

Research Items.

Pit-Dwellings at Kiatuthlanna, Eastern Arizona.—Ruins on the Long H ranch, Twin Salt Lakes, in Apache County, were excavated by Mr. Frank H. H. Roberts, jr., on behalf of the Bureau of American Ethnology in 1929, the results being described in *Bulletin* 100 of the Bureau. By the end of the field season, eighteen pit-houses, the remains of jacal structures, and a pueblo ruin with forty-nine rooms and four kivas had been recovered. The chronological sequence was in the order named. There were two forms of pit-house, of which the larger was a later development of the smaller. In each case there was a rectangular superstructure of poles with flat ceiling and sloping sides. The framework was covered with brush, leaves, etc., and a rectangular hole in the centre of the ceiling served as an entrance and smoke escape. Characteristic furnishings were a ventilator, fire-pit, a *sipapu* or symbolic representation of the mythical place of emergence, and a hole for the storage of small objects. This group of features survived in the later ceremonial chamber of the communal dwelling, a survival for ceremonial purposes of the old original type of house. The pit-houses occur in groups of four to six, perhaps representing a single family group or clan. Several might constitute a village. In some groups the central house was larger, suggesting that a definite ceremonial significance was becoming attached to a particular building, possibly representing the prototype of the kiva of later periods. The smaller houses were found to be reminiscent of structures belonging to the end of Basket Maker III. period, the larger of Pueblo I. of the Chaco Canyon of New Mexico and south-west Colorado. In general the pit-houses show a greater resemblance to dwelling forms excavated in the north than they do to those of the south and south-west. The jacal dwellings, which have upright walls of poles covered with mud and ranging from a single to several rooms, were contemporary with the large pit-dwellings.

The 'Vital' Factor in Diet.—In connexion with the letter on "Photographic Effects of Vitamins A and B", by Sophie Botcharsky and Anna Foehringer, published in our columns recently (*NATURE*, vol. 127, p. 856; June 6, 1931), and the note on p. 864, Dr. Chalmers Watson has sent us a paper by him on "The 'Vital' Factor in Diet: A Theory of the Nature of Vitamins", published in the *Edinburgh Medical Journal*, June 1931. He was impressed by the early experiments on rats in which it was shown that immediate and dramatic recovery was brought about when animals previously fed on abnormal diets were given a diet of bread and milk; by the capacity of irradiated milk to bring about a rapid healing of rickets in children; and by the valuable therapeutic effects of the 'Gerson' diet, which includes vegetable and fruit juices freshly prepared, wholemeal bread and milk, vegetables cooked in oil and potatoes cooked in their jackets, but with restricted amounts of meats and salt. Dr. Watson points out that the effectiveness of irradiated milk in the cure of rickets appears to be much greater than can be accounted for by its vitamin D potency as determined by tests on rats. Solar energy acts on the cells of plants and initiates the chemical energy which promotes healthy growth; this energy is passed on to the animal kingdom when the vegetable food is consumed. Artificial irradiation has the same effect as exposure to the sun's rays. The best source of vitamins is living food; much of that in common use is more or less dead or devitalised; in fact, the amount of vitamins present varies inversely

with the nearness of the food to the original source of its energy. Dr. Watson considers that the plant tissues hold some of the original vital (or solar) energy which initiated the chemical changes; in other words, they are activated. When the tissues are consumed by animals or man, that energy is in turn transmitted to them as a so-called vitamin.

Ringed Plover and its Eggs.—A series of simple and instructive experiments relating to the eggs of the ringed plover (*Charadrius h. hiaticula*) has been carried out by George Marples in an area where he had more than forty nests under observation (*British Birds*, vol. 25, July 1931). When eggs were removed a short distance from the nest, the birds found them and dragged them back; but they also dragged and sat upon egg-shaped pebbles which had been painted to resemble their own eggs, although the disguising of the shape of their own eggs by the addition of lumps of plasticine did not deceive them, nor did the painting of the eggs with bright yellow, blue, and red colours. A curious observation of Mr. Hughes, that the ringed plover keeps its eggs in the positions of the cardinal points of the compass, was tested, with the result that after the deliberate derangement of the clutches in 121 cases, it was found that 80 were rearranged exactly north and south, 11 were nearly but not quite restored to the cardinal point position, and 30 clutches remained in disarrangement, north-east and north-west. Tests with various scents placed upon the eggs indicated that the birds were deficient in sense of smell (though it may be merely that the parental instinct overcame any sense objection), and the numbering of the eggs and frequent examination of their relative positions in the nest failed to prove that there was systematic rotation of the clutch, though it was clear that movement, as distinct from rotation, usually takes place.

South American Sea Stars.—Mr. W. K. Fisher, of the Hopkins Marine Station, Pacific Grove, California, describes a number of star fishes, based on material collected by Dr. Waldo L. Schmitt, of the United States National Museum, in 1926 and 1927 during an investigation chiefly of the higher Crustacea of South America in various parts (*Proceedings of the United States National Museum*, vol. 78, No. 2859, art. 15). There are some very interesting finds, especially three forms of *Anasteria* from the Falkland Islands, which, although here recorded as three species, may very likely all belong to *A. minuta*. The handsome species *Ophidiaster agassizii* Perrier is figured for the first time, two specimens having been collected in Juan Fernandez, and there are, further, very good photographs of several other species.

Japanese Dinoflagellates.—In continuation of the series of papers dealing with the fauna and flora of Mutsu Bay, Prof. Charles A. Kofoid describes the unarmoured dinoflagellates (*Report of the Biological Survey of Mutsu Bay*; Number 18, "Protozoan Fauna of Mutsu Bay. Subclass Dinoflagellata: Tribe Gymnodinioidæ". Science Reports of the Tohoku Imperial University, Fourth Series (Biology): Sendai, Japan; vol. 6, No. 1, 1930). This is one of the contributions from the Marine Biological Station, Asamushi, Amori-Ken; No. 61. These lovely organisms must be studied alive, as the usual methods of preservation destroy their characters: 33 species are recorded, including 14 which are new to science, and these are figured in three striking coloured plates, the colours

ranging from pale yellow and green to pink, purple, and bright blue. A new *Nematodinium* bears large nematocysts, and there are two new species of *Pouchetia* having conspicuous eyes with complicated lenses. Prof. Kofoid's notes on *Pronoetiluca* are very interesting. The period of the prevalence of *Pronoetiluca pelagica* in Mutsu Bay coincides with that of sporulation of *Noetiluca*, and the theory that it is possibly a stage in the life cycle of *Noetiluca scintillans*, "representing the earliest stage in the life of that species before inflation by hydrostatic vacuoles", is very suggestive. *Noetiluca* itself has periods of great abundance in Mutsu Bay, especially in May and June, forming local shoals by wind action so dense that the water is much discoloured. In the same report and also from the Marine Biological Station of Asamushi (No. 19, "Notes on Recent Foraminifera from Mutsu Bay"), Dr. Yoshine Hada records 94 species and 6 varieties, 11 of the species being new to science. The paper is beautifully illustrated with text figures.

Additions to the British Coleopterous Fauna.—For a number of months past, a special feature of the *Entomologists' Monthly Magazine* has been the contributions of Mr. H. St. J. Donisthorpe on additions to the British coleopterous fauna. These articles are in the form of an annotated list of all additions made to this division of the fauna since the publication of the supplementary volume (6) of Fowler's standard work on the order. The excellent coloured plates that have appeared from time to time greatly enhance the value of these articles, and it is hoped that when the series is completed it will be available as a separate publication. The 'list' serves as an admirable example of how much work there still remains to be done, even in so well explored an order of insects as the Coleoptera, before our fauna can be regarded as having been fully studied. Many of the species, now rightly claimed as British, are only known from a single locality, or perhaps from but one or two places, and there is consequently plenty of work for the assiduous collector still to do in determining their actual ranges of distribution.

The Rift Valleys of South Australia.—The problem of the structural origin of the gulfs of South Australia and the Lake Torrens basin is discussed at some length in a paper by Dr. C. Fenner on the major structural features of South Australia in the *Transactions and Proceedings* of the Royal Society of South Australia, vol. 54. Dr. Fenner argues against the use of the term rift valley and prefers to call the features Spencer-Vincent and Torrens Sunklands, but maintains that there is insufficient evidence to support either the tension or compression theory of origin. Nevertheless, he believes that in the Mount Lofty and Flinders Ranges there is much to suggest that thrust movement and not tension has been the dominating factor. The fault block movements are generally considered to have occurred in late Miocene and Pliocene times, but there is much evidence of an intense phase in early Pleistocene and of differential movements along fault lines in late Pleistocene to recent times.

A New Uranium Mineral.—The uranium minerals of Spruce Pine, North Carolina, include a central core of black uraninite surrounded by a dark reddish brown zone, which is followed successively by brilliant orange-red gummite and an outer shell of bright yellow uranophane. The reddish brown zone has now been investigated in detail by Ross, Henderson, and Posnjak (*Amer. Min.*, May, 1931, pp. 213-220) and found to be a new mineral with distinctive chemical and optical properties and X-ray spectrum. They

propose to call it *clarkeite*, after the veteran geochemist F. W. Clarke. Henderson's analyses show a composition of the type $RO \cdot 3UO_3 \cdot 3H_2O$. The mineral is a direct hydrothermal alteration product of uraninite, and as it is rich in soda it was probably formed during the stage of pegmatitic alteration characterised by the replacement of microcline by albite. At a later stage the solutions became poorer in alkalis and richer in silica, and *clarkeite*, being unstable in their presence, altered to gummite, which in turn was changed to uranophane with still higher silica and more lime and water. A reinvestigation of gummite is foreshadowed, the authors having discovered that the optical properties of the Spruce Pine gummite differ from those given in the literature.

Nitrate Deposits of California.—The nitrate deposits of southern California are generally associated with the soils resting on tilted beds of Tertiary clays and shales. A typical section shows a few inches of *caliche* underlying a layer of soil that is efflorescent below and compact above. The *caliche* contains most of the nitrate, though the percentage is small compared with that of the associated chlorides and sulphates. The various occurrences and the problem of origin are dealt with by L. F. Noble in *Bull.* 820 of the United States Geological Survey. Three hypotheses are considered: (a) upward movement of soluble salts by sub-surface moisture through capillary action; (b) downward movement from the soil and other surface sources; and (c) enrichment at the contact zone between soil and bedrock by general erosion. The last of these is regarded as the dominant process, subject to there being a sufficient quantity of saline material available, ample time for concentration, and a favourable arid climate. Although the deposits investigated do not appear to justify commercial exploitation, workable deposits of other useful commodities have been found in the course of the investigation. These include bentonite and various clays, boron minerals, strontium minerals, rock salt, gypsum, and magnesite.

Luminous Phenomena accompanying Earthquakes.—There can be little doubt that the destructive Idu (Japan) earthquake of Nov. 26, 1930, was closely associated with the lights seen shortly before, and for at least an hour after, the earthquake. They were observed by Mr. K. Musya, who collected records from about 1500 observers on both sides of the Idu peninsula, in the valley of the Sagami river, and on the shores of Tokyo Bay and the Boso peninsula (*Earth. Res. Inst. Bull.*, vol. 9, pp. 177-215; 1931). The lights were very strong—in one place brighter than moonlight. They were usually described as bluish in colour, but sometimes as reddish yellow, yellow, or reddish blue. In shape, they resembled the rays of the rising sun, search-lights, and fireballs. The duration of each light was longer than that of lightning, and some careful observers report that the same light continued more than a minute. The directions in which they were seen pointed usually, but not always, to the epicentral region of the earthquake.

The Raman Effect.—The issue of the *Physikalische Zeitschrift* for May 15 contains an account, which extends to 20 pages, by Prof. K. W. F. Kohlrausch, of the University of Gratz, of the present position of our knowledge of the Raman effect. The author points out that Lommel in 1878 predicted the production of oscillations of frequency $n \pm w$ when light of frequency n impinged on a substance having a free frequency of w ; and that the theory of the production of such oscillations was further developed by Smekell, Herzfeld, Kramers, and Heisenberg from the quantum point of view in the years 1923-25, although Raman

and Krishnan were only able to establish their existence experimentally in 1928 (NATURE, 121, p. 501). After a short account of experimental methods, the author reviews the theories and deals with the structure of the undisplaced lines, the entry of rotational frequencies, the intensities of the displaced lines, and the relation between the displacement of the lines and the structure of the molecule of the substance. References to 103 papers on the subject are given.

Absolute X-Ray Wave-lengths.—Since it has been found possible to measure the wave-lengths of X-rays by diffraction from an ordinary ruled grating, there has been some doubt as to the value of the charge on an electron, which can be calculated from the X-ray data, and has appeared higher than Millikan's value. Some new absolute measurements of X-ray wave-lengths are described and discussed critically by J. A. Bearden in the second May number of the *Physical Review*. The lines measured were the *K* lines of copper and chromium, which are as long as can be used conveniently without an exhausted spectrometer. Gratings were used which had been ruled by Prof. R. W. Wood and under the direction of the late Prof. Michelson, and in some cases as many as eighty orders of diffracted lines were obtained. The results are of high accuracy, the wave-length of the *K_β* line of copper, for example, being given as 1.39225 Å., with a limiting error of ± 0.00014 Å., which is definitely about 0.2 per cent greater than the wave-length from crystal measurements. The corresponding charge upon the electron is 4.806×10^{-10} e.s.u. This could be taken to indicate that the standard value of 4.77×10^{-10} e.s.u. is wrong, and has at times been so interpreted. Dr. Bearden, however, now takes the contrary view, that the charge as found from the X-ray measurements is too high, and that there is a flaw in one step in the deduction of the electronic charge, in neglecting the imperfections in crystal structure the existence of which has been

pointed out by Zwicky. If the difference found is entirely due to this cause, it gives in fact a precise method for determining quantitatively the magnitude of the effect in crystals, and further, if a good independent estimate of the flawing existed, the present data could be applied to the determination of the electronic charge with higher precision than has been attained by other methods.

The Jet-Wave Rectifier.—The extending use of direct current for electric traction has caused a great demand for devices which will rectify alternating current into direct current. High power rectifiers based on the valve patented by Cooper Hewitt in 1903 are widely used. The Hartmann jet-wave rectifier, which is a purely mechanical device based on interrupting a jet of mercury carrying a current by means of a tungsten knife, is also being used in practice, but they each have special fields where they do not compete with each other. In a treatise entitled "The Jet-Wave Rectifier: an Account of its Constructional Development during the Years 1919-1929" (*Danmarks Naturvidenskabelige Samfund: Ingeniørvidenskabelige Skrifter*, A, Nr. 24. Pp. 300. København: G. E. C. Gad. 30.00 kr.), Jul. Hartmann gives a fairly complete account of the research work carried out by the Hartmann Rectifier Co. in Copenhagen on this rectifier. The author gives an interesting account of the development of the invention. When preparing for his master's degree at Copenhagen, in 1906, he was given by Prof. Christiansen the problem of determining the velocity and the charge-mass ratio of the particles of a cathode ray using the method of deflection in a magnetic field. A few months later, when using induction coils with mechanical interrupters, he found them very unsatisfactory. Thinking over his previous work, it suddenly struck him that a mercury jet might be deflected by a magnetic field in the same way as a cathode ray, and this led him to devise the jet-wave rectifier.

Astronomical Topics.

Encke's Comet.—A letter from Mr. H. E. Wood, Director of the Union Observatory, Johannesburg, announces that he detected this famous comet a week earlier than Mr. Bobone at Cordoba; but as he did not send a telegram, the announcement of the latter arrived first. The comet was so low in the evening twilight when first photographed that part of the field of the object-glass was cut off by the wall of the dome. In spite of this, the comet gave such a strong image with eight minutes' exposure that Mr. Wood estimates its magnitude as fully 7, which is 2 magnitudes brighter than Mr. Bobone's estimate. The plates have not yet been accurately measured, but the following rough positions are sent:

1931	R.A. (1931.0)	N. Decl.
June 14.7 U.T.,	7 ^h 1.6 ^m ,	15° 23'
June 16.7	7 10.8	13 38

These positions fully confirm those of Mr. Bobone in indicating that perihelion passage was about 18 hours earlier than Matkiewicz's prediction, which was June 3.84757 U.T.

This is the thirty-eighth observed apparition of the comet; it was seen in 1786, 1795, 1805, 1819 (when its periodicity was recognised by Encke), and at every return since then. The reason for the unbroken records held by this comet and by that of Halley is that their perihelion distances are small, so that they are easy objects when near their perihelion.

As a proof that Encke's comet is gradually fading, it may be mentioned that in 1865 the perihelion

passage was 5.7 days earlier than in 1931, so that the conditions of observation were similar; in 1865 the comet was observed in February with instruments of moderate size; but in 1931, Prof. G. van Biesbroeck, using the powerful instruments at Yerkes Observatory, failed to obtain the faintest image of it on his photographic plates in February and March.

Impact of Stars with Nebulae.—Mr. K. Hirayama, of Tokyo Observatory, investigates in *Proc. Imperial Acad. Japan* (7, No. 5; 1931) the effects of the impact of a star with a spherical nebula. The relative velocity is probably hyperbolic before impact, but it may be reduced by the impact below the parabolic value, in which case there will be repeated impacts, which will result in the capture by the star of part of the matter of the nebula, while the star's orbit relatively to the nebula will be reduced in size. The author suggests that the nebula might in time be so reduced and broken up as to form a system of planets revolving round the star; this is an alternative to the theory that explains the formation of the planets by the tidal action of a star passing near the sun. The paper goes on to show that a binary system passing through a nebula would have the size and eccentricity of the orbit diminished and the masses of the components increased. It also suggests that a large spherical nebula might, by capturing a great number of stars, form a globular cluster, while the repeated impacts of the stars with nebulous matter would end in the absorption of most of the latter.