

Research Items.

Bushman Paintings in Eastern Cape Province.—Mr. John Hewitt and Father P. Stapleton, *S.J.*, in vol. 4 of the *Records of the Albany Museum*, Grahamstown, South Africa, describe paintings and artefacts discovered in rock-shelters near Cala. Rock paintings in this area are very numerous, but have never been described in detail. The locality of the present investigation is Tembuland, which is east of the Drakensberg and south of the Stormberg. At Rebels' Kloof a great number of implements were found and the rocks were covered with paintings, some of fine technique but in poor preservation. In one case there were some very remarkable human figures with attenuated limbs in white. Other paintings of apparently the same age showed carnivores, elands, etc. Another series of human and animal figures was entirely in black, including a well-drawn black elephant. A rock shelter on the other side of the river contained a fine series covering nine or ten yards, with excellent decorative effect. The biggest figure is an eland in dark red and white. Yellow and white paintings here seem to be the most recent. Two human figures in chocolate, and faint, may be older. Not far distant was a hunting group in white. The hunter is approaching a herd of reboks, mostly at rest, with a 'gargantuan stride'. High up on the krantz, and inaccessible, near beautiful elands, were two human figures, remarkable for the fact that they wear skin capes reaching to the knees, giving the figures quite a European appearance. The faces are white, broadly bordered with chocolate bands, which is also the colour of the legs. As regards the artefacts, the major stone industry belongs to a group included in the Smithfield cultures. The pottery of Rebels' Kloof shows two distinct industries.

Uterine Cycle in the Marsupial *Bettongia*.—The species examined by Prof. T. Thomson Flynn, *B. cuniculus*, is one of the 'rat-kangaroos' of Tasmania, and the investigation adds usefully to the known facts concerning the reproductive phenomena of the diprotodont marsupials (*Proc. Linn. Soc. N.S. Wales*, vol. 55, 1930, p. 506). The species has several breeding seasons in the year, and there may actually be an overlapping of the gestatory and lactatory periods. Only one young is born at a time; but there are four teats in the pouch, so that three are unoccupied at a time, a condition the reverse of that in another marsupial group where the young exceed the teats in number. Hill and O'Donoghue have pointed out that marsupials show a progressive reduction in the number of teats present in the pouch, but there is also a progressive reduction in the number of the young, and this reduction has reached its limit in cases such as the present where reduction in number of young has proceeded in advance of teat reduction. Pregnancy is unilateral, and in normal circumstances occurs alternately in each uterus; but when one uterus is pregnant the other enters into and remains in a state of pseudo-pregnancy, which persists until parturition. In view of the likelihood that the ancestral marsupial was a placental mammal, it is interesting to find that this specialised form has only a small allantois, with no allantoic placenta; but the nutrition, respiration, and elimination of waste products of the foetus are efficiently carried out by a yolk-sac placenta.

Hydromedusæ in the North Sea and Channel.—Dr. P. L. Kramp, in "Hydromedusæ collected in the South-western Part of the North Sea and in the Eastern Part of the Channel in 1903-1914" (*Mémoires du Musée Royal d'Histoire Naturelle de Belgique*, No. 45, 1930), describes the Hydromedusæ from those parts

of the North Sea and Channel which were allotted to Belgium as its share in the International Plankton Research. The region is limited to the east by a line from the mouth of the river Schelde to Lowestoft, and to the west by a curved line from Fécamp to Newhaven. Most of the material was collected during the quarterly cruises (February, May, August, and November) at a number of fixed stations, supplementary collections being made in other localities and in other seasons. The rough results have already been published in the *International Bulletin*, but, so far as the medusæ are concerned, only a small part of the material was submitted to specialists. Twenty-nine species are now recorded, one of which is new to science. Five sections are recognised in the area investigated: the first in the eastern part of the Channel, the third in the shallow water along the North Sea coasts of France and Belgium; the second, in the Straits of Dover, being a transition area between two and three; the fourth, the mid-water region in the North Sea between the coasts of France-Belgium and England, which is a mixture of indigenous forms and species from the Channel; and the fifth, the English coastal region from Dover to Lowestoft, which is like the fourth, but less prolific. Conclusions as to the influence of 'Channel water' on the presence of medusæ show that indigenous North Sea species are particularly abundant there when there is little Channel water, and those few medusæ which come from the Channel are almost wholly found in the North Sea sections when the 35 per mille isohaline has a particularly extensive distribution. The new species *Trissocoma brownii* is of special interest. It was first observed by E. T. Browne—in the Channel and at the south-west coast of Ireland—who realised that it was a new species. Dr. Kramp has now found it in fair abundance in his fourth section in two localities between Zeebrugge and Orford Ness, and placed it in the new genus *Trissocoma*, having its natural position between *Cosmetira* and *Mitrocoma*.

Respiration in Higher Plants.—The *Proceedings of the Seventeenth Indian Science Congress* (Calcutta: Asiatic Society of Bengal), held at Allahabad in 1930, contains the presidential address to the Botany Section delivered by Prof. P. Parija. This deals chiefly with the respiration of cherry laurel leaves in air, in nitrogen, and in mixtures of oxygen and nitrogen, and with the interpretation of the results. In partially starved leaves, the effect of nitrogen was to increase slightly the respiration rate, and then, on returning the leaves to air, a considerable increase in carbon dioxide production was observed, the so-called 'after-effect'. In nitrogen (or anaerobic) respiration, two atoms of carbon are assumed to accumulate as intermediates to every carbon atom appearing as carbon dioxide. If, on admitting oxygen, all the intermediate substances were oxidised to carbon dioxide, the maximum increase of carbon dioxide production in the 'after-effect' should therefore be twice the nitrogen respiration, and this is, in fact, the case after long periods (48 hours) of respiration in nitrogen. After shorter periods of two to thirty hours in nitrogen, however, the 'after-effect' is only of the order of 1·1 times the respiration in nitrogen, and it is assumed, in agreement with other evidence, that the difference between the theoretical value of 2·0 and the value given is due to the oxidative building up of the remainder of the intermediates. Prolonged exposure to nitrogen is supposed to inactivate the mechanism which brings about the latter method of disposal. On exposing the leaves to different mixtures of oxygen and nitrogen, it is found that there is a minimum production of carbon dioxide when the

mixture contains 5 per cent of oxygen, and maxima in pure nitrogen and in 33 per cent of oxygen. The 'after-effect' is only observed when the proportion of oxygen is below 5 per cent, although an increase in carbon dioxide production of a different type is observed when the proportion of oxygen is greater than that in air.

Oxidation and Reduction in Bacteria.—The influence of various conditions on acetic acid formation by *B. pasteurianum* has been further studied by Hiroshi Tamiya and Kiyoshi Tanaka (*Acta Phytocimica*, 5, 167), with special reference to the suggestion that quinone may replace oxygen as a hydrogen acceptor in this type of fermentation. They find that carbon monoxide is wholly without influence on the production of acid in the presence of quinone, but greatly reduces it in the presence of oxygen. Toluol also delays the fermentation in the presence of oxygen, but influences the reaction only slightly in the presence of quinone or methylene blue. In the acetic acid bacteria, the indophenol reaction for oxidase is also reduced by carbon monoxide and toluol, although the latter was found to have no effect on the action of a *Lactarius* extract. The explanation given is that the normal function of cytochrome is disturbed by quinone and toluol, and it is concluded that the results agree with the theory that cytochrome acts as a regulator of oxygen pressure in this type of oxygen fermentation, as well as in the oxygen respiration of other plants and animals. The same publication (p. 119) also contains results by these authors and Tatsutaro Hida on the reduction of methylene blue by acetic acid bacteria (as an intracellular enzyme), by liver extract (as a free dehydrogenase), and various chemical agents (pyruvic acid and aceto-acetic ester). In all cases light is found to accelerate the reduction, a photochemical activation of methylene blue molecules being postulated as the cause. Carbon monoxide has no influence on the purely chemical reduction nor on the action of liver extract, but it markedly retards the action of *B. pasteurianum*. Quinone slows down all three types of action.

Bituminous Sandstone, Vernal, Utah.—Appropriately named "Asphalt Ridge", there occurs a series of low discontinuous hogbacks of bituminous sandstone, south-west of Vernal, Utah, U.S.A., which have recently been the subject of investigation by Mr. E. M. Spieker (*U.S. Geo. Surv. Bull.* 822-C). Most of the sandstone is of the Eocene age, and analyses show that the bitumen content ranges from 8 to 15 per cent by weight. Mechanical analyses were conducted to determine the various grade-sizes and proportions of such grades present in the sand; the average of the results given shows that the rock is of medium grade. The density varies from 1.99 to 2.03. The specific gravity of the sand as extracted is about 2.63, slightly less than that of pure quartz. Porosities are also variable, between 29.5 and 38 per cent. Apparently some samples gave exceptionally high porosity values, 47 to 49 per cent: it is pointed out that the usual pore-space of an aggregate of identical spheres is 47.64 per cent, but on the whole the evidence does not suggest that this particular sandstone is composed of markedly rounded grains, so that these high values are not characteristic. It is gratifying to note that so much attention has been given to mechanical and textural composition of these rocks, as frequently these vital properties to impregnation are passed over sketchily in favour of fuller description of the bitumen. It is anticipated that mining of this bituminous sandstone can be carried back some 1½ miles from outcrop, and thus over the area it is possible to estimate resources of some 1,970,000,000

tons of impregnated rock. The sandstone has already been successfully used for street-paving in Vernal. It is hoped to use the bitumen as a source of motor fuel by hydrogenation processes, but it is not clear whether the rock lends itself to easy and cheap extraction, or by what method this will be accomplished on a commercial scale.

Red Rain in Victoria.—Mr. Frederick Chapman, Palaeontologist of the Australian Commonwealth, has continued his observations on red rain in south-eastern Australia which he began in conjunction with H. J. Grayson in 1903. We are unable to print Mr. Chapman's communication in full, but his observations are summarised below. On the night of Dec. 31, 1927, after a strong northerly wind had carried thick clouds of dust over Victoria and blown the finer particles southward over Bass Strait, there were heavy but irregularly distributed falls of red rain. Mr. Chapman estimated the amount deposited in Balwyn, a suburb 8 miles east of Melbourne, at 51½ tons per square mile: the Commonwealth Meteorologist, Mr. H. A. Hunt, estimated the deposit at Elsternwick at 24 tons per square mile. The red dust on this occasion was exceptionally sticky, as the innumerable diatoms—*Nitzschia* and *Cocconeis*—still contained their endochrome. The red stains on leaves and flowers in the gardens were retained for days and even weeks. The impressions on glass indicate that each raindrop was coated by a thin film of the dust. On Nov. 3, 1920, after a northerly gale, showers of red rain fell at 7 P.M. and after 9 P.M. The amount of the red sediment collected in a vessel in Mr. Chapman's garden indicated a fall of 64 tons to the square mile, or if it had been equally distributed over Victoria, a fall of nearly six million tons in that State. Both the minute reddish flakes of sediment and the diatoms and sponge spicules show that the material had been derived from the arid regions in the north-west of Victoria and in Central Australia.

Climatic Changes in East Africa.—In a recent lecture to the Royal Geographical Society, Dr. L. S. B. Leakey gave an account of the old lake terraces of the East African rift valley lakes of Nakuru, Elementaita, and Naivasha. All these lakes would appear to date from the mid-Pleistocene period. Dr. Leakey claims to be able to trace the following sequence of events in Lake Nakuru: a high-level lake left a terrace at 775 feet above the present level; this fell to 250 feet, rose to 510 feet, and, lastly, fell until it dried up completely. Afterwards, in a wetter climate, the waters rose again to 375 feet and then fell, and desiccation again occurred. Comparable evidence is obtained from Lake Naivasha and elsewhere in East Africa. It shows two major pluvial periods, with oscillations, separated by a dry period, during which faulting and volcanic activity were noteworthy. The first and second of these pluvial periods Dr. Leakey calls respectively the Makalian and Nakuran periods, and these he correlates with the Bühl and sub-Atlantic wet phases of Europe.

The Gyromagnetic Effect.—The University of California has issued, as a pamphlet of 43 pages, Prof. S. J. Barnett's Research Lecture delivered before the University on "Gyromagnetic Phenomena". When a magnet rotates about its magnetic axis, the gyrostatic action of the electrons brings their planes of rotation towards that of rotation of the material of the magnet and the rotations in the same direction. This changes the magnetisation of the magnet, and Prof. Barnett used two methods of measuring the change. The first depended on the change of the magnetic induction through a coil surrounding the magnet and connected

to a magnetic flux meter ; the second on the change of the magnetic field produced by the rotating magnet at a magnetometer needle in its vicinity. Both methods gave results which agree in showing that the electricity in motion in a magnetic molecule is negative, and that the gyromagnetic ratio is 1.04 m/e for iron and 1.05 m/e for permalloy, while the theory of the planetary atom predicts 2 m/e . Prof. Barnett concludes that the electron is a negatively charged sphere spinning about its axis without distortion, which would give the ratio m/e , and that such electrons constitute the chief part of the elementary magnet.

Raman Effect for Water.—An application of the Raman effect to the study of the composition of water and of its variation with temperature and other conditions is described by I. R. Rao in the February number of the *Proceedings of the Royal Society*. Mercury arc excitation was employed, and the rather broad band which appears with a shift corresponding to about 3μ examined with a microphotometer. The explanation offered of the temperature changes is that water consists of single, double, and triple molecules, and that the relative number of the single ones increases with temperature. Addition of at least the electrolytes which have been studied also appears to increase the proportion of single molecules, but in this case there is the complication of a new hydrate band superposed on the pre-existing water band. The explanations of the changes which have been proposed by Dr. Rao bear a certain resemblance to those which have been offered for the existence of anomalies in the specific heats of solutions of electrolytes, although no comparison of the two sets of phenomena is presented in this paper.

New Measurements of Cosmic Radiation.—Some very accurate measurements on the absorption of the cosmic radiation, made with an electroscope containing gas at a pressure of 30 atmospheres, are reported by R. A. Millikan and G. H. Cameron in the first February number of the *Physical Review*. Their older results have been made more exact for all thicknesses of absorbing material and have also been extended both towards harder and softer components. The conclusions drawn are much as before. It is concluded, on the basis of the Klein-Nishina formula, that there is quantitative evidence that the strongest and most easily absorbed cosmic ray band arises from the formation of helium out of hydrogen, and it is considered that there is also good qualitative evidence that the three more penetrating bands are due to formation from hydrogen of the oxygen, silicon, and iron groups of elements. Prof. Millikan and Dr. Cameron take the view that some of their results require a participation of the nucleus in the absorption process and refer to some work which has been done upon ordinary gamma radiation as supporting this. The point raised is naturally a very important one, as it would imply that the Klein-Nishina formula is only approximate, and has also been referred to by Dr. L. H. Gray in a paper in the February number of the *Proceedings of the Royal Society*. Dr. Gray states that he has experiments now in progress which are designed to reveal any evidence for emission of a secondary radiation from such nuclear interaction.

Scattering of X-Rays.—An important development in the technique for the examination of scattered X-rays is described in the *Physical Review* for Jan. 15, by J. W. M. DuMond and H. A. Kirkpatrick. Two of the main difficulties which arise consist in the exact definition of the angle of scattering, and in obtaining a quantity of scattered radiation which can be recorded by photography in a reasonable time. These

have been, to a large extent, overcome by the adoption of a new form of multi-crystal spectrograph. Fifty small perfect crystals of calcite are mounted with Seeman wedges on an arc of a circle, and so arranged that they all reflect a standard line—in this case the $K\alpha$ doublet of molybdenum—to exactly the same point on a photographic film coinciding with an opposite arc of the same circle ; the geometry of this arrangement is then such that all other wave-lengths and orders will be in focus on the same circle. The scattering body is set so that each crystal is protected by a pair of baffles from all radiation except that scattered from a small area, and the X-ray bulb, scatterer, and spectrograph arranged so that all the crystals receive only radiation scattered through a range of less than one degree about the mean angle of scattering. The troublesome background of general scattered radiation is almost entirely eliminated by the baffles, and the radiation which is scattered without change in wave-length appears with excellent definition. The radiation which has undergone the Compton change in wave-length is, however, definitely spread over a range of wave-lengths, the breadth of which increases with increase in angle of scattering. This lack of sharpness, although not in complete agreement with the results of earlier investigations, appears to be real, and is ascribed to the fact that the electrons responsible for the scattering have an initial motion in addition to the speed imparted to them in the scattering process.

Resolution of *dl*-Menthol.—Although the naturally occurring *l*-menthol is fairly readily obtained by the resolution of *dl*-menthol, the method does not yield *d*-menthol in quantity. Read and Grubb, in the January number of the *Journal of the Chemical Society*, show that a mixture of *l*-menthyl-*d*-camphor-10-sulphonate and the corresponding *d*-menthyl compound, easily obtained by the interaction of *dl*-menthol and *d*-camphor-10-sulphonyl chloride in quinoline, yields the first of these esters in a state of purity after four crystallisations. The odour of pure *d*-menthol is fainter than that of *l*-menthol. The crystallographic data for *d*-menthol, which can be obtained from ethyl acetate solution in very large, magnificent prisms, are given in the paper.

Numerical Solution of Differential Equations.—In an extensive memoir (*Bulletin* of the Academy of Sciences of the Ukraine, 1930-31, in the Ukraine language), E. Remes gives a comprehensive survey of previous work on the numerical solution of differential equations, and contributes some valuable new methods. The methods of Runge and of Adams (or, as the Russians say, Adams-Störmer) are of great practical value ; but they have the defect that they do not indicate exact limits between which the error must lie. A method for the determination of such limits was given by Piaggio—but in a form unsuitable for practical application. Remes has now combined the advantages of both methods. The memoir has several worked examples, showing the application to single differential equations and also to systems of such equations. The work is complicated, but in cases where great accuracy is desirable, the results justify the labour involved. As an alternative to Adams's method, little-known formulæ, due to Steffensen-Stekloff, are given. (Mr. Remes and his colleagues at Kieff have sent to University College, Nottingham, a quantity of Russian work on the numerical solution of differential equations, including A. N. Kryloff's valuable book on this subject, together with manuscript translations or summaries in French or German. These may be borrowed for a short period by university librarians.)