Old Red Sandstone and Silurian country of Southern Ireland.

From Australasia we receive comprehensive descriptions of the "Palæozoic Geology of Victoria," by E. O. Teale (Proc. Roy. Soc. Victoria, vol. xxxii., p. 67), with a map of the Mount Wellington area; also of the "Geology of Western Australia," by A. Gibb Maitland, extracted from the Mining Handbook published in 1919 by the Geological Survey. The latter memoir has excellent sketch-maps and illustrations throughout the text, and includes a large coloured geological map of the State, dated 1920, corresponding with that described in NATURE, vol. cv., p. 498. This summary should be serviceable in very many libraries in the homeland, and should be made available in all Australian schools.

In Bulletin 21, at the moderate price of 5*s.*, the New Zealand Geological Survey continues its illustrated descriptions of the Dominion. The Osborne and Whatatutu subdivisions, which are here dealt with by J. Henderson and M. Ongley, lie on the east side of North Island, and include peaks rising to 4000 ft. on the main divide. Oil is found in the district, probably oozing from the Te Arai (Lower Miocene) and Cretaceous strata. As usual in these bulletins, the authors pay full attention to the origin of surface-features, and one of their pleasing landscapes shows us, incidentally, the gathering of thousands of sheep under the raised rock-platform of Waihau Beach.

New Zealand now extends its responsibilities to Pacific isles; and J. Allan Thomson describes (*N.Z. Journal of Science and Technology*, vol. iv., p. 49, 1921) the geology of Western Samoa. The lava-tunnels appear to have been used as dwellings, and terraces for sleeping-accommodation have been built up in them—a feature that will pleasantly remind playgoers of the opening scene of Kelly's "Bird of Paradise."

Among American publications, we may note, for comparison with the Triassic beds of Cheshire, the cemented sand-dunes of Eocene age in north-eastern Montana (A. J. Collier, U.S. Geol. Surv., Prof. Paper 120–B, plate iv.), and the cross-bedded De Chelly sandstones (Permian?) of Arizona (H. E. Gregory, *ibid.*, Prof. Paper 93, p. 31, etc.). The latter paper, which is on the "Geology of the Navajo Country," contains notable illustrations of erosion in an arid land. E. G. Fenton (Sci. Proc. Royal Dublin Soc., vol. xvi., No. 19, 1921, 4*s.* 6*d.*), in his "Studies in the Physiography and Glacial Geology of Southern Patagonia," brings us to an unusual field. He has specially examined, through years of residence, the results of glacial outwash and of river-erosion between the Andes and the Atlantic coast. He interestingly attributes the hollows known as *bajos* to the action of water falling over an ice-front during a pause in the general retreat of the pampas glaciers. Though he traces several epochs of retreat and of renewed glaciation, during some of which lavas flowed down into valleys cut by rivers streaming from the ice, Dr. Fenton finds no evidence of any genial interglacial epoch in Patagonia.

G. A. J. C.

Artificial Farmyard Manure.

AN article in the current issue (August) of the *Journal of the Ministry of Agriculture* under the above title somewhat modestly announces what must be regarded as one of the most notable advances in agricultural science made by our oldest agricultural research laboratory, the Rothamsted Experimental Station. For many years the composition and fertilising value of farmyard manure have occupied the attention of investigators. The chemical problems involved at first sight appear simple. When cattle are fed with food rich in nitrogen there is a corresponding enrichment of their excrement. "Cake-fed" dung has long been given a high value by the farmer, and on a purely chemical basis its merit was recognised by the man of science. Hence such publications as "Hall and Voelcker's Tables," which give the "residual" values of various foodstuffs—that is to say, the value of the fertilising constituents (mainly nitrogen) in various substances present in the dung of animals to which they have been fed. But the perplexing fact emerged that dung with this higher theoretic value did not give crop increases corresponding to its assumed chemical content. Nevertheless, so strong has been the effect of the publication of these theoretic values that they are given quasi-statutory effect. Entering tenants have generally to pay compensation "for improvements" based upon the quantity and quality of the foods consumed on the farm during the years preceding their entry.

In the paper alluded to Messrs. Hutchinson and Richards indicate the solution of the conundrum. Put shortly, they have established that the whole of nitrogen in the urine of animals will not be present in the manure as applied to the crops unless a certain ratio subsists between the nitrogen voided by the animals and the carbonaceous matter of the litter by which the urine is absorbed. It seems to follow that "compensation for improvements" should not be awarded on the basis of the food supplied to the stock until the valuer is assured that the feeding was accompanied by an adequate supply of litter, the adequacy being determined by the amount of nitrogen voided by the animals.

Messrs. Hutchinson and Richards show that the factors involved are, in the main, biological, not chemical. The "making" of farmyard manure is essentially the rotting or fermentation of straw. The former writer has published a paper (*Journal of Agricultural Science*, 1919, p. 143) which establishes that straw is fermented by a new aerobic organism, *Spirochaeta cytophaga*, and that this organism requires (in addition to air) a supply of nitrogen, preferably in the form of an ammonia compound (such as, in effect, urea is). It is shown that the amount of nitrogen required for the fermentation of 100 lb. of straw is 0·72 lb. Further, if the nitrogen is in excess of this amount, it tends to pass into the atmosphere as ammonia, with the result that, with a free supply of air, the end product is dung containing about 2 per cent. of nitrogen, *whatever* the original content of the excrement may have been. Under the conditions, however, which obtain in the ordinary farmyard, where some portions of the heap may receive more excrementitious matter than others, the ammonia set free where the nitrogen : cellulose proportion is greater than 0·72 : 100 may be picked up by those portions where the ratio is less, and used to build up their nitrogen content until the whole heap reaches the characteristic and uniform 2 per cent. content of nitrogen.

Using these results, it has been found possible to make an artificial product, closely resembling farmyard manure in appearance as well as in properties, by

the addition of predetermined amounts of ammonia salts (such as ammonium sulphate) to straw. The commercial value of this development may be considerable. With the advent of the motor the supply of town dung has fallen off. Many market-gardeners are, consequently, in straits, for the so-called artificial manures are lacking in organic matter (humus), without which many garden and glasshouse crops cannot be grown satisfactorily. It may be that the ordinary farmer, too, will find a use for the artificial product. It is difficult under modern conditions to maintain sufficient animals to make all the straw produced into dung. Again, where animal excrements exist in abundance (as in milk production), lack of knowledge of the principles of the interaction between urine and straw leads to much waste of valuable fertilising material.

Another direction in which these discoveries may have a practical outcome is in removing the soluble compounds of nitrogen present in sewage. Under the existing sludge processes very little of this soluble matter is recovered. It has been shown that if liquid sewage is used to ferment straw, the effluent is practically free from nitrogen; it has all been retained by the straw.

Enough has, perhaps, been said to indicate the great practical importance of the discovery made by the Rothamsted workers. The scientific advance is not less notable, and marks another stage in the capture by the biologists of the agricultural field of research.

West Indian Zoology.[1]

By PROF. J. STANLEY GARDINER, F.R.S.

IN 1895 the State University of Iowa, acting through Prof. C. C. Nutting, who was already well known as a member of several marine expeditions, organised a zoological exploration of the Bahamas. Its object was twofold: to give their people experience of marine life in tropical seas, and to secure material for morphological and systematic research and for ordinary laboratory purposes. So satisfactory were the results that Prof. Nutting's staff themselves suggested a further expedition, this time to the Lesser Antilles. Preparations were commenced in 1916, so little was the entry of the United States into the war anticipated. Prof. Nutting himself went down to prospect in 1917, and finally the expedition sailed in April, 1918, the party consisting of nineteen persons, including six ladies.

Barbados was first visited, the party camping for six weeks in the quarantine station on Pelican Island, which was placed at its disposal by the Barbados Government. Groups were formed for shore collecting, row-boat work, launch dredging to 200 fathoms, land work, and laboratory observations.

Barbados Island itself is the most eastern of the Antilles, and, although now consisting largely of elevated coral and limestone rocks, contains the remains of land connecting it in early Tertiary times to South America. It was then sunk to great depths and overlaid by beds of ooze, "Barbados earth," noted for their richness in radiolaria and foraminifera. The uplift raised the sea bottom high enough for corals to thrive, and subsequent elevations are responsible for the terraced effects so apparent in the topography of the present land. The island is about 21 by 14 miles, and has now a population of nearly 200,000. All is cultivated, and land collecting was hence little likely to yield results of much value. The expedition, indeed, mainly concentrated on marine work, and the more striking animals of different groups are described; the whole forms a guide which will be of value to future workers. The general variety of life is interesting, but the uniformity of all tropical marine life in the coral-reef regions of the world is still more striking; indeed, Prof. Nutting's descriptions would apply almost equally well to faunas from similar grounds off Ceylon, Seychelles, or Fiji.

The second camping place was in the British dockyard in English Harbour, Antigua. Here, on account of the heavy swell, work had to be concentrated in the harbour and in the neighbouring Falmouth and Willoughby Bays. There were compensations in a neighbouring mangrove swamp with its peculiar fauna, in fairly smooth bottom, and in the land being little altered and still largely wild, covered with close tropical jungle. There are volcanic rocks of some age on this side, limestone rocks occurring principally in the north of the island, off which are the chief living coral reefs. The marine crustacean, holothurian, and worm faunas proved particularly interesting, and there are many observations on the modes of life of different forms. Clearly, while the whole surroundings were not so exciting to the party as those of the coral reefs of Barbados, the expedition must have obtained a large number of animals of great interest. Geographically, the mollusca in the clearly capable hands of Mr. Henderson, and the fossil geology in those of Prof. Thomas, may be expected to yield valuable information.

The immediate scientific results of this expedition are not likely to be great, but the whole idea underlying it, and its scope, are of great interest, for it might well be copied by British universities. Here was a party of nineteen charming people, half of whom were interested professionally, while the rest were students. They went off for a term, and came back to their university with a glimpse of what tropical life really is, an abiding picture which will make those who teach interesting to their students, for they will be describing what they have seen, living forms in their natural environments.

[1] University of Iowa Studies in Natural History. Vol. viii., No. 3. "Barbados-Antigua Expedition." By C. C. Nutting. Pp. 274. (Iowa City: University of Iowa, n.d.)

Thomas Wharton Jones, F.R.S.

SIR RICKMAN GODLEE'S memoir of Wharton Jones, reprinted from the *British Journal of Ophthalmology*, March and April, 1921 (London: Geo. Pulman and Sons, Ltd.), is a most admirable short study. It gives us in close compass not only the man's work, but also the man, from 1808 to 1891—a long life in the service of physiology and ophthalmology. Wharton Jones's work on the capillary circulation and on the processes of inflammation is memorable, and was recognised and honoured by all men of science: but the advance of the medical sciences carried the younger men far ahead of him. From Edinburgh, where Wharton Jones was one of Knox's assistants, and suffered a share of the public hatred which flared up over the Burke and Hare murders, he came to London in 1838