

Research Items

Archæological Exploration in Derbyshire Caves. A Research Committee of the British Association appointed to explore caves in the Derbyshire district (Mr. M. C. Burkitt, chairman, and Dr. R. V. Favell, secretary) reported at the Leicester meeting of the Association on the work of the year 1932-33. The excavation of the Pin Hole Cave, Creswell Crags, has been continued by Mr. Leslie Armstrong. Breccia was removed from the whole area of the passage on the east side of the main chamber and in the trefoil-shaped terminal chamber, revealing four large cavities in the rock floor, one coinciding with the width of the passage and extending 7 ft. along it. These were entirely filled with cave earth of Mousterian age, 2 ft. 7 in. deep, and an underlying deposit of sterile red sand. The Mousterian deposits yielded the usual fauna, including the greater portion of the skull and jaw of a young mammoth with complete dentition, and two large fragments of the lower jaw of a giant deer. The large cavity showed evidence of human occupation in a small but well-preserved hearth and a stone pounder, animal bones, split and charred, and crude artefacts of quartzite and crystalline stalagmite. Similar tools were recovered from the smaller cavities at the rear of the chamber. Several worked bone tools included a bone knife and two awls. In the large inner cave of the chamber the deposits were excavated from the 12 ft. level to the base at a depth of 17 ft. An exceptionally thick layer of limestone slabs pointed to the probability that this part was unsuitable for occupation. The remains of Mousterian age recovered here are less numerous than elsewhere in the cave, but include a fine side-scraper of flint.

Sumerian Copper. The fifth report, presented at the Leicester meeting of the British Association, of the research committee appointed to report on the probable sources of the copper used by the Sumerians (Mr. H. Peake, chairman, and Prof. C. H. Desch, secretary), states that during the past year specimens have been received and examined from a number of sites, as well as a few ores. The presence of arsenic in relatively high proportions in several objects of early date has made it necessary to regard this, like nickel, as a key element, which should assist in the location of the source of the original copper. Unfortunately, works of reference, as well as geological monographs, seldom make mention of the presence of accessory elements, and native coppers received by the committee for examination have been derived from deep-seated deposits of pyrites, whereas ancient copper was undoubtedly derived mainly from oxidised outcrops. The known occurrences of arsenical copper ores, sometimes containing nickel, have been mapped and the region within which such mixed ores may occur appears to form a band extending through Anatolia, Armenia and Azerbaijan, though at present sources farther afield cannot be excluded. Several objects have been subjected to analysis or micrographic examination. Among these a thin piece of metal from Kish, 3200 B.C., gave 95.17 per cent copper, 0.08 per cent nickel and 0.15 per cent iron. Two objects of early date from Ur proved to be copper, hammered and slightly reheated after casting, while the bronze was in cast condition. The bronze contained 11.65

per cent tin and 0.20 per cent nickel; the copper spear, 0.56 tin and 1.36 nickel. A spear-head from Nineveh proved to be of pure copper without tin or nickel. A thin razor of the Egyptian Fourth Dynasty, received from Sir Robert Mond, in appearance of copper, proved to be of bronze, containing 8.5 tin. The edge had been hardened by severe hammering. In view of the high proportion of sulphur in objects from Mohenjo-daro, the possibility of its derivation from the soil was examined, but it would appear that the sulphur in the specimens is derived from the ores.

Snails from the Philippine Islands. Mr. Paul Bartsch has discussed some interesting land molluscs from the small islands and islets in the Mindoro Province ("The Land Shells of the Genus *Obba* from Mindoro Province, Philippine Islands"). Contributions to the Biology of the Philippine Archipelago and Adjacent Regions. United States National Museum. Bull. 100, vol. 6, part 8, 1933. These islands are ideal collecting grounds, for each one apparently harbours a special form of *Obba*, regarded by the author as a race or sub-species. The genus, all the species of which have a flattened shell with a thickened aperture, is a large one and the shells differ widely in form, sculpture and colouring. *Obba listeri*, Gray was figured by Martin Lister in his "Synopsis Methodicæ Conchyliorum et Tabularum Anatomicum", published in 1770; Gray in 1825 listed it as *Caracolla*, and it was described by Broderip in 1841 as *Helix (Caracolla) listeri*, the habitat being Luzon, on trunks of trees. It occupies a very wide range in the Philippine Archipelago and, like most widely distributed species, it breaks up into a host of so-called races, each of which occupies a limited zoogeographical horizon. There are nine from the Mindoro province which the author designates as sub-species, but he believes that there are probably many more still to be found, as the small islands, and even Mindoro itself, have not been explored adequately. Six species of *Obba* are recorded and described here, each with a number of sub-species.

Recent Knowledge of the Slime Fungi. The presidential address by Miss G. Lister to the British Mycological Society is a valuable review of present-day knowledge of the Myxomycetes ("Field Notes on Mycetozoa", *Trans. Brit. Mycol. Soc.*, 18, pt. I, pp. 18-29, Aug. 1933). The work of Prof. Brandza of Roumania is described. 'Nurseries' of straw, pine needles, dried leaves and other substances were placed in various positions in the city of Bucharest, and all yielded interesting specimens. It seems possible that physiological species are to be found in the Myxomycetes, for *Fuligo septica* arises either from a yellow or a cream-coloured plasmodium. Differently coloured plasmodia will not fuse to form one æthaliium, but plasmodia of a similar hue will readily do so. Work by M. Charles Meylan and M. J. Jarocki on the alpine slime fungi of Europe is mentioned, and the mycetozoa flora of a sea-beach has been studied by Hagelstein in New York State. Many other papers are reviewed, and the main thesis of the address is that slime fungi are active over a much wider range of climatic and edaphic conditions than was at one time supposed.

Preservation of Cattle Fodder. One of the most important problems of modern agriculture is to discover a process for preserving cattle fodder which will produce a wholesome and palatable food, retaining, as fully as possible, the original nutritive value and vitamin content of the fresh material. The chief difficulty in preserving fodder is to prevent breakdown of protein, and A. I. Virtanen (*Empire J. Exptl. Agric.*, 1, July 1933) has developed the A.I.V. method, which is based on the assumption that all detrimental breakdown processes would be eliminated by treating the fodder, at the time of ensiling, with such amounts of acid as would rapidly raise the acidity of the mass to a point below pH 4 (see NATURE, 130, 783, Nov. 19, 1932). Sulphuric and hydrochloric acids give the best results, the amount required depending upon the kind of fodder plant and the acidity, and the lime content of the soil on which it grows. Experiments have shown that the fodder has no harmful physiological effect on the animals consuming it and that the quality of the milk produced is at least up to the standard of that from cows fed on hay, resembling that of summer milk. Butter quality is improved, but care is needed in the use of A.I.V. feeding in the manufacture of certain grades of cheese. Details are given of the most economical method of preparing this type of fodder, together with tables showing the reduction in concentrated food that can be brought about by its use.

Lower Limit of Earthquake Perception. Several seismologists have tried to evaluate the maximum acceleration of vibrations that are just perceptible to human beings. Measured in mm. per sec. per sec., Omori placed the limit at 17, Cancani at 25, McAdie at 10 and Suyehiro at 9-17. Messrs. M. Ishimoto and M. Ootuka have recently made some interesting experiments on the subject (*Earthq. Res. Inst. Bull.*, vol. 11, 113-120; 1933). The observer is seated on a chair placed on a wooden platform that is suspended by four cords. An electric motor gives a periodic motion to the platform, which is measured by a seismograph placed on it. The experiments were made with five observers, the results in each case being similar. When the period of the oscillations amounts to about half a second, it was found that the limit of perception is lowest. With a period less than this, the limit is inversely proportional to the period. When the period becomes about one second or more, the limit of perception is practically constant, and, for different observers, lies between about 7 mm. and 10 mm. per sec. per sec.

Recent Work on Cosmic Rays. Several papers have recently appeared on the directional distribution of cosmic ray particles. An asymmetry may be produced by the deflection of charged particles in the earth's magnetic field, but previous work has failed to reveal an asymmetry at stations lying at sea-level and at geo-magnetic latitudes greater than 44°. Johnson and Stevenson (*Phys. Rev.*, July 15) find the east intensity to be 3 per cent greater than the west at Swarthmore (geomagnetic latitude 51° N.). This confirms the asymmetry previously found by these workers in Mexico. Viljoen and Schonland (*Phil. Mag.*, Aug.), working in Cape Town (geomagnetic lat. 31° S.), find no significant difference between east and west intensities. They also examined north and south directions, since they thought that thunderstorms over the African continent might lead to an asymmetrical bombardment with particles

of terrestrial origin. This result was also negative. There was a defect from both east and west as compared with north and south which was on the limit of significance. This may possibly correspond with a cosmic bombardment of both signs. In any event, a large part of the radiation was probably of secondary origin. Swann (*Phys. Rev.*, July 15) points out that if interstellar space does not contain particles of both signs, the space charge corresponding with the intensity of cosmic rays would lead to inadmissibly high potential differences in comparatively small portions of space.

Isotopes of Cobalt. By means of the magneto-optical method of Alison (*J. Amer. Chem. Soc.*, 52, 3796; 1930), Ball and Cooper (*ibid.*, August 1933) find evidence for the existence of two new isotopes of cobalt lighter than the single mass 59 found by Aston. The masses are probably 57 and 58, the order of abundance being 59, 57, 58. The 57 isotope had been predicted on theoretical grounds by Bartlett (*NATURE*, 130, 165, July 30, 1932). The value of the magneto-optical method is favourably reported on by H. D. Jones and R. Goslin in another connexion (*J. Amer. Chem. Soc.*, August).

Temperatures of the Nuclei of Planetary Nebulae. A new application of Zanstra's theory, by R. H. Stoy, appears in the June issue of the *Monthly Notices of the Royal Astronomical Society*. It will be recalled that the main feature of Zanstra's theory is the assumption, which at first sight appears extremely singular, that every quantum emitted by the nucleus of a planetary nebula the frequency of which is above a certain limit (the limit is that frequency for which the quantum is able to ionise a hydrogen atom in its normal state), one quantum, and one only, of one of the frequencies in the Balmer series will escape from the nebula into space. One traces the progress of one ultra-violet quantum from the nucleus out through the nebula. This is considered to contain an immense quantity of hydrogen, mostly ionised into protons and electrons, but when these are combined to form hydrogen, it is nearly all in the ground state. Under these conditions, one quantum of the Balmer series must appear at the outside of the nebula. It follows that the total light emitted in the Balmer series gives the total light emitted by the planetary nucleus in the far ultra-violet, and we are on the track of the nuclear temperature. As Zanstra left the theory, it was in a form in which line intensity was compared with the intensity of the continuous light from the nucleus to give the nuclear temperature, but Stoy gives an improved form in which line intensities only are to be measured. This is a great advantage in those cases where the nucleus is a feeble object. Stoy points out that the application to He lines is false: the ingenious theorem cannot be applied, as there is no excess of He as there is of H. It is unfortunate that the observers on whose work the actual temperatures that Stoy gives are based did not use red sensitive plates, so that H_γ is missing from the observations. Stoy has to use H_β, H_γ, etc., and the intensity of H_γ, the strongest line, has to be estimated by extrapolation. Mr. Stoy himself has gone to the Lick Observatory and will no doubt collect improved data to which to apply this arresting theory. The temperatures that he quotes at present range from 20,000° to 50,000° for the seven nebulae for which data are available.