

The Mount Everest Expedition, 1933—Geological Impressions*

By L. R. WAGER

THE route taken on the outward journey by the recent Mount Everest Expedition was the same as that followed by the previous expeditions and covered a region which, in part, had been geologically investigated by Hooker, Mallet, Hayden, Prof. E. J. Garwood, Dr. A. M. Heron and Mr. N. E. Odell. During the return journey some of the party zigzagged along the junction between the metamorphic complex of the main range and the Tibetan sedimentary zone, and the data obtained on the two journeys made it possible to extend the geological mapping in the strip between Mount Everest and Phari.

Over this whole distance (120 miles) a limestone, about 2,000 ft. thick (Heron's ? Permo-Trias), could be traced with but few interruptions. A thick, dominantly pelitic series much injected by granite occurred below this limestone, and above was a quartzite and shale series which underlay typical Jurassic shales. In the Quartzite and Shale series on the Lachi Ridge, four miles north-west of the Donkia La in North Sikkim, a brachiopod fauna was found. A preliminary examination suggested that the fauna is Lower Permian in age. The thick limestone below the fossiliferous horizon, since it forms the summit of Mount Everest, is called the Upper Everest Limestone; it can probably be assigned to the Permo-Carboniferous or Carboniferous system, while the Everest Pelitic series and Odell's Lower Calcareous series must be older.

The structure of the northern border of the eastern Himalaya in eastern Nepal and Sikkim is simple, consisting of Permo-Carboniferous and lower beds dipping gently northwards under the Tibetan Jurassic and Cretaceous rocks (so far the existence of the Trias has not been proved). Outliers of the conspicuous Upper Everest Limestone were found on various peaks in the Everest district, and also, according to Dyrenfurth, on the Jongsong Peak. Granites injecting the Everest Pelitic series, the

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Upper Everest Limestone, and sometimes the Jurassic beds are probably Tertiary in age. It is believed that in a more southerly zone a distinction can be drawn between Tertiary gneisses and granites and gneisses associated with migmatite and amphibolite which are older and equivalent to similar rocks of Peninsular India.

In the Darjeeling district, Mallet's careful mapping proves large-scale inversion, as the Darjeeling gneiss rests on the chloritic schist of the Daling series which in turn overlies the Damudas and Tertiary beds. The Damudas are roughly contemporaneous with the Quartzite and Shale series or the Upper Everest Limestone, and thus it is probable that the Daling series should be correlated with the Everest Pelitic series. It is interesting to find that to the east of the Darjeeling district the Baxa series, including thick dolomites, occurs between the Damuda and Daling series, the rocks in that area showing, therefore, a close lithological similarity with those of the same age to the north of the main range.

The main Arun gorge and the Yo Ri, the Rongme, and the Jikyop gorges of the Arun River were visited, and Oldham's view, that they are due to uplift of the main Himalayan range subsequent to the establishment of the drainage system, is regarded as the most satisfactory explanation. It is believed that the form of the range after the main compressive movements had occurred can be accurately determined from the present river pattern. The northern part of Sikkim, including Kinchenjunga (28,146 ft.) and the Tista Valley as low as 4,000 ft., is isostatically equivalent to a continuation southwards of the Tibetan plateau at a height of about 16,000 ft. Without wishing to imply anything approaching complete isostatic balance in the region, it is suggested that the grooving by rivers of the edge of the extended Tibetan plateau has resulted in a local upward movement of the crust which has raised the peaks of the eastern Himalaya to their present eminence.

The Neutron

IN his Bakerian lecture delivered before the Royal Society on May 25 and recently published (*Proc. Roy. Soc.*, A, Oct.), Dr. J. Chadwick gave an account of recent work on the neutron. It is now well known that neutrons are produced by bombarding light elements with α -particles, and neutrons have been detected from all the elements up to aluminium, with the exception of helium, nitrogen, carbon, oxygen. These exceptions are to be expected from the general rules of nuclear structure, for in all known nuclei, the atomic mass A is equal to or greater than $2Z$ and this condition would be violated by the new nuclei formed by the disintegration of the elements named with emission of a neutron. Some elements, for example, aluminium and fluorine, may disintegrate, giving either a neutron or a proton, and since these elements are isotopically simple, these are really alternative processes.

The dependence of neutron emission on the velocity of the primary α -particles has been examined and

in the cases of boron and beryllium it appears that α -particles of comparatively low velocities penetrate the nucleus by a resonance process, while fast α -particles can enter over the top of the nuclear potential barrier. The energy balance sheet for the disintegration is difficult to construct because the energy of a neutron can only be inferred from the energy transferred to a recoil atom when the neutron strikes a nucleus. In the case of beryllium, it seems probable that the disintegration may result in the formation either of a fast neutron, or of a slower neutron and a γ -ray of about 7 million volts, energy and momentum being conserved.

The energy relations for several neutron-producing disintegrations suggest that the mass of the neutron is about 1.007—slightly less than that of the hydrogen nucleus. The neutron may be an elementary particle of this mass or it may consist of a proton and an electron, and the arguments on this point are conflicting.

Turning to the collisions of neutrons with atomic nuclei, the interaction is very small except at very small distances, on account of the small external fields of the neutron. The collision radius for a number of elements has been calculated by Massey and measured experimentally by a number of workers—in the very interesting case of hydrogen the cross section found experimentally is too small for the theory, and Chadwick makes the suggestion that if either the neutron or the proton is a complex particle, there may be an exchange interaction between the particles which reduces the effective cross section. In addition to these elastic collisions between neutrons and nuclei, inelastic collisions, resulting in disintegration of the struck nucleus, have been observed. The production of positive electrons by neutrons has been reported, but more work is needed here to separate the effects of neutrons and γ -rays.

University and Educational Intelligence

CAMBRIDGE.—The Appointments Committee of the Faculty of Biology "B" will shortly proceed to appoint a University demonstrator in pathology, the appointment to commence on July 1, 1934. Particulars as to stipend and duties may be obtained from Prof. Dean at the Department of Pathology, to whom applications should be sent on or before February 1, 1934.

The Adam Smith prize has been awarded to B. P. Adarkar, of King's College.

READING.—Prof. Francis A. Cavenagh has been appointed professor of education as from September 30. Prof. Cavenagh is at present professor of education in University College, Swansea.

Mr. H. R. Dent has presented to the University Library a complete set of "Everyman's Library", about nine hundred volumes, as an expression of his appreciation of the growth and work of University College and the University of Reading, as recorded in Dr. Childs's recently published book "Making a University".

LORD WAKEFIELD has undertaken to provide funds for a special lecturer in aeronautics for a period of three years at University College, Hull. The salary offered is £450 per annum. Applications should be made to the Principal, University College, Hull.

SCIENTIFIC research in the University of Wisconsin is to be stimulated on a lavish scale by relieving thirty-six full professors of all teaching duties, for periods ranging from a semester to a year, to devote themselves to research in various fields of pure and applied science. This new departure in university policy is the more striking by reason of the source from which it is being financed, namely, the Wisconsin Alumni Research Foundation, a non-profit-making corporation holding the patents of many discoveries made at the University by members of the faculty and using the income derived from them to promote more research. Most famous among these patents is one relating to the Steenbock process by which the vitamin D potencies of cod liver oil and other substances have been standardised and raised by irradiation with ultra-violet light. An announcement of the scheme has been circulated by Science Service, of Washington, D.C.

Calendar of Nature Topics

A Christmas Bird Census

A happy custom, now widely spread through Canada and the United States, is the combination of a holiday outing on or about Christmas Day with a methodical census of the birds in the district. The results, which give numerical statements of the bird population at many different places, ought to be as useful in interpreting the winter relations between residents and migrants, and the effects of different kinds of winters upon the distribution of birds, as summer censuses in Great Britain are in fixing the density of breeding populations. An indication of the extent of the Christmas Bird Census movement is given by the records of the observations made in Canada in 1931, published in the *Canadian Field Naturalist* of February 1932. Sixteen field clubs, ranging from Vancouver Island to Montreal and Toronto, have contributed their observations, generally made by small parties of observers—Ottawa had twenty-one observers in ten parties in the field, the Brodie Club of Toronto thirty observers in eight parties working from 7.30 a.m. until 3 p.m.

The Toronto Club saw 1,989 birds belonging to 41 species, excluding the introduced English sparrow, the only uncountable bird, recorded simply as "abundant" by every party. The Ottawa census revealed the largest number of starlings (831) in any Ottawa Christmas census, the previous record being 608 in 1930, an indication that this introduced species is also finding conditions very favourable.

It is a striking fact that in both censuses these introduced birds far exceed in number any of the native species—the numbers are remarkable: Ottawa, English sparrow 997, starling 831; Toronto, sparrow "abundant" everywhere, starling 508; the native bird which most closely approaches these aliens in the Ottawa district is the eastern snow-bunting with 308 individuals, and in the Toronto area, the old-squaw duck with 285, closely followed by the herring gull with 275. Of ruffed grouse the 1931 number (14) was exceeded only in 1926 (16); the number of American golden-eyes (45) was beaten only in 1927; and the 167 black-capped chickadees of 1930 were exceeded only in 1927 and 1929. The standardising of the routes traversed by the parties each year may lead to results of more value for comparative purposes. The idea of the Christmas Bird Census might be developed with advantage in Great Britain.

Sea-Lion Breeding Season

From about the end of December until the end of January the pups of the southern sea-lion (*Otaria byronia*) are born upon the Falkland Islands, and during the time when they remain with their mothers they undergo a training in aquatic habits. At first the pups, which from a very early age are tolerably active, play with each other upon the beach and later in shallow tidal pools, but J. E. Hamilton found that they avoided deep water and were only induced to leave the shallows by the deliberate enticement of the cows (*Nat. Hist. Mag.*, 4, 56; 1933). A cow swims off-shore, her pup following as a dog swims, head held high, flippers beating rapidly. When water of a suitable depth is reached, the cow sets an example of shallow diving, endeavouring to get the pup to follow, and if the tired youngster endeavours to find a haven of refuge upon its mother's