Research Items

Buffalo Sacrifice.—The sacrifice of a buffalo at an annual festival in honour of one of the two chief village deities of Manakaddu, Salem City, Madras Presidency, is described by Mr. F. J. Richards in the *Indian Antiquary* for August. The festival is held in February or March in each year and usually lasts for some weeks. The sacrifice here described took place on March 7–8, the seventeenth day of the festival, which had begun on February 19. In the evening the processional images of the two deities, Mâri-amman and Selli-amman, are brought to the temple of Kâli, with whom Selli-amman is identified, and after the sacrifice of a sheep the images of the goddesses are carried in procession around the village, Selli-amman's vehicle being a lion and that of Mâri a horse. In front walks the pariah whose privilege it is to slay the buffalo, carrying the sacrificial knife on his shoulder. His torch-bearer is also a pariah, whose office is hereditary. The goddesses are then carried clockwise around the temple. A plaintive hymn is sung while two men rock the images of each goddess. After the singing of the hymn all females must go home. The buffalo victim is then led to the edge of a pit 50 yards in front of the temple. It must be male. After offerings have been made to the victim by the priest and it has been garlanded and sprinkled with red-ochre, sandal and saffron on the forehead, the pariah awaits the signal that the goddess accepts the victim. This is signified by the shivering of the beast. The victim is held by the people and the pariah severs the neck with two or three blows. The attendant then mixes the blood with boiled rice, which he hands to the executioner, who conveys it to his mouth and then rushes like a madman around the village, at each corner throwing a few grains of blood-sodden rice into the air. The pariahs at the graveside throw the body into the pit, and it must be completely buried before the pariah returns from his circuit of the village. The pariah returns in front of the temple and after a few ecstatic screams, the spirit of the goddess leaves him. The festival closes with the sacrifice of sheep and a general feast on the 8th or 16th day after.

Puebloan Decorative Designs.—The Elden Pueblo, 6½ miles from Flagstaff, Arizona, when excavated by Dr. Walter J. Fewkes in 1926, yielded a variety of pottery, of which the decorative designs have been studied by Dr. Walter Hough (*Smithsonian Misc. Collect.* vol. 87, art. 7). Elden Pueblo is classed as a gray-ware site dating from the 'Great Period' of Kidder and is one of the many of northern type settlements penetrating the Little Colorado area. Band designs and parallel striping are applied in agreement with the structure of the ware, that is, on the corded junctions. Bands did not disappear with the coming of the quadrant art, which is also old and was introduced from the north. Allied to the band are all-over designs made up of a network of interlocking stripes. The quadrant designs seem to mark a profound change in Pueblo cosmogony, which probably began at Elden in Pueblo III. The Elden red-ware takes on the variety of paste and design of the polychrome area of the Little Colorado valley. The whole decorative field of the Elden pottery is elaborated from the bird motive. In its early form it is not realistic, but two engaged spirals generally arising each from a triangular or wedge-shaped base are taken to be the body of the bird. No other symbol is so wide spread in time and space as that derived from the bird. At Elden it occurs in various stages of convention. As a rule two birds are represented in apposition. The most ancient form is curvilinear, expressing motion. The body is sometimes shown as a triangle, sometimes supplied with a head and a tail. The list of small units is not long. Hachuring passed out of use with the discontinuance of gray-ware, about A.D. 1250.

Mammals of Central and South-eastern Asia.—The Kelley-Roosevelt Asiatic Expedition of the Field Museum, Chicago, in a relatively short period in 1928-29, was able to cover a wide extent of territory in central and south-eastern Asia. This was due to the division of the expedition into three sections, each of which touched faunal areas not reached by the others, and the result was a collection of mammals of unusual size, variety and interest. Species are represented from very different regions so that in the systematic account, by Wilfred H. Osgood, which has just been published (*Field Mus. Nat. Hist., Zoo. Series*, vol. 18, No. 10, 1932), inhabitants of the tropical coast of Cochin China rub shoulders with alpines from the highlands of western Szechwan near the Tibetan border. The accounts, however, show that in spite of its temperate climate western China possesses a mammalian fauna many elements of which extend into French Indo-China. To some extent the area covered overlaps that from which the late Oldfield Thomas obtained collections, and the author pays a warm tribute to the co-operation of the scientific staff at the British Museum, in which are housed the type specimens of new forms collected by the French ornithologist, Jean Delacour, whose mammal collections also are described in the Field Museum memoir.

Innervation of the Crustacean Heart.—J. S. Alexandrowicz (*Quart. J. Micr. Sci.*, vol. 75, Pt. 2, pp. 181–249, 3 pls., 1932) gives an account of the innervation of the heart of decapod Crustacea. Three systems of nervous elements can be distinguished: (1) a local system of neurones in the heart itself; (2) nerve fibres connecting the heart with the central nervous system; (3) nerves supplying the valves of the arteries which issue from the heart. The first system consists of a nerve trunk in the dorsal wall of the heart from which branches pass to the muscle-fibres of the heart. The cells in this nerve trunk are of two kinds—large and small—and their number was found to be constant; in *Cancer pagurus*, *Maia squinado* and *Homarus vulgaris*, five large and four small cells were present, but in *Potamobius astacus* there were eight large and eight or may be nine or ten small cells. The cells are multipolar and their long processes (the axons) after sending out short branches (regarded as dendrites) give off long branches to all the muscles of the heart including those of the ostia. The fibres which connect the heart with the central nervous system arise from the suboesophageal ganglion, travel in the nerves which run on the thoracic muscles to the dorsal side of the heart, where they pierce the wall and reach the local system. The thicker fibres, possibly inhibitory, break

up into richly arborising branches forming a neuropile which is the field of conjunction of these fibres with each other and with the neurones of the local system. The nerves of the third system, forming four pairs, arise from the thoracic nerves and innervate the valves of the arteries, except the ophthalmic artery which has a separate nerve from the stomatogastric system. The local system is an autonomic nervous apparatus from which the muscles of the heart receive impulses necessary for their regular contractions; the nerves to the valves bring about contraction of the muscle fibres of the valves during the diastolic period.

Alcohol and Inheritance in Guinea-Pigs.—An extensive experimental investigation of the effects of alcohol on guinea-pigs, made by Miss F. M. Durham and Miss H. M. Woods, has been issued by the Medical Research Council as Special Report No. 168 (London: H.M. Stationery Office, 1932). Prof. Stockard found that treatment of guinea-pigs with alcohol by inhalation led to the appearance of abnormalities which were inherited, also to reduced fertility and higher mortality records. Repetition of these experiments with careful controls leads to negative results, and it is suggested that a smaller amount of green food may have caused a deficiency of vitamins and so produced some of the abnormal offspring in Stockard's experiments. In the present work four successive generations of guinea-pigs were treated with alcohol by inhalation from a half-saturated atmosphere. Ten abnormalities occurred among 6,309 alcoholic stock and one among 674 control stock. There was no evidence that fertility was affected by the alcohol, or that males were more affected than females. A certain decrease in fertility occurred, which is ascribed to genetic qualities in the stock and the effects of inbreeding, but the controls were not extensive enough to prove this point. Some deterioration in weight also occurred, but this, too, may be due to inbreeding. The general conclusion is reached that there is no evidence that alcohol has had a deleterious effect on the genetic behaviour of guinea-pigs, and this is in accord with the results of most other workers.

Management of Race-horse Paddocks.—Prof. J. A. Hanley gives an account of management of race-horse paddocks in the *Student's Gazette* of the Royal Agricultural College, Cirencester, for 1932 (vol. 19, new series, part 1). The type of grass required differs in many respects from that which the farmer wishes to obtain and the methods of management in the two cases must in consequence be different. Paddocks used for exercise, for example, should have a soft springy turf or 'mat', a condition which a farmer would regard as indicating a serious state of deterioration. Owing to the great value of race-horses, oats and bran are fed without stint, and too little attention is often paid to the value of paddocks for grazing. Further, hand feed is apt to be deficient in lime, a danger for which fresh grass is the best natural corrector. To meet the varying needs of the yearlings, breeding mares and foals, and to provide leafy herbage for grazing throughout the greater part of the year, it is evident that a number of paddocks to be used in rotation are needed, and a scheme of management, including manuring, is outlined to show how this may be done. Horses are notably selective in their grazing, so that it is essential to include some other stock (preferably polled bullocks) in the scheme if the grazing is to be of the best quality, and there seems no doubt that the performance of a horse depends in no small degree on the management of the paddocks at the stud where it was reared.

Liquid Inclusions in Minerals.—Most of the known data on the composition and concentration of primary fluid inclusions in minerals is assembled in a paper by W. H. Newhouse in *Economic Geology* for August. Sodium chloride appears to be one of the most abundant and widespread of the constituents present, especially in or adjacent to sulphide ore deposits. It is suggested that the sulphides are carried in solution with sodium chloride and probably at higher temperatures with potassium chloride. The concentration in solutions found in galena and zinc blende from the Mississippi valley ores excludes the possibility of formation by descending meteoric waters. Similar solutions were found in galena from localities where the ores are related to visible igneous rocks (Leadville, Freiberg, etc.), and it is concluded on this evidence that the only known available sources for such concentrated solutions (apart from saline deposits) are magmatic or possibly the first artesian flow from newly tapped beds containing connate waters.

The Elastic Limit of Metals.—Dr. G. Cook describes in the September *Proceedings of the Royal Society* experiments designed to test several rival hypotheses about the stresses necessary to produce elastic breakdown in a metal. The hypotheses which have been suggested include (1) definite shear stress at yielding, (2) definite total strain energy, and (3) definite energy of shear strain. The second hypothesis requires that failure may be produced by superposing a sufficiently large hydrostatic pressure on a constant shear stress which is itself insufficient to cause breakdown, and a direct test led to the rejection of the hypothesis. In the main experiments a triaxial stress, the three components of which could be varied separately, was used instead of the simplified stress systems which have usually been used in work on elastic breakdown. The triaxial stress was obtained by using a hollow steel cylinder exposed to combined axial tension and internal pressure. A large number of samples were tested and analysis of the stresses at breakdown agrees with the assumption that failure takes place when the shearing stress reaches a certain value which agrees rather closely with the limiting stress in simple torsion. A comparison of the limiting stress in simple tension experiments shows some discrepancy, and the author concludes that, while the maximum shear stress is the principal condition of failure, the mode of distribution of the stress has some influence on the yield conditions.

Intensity Distribution in a Band Spectrum.—It is a characteristic of modern spectroscopic theory that it concerns itself with the probabilities of spectral transitions and hence with intensities in spectra. Condon in 1926 gave a theory to explain the general features of the intensity distribution in band systems, but little accurate photometric work has yet been done on band spectra. R. C. Johnson and N. R. Tawde (*Proc. Roy. Soc.*, Sept.) publish a photometric study of the Swan bands of carbon (C_2 molecule). Photometric work over a large range of optical frequencies is very difficult. The method

adopted in the present work is the use of the photographic plate and microphotometer to compare the intensities at the intensity maxima of the (unresolved) bands with the intensity distribution of a calibrated tungsten lamp. The points of technique discussed in the paper are fairly well known to workers in this field. From the observed intensity distribution the transition probabilities are calculated and they agree in a general way with the Condon predictions of the most probable transitions. The experiments with different methods of excitation (bunsen flame, oxy-coal gas flame, argon discharge, and spark under glycerine) show that the populations of the different states do not agree with thermodynamic equilibrium at the temperature of the source.

Water Transport in Electrolysis.—A well-known method for determining the hydration of ions consists in adding to the solution of the electrolyte an indifferent substance such as urea, from the changes in concentration of which around the electrodes it is possible to calculate the amount of water transported by the ions. Experiments by Miss Taylor and Sawyer in 1929 showed that in the electrolysis of sodium chloride, water is transported from the anode to the cathode, the transference per faraday being greater the lower the concentration of the solution. A further investigation by Davies, Hassid and Taylor (*J. Chem. Soc.*, Sept.) extends the results, and it is shown that the transference of water increases with dilution at a rate which is too great to be accounted for by change in the transport number of the ions. It also increases with decrease in temperature, whereas the transport number of the cation decreases with fall in temperature. The calculation of the absolute hydrations of the ions on the assumption that the hydration is independent of the concentration and that the decrease in water transport with concentration depends on the change in transport number, gives impossible values of 240 and 145 molecules of water for the sodium and chlorine ions, respectively. It is concluded that, since activity considerations point to a total ionic hydration which is independent of concentration, the results obtained must be interpreted as indicating that the ions during migration transport a considerable quantity of water with which they are not chemically combined.

Astronomical Topics

Eta Aquilæ and the Cepheid Problem.—Vol. 4, No. 8 of the Publications of Michigan University Observatory contains a study of the spectrum of Eta Aquilæ by Dr. D. W. Lee. The star has been known as a variable since 1784, its period being about 7·2 days. It was soon recognised that the eclipse explanation did not fit this case and many other theories were tried in turn, the one usually accepted at present being Prof. Shapley's pulsation theory. The present paper supports this theory, but with the modification that the pulsations are to a large extent in the star's atmosphere. The spectroheliograph has enabled us to study the behaviour of gases at different heights in the sun's atmosphere, and the experience gained there may be extended to stellar spectra. D. Lee notes that if the pulsation arises from a central impulse, there would be a lag in the phases of the outer layers as compared with the inner ones; his observations confirm this, and indicate the presence of a compressional wave which is traced through four of the lower layers of the atmosphere. A companion paper by W. Carl Rufus in No. 7 of the same publication contains a diagram of the mean velocity curve for all levels. This shows a marked pause in the middle of the ascending portion of the velocity curve. The curves from hydrogen and strontium lines have a secondary maximum at this point. The light-curve has a similar pause, which is supposed to indicate a stage of comparative rest in the atmosphere.

The light maximum follows maximum compression of the body of the star by about one quarter of the period; but the maximum compression of the atmosphere would be later than that of the body, owing to the lag in the outer layers. It is concluded that the atmospheric compression plays a large part in the increase of light.

The Place of the Moon derived from Occultations.—Prof. E. W. Brown succeeded in his attempt to interest a large number of astronomers in the observation of occultations of stars by the moon. The observers are so widely scattered that the risk of bad weather is largely obviated, and a sufficient number of results is obtained every year to give a good value of the mean error of the moon in longitude. There is, however, one point that prevents us from taking the result as giving the absolute error of the moon; this is the fact that Prof. Brown rather discourages the observation of re-appearances of stars, so that practically all the observations are made between new and full moon. He gives as a reason that re-appearances are more difficult to time with accuracy than disappearances; but this difficulty can be overcome with sufficient practice; there would necessarily be fewer re-appearances observed, since the majority of them occur after midnight; this would necessitate some weighting of the results, to obtain the mean error of longitude. The present system cannot be relied on to give the true error of the moon in longitude, for errors in the assumed semidiameter and in the assumed coefficients of the variation and the parallactic inequality are not eliminated. However, the errors from these sources should be the same every year, so we can take the results with confidence as showing how the mean error of longitude is changing from year to year. Prof. Brown and Dr. Dirk Brouwer have published (*Astr. J.*, 970) their discussion of the observations of the year 1930, and also give a preliminary result for 1931. The following table gives the values for different years, with their differences :

Year.	Obs. minus Tab. Long.	Diff.
1927	+ 6·92″	
		− 0·60″
1928	+ 6·32	
		− 0·36
1929	+ 5·96	
		− 0·17
1930	+ 5·79	
1931	+ (5·6) provis.	

They conclude, from the run of the differences, that the error of longitude probably passes a minimum in 1931 or 1932, and will then increase again.