in latent energy, which may be estimated by comparing it with the energy absorbed by the lattice in thermal expansion. The maximum distortion observed corresponds to an increase in energy of the order 1.7 cal. per gm. This magnitude is comparable to that obtained by direct measurement in the case of copper under torsion.

Quantitative Study of Pleochroic Haloes. G. H. Henderson, with S. Bateson and L. G. Turnbull, has recently described quantitative measurements of the blackening in pleochroic haloes in mica (*Proc. Roy. Soc.*, A, July). The haloes were examined directly in a specially constructed recording photoelectric photometer, and a number of curves are given showing the darkening at each point of the halo. These curves

show humps corresponding very clearly to the dark rings in the haloes. A specimen of the mica was artificially blackened by exposure to radium emanation and a 'characteristic curve', including the phenomenon of reversal, was obtained. It is then shown that the darkening in the haloes may be calculated on the assumption that the 'effective exposure' produced along an α -particle track is proportional to the ionisation produced along the corresponding part of a track in air, the blackening produced being calculated from the 'exposure' by use of the characteristic curve. The method has been applied to several biotites. In some biotites, rings due to actinium products are found, and it is shown that the relative intensity of these rings and the uranium series rings gives values for the ages of the minerals which are in tolerable agreement with other estimates.

A New Multiple-Electrode Thermionic Valve. The now common supersonic heterodyne type of wireless receiver involves the use of a frequency changing stage, which, until comparatively recently, included two valves. One valve operated as an oscillator, and its output was applied with the incoming signal to the second valve, which functioned as a detector producing oscillations of an intermediate frequency for subsequent amplification. Progress in the technique of valve design and construction led to the combination of these two valves in one envelope; first, as a pentode frequency changer, and later, when additional electrodes were required for volume control purposes, the heptode and octode were developed. Such valves have previously operated with all the electrodes lying in a single electron stream, and this gives rise to interaction between the signal-frequency and oscillator circuits, which is very undesirable, particularly in short-wave reception. In the *Wireless World* of October 5, an article by E. E. Shelton describes a new valve, which is claimed to be free from faults of this type. This new frequency changer consists of two separate valves constructed in a single envelope. These two valves, one a triode and the other a hexode, operate with separate electron streams although the emission for these is obtained from a common cathode. The triode is employed as the oscillation generator, and its grid is directly connected to the appropriate grid of the hexode, which receives the incoming signal at controllable intensity and rectifies the combination of the two sets of oscillations. Owing to the fact that two screen grids of the hexode are connected together internally, the valve is provided with the conventional seven-pin base, with an additional electrode at the top for the control grid, which is connected to the signal circuit. The advantages claimed for this new valve over other frequency changers are that, while it is non-radiating and can be employed with an automatic volume-control system, it gives complete freedom from interaction between the signal and oscillator frequency circuits, and also a lower level of background hiss. These points are important in normal broadcast reception, but they are doubly so on short wave-lengths.

***d*-Sorbitol.** The rare sugar alcohol *d*-sorbitol has been found by H. H. Strain (*J. Amer. Chem. Soc.*, 56, 1756; 1934) to occur in large quantities in the so-called Toyon berries, the fruits of *Photinia arbutifolia*, Lindl., from which it may be isolated by extracting with hot water, filtering through charcoal

and siliceous earth, fermenting with yeast, evaporation under reduced pressure and extraction with alcohol. Another process depending on crystallisation from pyridine was also used. The properties of the purified *d*-sorbitol (m.p. 89°–93°; specific rotations) and some derivatives (triacetone-sorbitol, triformal-sorbitol, benzal-sorbitol and sorbitol hexaacetate) are described. Sorbitol forms crystals containing one molecule of pyridine; this compound and triacetone-sorbitol are easily converted into triformal-sorbitol, and this reaction provides a ready means for the identification of *d*-sorbitol and many of its derivatives.

Molecular Weights of Red Blood Proteins. The red blood protein, to which the old name erythrocrucorin has been applied by Svedberg, exists in several different modifications characterised by different molecular weights as determined by the ultracentrifuge method (cf. Svedberg and Hedenius, *NATURE*, 131, 325; 1933). T. Svedberg and I. B. Eriksson-Quensel (*J. Amer. Chem. Soc.*, 56, 1700; 1934) now report investigations on the erythrocrucorins from *Planorbis corneus*, *Daphnia pulex*, *Petromyzon fluviatilis*, *Arca pexata*, *Notomastus latericius*, *Chironomus plumosus*, *Thyone briareus* and *Myxine glutinosa*. These red respiratory proteins form, together with hæmoglobin (which is strictly limited to the five higher classes of the vertebrates), a system of molecules built up of units of weight 34,500 and half this value in simple multiple proportions. In some cases, mixtures of molecules are present. The observed molecular weights range as high as above three million, corresponding with 192 hæmin groups, and the multiples of the unit ($\frac{1}{2} \times 34,500$) found by the sedimentation method are 1, 2, 4, 24, 96 and 192; the multiples 8, 16 and 48, not determined for red pigments, are known from measurements on other proteins.

Dimensions of the Galactic System. The apparent disparity between our galaxy and the Andromeda nebula (which is the largest known external galaxy) has long been a problem requiring explanation. The theory of galactic rotation gives an independent method of computing the size of our galaxy, and Drs. J. S. Plaskett and J. A. Pearce, using this method, have now given evidence that the disparity is not real (*Mon. Not. Roy. Astro. Soc.*, 94, 680; 1934). They have used the radial velocities and proper motions of O5 to B7 stars alone, in order to obtain homogeneous material from stars at distances as great as possible. They find the centre of the galaxy to be 10,000 parsecs from the sun, and its diameter 30,000 parsecs, values agreeing with Shapley's, if the latter are corrected for the absorption of light in space. The diameter is thus only 2.5 times that assumed for the Andromeda nebula, while independent investigations by Hubble and by Stebbins have shown that this assumed value is probably too small, and should be about 30,000 parsecs—thus completely removing the above-mentioned difficulty. Incidentally, the problem of the well-known 'K term' in the radial velocities is also solved in the course of the above investigation. Where corrected for galactic rotation and (in the southern hemisphere) for stream motion of the B-type stars, this K term is reduced to 1.1 km./sec., a quantity which can then be explained by the Einstein gravitational displacement of spectral lines towards the red without assuming unduly large masses or densities.