PRE-CAMBRIAN ALGAL LIMESTONES

SIR,—I would like to comment on the article entitled " Pre-Cambrian Algal Limestones in Western Australia ", by Rhodes Fairbridge, which appeared in your issue for September–October, 1950, pp. 324–330.

No unsilicified algal limestone has yet been found *in situ* by Dr. Fairbridge, although blocks of stromatolitic limestone in every stage of silicification have been found as erratics in the Permian Nangetty Tillite of the Irwin River Basin. His recognition of the structures is, therefore, all the more commendable.

In the course of field survey work with our senior students in May, 1950, algal limestones showing no sign of silicification and associated with minor developments of intraformational breccias, were found *in situ*. These limestones occur at a spot situated 1½ miles on a bearing E. 25° S. from Yandanooka Railway Station. They appear to be confined to a narrow meridional belt about 200 feet stratigraphically above the unconformity of the Yandanooka Series with the Archaean gneisses.

The algal limestones are set in a broad calcareous band within the chocolate slates and siltstones which make up the bulk of the Yandanooka Series in the vicinity. It is pale pink, compact, cryptocrystalline, and absolutely unsilicified. Judging by its rapid reaction to cold acids, it is a limestone low in magnesia. This counters the suggestion made by Dr. Fairbridge in connection with the silicified limestones that the associated intraformational breccias were originally dolomitic, or even brecciated cherts. The algal structures in the limestones, although much smaller, are similar in character to those figured by Dr. Fairbridge. Orientated specimens have been collected for further thin section study.

I am impressed by the close similarities of many features of the Yandanooka Series and the last stage of sedimentation in the Late Proterozoic Adelaide System in the Mount Lofty and Flinders Ranges in South Australia, with which I am familiar. The algal limestone with its associated intraformational breccias is comparable with Mawson's " Hieroglyphic Limestone " of the Flinders Ranges. The chocolate slates and siltstones of both areas are remarkably similar, even to the presence of mica flakes and microscopic lenses of fresh felspar and angular quartz and large areas in the field devoid of any kind of lamination. However, in both areas there are layers of rounded sand grains and other features characteristic of normal subaqueous deposition.

In view of his recent discovery of the Elatina Tillite and associated basic volcanic necks, Mawson (1949, *Trans. Roy. Soc. S. Aus.*, 73, p. 120) was able to point out that the chocolate slates of the Flinders Ranges owe their colour and much of their substance to loess derived from " glaciation of basaltic highlands, and also granitic and gneissic terrains elsewhere located and subject to ice sheet erosion ". Since basic volcanic activity seems to have occurred in the Late Pre-Cambrian near Arrino a few miles to the south of Yandanooka, the setting is unusually similar to that obtaining in the Central Flinders Ranges. Thus, while allowing that tuffaceous material may have been significant in some beds, I suggest a loessial source for the very fine-grained structureless chocolate " siltstones " of the Yandanooka Series.

Tillite, as yet, has not been discovered in the Yandanooka Series (nor, for that matter, anywhere in the Nullagine System). But since the Elatina Tillite of the Flinders Ranges occurs immediately below the Hieroglyphic Limestone, a local development of tillite could, if the correlation I have suggested is valid, be expected beneath the algal limestones near Yandanooka.

If, as it appears, products of ice action (in the form of loess) played a significant part in sedimentation about the time of formation of the algal limestones, it is difficult to see how they could have been formed in conditions favouring an extensive evaporite formation, as suggested by Fairbridge (p. 327). Desiccation is an unlikely prime cause of the brecciation associated with these algal growths, for, as Fairbridge has noted, the characteristic " desiccation mud curl " is very uncommon. I would make the tentative suggestion, therefore, that the algae were living in shallow lakes (such as

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described in 1929 by Mawson from South Australia : *Quart. Journ. Geol. Soc.*, 85, 613–623 ; and in 1946 by Clarke and Teichert from Western Australia : *Amer. Journ. Sci.*, 244, 271–276), and that brecciation of the carbonate mud was not only caused by the growth of the algae themselves, but also by expansion (especially in the shallows) of ice forming periodically in the algae-infested lakes.

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MICROPALAEONTOLOGICAL TECHNIQUE

SIR,—Just over a year ago, a method of breaking down shales for micropalaeontological study was mentioned in abstract in the *Micropalaeontologist* by Mr. N. M. Layne, jun. Quoting from the abstract, the details of the method are as follows :—

" First heat the sample on a gas plate or in an oven sufficiently to drive off the interstitial moisture. After it has cooled pour gasoline over it and allow to stand for about half an hour. Next decant the gasoline, and cover the sample with water."

Since reading of this method, I have carried out several experiments with it, using a slight variation in that the sample is dried again after the gasoline is decanted, and before the water is added. With this method, samples of extremely hard shale which normally take five to six hours to prepare by the normal repeated hydration and dehydration, are ready for microscopic examination within one hour. Pure sandstones are not affected by this method, but impure sandstones are found to break down, the speed of the reaction increasing with the proportion of argillaceous matter present.

I mention this process here because the *Micropalaeontologist* has a somewhat restricted circulation amongst general palaeontologists in England, and also because the applicability of the method goes well beyond the field of micropalaeontology into that of general palaeontology. In one of the experiments I was able to extract from an impure sandstone entire shells of macrofossils so cleanly that the internal and external details could be seen perfectly.

It would seem therefore that this method of breaking down samples could do much to speed up the work of palaeontologists, as well as lessen considerably the risk of damage to specimens whilst cleaning them mechanically.

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28th February, 1951.

REFERENCE.—LAYNE, N. M., A Proceedure for Shale Disintegration. *The Micropolaeontologist*, iv, No. 1, 1950.

LINEATION IN HIGHLAND SCHISTS

SIR,—In three short Notes recently published in the *Geological Magazine*, I have attempted to demonstrate a simple, and I feel useful, macroscopic way of looking at folded rocks. Applying this point of view in many parts of the Highlands, I have been impressed by the prevalence of *b*-lineations similar to those described in the Notes. It should perhaps be pointed out that my approach is more similar to that employed by Dr. F. Coles Phillips in his important pioneer work on the fabric of the Moine (*Quart. Journ. Geol. Soc.*, xciii, 581–620) than might be evident at first sight. When it is realized that my text-figures represent profiles at right angles to the fold-axes, it will be appreciated that in my examples, as in those of Dr. Coles Phillips, there is a marked tendency for the micas at any rate to lie on a more