

Research Items

Mortuary Caves of Szechwan, China.—Relics from the artificial caves of Szechwan Province in western China have been described by the collector, Mr. David C. Graham (*Proc. U.S. Nat. Mus.*, Art. 16, vol. 80). Thousands of these artificial caves are to be found in the sides of the hills and cliffs from Hupeh Province on the east to the highlands of the Szechwan-Tibetan border and along the Yellow River in the province of Kansu. Varying from a few feet to 130 ft. in depth and about six feet high by six feet wide, they are carved from the solid stone, the sides plainly showing chisel marks. Some are so close to one another that holes have been knocked in the dividing walls. It is popularly believed that they are 'barbarian'; but on both historical and archæological grounds it is demonstrable that they do not antedate the Chinese and almost certainly belong to the Han dynasty at about the beginning of the Christian era. The best caves have elaborate carvings above and around the front openings and on the sides and pillars near the entrance. Certain conventional designs in these carvings are also found on Han monuments of various types. A large number of burnt clay figures have been collected from the caves. Glazed figures are rare, but a fragment of a bottle-neck and part of a pottery bell show a green glaze. The figures include the foot of an elephant, dogs, fowls, horses' heads, human figures—among these, servants, actors, a figure playing a flute, etc., in costumes which indicate that little change has taken place in dress down to the present day. The clay vessels show the use of the potter's wheel. The commonest artefact is the earthenware coffin. Many carvings and artefacts reflect customs or represent implements in present use among the Chinese, but not among any primitive tribes.

Archæology of Eastern Colorado.—The second report by Dr. R. B. Renaud, director, on the work of the Archæological Survey of Colorado (published by the Department of Anthropology, University of Denver) describes the field-work carried out during the summer of 1931. It covered the valley of the Upper Arkansas in southern Colorado and the valley of the South Plate River and the territory north of it in the northern part of the State. The ground has now been cleared for preparing a better contact between Colorado and Wyoming and for an approach to western Nebraska, the next field of operation. The total number of sites covered in the present report is 116, of which eleven are double, that is, pictographs are found on both sides of the river or there is a major site on one side and a minor, possibly a look-out, on the other. Camp sites were by far the most frequent, 37 being reported from the South-Platte drainage area, 19 from the Upper Arkansas, and 8 south of Denver. A great many possibly date from the prehistoric period. 19 workshops were found, of which 13 were in the north. The northern area is distinguished by its more abundant camp sites and workshops, its more frequent sites with tipi rings, as well as its more numerous metates and manos. On the other hand, the southern area comprises all the sites with pictographs and stone enclosures, as well as two of the three known rock shelters. There are evidently cultural and geographical differences between the two areas. The collection of artefacts made in 1931 was not extensive; but some large collections in private hands were examined. The same distinction between the culture of the northern and southern areas is to be noted in the distribution of the classified types of implements; while in regard to their material, in both

areas that most commonly employed is quartzite, but the place of flint, which comes second in the south, in the north is taken by chaledony.

Brachial Muscles of Primates.—In a paper on the brachial flexor muscles in primates, A. B. Howell and W. L. Strauss, jr. (*Proc. U.S. Nat. Mus.*, vol. 80, 1-31; 1931), state that these muscles as a whole exhibit no distinct phylogenetic trend; the variations are individual rather than generic. The authors direct attention to the contrasting specialisations of the biceps muscle in the Lorisinae and the Hylobatidae. In all other primates this muscle is normally composed of the coracoid and long heads. In the lorises (*Nycticebus*, *Loris*, and *Stenops*) the biceps possesses one head of the long variety, the coracoid head being missing. In the gibbons (Hylobatidae) the long head is present, but the coracoid head is replaced by one arising from the humerus, and there are most intimate connexions with the surrounding muscles, for example, the pectoralis major and the forearm flexors, which produce a mechanical arrangement well adapted to the extreme mode of brachiation exhibited by the gibbons. This unique anatomical arrangement is clearly an extreme functional adaptation peculiar to the gibbon, and cannot be regarded as representing a stage in the evolution of the biceps of man and the anthropoid apes. While this structure of the gibbon's biceps seems undoubtedly to be adaptive, it is apparently not a necessary outcome of the brachiating mode of locomotion, for such able and constant brachiators as *Ateles*, *Colobus*, *Pan*, and *Pongo* exhibit no trace of such an arrangement.

Deep Sea Collecting.—For three years now the Bermuda Oceanographic Expeditions of the New York Zoological Society under the leadership of Dr. William Beebe have made collections of deep-sea animals in the same region nine and a quarter miles south south-east of Nonsuch Island, Bermuda. That these collections must be becoming very complete as representative of the deep-sea fauna in that area is shown by a recent publication (*Zoologica*, 13, No. 3), which gives the lists of hauls made during May-November in 1931. Up to the present date, 1350 collections have been made at all depths down to 2000 fathoms in mid-water, the majority being at the surface and between 500 and 1000 fathoms. The fruitfulness of these collections is already shown by two further publications in the same periodical (13, Nos. 4 and 5). In the former Dr. Beebe describes nineteen new species of deep-sea fish, and in the latter the same author and John Tee-Van record six new species of shore fish from that region. It is by such continuous collecting that the sparsely distributed members of the pelagic deep-sea fauna will become better known, and we hope that more material will be accumulated; for until the many unknown forms have been fully classified and described the study of their life histories is impossible.

Nuclear Structure.—Prof. Ruggles Gates devoted his presidential address to the Royal Microscopical Society (*J. Roy. Micr. Soc.*, 52, 1932, pp. 1-19) to a consideration of recent work on nuclear structure. Evidence is accumulating that in plant cells the nucleolus generally contains two substances which may occasionally form separate bodies, and that one of these substances enters into the prophase transformations of the chromosomes, while the other does not. He referred to observations on the chromosome vesicles or karyomeres which show that these become closely appressed in the resting condition of the

chromosomes (for example, in the teleost *Fundulus*), but the delicate vesicle-walls persist and the vesicles do not completely coalesce until after each has formed a chromosome within itself in the prophase. This and other examples afford evidence that each chromosome maintains its morphological peculiarities from one cell generation to another, and confirms the view that the resting nucleus contains the chromosome materials in the same spatial arrangement as in the preceding telophase. Interesting comments are given on the spindle fibres and on cases of polyploidy in certain somatic tissues while the germ cells in the same animals remain diploid. Prof. Gates discussed the internal structure of the chromosomes and their method of division and made reference to mitoses in cells of root tips, which show that the chromosome splitting occurs in one metaphase for the separation which is to take place in the next. In an estimate of the size of genes, Prof. Gates remarked that it would appear probable that they and virus particles are about the same order of size, each containing not more than a few hundred organic molecules, and that it seems likely particles of this size are the smallest in which vital phenomena can be exhibited.

Virus Diseases of Potatoes.—The results of the studies of plant virus diseases financed by the Empire Marketing Board are now being published. The most recent works are to be found in the *Scientific Proceedings of the Royal Dublin Society*, vol. 20 (n.s.), Nos. 15, 18, and 20, May 1932. Paper No. 15 is by Dr. Phyllis Clinch and reports the results of "Cytological Studies of Potato Plants" (pp. 143-172). The green parts of mottled leaves have a structure similar to healthy organs, whilst the yellow areas are distinctly thinner. The peculiar vacuolate inclusions known as X-bodies have been found in the chlorotic areas of leaves infected with crinkle, streak, interveinal, and simple mosaics. They were not seen in aucuba mosaic or leaf roll plants, or on healthy leaves. Their discovery seems to confirm their inclusion in the virus diseases, since the X-bodies are almost exclusively found in this group. Paper 18 is by Dr. P. A. Murphy and is entitled "A Critical Review of some Recent Work on the Occurrence of Virus Complexes in the Potato" (pp. 193-210). The author reviews the literature, which suggests that many virus diseases of the potato are not single diseases but are the results of two or more viruses acting together. Dr. Murphy considers that it would be easier to explain these phenomena by regarding the virus as a chemical substance. Paper 20 is by Dr. P. A. Murphy and Mr. R. McKay. It describes "The Compound Nature of Crinkle and its Production by Means of a Mixture of Viruses" (pp. 227-247). A virus, called 'virus A', has been found to produce symptoms of the disease known as crinkle on the variety Irish Chieftain if the latter was previously infected with simple mosaic. This finding is in accord with the work of Dr. R. N. Salaman of Cambridge, who has separated three constituent viruses from English crinkle.

Age of Monazite from Portland, Conn.—Dr. C. N. Fenner has analysed for uranium, thorium, and lead a crystal of monazite from a pegmatite occurring at Portland, Connecticut (*Amer. J. Sci.*, April 1932). The results may be summarised as follows:

PbO = 0.1086 per cent	Pb = 0.1007 per cent
U ₃ O ₈ = 0.00	U = 0.00
ThO ₂ = 8.52	Th = 7.489
$\frac{\text{Pb}}{0.36\text{Th}} = 0.037.$	Age = 278 million years.

The age corresponds with the close of the Devonian. Special interest is attached to this result from the fact

that the uraninite from the same quarry which was analysed by Hillebrand many years ago has a lead-ratio of 0.038. The check is very gratifying and gives additional support to the essential correctness and reliability of the principles on which the age of radioactive minerals are based. In particular it should be noticed that the agreement depends on the use of the value 0.36 for k (the factor by which Th is multiplied in the formula). With $k = 0.25$, as recently advocated by Kirsch, there would be a considerable discrepancy. The value 0.36 is further supported by the concordant results obtained by Fenner from samarskite and monazite from Brazil.

A Fossil Horned Artiodactyl Ungulate from Texas.—Among the fossils recently acquired by the Palaeontological Museum of the University of California through the generosity of Miss Annie M. Alexander, is the skull of a remarkable horned artiodactyl from the Pliocene of Texas. It is described by Dr. R. A. Stirton (*Bull. Dept. Geol. Univ. California*, vol. 21, No. 6, 1932), who shows that it represents an extreme development of the four-horned skull of *Protoceras* which was discovered by the late Prof. O. C. Marsh in the Oligocene of South Dakota. *Protoceras* has a pair of frontal horns and a pair of premaxillary horns of moderate size. A somewhat larger animal, *Syndyoceras*, from the Lower Miocene of Nebraska, has the same horns much elongated. The new skull from Texas, which is of still later geological age and is named *Synthetoceras*, is again larger, and has the premaxillary horns relatively enormous and fused together except at their free tips. The succession is thus interesting as showing the same increase in the relative size of the horns which is already known in successive members of other groups of artiodactyls, such as the deer.

Estimation of Ground Water.—In connexion with the important series of reports on ground water supplies in the United States, the Geological Survey of that country has published a pamphlet on "Methods of Estimating Ground-water Supplies" (*Water-Supply Paper 638-c*), which contains a full discussion of the problems involved, with references to the literature of the subject. No one method is applicable to all conditions. Some water-bearing formations function chiefly as reservoirs, others chiefly as conduits, but all of them have some of the properties of both. Some of the methods estimate the intake from surface streams by gauging stations, others estimate the discharge from springs, or the intake may be estimated from rain and melting snow and the discharge by evaporation from the soil or by the transpiration of certain selected plants grown in tanks with measured quantities of water. It would appear, however, that the most trustworthy measurements are obtained by water-stage recorders installed over wells. Water levels in wells are sensitive to every change that takes place in ground water, and these changes can be almost perfectly recorded by an automatic recorder. But all methods are being tried, and great improvements have been effected in recent years.

Spectrum of the Solar Corona.—A paper was read by M. Bernard Lyot on Feb. 19 before the Société Française de Physique, in which he gave an account of the success which has now attended his efforts to study the solar corona at the Pic du Midi at other than eclipse times (*J. Phys.*, 3, 31 S). The main new feature in his work is the great care taken to avoid parasitic light in the optical system; the other usual source of trouble, diffraction by gross particles in the atmosphere, was not serious. The spectrum of the green line has been obtained on a grating with a dispersion of 1.2 Å. per mm., and the red line has been photographed with a prism giving 11 Å. per

mm.; the average wave-lengths for these are given as 5302.83 ± 0.03 A. and 6374.75 ± 0.15 A. respectively. One feature of special interest is the breadth of the green line, which extends over 1.3 A. and has an intense core about 0.6 A. wide. These results were obtained at relatively unfavourable times, three or four years after the maximum in solar activity, and show that the methods employed will permit of the study of the red and green lines at any time, whilst it is quite possible that other lines can be obtained at times of greater activity.

The Positive Column.—Two accounts of the positive column which have just appeared, by R. Seeliger (*Physik. Z.*, April 1) and R. Holm (*Z. Phys.*, March 31), emphasise how unsatisfactory our knowledge of the passage of electricity through gases still is, even in the simplest cases. Langmuir has given a very full theory of the uniform positive column, and Schottky and Townsend less complete treatments, but attempts to compare these with experiment, except perhaps in the case of mercury, are limited both by lack of data

for such discharge parameters as the temperature of the gas and of data for various atomic properties. Seeliger's article, which deals with monatomic gases, is largely an elaboration of Schottky's diffusion theory. Seeliger accepts the experimental result which lies at the basis of much of Langmuir's work, that the electrons have often a Maxwellian distribution of velocities corresponding to a temperature much in excess of that of the gas, and makes some interesting comments on how this temperature may be maintained. There are, however, special difficulties with the noble gases on account of the frequent occurrence of moving striations and the practical impossibility of finding the concentration of metastable atoms by other than delicate optical methods. Holm discusses diatomic gases, again starting from Schottky's theory, which he shows to be in reasonable agreement with his and Güntherschulze's measurements of the field in the positive column, but makes a distinct break from earlier work in his insistence on the importance of negative molecular ions, the conditions for the formation of which are still little understood.

Astronomical Topics

Comets.—An interesting point has arisen with regard to Newman's comet (1932*f*). It appears that there are two comets, several minutes of arc apart, that have similar motion. This was first detected by Herr Schmitt, and was announced in a telegram from the I.A.U. Bureau on July 1. It is quite probable that some of the observations supposed to belong to Newman's comet actually belong to the other one. The following orbits of Newman's comet have been computed; the first is by Dr. Whipple and Mr. Cunningham from positions on June 1, 7, and 20 (*Harvard Card 222*), the second by Dr. M. Davidson from observations by Dr. W. H. Steavenson on June 21, 25, and 30 :

<i>T</i>	1932 Sept. 27	1932 Sept. 25-01 U.T.
ω	73° 50'	70° 9' 16"
Ω	244 50	245 7 33
<i>i</i>	76 50	78 21 20
<i>q</i>	1.57	1.6421

Three positions are given below; the first is presumed to belong to Newman's comet, the second is the discovery position of Schmitt's comet. Dr. Davidson considers that the third also belongs to Schmitt's comet :

U.T.	R.A. 1932.0.	N. Decl. 1932.0.	Observer.	Place.
June 22-1454	15 ^h 33 ^m 44.4 ^s	9° 12' 10"	van Biesbroeck	Yerkes
25-8682	15 28 36	11 45	Schmitt	not stated
July 1-9666	15 16 59.8	15 0 56	Steavenson	Norwood

Schmitt gave the daily motion of his comet as $-1^m 40^s$, N. $35'$, which was practically the same as that of Newman; it can scarcely be doubted that these two bodies are portions of a single comet that split into two portions at some date in the past, like Biela's comet; this would make it probable that the period of the comets is not very long. A search through the catalogues has not revealed any comet with similar elements; there is a distant resemblance to 1898 I (Perrine), but that has a period of three or four centuries.

Orbits of Double Stars.—*Circular* No. 86 of the Union Observatory, Johannesburg, contains a determination by Dr. R. T. A. Innes of the orbit of the star Innes 35, the duplicity of which he discovered in 1897; the position is R.A. $6^h 53.7^m$, S. Decl. $35^\circ 22'$ (1900). It is a very close binary, the greatest elongation being only $0.3''$. It has now completed two

revolutions since discovery, and the period is thus known with considerable accuracy. This, as Dr. Innes points out, is a help in finding the other elements; they run as follows; Period 16.5 years, periastron 1926.8 , *e* 0.586 , *a* $0.315''$, *i* 56.3° , 269.7° , 116.4 . Applying Eddington's mass-luminosity relationship, Innes finds a parallax of $0.040''$, masses of 0.91 and 0.87 of the sun, and absolute magnitudes of 4.8 and 5.0 . The apparent magnitudes are 6.8 and 7.0 , the spectral type *F5*. The separation of the stars at periastron is only $0.07''$, so that most of the observations are in the region near apastron. Dr. Innes gives a second paper, explaining his method of computing double-star orbits, which makes use of the *X.Y.* Tables that he published in 1927; he adds a new table that gives the value of arc *minus* sine for various angles.

Norman Lockyer Observatory.—The Council of this Observatory has recently published its report for the year ended on March 31 last; great satisfaction is expressed at the large amount of work carried out by Dr. W. J. S. Lockyer and Mr. Edwards. The former has recently published in the *Monthly Notices of the Royal Astronomical Society* a study of the relation between the corona and the prominences; the latter has made a study of the spectra of stars of type *B*, and continued the work of deducing spectroscopic parallaxes which has been going on for some years. The collection of stellar spectra photographed at the Observatory now amounts to 6458. The chief event of the year has been the completion of the photographic equatorial presented by Sir Robert Mond (see *NATURE*, June 4, p. 838); it includes four Zeiss triplet lenses of different diameters, and has an electrically controlled driving clock by Messrs. Cooke, Troughton and Simms. An interesting photograph of a bright meteor passing the Pleiades was obtained with it by Dr. Lockyer on Jan. 11; it is reproduced in *Monthly Notices, R.A.S.* for March, and gives much information as to the changes of brightness exhibited by the meteor in its flight; unfortunately it was not observed visually, so the exact time of its appearance is not known. It will be remembered that Dr. Lockyer photographed another interesting meteor in 1922 (*Monthly Notices, R.A.S.*, vol. 83). The investigations at present in hand include studies of the spectra of ζ Tauri, β Canis Majoris, and 52π Aquarii; also of certain stars with bright hydrogen lines.