

Research Items.

THE PERUVIAN QUIPUS.—Baron Nordenskiöld continues his study of the quipus, the systematically knotted cords found in Peruvian graves, in the second part of No. 6 of his "Comparative Ethnographical Studies" (Göteborg: Elanders Boktryckeri Aktiebolag). He here follows up his previous suggestion that the quipus have a calendrical significance by a detailed study of seven quipus on a numerical evaluation of the knots according to their position and the colour of the cords. As regards the ancient Peruvian calendar, the statements of early writers are ambiguous and contradictory as to the division of the year into months, the extent to which the distinction between the lunar and solar year was recognised, and the date on which the year began. It is possible that this confusion arose out of the fact that the more intimate and accurate knowledge of the calendar was confined to the priests, with whom the whites were less likely to come into contact, while the common people, from whom these writers obtained their information, used the lunar year; the solar year, divided up into months of thirty days with five intercalary days, being the property of the learned and not in general use everywhere. Certain results common to the quipus here examined are found to emerge from the numerical evaluation. It would appear that the Incas worked with solar years of 365 days and with months of either 29½ or 30 days, the classification of knots according to the colour of the strings producing both results on the same quipus. The number 7 has special significance. The Incas worked both with synodical months and with a division of the year into 12 months of 30 days plus 5 extra days. It is possible that they knew and reckoned with a synodical revolution of Jupiter calculated at 397 days. The results obtained support the statements of the old writers.

STONE IMPLEMENTS FROM NORTH-WEST PERU.—Relics of a remarkable lithic industry found in north-west Peru are figured and described by Mr. C. Barrington Brown in *Man* for June. Flakes apparently made by human agency were first observed in 1911 at Punta Picos, south-west of Tumbes, on the sandy surface of an ancient sea floor now sixty feet above sea-level. They were of the simplest type and of various materials, showing in every case one side as a single fracture. Later similar flakes, with a few showing secondary pressure flaking along an edge, were found at many different sites, on hilltops and slopes, river terraces and plains. In 1924, on the occasion of a second visit to that locality, not only large quantities of flakes, several reworked, were found, but also stone implements of a skilled manufacture, polished axes, mortars, bowls, etc. At the head of a canyon was found a piece of worked slate which may be a phallus. In three places flakes were found with modern Inca remains which may have been due to Inca occupation of ancient sites. So far, finished implements have been found in one locality only. In the majority of cases no pottery fragments, no bones, and no metal were found. The most interesting and important site is that of El Estero, a small pond 22 miles inland due east from Cabo Blanco on the highest point, at an elevation of 85 feet above sea-level, of a low pass through the Buitre hills. Most of the axe-heads and implements were lying on the surface a few yards from the trail. The area of habitation covers about 1000 square yards with an accumulated thickness of reddish-grey earth of about 4 feet. Here thirty-one axe-heads were found, all except one showing a feature unique in axe-heads,

the sides and butt being filed down into a flat or slightly concave face. The butts are provided with protuberant ears of unusual shape. Two examples from Ecuador in the British Museum have the protuberant ears but not the typical flattened butt and sides. The absence of pottery suggests a pre-Inca industry.

BIRDS IN SOUTH AMERICA.—Comparatively little is known of the migration of birds in the southern hemisphere, and in order to some extent to repair this blank, A. Wetmore spent ten months in the southern States of South America, particularly to observe North American birds in their winter quarters, and of these more especially the waders. The results of this expedition, which lasted from June 1920 until April 1921, have recently been published (Smithsonian Institution, *United States National Museum Bulletin*, 133, "Observations on the Birds of Argentina, Paraguay, Uruguay, and Chile"). They comprise much more than the main object of the journey, for his travels in Argentina, Paraguay, Uruguay, and Chile brought the author in contact with many native birds, regarding which he has made comprehensive and excellent field notes. The descriptions of several racial forms new to science have already appeared in other scientific publications, but are here repeated. Many valuable notes on migration, a detailed itinerary, a good map, and many excellent photographs of the various types of bird country, add to the interest of this contribution to the knowledge of South American bird life.

THE SOURCE OF HYDROGEN SULPHIDE IN THE BLACK SEA WATERS.—It has long been known that the upper layers of the waters of the Black Sea only are free from hydrogen sulphide, which is present from the depth of 150 metres downwards, so that no life except bacteria is possible between 150 metres and the bottom (2188 m. in the deepest parts). Nothing was known, however, as to the origin of this hydrogen sulphide, and only recently Prof. B. L. Issatchenko has proved that it is produced from the sulphates dissolved in water by anaerobic bacteria similar to *Microspira aestuans*, known from the northern seas. The Black Sea organism is exceedingly active and can produce so much as 0.3 gm. of hydrogen sulphide per litre of water. Apart from this organism, there are in the bottom mud of the Black Sea some other bacteria able to produce hydrogen sulphide from albumins, but their productivity is far lower and the conditions for it in the depth of the sea are less favourable. Another problem investigated by Prof. Issatchenko was why the surface layers of water are free from hydrogen sulphide. This was formerly ascribed to the presence of an intermediate layer populated by bacteria which are able to oxidise hydrogen sulphide produced in the deeper waters. No such bacteria could be found by a systematic sampling of water, and it is concluded that the oxidation of hydrogen sulphide in the upper layers is due simply to the circulation of water (*Privoda*, 1925, Nos. 4-6).

DUSTING BY AEROPLANE AGAINST MOSQUITOES.—Circular 367 of the United States Department of Agriculture is devoted to an account of experiments carried out for testing the possibilities of employing aeroplanes in the control of the breeding of *Anopheles* mosquitoes. The authors, Messrs. W. V. King and G. H. Bradley, mention that Paris green was distributed from aeroplanes on the extensive marshes and swamps near Mound, Louisiana, in 1923 and

1924. As the Paris green is effective in very small quantities, it was diluted by mixing with an inert carrier, fine silicious earth being mostly used. No special difficulty was experienced in distributing the insecticide over open water or rice fields: the most difficult conditions encountered were in heavily wooded areas where the water was protected by dense foliage. In the latter conditions a larger amount of the arsenical is required as compared with about half a pound per acre in open areas. The two final tests of 1924 gave particularly clear-cut results. In areas overgrown with aquatic vegetation, 88 per cent. to nearly 100 per cent. of the *Anopheles* larvæ were destroyed. Controls were made by the use of open porcelain pans of water containing ten larvæ each. These were placed at the different stations before the dust was applied by aeroplane, and were examined the following day for the percentage of larvæ killed.

GENETICS OF THE CABBAGE TRIBE.—The cabbage tribe forms an interesting variation group. All the forms of cabbage, kale, kohlrabi, brussels sprouts, broccoli and cauliflower, are believed to have been derived from the wild *Brassica oleracea* found on various European coasts, for example, on the cliffs at Dover. The ancient Greeks recognised three varieties. The others have appeared since, but little is known as to how or when. Mr. M. S. Pease (*Journ. Genetics*, vol. 16, No. 3) is making a genetical study from crosses of savoy, kale, and kohlrabi. Kale is found to have two independent factors, in the absence of which the cabbage heart develops, one factor giving an intermediate condition. Malinowski found three polymeric factors for heart in certain other cabbages. The heart factor also shows linkage with a number of others, and some of these linkages, as of curly leaf with heart, are of peculiar character, showing a strict association between degrees of hearting and degrees of smoothness. Although there is difficulty in classifying degrees of hearting, Pease obtained consistent results by growing the F_3 and F_4 and back-crossing. A peculiar monstrosity (*Asparagodes*) in which leafy outgrowths occur on the midribs of the leaves, was first described in Gerard's "Herbal," but is believed to be as old as the Greeks. It behaves as a simple dominant in crosses. Another independent factor gives the difference between the purple and green types. Pease distinguishes in addition two linkage groups, one containing a factor (*a*) for heart, (*b*) for tallness, and (*c*) for curliness of leaves. The other group contains the other hearting factor as well as factors for petioles, lyrate leaves, and broad leaves. Thus four linkage groups have already been recognised, while the number of chromosome pairs is nine. Difficulties of observation arise from the fact that the multiple factors frequently give an apparently continuous series of variations, and self-sterility is also involved.

UNUSUAL FORMS OF FOSSIL CRINOIDS.—Among the unusual forms of crinoids described by F. Springer (*Proc. U.S. National Museum*, vol. 67, art. 9, 1926) are those in which the stem loses its characteristic shape, becomes coiled, and the columnals (stem plates) are flattened or concave at the inner side and consequently crescentic or elliptical in cross-section; the cirri, instead of occurring in whorls around the stem, are borne only in two rows at the flattened or concave side. In such crinoids there is a tendency for the crown to bend back upon the stem, and for the stem to coil around it in the opposite direction in such a way that the crown may be tightly enclosed within the coil and completely enveloped by the cirri. This character, which was evidently protective,

originated independently in a number of unrelated genera ranging from the Silurian to the Carboniferous. Other crinoids are described with the arms in a recumbent position instead of being outstretched or folded together as is the case with existing forms; in these the arms were normally pendent, with the dorsal side pressing backward upon the calyx and stem.

THE DEPTH OF ORIGIN OF EARTHQUAKES.—More than any other living man Mr. R. D. Oldham has helped to bring the science of seismology to its present vigorous state, and his latest contribution to the subject is, like most of his work, of fundamental importance. Dealing with *episeisms* (surface shocks) as opposed to *bathyseisms* (deep-seated shocks), Mr. Oldham shows that the depth of origin can be calculated from an empirical formula based on the intensities at a point directly above the disturbance and at another distant point (*Q.J. Geol. Soc.*, vol. 82, 1926, p. 67; and *The Observatory*, March 1926, p. 86). Loss of energy by absorption is allowed for from a study of earthquakes that have been worked out in great detail. Applying the formula to 5605 Italian shocks that occurred between the years 1897 and 1910, he finds that 90 per cent. originated at depths of less than 8 km.; and only 1 per cent. gave a depth greater than 30 km. From the long-distance records of bathyseisms, Prof. Turner has found that most of these disturbances originate at a depth of about 200 km., with smaller proportions at about 100 km. and 500 km. Fracturing of the rocks of the outer crust is by far the most probable cause of the surface shocks, but this explanation is out of the question for bathyseisms. Changes of state accompanied by changes of bulk might cause the long-distance earthquakes and at the same time fracture the surface rocks, thus leading to a nearly simultaneous episeism. The San Francisco earthquake was a compound phenomenon of this kind. The local effects indicated a depth of 20 km., while the long-distance records gave 140 km. Seismology, thus becomes the study of two very different types of earthquakes.

GEOLOGICAL TIME.—In the *Phil. Mag.* for May 1926, pp. 1055-74, Dr. Arthur Holmes gives a review of all the evidence in favour of the longer estimates of geological time which have been based on lead-ratios. The adverse criticisms by Prof. Joly are shown to be founded either on faulty data, or on speculations that are not necessarily true. The sodium method is rejected on grounds already reviewed in *NATURE* (April 24, p. 592). It is suggested that the discrepancies in thorium minerals are due to the fact that lead present as oxide or silicate would be more easily removed by percolating waters than the lead in uranium minerals, which is most probably present as a highly insoluble uranate. An analysis of atomic weight determinations on lead from thorium minerals supports this conclusion, and shows further that there can be very little actinium D in 'uranium lead.' Thus the ages calculated from the lead-ratios of uranium minerals, if they are otherwise free from suspicion, cannot be more than a few per cent. too high. The variation in the radii of uranium haloes is shown to be explicable by other hypotheses besides that advocated by Joly, so that no evidence is valid along this line of attack until the isotopic constitution of 'uranium' has been revealed. It is concluded that the time elapsed since the crystallisation of the middle pre-Cambrian pegmatite-minerals of Norway, Sweden, Texas, Ontario and Africa is of the order of 1000 million years. No higher ages are yet well established, though the age of the oldest rocks must, of course, be considerably greater than these of the middle pre-Cambrian.

RATE OF AERATION OF WATER.—W. E. Adeney has published a series of observations in which he has determined the rates of solution of oxygen, expressed in percentages of saturation, by films of de-aerated fresh, or salt waters, 0.05 cm. thick, when uniformly exposed to the air, and independent of evaporation and downward streaming ("On the Rate and Mechanism of the Aeration of Water under Open-air Conditions," *Sci. Proc. Roy. Dublin Soc.*, 18 (No. 20), 211-217, April 1926). This has been followed by determinations of the rate of solution by quiescent columns of water. Owing to the cooling produced by evaporation, minute streamlets sink towards the bottom. In the case of salt water, density changes also assist the mixing. Movements occurring at the surface facilitate the saturation of the water with gas. Quantitative results are given for certain limiting cases, and suggestions made as to the probable values under various intermediate conditions.

SPECTRA OF EXPLODED METALS.—In the *Scientific Papers of the Institute of Physical and Chemical Research*, Tokyo, vol. 4, No. 48, T. Hori describes some interesting experiments on the spectra of exploded metals by the method of Anderson. A thread of mercury contained in a fine capillary tube, when exploded in that way, gave a good continuous spectrum crossed by some absorption lines of mercury. Other metals gave a less satisfactory continuous background, but when exploded in the form of fine tubes containing mercury, many absorption lines were seen on the continuous spectrum produced by the mercury. Under reduced pressure the Swan spectrum appeared in absorption by this process, owing to the presence of oil in the explosion chamber. A satisfactory substitute for mercury as the source of the continuous background was found in incandescent carbon particles produced by placing asbestos fibre saturated with petroleum at the exploding centre. Several absorption spectra—including bands of compounds and series and non-series lines of elements—were produced by this device. In the same volume (No. 56) Messrs. Fukuda, Kuyama and Uchida record the appearance of several lines, forbidden by the spectroscopic selection rules, in the spectra of constricted arcs *in vacuo*, while Fukuda, in No. 55, records the production of similar lines in vacuum tubes carrying heavy discharges.

CARBON TETRAFLUORIDE.—In the issue dated May 31 of the *C. R. Acad. Sci.*, Paris, Messrs. P. Lebeau and A. Damiens give an account of the preparation and properties of carbon tetrafluoride, CF_4 , from which it would appear that the compounds previously described under that name were far from pure. By the direct action of fluorine on various forms of carbon and passing the products of the reaction through a vessel cooled with liquid air, a colourless liquid is obtained which, from its varying boiling-point, is obviously a mixture. The most abundant constituent of this mixture was isolated by repeated fractional distillation and was found to boil at about $-150^\circ C$. The gas is odourless and without action on water, is not attacked by aqueous or by alcoholic potash (differing from the gas hitherto described as carbon tetrafluoride by Moissan and by Chabrié), and is not even attacked by fused potash at $740^\circ C$. Its composition was established by the reaction with sodium heated to $500^\circ C$, which is according to the equation $CF_4 + 4Na = C + 4NaF$. It also reacts with metallic calcium at about $700^\circ C$, giving calcium fluoride, calcium carbide, and carbon. A repetition of the work of Chabrié has established that the substance described by him as carbon tetrafluoride was a mixture, the principal constituent of which was a fluochloride, CCl_2F_2 .

PROPAGATION OF RADIO WAVES.—Radio engineers are making strenuous endeavours to understand the mechanism of radio transmission. The Radio Corporation of America and its associated companies are making systematic researches, both theoretical and experimental, to discover this mechanism. They admit that electric currents in wires, in a vacuum and in electrolytes, can be explained by means of the electron, but the structure of the electromagnetic field still remains a mystery. Each new discovery in long-wave and short-wave propagation is eagerly studied with this end in view. This is shown in the paper read by E. F. W. Alexanderson on radio wave propagation to the Academy of Swedish Engineers in July of last year. After describing the various phenomena generally referred to as 'fading,' he divides the waves sent out from a radio station into the earth-bound wave, which is guided by the proximity of the conducting earth, and the space wave or high angle radiation, which is guided by refraction in an ionised layer in the upper atmosphere. Long-wave telegraphy depends mainly upon the earth wave. Short-wave long distance communication depends entirely upon the space wave. Broadcast reception depends upon the earth-bound wave for near stations, and on the space wave for distant stations. It is stated that at a distance of about 100 miles from the station the intensities of the two waves are nearly equal. It has been found that at a distance of ten miles from a fifty-metre station the plane of polarisation of the space wave has been twisted by between 20° and 30° . It follows that at some distance between 60 and 90 miles the twist would be 180° . The earth-bound wave maintains its vertical plane of polarisation; the two waves, therefore, may cancel one another at a distance of about 100 miles. This explains 'blind' spots. As a model of radio transmission, he discusses the motion of a horizontal rubber sheet actuated by a vertical shaft making rotatory oscillations. Straight lines drawn on the rubber sheet will appear to have a wave motion. In order to reconcile the old and new points of view he thinks it necessary to prove that the electron is an entity with an aurora reaching from it into infinite space.

A NEW REFLEX CAMERA.—Reflex cameras possess many advantages, particularly in regard to instantaneous photography, over those of the ordinary type. The 'Press' reflex camera recently placed on the market by Messrs. J. H. Dallmeyer, Ltd., 31 Mortimer Street, London, W.1, should help, in large measure, to meet the demand for an instrument of this type at a reasonable price. We have examined one of these cameras, and find it a serviceable and well-made instrument, easy to manipulate, and capable of giving excellent results. It is fitted with a single wind, self-capping, focal-plane shutter, giving speeds from $\frac{1}{15}$ th to $\frac{1}{1000}$ th of a second and capable of adjustment for time exposures. The shutter runs very close to the plate, and is smooth and easy in action. The hood is detachable and can be fixed at right angles to its normal position. The reversing back is fitted with a hooded focussing screen, which can be used when the camera is mounted on a stand and critical focussing is required. Sufficient extension is provided to enable objects at a distance of about 18 in. to be brought into focus. The camera can thus be employed for photographic work in the laboratory. The outstanding feature of the equipment is the Dallmeyer 6 in. focus, $f/3.5$, anastigmatic lens, which gives excellent definition over the whole field. Its large aperture makes it extremely useful for very short exposures, as in certain types of Nature photographs, or for indoor and other work under restricted lighting conditions.