

Research Items

Jaina Temples. Two Jaina temples in the village of Tiruparuttikunram on the outskirts of Conjeevaram in the Deccan, described and fully illustrated in a monograph by T. N. Ramachandran (*Bull. Madras Government Museum*, N. S., 1, pt. 3), the larger, early Chola with a *mandapa* in Vijayanagara style, the smaller in late Pallava style, supply an epitome of the main features of the chronological development of Dravidian temple architecture. Jainism, which was the most powerful religion in the south from very early times, is held to be the result of a partial attempt to Aryanise the Dravidian races. Conjeevaram has been identified with some certainty as Jina-Kānchi, where a regular colony of Jains seems to have settled early. The larger Jaina temple here studied is the biggest in the taluk, and nowhere else is the style found in so concise and well-balanced a form. The chronological evidence afforded by style is supported by inscriptions, in which the larger temple is peculiarly rich. The ceilings and veranda are adorned with paintings illustrating Jaina mythology. The smaller temple, and the older, is dedicated to Chandraprabha, the eighth tirthankara, and the larger to Vardhamāna, the twenty-fourth tirthankara. Local tradition says that the two owe their existence to a Pallava king and that he built them at the instance of two Jaina teachers, who lived in the village. While the first part of the tradition is in accordance with the style of architecture, the latter part is evidently incorrect, as an inscription in the temple shows that the two teachers were not contemporaneous with the Pallavas, but flourished six centuries after them, that is, in the fourteenth century.

Animal Worship in Bengal. An account of an animal shrine and worship at Uttarbhag, Lower Bengal, by Dr. Sunder Lal Hora has recently been published (*J. and Proc. Asiatic Soc. Bengal*, N. S., 29, No. 1). This desolate part of the Sundarbans, dense jungle and infested with wild animals, is visited annually in October and May by a large number of people for wood-cutting and fishing. They practise a great variety of religious rites to propitiate the deities of jungle terror of all sorts. Uttarbhag is a small trading village, 23 miles to the south of Calcutta. In the month of February it was noted that some kind of *pūjā* had been practised at three different places in the village. The most conspicuous evidence of the ritual was a mud platform, on which were four images representing *Manasā*, the serpent goddess, *Makar*, the crocodile, *Dakshindar* or *Bōn Bābi* and *Pānch-pīr*. Inquiry elicited the fact that the people had no conception of the godlings they worshipped. They referred the inquirer to the Brahmin who had performed the ceremony. The *pūjā* is performed jointly by Mohammedans and Hindus. The services of a Hindu priest are required for the worship of *Manasā* and *Makar* and of a Mohammedan, usually a *faqīr*, for that of the remaining two. The *faqīr* is said to have the power of driving away the harmful beasts of the jungle. It is significant that at Uttarbhag these five deities are worshipped at a single festival in January–February, instead of separately on the day of the year appropriate to each. In Bengal the worship of *Manasā* occupies a prominent place. At Uttarbhag she was represented by two conical

mounds of mud, each mound having three clay heads of cobra arranged on one side and a mark in vermilion on the front. The crocodile was represented by a mud model. Of the four images of *Dakshindar*, two were said to represent the wife of Dakṣin Rāy. This wife is an innovation. The *Pānch Pīr*, 'Five Saints', were five balls of earth placed on a mud platform. Their names were unknown to the people.

Races of the Chimpanzee. Variation in the hair coat, affecting both distribution and colour, and in the colour of the skin, have led to the creation of unwarrantable specific names for chimpanzees. Ernst Schwarz considers that all the varieties represent no more than four local races of one species, variously known as *Pan satyrus* or *Anthropopithecus troglodytes*. Of these racial forms, the typical *satyrus* is confined to the French Congo, *verus* to the forested parts of Upper Guinea from the Niger as far west as the Gambia, *schweinfurthi* to the forests of Central Africa, north and east of the Congo, and the distribution of *paniscus* is not stated, on the ground that it was adequately described in 1931 (*Ann. Mag. Nat. Hist.*, June 1934, p. 576).

Evolution of the Hermit Crab. Prof. Charles Pérez has recently gathered together, in a short survey, the scattered information on the general biology of the commoner species of hermit crabs; and by indicating the adaptations of type species arranges the Paguridea into an evolutionary sequence ("Les Pagures ou Bernardes L'Ermite: un exemple d'adaptation". *Actualités Scientifiques et Industrielles*, 101; 1934). According to Prof. Pérez, the Decapoda in general show development from a primitive lobster-form to a more highly evolved crab-type. He suggests that though there is a lack of geological evidence, existing forms of Paguridea may be taken as indicating a line of evolution in the Decapoda which has gone through the hermit crab stage to arrive finally at the more advanced crab-type; and has carried with it, in the structure of the adult and to a certain degree in the life-history of the individual, evidence of the route which it has taken. To the non-specialist, interested in natural history subjects, this paper should prove both interesting and instructive; the serious zoologist already will be familiar with most of its contents.

Habits of the Corn-Bunting. In North Cornwall, where Lieut.-Col. and Mrs. B. H. Ryves have studied the corn-bunting (*Emberiza calandra*) intensively for two years, the species is undoubtedly double-brooded, although many hens are content with raising only one brood in the course of a season (*British Birds*, June 1934, p. 2). Three broods are probably a very rare occurrence. Such restricted breeding may be associated with the extent of the duties carried out by the female, for she alone is concerned in the building of the nest and in the incubating of the eggs, and almost alone she undertakes the rearing of the young, which on rare occasions may be fed by the male parent. Perhaps the devolution of work upon the female has encouraged also the habit of polygamy; the twenty-four males observed during the season of 1933 had between them forty-five hens, and a total number of fifty-four nests, from which at least 126 young were safely reared. The nests of a breeding

group were sometimes close together, sometimes separated by distances up to 60 yards, but neither within the groups nor between the groups were there shown signs of territorial jealousy, although territories were well defined. In the first week of August, song diminishes in quantity, by mid-August the birds are silent, and by the end of August breeding territories are deserted.

Vegetative Propagation of Cacao. The third annual report on cacao research, 1933, published by the Government Printer, Trinidad, 1934, shows the botanical section of the Imperial College of Tropical Agriculture making progress with the problem of propagating this plant vegetatively. Extensive survey work is gradually achieving the first object, the location of a thousand trees suitable for more intensive study. Some 750 of these trees have been located and progress made with the next stage, of reducing their number to 100 suitable for more careful record of yield. These are then to be gradually reduced in number by careful field studies until types suitable for propagation as clones are available. In the meantime, experience is being gained of the technique of propagation, and fair results obtained by the use of cuttings in fine sand. One point of interest reported upon by Mr. E. E. Pyke is the branch habit of the plant in relation to propagation. The original seedling stem has a 3/8 phyllotaxis and a radial habit, but most branches have two ranked leaves and a plagiotropic habit. Obviously the first type has advantages for cutting propagation, and so it is desirable to study methods of stimulating the production of erect branches with radial habit. Cutting back the branch system, coupled with ring-barking, has proved very successful. It might be worth while, as in the case of apple stocks, to try the effect of cutting back coupled with earthing over the base of the branch shoots to stimulate root production before they are removed from the parent plant as isolated cuttings.

Gilled Fungi of Victoria. An article by Mr. J. H. Willis on "The Agaricaceæ or Gilled Fungi; Some Species common in Victoria" appears in the *Victorian Naturalist* (50, No. 18, 264, April 1934). Field study of the Agaricaceæ is in its infancy in Australia, but the paper under review provides a very useful introduction to the would-be student of outdoor mycology. A key for the determination of about seventy of the commoner species is given, and descriptions of each species appear. It is interesting to note that most of the species are such as are found in England, and the list would be a guide to our most common species here. The account is enriched with two coloured plates and numerous text figures. A very interesting fungus is "Blackfellow's Bread" (*Polyporus mylittæ*) which produces a large, dark sclerotium just below the surface of the soil. *Cordyceps Gunnii* and *C. gracilis*, two Ascomycetes, are also described, the former producing ascospores in threads emerging from the perithecia.

Plant Diseases in the Philippines. Trinidad Valley and the environs of Baguio are districts in the Philippine Islands where vegetable crops are grown intensively. Seeds and plants have been imported from other countries, and a considerable number of diseases have also made their appearance. These have been studied by Dr. T. G. Fajardo, who has published the results of his survey (*Phil. J. Sci.*, 53, No. 1, 67, Jan.

1934). Diseases of the cabbage and other cruciferous crops, cucumber, chayote, pea, bean, egg-plant, pepper, potato, tomato, celery and other plants are described, and symptoms of several maladies are shown upon twenty-five excellent plates. Many of the diseases are well known in the British Isles—black rot of cabbage (*Phytophthora campestris*), bean rust (*Uromyces appendiculatus*), potato blight (*Phytophthora infestans*), potato scab (*Actinomyces scabies*) and several virus diseases. No specific methods for the control of each disease are given, but general methods of plant hygiene, spraying and the use of resistant varieties are set forth at the end of the paper.

Lower Cambrian Archæocyathinæ of South Australia. The Archæocyathinæ of South Australia were investigated very thoroughly by T. Griffith Taylor (1910). His work has now been supplemented by R. and W. R. Bedford in a paper on "New Species of Archæocyathinæ from the Lower Cambrian of Beltana" (*Mem. Kyancutta Mus.*, No. 1, pp. 1-7, pls. i-vi, 1934). These authors have obtained new material from the Ajax Mine in the Flinders Range, from which they describe and illustrate 32 new species and 8 new genera. Notwithstanding the excellent state of preservation of the Australian Archæocyathinæ, their systematic position is still a matter of uncertainty, and the present authors refrain from discussing this interesting question. These organisms have been variously referred to algae, sponges, corals, or an independent group allied to Cœlenterates. Taylor was inclined to regard them as related to calcareous sponges, although some of their structures at any rate simulate those found in corals. A new genus, *Acanthocyathus*, may lend support to this view since it is claimed that the outer wall is formed of spicules. The Archæocyathinæ seem to have had a world-wide distribution in Cambrian times. Recently a considerable number of new forms have been described from Siberia by Wologdin.

Crustal Movements in South Africa. Evidence of recent rising in the coastal zones and warping of the interior of South Africa are discussed by Dr. A. L. du Toit in the *South African Geographical Journal* of December 1933. He points particularly to the eastern plain of Mozambique and the south and south-west coasts of the Cape Province. This uplift which affected the whole of South Africa was differential, and thus there were caused areas of depression or basins separated by ridges or axes of uplift. Such depressed areas are the Karroo-Basutoland, the Bushveld, Limpopo, Ngami, Ovampoland, Zambesi and other depressions. These have involved vertical movements of several thousand feet in places. The axes of the uplift and the longer axes of the depressions lie south-west and north-east or east-north-east, which suggests that they all owe their origin to the same tectonic causes. Dr. du Toit believes that these features mark a southerly expansion of the Central African rift system. The volcanic activity characteristic of the rift system is absent from the south, but occasional earthquake shocks are experienced there. It is suggested that there is evidence that these tectonic movements have persisted into the human period.

Fine Structure of Valve Characteristics. B. van der Pol and Th. J. Weijers have made an important investigation of the detailed structure of diode,

triode and tetrode characteristics (*Physica*, 1, No. 6, 481, April 1934). The experimental method consists in impressing a sinusoidal voltage on the steady grid potential and separating and measuring the harmonics in the anode current. It is shown that the amplitudes of the successive harmonics are, in general, proportional to the various differentials of the characteristic curve. (This is, however, not true at points of discontinuity.) The results show that the differential curves often indicate a large number of maxima and minima. They reveal that certain points on the characteristics may show a marked absence of detecting properties. In addition to this result of technical importance, the authors consider that their method may be of use in investigating such physical points as the critical potentials in secondary electron emission. They also discuss the use of the functions called Tchebycheff polynomials in the representation of valve characteristics.

Numerical Solution of Differential Equations. D. R. Hartree (*Mem. Manchester Lit. and Phil. Soc.*, 77) has given a detailed description of a method of solving the differential equation:

$$\frac{d^2y}{dx^2} = f(x, y)$$

by numerical methods. This equation arises in Hartree's method of calculating self-consistent atomic fields, but it occurs very frequently in other branches of physics. The method given is applicable to equations involving functions specified by tables, in the absence of an analytical form. It is claimed that it is rapid and easy to apply. The method is self-checking, so that computing errors are apparent before they are deeply involved in subsequent work.

A Photoelectric Illumination Meter. Much interest has recently been taken in the new direct-reading photometers based on the use of photoelectric cells. The latest instruments of this type comprise only two essential parts, a photoelectric cell and a moving coil indicator. The cell is exposed to the illumination to be tested, the movement of the pointer being proportional to the intensity of the light. Photoelectric cells of the alkaline metal type have the drawback that a battery of constant E.M.F. is needed; also the electrical output is so small that a highly sensitive instrument is necessary. The metal oxide type of cell, on the other hand, does not need a polarising battery, and the output is much greater. Thus a single selenium oxide cell suffices to operate a relatively robust instrument. In one recent type of apparatus, the Salford foot-candle meter, a cell $1\frac{3}{8}$ in. in diameter, is mounted in the hinged lid of the box containing the measuring instrument, the scale of which is graduated in foot-candles (50 ft.-c. giving the full-scale deflection). It is claimed that with such a photometer, most artificial lighting installations can be measured with sufficient accuracy. Under reasonable conditions, in the measurement of light from incandescent (filament) electric lamps, an accuracy of 2 per cent is stated to be possible. Fatigue is, however, set up by over-exposure of the cell to very bright light, and there is some degree of colour-error in the case of systems departing very widely from the normal daylight spectrum. Errors up to 30 per cent may, for example, be experienced with gaseous discharge lamps. A correction may be applied to obviate this

difficulty which, however, does not arise in comparative measurements with the same type of source of light.

Interstellar Matter. The presence in interstellar space of widespread light-scattering material is now fairly generally accepted as the explanation of the well-known 'reddening effect' in the more distant stars. The question of the distribution of this light-scattering material is discussed by E. G. Williams in the *Astro-physical Journal*, vol. 79, p. 280. The diffuse matter giving rise to the 'stationary lines' of calcium has already been shown to be approximately uniformly distributed, and a comparison of the intensities of these interstellar lines with the colour excesses of stars is a useful method of judging the uniformity of the former (light-scattering) material. The author has measured the intensities of the interstellar [K] line in the spectra of 67 stars. The spectrophotometric method is described, and total absorptions are obtained with probable errors of about 5 per cent. These are compared with colour excesses obtained from three sources, which have been corrected on account of absorption by the Balmer lines of hydrogen. A statistical correlation is found between colour excess and interstellar [K] intensity, but the considerable dispersion indicates that the scattering matter is not co-extensive with the calcium. The bright-line stars form a group to themselves, and are all too red for their distances. This may have some bearing on Struve's theory of their origin, in which the extra reddening effect would be caused by an atmosphere of scattering matter ejected from rapidly rotating stars.

The Gas from Indian Oil Wells. Under the auspices of the Geological Survey of India in co-operation with leading oil companies, some interesting investigations of the oil-gas of Burma and Assam have recently been carried out. The results of these investigations are recorded in a paper by G. P. Kane, K. R. Krishnaswami and H. E. Watson (*J. Indian Inst. Sci.*, 17A, Part 3; 1934). The primary object of the undertaking was to assess the helium content of these gases, but complete analyses comprising carbon dioxide, carbon monoxide, oxygen, nitrogen, hydrogen, methane and propane contents were also effected. Throughout the investigations, special precautions were taken owing to the high methane content of the gases. This constituent is appreciably absorbed by alkaline pyrogallol, bromine and ammoniacal cuprous chloride, while with the higher hydrocarbons the tendency is even stronger. For this reason, the gases were submitted to fractionation before analysis. Tabulated results indicate quantities obtained by fractionation, amounts of the different gases present in each sample expressed as percentages on the dry gas, and helium content in parts per 100,000. Scrutiny of this table shows that the five samples from Burma were somewhat similar in composition, with the exception of one which had an abnormally high nitrogen content. One of the seven samples from Assam resembled the Burmese gases except for its high carbon dioxide content; two were remarkable for their high nitrogen content and four for their low ratio of methane to other hydrocarbons. A natural gas from a seepage at Gogha, Bombay, was practically pure methane mixed with air. In all cases the amounts of helium determined were of the same order as in air, and in no case was the quantity sufficient for commercial extraction.