

CORRESPONDENCE

FORAMINIFERAL ZONES IN THE TERTIARY OF AUSTRALIA

SIR,—I am concerned that in the discussion of certain controversial matters in this correspondence the observed facts should not be overlooked.

Miss Crespin and I have collaborated in recent years in a detailed examination of many sections of Tertiary rocks exposed on the South Coast of Victoria between Torquay and Princetown. I have measured the sections and collected samples systematically from them; Miss Crespin has examined the samples and identified the foraminifera.

We have jointly examined some of the more interesting sections and checked critical evidence. As a result we consider we have obtained much new evidence on the fossil content and correlation of beds below the top of the Jan Juc Formation (Raggatt and Crespin, 1952, pp. 143-7).

Dr. Glaessner (*Geol. Mag.*, 1951, 273-283), stated that his contribution was intended to provide "a tentative framework of zones of definite stratigraphic position in the local as well as in the European time scale". He identified three zones in descending order as follows:—

- (3) *Austrorillina howchini*
- (2) *Victoriella plecte*
- (1) *Hantkenina alabamensis*

Glaessner also suggested that there may be a "possibility of establishing a zone [of *Sherbornina*] intermediate between the *Victoriella* and *Austrorillina* Zones" (p. 278).

The principal points of Miss Crespin's criticism of Glaessner's paper, which I desire to emphasize, are:—

(1) That near Torquay *Hantkenina*, *Victoriella*, and *Sherbornina* all occur together in the same bed at the top of the Jan Juc Formation.

(2) That near Torquay *Victoriella* and *Sherbornina* occur also in the lower part of the Jan Juc Formation where, so far *Hantkenina* has not been found.

(3) That between Brown's Creek and Johanna River *Victoriella* occurs in the same bed as *Hantkenina*.

Attention was also directed to certain errors in field observations which it is desirable should be corrected. In the Brown's Creek—Johanna River section—

(1) The beds with *Hantkenina* are not the lowest fossiliferous strata in the Tertiary sequence. Below them are beds with a rich marine fauna; these overlie purple siltstones with *Cyclammina* and, underneath the siltstones are the basal beds of the section (sandstone), the equivalent of Baker's Pebble Point Beds.

(2) As indicated in (1) the *Cyclammina* siltstones ("Anglesean" of Singleton) are below not above the bed with *Hantkenina*.

In his reply to Miss Crespin (*Geol. Mag.*, 1952, pp. 228 and 229), Glaessner suggests that the occurrences of *Hantkenina* at the top of the Jan Juc Formation requires confirmation. This record could only be questioned on the grounds that the fossil is not autochthonous. However, there is no evidence to support this. Six well-preserved specimens have been noted in the Jan Juc material and the assemblage is also significant. It may be noted that *Hantkenina* is not common at either of the other two places in Victoria from which it is recorded, and Glaessner quotes Parr as stating that he had found only one specimen in the material from Maslin Bay.

When Miss Crespin told me that she had identified *Victoriella* in a sample I collected from near Brown's Creek it seemed a natural corollary that *Hantkenina* should be found in the Jan Juc Formation.

The field evidence shows that very broadly the lithological sequence in the lower part of the Tertiary sequence in Southern Victoria in descending order is:—

(3) Calcareous limestone and/or calcareous clays and siltstones with a rich marine fauna which includes *Hantkenina*.

(2) Siltstones commonly lignitic and purple in colour with abundant *Cyclammina*.

(1) Medium to coarse quartz sandstone, markedly carbonaceous (including seams of lignite in some places) at the base.

— Jurassic.

The difficulty was that in earlier discussions this general sequence was not well understood; indeed, as pointed out above, the order of the beds (2) and (3) was reversed by some authors. The correction of this error, the discovery of *Victoriella* at Brown's Creek and of *Hantkenina* at Torquay provide three pieces of evidence which support one another and allow correlation of sections many miles apart to be made with confidence. (Raggatt and Crespin, 1952).

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REFERENCES

- RAGGATT, H. G. and CRESPIN, IRENE, 1952. Geology of Tertiary Rocks between Torquay and Eastern View, Victoria. *The Australian Journal of Science*, xiv, 143-7.
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LINEATION IN THE SHETLAND ISLANDS

SIR,—In his paper on "A Tectonic Analysis of the Munes Phyllite Block of Unst and Uyea, Shetland" (*Geol. Mag.*, 1952, 263) Dr. D. Flinn gives some interesting particulars with regard to the dimensions of pebbles in conglomerates. So far as the writer knows, such particulars had not previously been given about the constituents of any Scottish conglomerate in an area of lineation, and they have an important bearing on the theory of this subject.

The average dimensions of more than 50 specimens were found to be in the ratio 15.3 parallel to the lineation, 2.3 normal to the lineation, but in the plane of schistosity, and 1.0 across the schistosity. Dr. Flinn infers that if the specimens were originally roughly of the same diameter in all directions, they have been elongated, parallel to the lineation, to about 4.6 times their original length.

In a paper published by the writer in 1948 (*Quart. Journ. Geol. Soc.*, civ, 99) other instances were mentioned where it had been found that lineation and the extension of pebbles were parallel. In most of these cases it was impossible to infer, from the published data, whether the joint direction was *a* or *b*. A description by A. Kvale, however (1945, *Norsk. Geol. Tidsskr.*, xxv, 193) refers to an instance, in the Bergsdalen quadrangle, in Norway, where there is no possible doubt that both the lineation, and the main extension of pebbles, is in the *a* direction.

Dr. Flinn, on the other hand assumes both structures to be in the *b* direction, and explains the extension by rolling. This is the "orthodox" explanation, but it does not seem to be easily intelligible. A pebble in a matrix which is undergoing distortion may be expected to alter its dimensions, but surely it will lengthen them more in the direction of transport than in either of those which are at right angles to it. By "transport" one means the relative movement of two superimposed layers, and if Dr. Flinn is right, this must be either from west to east, or from east to west, corresponding to