Research Items

Kent's Cavern. In "The History of Kent's Cavern, Torquay", by Mr. H. G. Dowie (W. F. and J. W. Powe, Kent's Cavern, Torquay), an account is given of the stratification of this important station, which supplements previously published information in the light of recent excavation. The oldest known deposit, as yet incompletely examined, appears to be a silt passing below the breccia in the Bear's Den and elsewhere. So far as known, it is almost barren of animal and human remains. Of the same phase is a floor of stalagmite completely broken up by later disturbance. Then follows the deposit of 'breccia' divided into two distinct deposits, a concreted bone bed and an incoherent grit, the latter nearly barren. The deposit known as the Middle Stalagmite floor was followed by a period of disturbance, carrying in the cave earth containing a fauna consisting of hyænas and their prey. Above that, during a period of calm, the Upper or Granular Stalagmite floor was formed, on which accumulated the Black Mould, in part perhaps of æolian origin, containing the remains of existing species of animals. There would appear to have been three periods of calm, during which the stalagmite was laid down, and three periods of disturbance, during which the principal deposits were introduced into the cavern. Of the artefacts which have been found in the cave, the Chellean tools are probably very early, and show no very considerable evolution beyond the prototypical rostro-carinate. They seem to belong to the deposits of the subterranean river rather than to the incoherent grit with which they were swept up. They may be claimed as older than any implement so far discovered in any cave in Europe.

Population Map of Great Britain. A map showing the density of population in Great Britain on the basis of the 1931 census is being published by the Ordnance Survey in two sheets, price 1*s.* 6*d.* each, and the northern sheet has been issued. It covers the whole of Great Britain north of lat. 54°, that is to say, the country north of a line from Morecambe Bay to Bridlington Bay; Ireland and the Isle of Man are left blank. The Shetlands appear as an inset. The scale is 1 : 1,000,000 and the foundation map is in the style of the international map of that scale. Density of population is shown by white (0 to 1 per square mile) and eleven tints of deepening colour ranging from light brown through darkening browns to dark greys and black. The last is for 'very congested' population of 76,800 or more per square mile. The colour printing is excellent and on this relatively small scale the tints give a satisfactory impression of gradations. Place names, in black, used with wise discrimination and names of water features, in blue, avoid any suggestion of crowding even in the most densely populated areas. County boundaries are shown but county names are given only in an inset. Marginal numbers and letters provide index facilities.

Nesting Season of Birds in relation to Food. It would appear that the span of the nesting season amongst birds may bear some relation to the nature of their food. At any rate, three years' intensive observations in Butte County, California, have led William B. Davis to these conclusions (*Condor*, 35, 151; 1933). Nesting activities begin in February, reach their peak in the last two weeks of April and decline rapidly after May 15. The flesh-eating birds as a rule began nesting first and had the longest span of nesting season; vegetable and seed-eating birds, as a group, began nesting last and had the most concentrated span of season; and omnivorous and insect-eating birds were intermediate in both these respects. The order in which the four groups followed each other in nesting activities suggested that a positive correlation existed between the availability of food used for young birds and the time of nesting.

Sheep Blowfly in Australia. Blowflies, directly and indirectly, are among the most serious afflictions with which the Australian pastoralist has to contend. In bad years these insects entail losses upwards of £4,000,000 per annum. Under the title "The Sheep Blowfly Problem in Australia. Report No. 1" a comprehensive account of the whole subject, edited by Drs. R. J. Tillyard and H. R. Seddon, has recently been issued by the Council for Scientific and Industrial Research acting in conjunction with the New South Wales Department of Agriculture. This report brings the latest information together and includes both published and unpublished observations made by numerous investigators. The great frequency of the blowfly trouble is attributed largely to (1) the breeding of a type of merino sheep that is specially susceptible to attack and (2) to the accidental introduction and spread of the fly *Lucilia cuprina*, which is responsible for most of the primary infestations on the sheep. The report lays stress on the fact that sheep blowflies are divisible into primary and secondary species. Primary flies initiate the attack on the living sheep, whereas secondary flies follow after the attack of the primary species, although the effects may be even more severe. Notwithstanding the large amount of investigation already done, the problem is still to a large extent unsolved, and an extensive scheme for future work has been adopted.

Life-History of *Ambystoma*. G. K. Noble and M. K. Brady (*Zoologica*, Scient. Contr. New York Zool. Soc., vol. 11, No. 8, 1933) record observations on the life-history of the marbled salamander, *Ambystoma opacum*, which lays its eggs under leaf mould or other cover in situations which will be flooded by the winter rains. The breeding female is not at home in the water and will drown if confined in water. An account is given of the behaviour of the males and females at the breeding time and the spermatophore is described as being about 5 mm. in height, 2 mm. wide at the base and having a quadrangular summit. The female lays about 150 eggs, each of which has four capsules and can withstand desiccation without destruction. After laying, the female usually remains with the eggs for a period of at least several weeks. Eggs hatch on land as well as in water; moisture facilitates development. Hatching is accomplished by the digestive action of a series of unicellular glands scattered over the head of the embryo. The terrestrial stage in the life cycle of *A. opacum* is an adaptation permitting the species to compete successfully in the same region with other species of *Ambystoma*.

Chromosomes in Insect Eggs. Besides important observations on vertebrate embryology and cytology, on tissue culture and on comparative anatomy, the report of the Department of Embryology in Year Book No. 31 of the Carnegie Institution of Washington contains interesting summaries of work in progress on the study of chromosomes in entire eggs of insects. By applying the Feulgen reaction, Dr. C. W. Metz and Miss M. L. Schmuck have been able to stain the chromosomes so that they are clearly seen in entire eggs of the fungus gnat (*Sciara*). This eliminates the elaborate sectioning technique and adds to the accuracy with which their structure and relative position in the egg can be determined. Dr. A. M. Du Bois has found that, at the fifth cleavage in the egg of *Sciara*, one or two chromosomes remain in the middle of the spindle, are not included in the daughter nuclei, and eventually disappear. The supernumerary chromosomes may be eliminated in one cleavage or more; they may be seen to be eliminated in the seventh, eighth or ninth cleavages. "That any of these supposedly indispensable bearers of the genes may be thus spared is a matter of great theoretical interest. The period during which the chromosomes are eliminated (fifth cleavage) is an important one, being the time at which the first two germ-cells differentiate and locate in the posterior end of the egg. From then on the germ cells divide actively but no longer synchronously with the somatic cells."

Electrical Phenomena and the Rise of Sap in Plants. An account of the beneficial effects of external electrostatic and electromagnetic fields on the growth of certain plants has recently been given by Marinesco ("Actualités scientifiques et industrielles", 37, Exposés de biophysique I, Hermann et Cie, Paris, 1932), in a brief review of research carried out by himself and other workers. Connected with the existence of a Helmholtz double layer in woody tissues, at the surface of separation of sap and cell wall (the sap being negatively, and the wall positively, charged), a series of interesting phenomena occurs. A potential difference placed across electrodes, either inserted in the stem or even situated entirely outside the plant, causes a variation of the rate of flow of sap between relatively wide limits, according to the sign and magnitude of the applied potential difference. If the higher electrode is positive with regard to the lower, then the flow of sap is increased considerably; if the higher electrode is negative, then the flow is impeded and can even be reversed, while an alternating E.M.F., applied across external electrodes, always causes an increase in the rate of ascent, by a process briefly explained in the paper. The most beneficial results are obtained by intermittent treatment. The author has obtained experimental results which suggest that the controlling factor in the normal flow of sap is the natural atmospheric potential gradient.

Tapioca in Malaya. The tapioca crop is important in many tropical countries, but its economic relations with the rubber plantations of the Straits Settlements and the Federated Malay States have called forth a monographic study by Messrs. V. R. Greenstreet and J. Lambourne ("Tapioca in Malaya". Dept. of Agriculture, Straits Settlements and Federated Malay States General Publications No. 13, pp. 1–76; 1933). The history of the introduction of the plant *Manihot utilissima* into cultivation is traced, and the numerous varieties at present in commerce are described and classified in detail. Tapioca is grown on small-holdings and on large plantations, but its greatest importance lies in the fact that it can be used to fill up a rubber plantation in the early stages. Indeed, it is possible to defray the cost of establishing a rubber plantation by growing tapioca between the trees. Large amounts of manure must be applied to the inter-crop, however, as it makes great demands on the soil nutrients. The manufacture of tapioca products is described, and the economics of the crop and the refined articles are discussed at length. Pests and diseases receive a short but adequate treatment, and an extensive bibliography is appended.

Stocks for Rose Bushes. A paper of outstanding interest to rose growers and scientific gardeners appears in the *Journal of the Royal Horticultural Society* ("A Botanical Study of Rose Stocks", by Miss J. Ferguson. Vol. 58, Pt. 2, pp. 344–371. Sept. 1933). The history of rose culture is traced briefly, especially as it relates to the readily-propagated stocks upon which the choicer varieties may be budded. Twenty species and varieties of roses suitable for stocks are described in detail and a key for their determination is given. One section deals with propagation both by cuttings and by seed, whilst another part describes the cytology of the various plants, many of which are polyploids. The list does not cover all the rose stocks in common use, but the knowledge set forth by Miss Ferguson has been keenly desired by rose-growers for some time. A summary at the end of the paper enumerates the characters most desirable in a rose stock for British conditions, and emphasis is laid upon the necessity for vegetative propagation, as seed-propagated stocks are rarely uniform.

Charnockite Series of Uganda. At the meeting of the Geological Society on December 6, Dr. A. W. Groves described the mode of occurrence and characters of a charnockite suite in Uganda. The charnockitic facies range from ultra-basic to acid rocks, and grade imperceptibly into the surrounding orthogneisses from which, chemically, they are indistinguishable. Altered dolerites which are magmatically unrelated to the suite under discussion become charnockitic heteromorphs within the charnockitic areas, while outside the latter they occur as amphibolites. This noteworthy evidence, combined with the general inversion of the order of Bowen's reaction series, indicating mineral reconstitution of the rocks in the solid state, leads to the conclusion that the Uganda charnockite series has originated from very deep-seated metamorphism of pre-existing rocks. This is in accord with chemical evidence, which shows that the rocks belong to the calc-alkali series and do not differ in any significant way from non-charnockitic examples of the series. Ten rocks and eight minerals have been analysed, and it is pointed out that the barium content of the rocks is localised in the orthoclase and biotite.

Zululand Earthquake of December 31, 1932. We have received an advance proof of a report on this earthquake by Messrs. L. J. Krige and F. A. Venter, who contributed a paper on the subject to the Geological Society of South Africa on August 14. On the map of the earthquake, the courses of five isoseismal lines are shown, and these indicate that

the epicentre lay beneath the sea, its position as determined from seismographic records being in lat. 28° 30′ S., long. 32° 50′ E., or about twenty-five miles off the coast near Cape St. Lucia. Along a strip of the adjoining coast, several buildings were damaged. A remarkable feature of this earthquake was the extent of its disturbed area. The shock was distinctly felt at Johannesburg, more than 300 miles from the epicentre, and it is estimated that it must have been sensible over an area of about 300,000 square miles, or nearly equal to that shaken by the great Mino-Owari earthquake of 1891.

Sunspots and Depressions. A statistical study of the relative frequency of formation of depressions in different parts of North America at times of sunspot maximum and sunspot minimum, with the object of bringing out any relationship that may exist between the solar and terrestrial phenomena, is the subject of a recent paper by C. J. Kullmer, of the University of Syracuse ("The Latitude Shift of the Storm Track in the 11-year Solar Period". Smithsonian Miscellaneous Collections. Vol. 89, No. 2). The author is led to seek for a shift of latitude in the principal storm track on the grounds that there is, according to Spoerer, a striking latitude shift in the sunspot cycle, each new cycle of solar activity beginning in about 25° solar latitude and ending in about 10°. The method of study is, however, such as to bring out differences in longitude almost equally well: the whole country is divided up into units covering $2\frac{1}{2}$° of latitude and 5° of longitude, and the frequency of occurrence of storm centres in each unit area during three years at sunspot maximum and three years at the preceding minimum are compared, beginning with the maximum of 1882–84 and ending with that of 1927–29, making five sets of figures that are presented cartographically. The resulting pattern of distribution shows distinct similarity in the five cases. The sunspot maxima show an area of pronounced excess of storm frequency that extends almost completely across the northern part of the continent around latitudes 45°–55°, with a southward extension that generally reaches the Gulf of Mexico. Eastward and westward of the upper part of the extension are areas of deficient storm frequency. A curious feature is a progressive eastward and northward shift of the whole pattern for three solar periods, and then a sudden return to an even more southerly and westerly position. It is clear that the permanent existence of such an orderly progression cannot be accepted without further data.

Ignition of Firedamp by Electric Light Filaments. The Safety in Mines Research Board has just issued Paper No. 80 (London: H.M. Stationery Office), which records experiments by G. Allsop and T. S. E. Thomas on the ignition of firedamp by the filaments of broken electric lamp bulbs. In the ordinary electric bulb the filament is heated to a temperature of 2,000° C., and as the capacity of the filament for retaining heat varies as the square of its diameter whilst the heat losses from the surface varies the diameter, it is obvious that thick robust filaments are the more dangerous. It is, however, shown that with voltages up to 6 and with currents of less than 1 ampere, a protective cut-out, operated when the bulb is broken, is relatively safe, especially with gas-filled bulbs. Even in the best cases, the protective cut-out must function within a period between 0·02 and 0·12 sec.

Atomic Weight of Potassium. Hönigschmid and Sachtleben have described (*Z. anorg. Chem.*, **213**, 365; 1933) analyses of potassium chloride and potassium bromide by the ratio to silver. Eighteen determinations of the ratio KCl : Ag gave the value 0·691069, practically in agreement with the value of Richards and Stähler, 0·691073, and the atomic weight K = 39·096. Nine determinations of the ratio KCl : AgCl gave 0·520132, corresponding with K = 39·097. Six determinations of KBr : Ag gave 1·103197, in agreement with Richards and Müller (1·10319) and K = 39·097. The independent value of KBr : AgBr, 0·633720, gives K = 39·094. The mean of 39 determinations leads to K = 39·096. This value is in agreement with that found recently by Baxter and MacNevin (NATURE, **132**, 790; 1933), namely, 39·094–39·095, and the earlier, higher, values found by Hönigschmid and Gobeau are not confirmed. The cause of the higher value is not explained.

Structures of Carbonyl Compounds. An examination of the structures of the molecules of compounds is possible by the method of electron diffraction. The electrons are diffracted from a beam passing through a jet of gas entering a chamber at low pressure and condensed by a trap immediately above the gas nozzle, the chamber being evacuated by a pump. The diffraction photographs are then examined by a recording microphotometer and the diameters of the diffraction rings measured on the enlarged photometer curves. The formula used in calculation is

$$I = k \sum_i \sum_j \psi_i \psi_j \frac{\sin x_{ij}}{x_{ij}}$$

where $x_{ij} = 4 \pi l_{ij} (\sin \theta/2)/\lambda$, I is the relative intensity of electrons scattered at the angle θ, k is a constant under the experimental conditions, ψ is the electron scattering coefficient, which may be replaced by Z, the atomic number, l_{ij} is the distance between the ith and jth atoms, and λ is the wavelength of the electrons. Dornte (*J. Amer. Chem. Soc.*, October) has investigated by this method the structures of carbonyl sulphide, chloride and bromide, and acetyl chloride and bromide. Carbonyl sulphide has a linear molecule, the distances being C–S 1·58 and C–O 1·13. The other carbonyl molecules have plane *Y*-structures, the angle between the halogen atoms of carbonyl chloride and bromide being 110°. The tetrahedral model was found for acetyl chloride and bromide. The C–O distance was constant and about 1·13 for all these carbonyl compounds; the other interatomic distances are given.

Accuracy of Analysis of Fuels. The reliability of laboratory measurements of the properties of fuels depends on the combined errors of sampling and analysis. In order to ascertain the share of analytical error in the total, an investigation of the "Accuracy of Analytical Determinations on Coal and Coke" has been carried out by H. V. A. Briscoe, J. H. Jones and C. B. Marson (Phys. and Chem. Survey of Nat. Coal Resources, Paper No. 29. H.M.S.O., 9*d*. net). A single sample of coal was divided into 64 samples each of which was subjected to the usual tests. The results were examined statistically to arrive at the probable error. The results for calorific value varied by ± 80 from the mean. Similarly the calorific value determined in twelve different laboratories showed a variation of ± 95. While these figures will not surprise anyone familiar with the problem, they suggest that measurements of fuel efficiency are all liable to an error of 1 per cent.