

THE ZONES OF THE LOWER CHALK.

SIR,—In the November number, p. 507, Mr. Jukes-Browne comments on my "curious method of estimating the affinities of a fauna."¹ The faunas compared are those of—

- A. The Chalk above the Burwell Rock of Cambridgeshire and Suffolk, containing 51 species, 33 of these being common to the Burwell Rock.
- B. The Burwell Rock of Cambridgeshire, with 87 species.
- C. The Chalk Marl of Cambridgeshire, with 25 species, of which 23 occur in the Burwell Rock.

The "more rational" course advocated by Mr. Jukes-Browne is to ascertain whether A or C contains the greater number of species common to B, irrespective of the fact that fauna A is twice as large as fauna C.

By his method, since all three faunas are closely related, the larger of the two faunas A and C is bound to appear the more closely related to B. Therefore I prefer to compare the percentage of forms in A common to B (67 per cent.) with the percentage of forms in C common to B (92 per cent.).

With Mr. Jukes-Browne's statement that taking a larger area, including Bedford and Hertford, the fauna of the Totternhoe Stone, excluding reptiles, "comprises 96 species, of which only 23 range downward into the Chalk Marl of the counties mentioned," I cannot agree. His own General Memoir records 31 such forms; and I have already recorded *Nautilus elegans* in addition to all these. The Chalk Marl of these counties contains 35 species, of which 32 are common to the 'Totternhoe Stone,' i.e. 91 per cent., a figure in close agreement with the percentage quoted for the smaller area. In support of my contention that the zone of *Ammonites varians* should include the Totternhoe Stone, I give the subjoined chart, p. 575. Upon this I have plotted most of the species in the Burwell Rock of Cambridgeshire which are not recorded from the Chalk Marl of that county. The species chosen occur in the Lower Chalk of Folkestone and also at some intermediate locality.

Forms above the line **ABC** have not been recorded below the 'Totternhoe Stone' of the region indicated.

Forms below the line **ABC** are not recorded above the Chalk Marl (unless marked *).

Forms actually upon the line **ABC** occur in the 'Totternhoe Stone' and also in the Chalk Marl.

Thus the line **ABC** represents the base of the 'Totternhoe Stone.' The straight line **AD** represents the top of the 'Totternhoe Stone,' and also, as I maintain, the top of the zone of *Ammonites varians*.

Thus we see that the fauna which occurs above the base of the 'Totternhoe Stone' in the north, is within the Chalk Marl of the south, and that the transition is gradual.

But, on the other hand, the line **AD** separates two different faunas.

¹ See my Article "Zones of the Lower Chalk," *GEOL. MAG.*, Sept. 1906, p. 412.

Below it there is always the *Ammonites varians* fauna, containing: *Pecten elongatus*, *Discoidea subuculus*, *Nautilus deslongchampsianus*, *Nautilus elegans*, *Turrilites*, *Baculites*, and *Actinocamax lanceolatus*.

Above it is the *Holaster* Chalk with *Cidaris Bowerbanki*, *Echinocyphus difficilis*, *Holaster trecensis*, *Discoidea cylindrica* (hemispherical form), *Ptychodus decurrens*.

CAMBRIDGESHIRE.	BEDFORDSHIRE and HERTFORDSHIRE.	OXFORDSHIRE, BUCKINGHAMSHIRE, and BERKSHIRE.	FOLKESTONE.
Chalk containing <i>Cidaris Bowerbanki</i> , <i>Ptychodus decurrens</i> , <i>Holaster trecensis</i> , <i>Echinocyphus difficilis</i> , and <i>Discoidea cylindrica</i> (hemispherical form).			
A			
<i>Oxyrhina Mantelli.</i>	<i>O. Mantelli.</i>	...	<i>O. Mantelli.</i>
<i>Protospheerena ferox</i> . ¹	<i>P. ferox.</i>	...	<i>P. ferox.</i>
<i>Notidanus microdon.</i>	<i>N. microdon.</i>
<i>Corax falcatus.</i>	<i>C. falcatus.</i>
<i>Ammonites cenomanensis.</i>	<i>A. cenomanensis.</i>	...	<i>A. cenomanensis.</i>
<i>Actinocamax lanceolatus.</i>	<i>Act. lanceolatus.</i>	...	<i>Act. lanceolatus.</i>
<i>Pecten Beaveri.</i>	<i>P. Beaveri.</i>	<i>P. Beaveri.</i>	* <i>P. Beaveri.</i>
<i>Pecten elongatus.</i>	<i>P. elongatus.</i>	<i>P. elongatus.</i>	<i>P. elongatus.</i>
<i>Pecten decussata.</i>	<i>Ph. decussata.</i>	<i>Ph. decussata.</i>	<i>Ph. decussata.</i>
<i>Inoceramus striatus.</i>	...	<i>I. striatus.</i>	<i>I. striatus.</i>
<i>Ammonites navicularis.</i>	<i>A. navicularis.</i>	<i>A. navicularis.</i>	<i>A. navicularis.</i>
<i>Hemiasiter Morrisi.</i>	<i>H. Morrisi?</i>	<i>H. Morrisi.</i>	* <i>H. Morrisi.</i>
<i>Solarium.</i>	...	<i>Solarium.</i>	<i>Solarium.</i>
<i>Nautilus deslongchampsianus.</i>	...	<i>N. deslongchampsianus.</i>	<i>N. deslongchampsianus</i>
<i>Turrilites costatus.</i>	...	<i>T. costatus.</i>	<i>T. costatus.</i>
<i>Turrilites Scheuchzerianus.</i>	<i>T. Scheuchzerianus.</i>	<i>T. Scheuchzerianus.</i>	<i>T. Scheuchzerianus.</i>
<i>Ammonites rhotomagensis.</i>	<i>A. rhotomagensis.</i>	* <i>A. rhotomagensis.</i>	* <i>A. rhotomagensis.</i>
<i>Pleurotomaria.</i>	<i>Pleurotomaria.</i>	* <i>Pleurotomaria.</i>	<i>Pleurotomaria.</i>
<i>Neithea quinquecostata.</i>	<i>N. quinquecostata.</i>	* <i>N. quinquecostata.</i>	<i>N. quinquecostata.</i>
<i>Lima aspera.</i>	<i>L. aspera.</i>	* <i>L. aspera.</i>	<i>L. aspera.</i>
<i>Ammonites Coupei.</i>	<i>A. Coupei.</i>	<i>A. Coupei.</i>	<i>A. Coupei.</i>
<i>Palæga Carteri.</i>	<i>P. Carteri.</i>	<i>P. Carteri.</i>	<i>P. Carteri.</i>
<i>Aporrhais.</i>	<i>Aporrhais.</i>	<i>Aporrhais.</i>	<i>Aporrhais.</i>
<i>Scaphites æqualis.</i>	<i>S. æqualis.</i>	<i>S. æqualis.</i>	<i>S. æqualis.</i>
<i>Ammonites varians.</i>	<i>A. varians.</i>	* <i>A. varians.</i>	<i>A. varians.</i>
<i>Nautilus elegans.</i>	* <i>N. elegans.</i>	<i>N. elegans.</i>	<i>N. elegans.</i>
<i>Discoidea subuculus.</i>	...	<i>D. subuculus.</i>	<i>D. subuculus.</i>
<i>Rhynchonella Martini.</i>	<i>R. Martini.</i>	<i>R. Martini.</i>	<i>R. Martini.</i>
<i>Ammonites Mantelli.</i>	<i>A. Mantelli.</i>	<i>A. Mantelli.</i>	<i>A. Mantelli.</i>
<i>Rhynchonella grasiana.</i>	* <i>R. grasiana.</i>	* <i>R. grasiana.</i>	* <i>R. grasiana.</i>
<i>Turrilites tuberculatus.</i>	...	<i>T. tuberculatus.</i>	<i>T. tuberculatus.</i>
<i>Lima globosa.</i>	* <i>L. globosa.</i>	* <i>L. globosa.</i>	<i>L. globosa.</i>
<i>Inoceramus latus.</i>	* <i>I. latus.</i>	<i>I. latus.</i>	...
And 14 others.	Etc.	Etc.	Etc.

Fossils of the Chalk Marl.

In conclusion, I may say that the *Discoidea*s from the *Holaster trecensis* beds of Cambridgeshire seem to be distinguishable from those in the zone of *A. varians* (including the Burwell Rock), but I am not yet sure of being able to separate them from the large forms in that zone in the south.

¹ Not listed in the General Memoir, but fairly common at Burwell.

On the other hand, *Cidaris Bowerbanki* is a characteristic and easily recognisable fossil in the Chalk above the zone of *A. varians* as understood by me. It has only been recorded in the lower zone near Lewes, and does not occur in the 'Totternhoe Stone.' As an index, it seems much more suitable and definite than any of those species suggested by Mr. Jukes-Browne.

I still maintain, however, that it is more practicable to use the "Two Holasters," which are commoner fossils; and it does not seem unreasonable to use in partnership two contemporary species of different habitat to indicate beds deposited under variable conditions at the same time. Mr. Jukes-Browne has shown at some length that my brief summary of the occurrences of *Holaster subglobosus* contains some inaccuracies. This I am willing to admit; but the necessary corrections do not affect the main conclusion—that it requires the *two* Holasters to define the whole zone.

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OBITUARY

FREDERICK JUSTEN, F.L.S.

BORN FEBRUARY 29, 1832.

DIED NOVEMBER 20, 1906.

It is with deep regret that we record the death, on Tuesday, 20th November, of our dear and valued friend, Mr. Frederick Justen, F.L.S., the publisher of this journal.

Mr. Justen was born at Bonn on the 29th February, 1832, and came to England as a German Assistant to the firm of Messrs. Dulau & Co., 37, Soho Square, W., in 1851.

Upon the decease of the late Mr. Twentyman, the then acting partner, Mr. Justen became the sole proprietor of the firm, and for many years devoted his energies to supplying the requirements of the British Museum and the Libraries of the various scientific societies of London and the provinces with foreign publications.

It was his strong sympathy with the aims and objects of the Geological and Palæontographical Societies, the Geologists' Association, and other kindred institutions, that prompted him, in 1895—irrespective of any pecuniary considerations whatever—to undertake the publication of the GEOLOGICAL MAGAZINE, in the success of which he always took the deepest interest.

It is not too much to affirm that the onward progress of the GEOLOGICAL MAGAZINE in the last 12 years has been mainly due to the public-spirited support given to it by Mr. Frederick Justen, and no one of all our friends and supporters rejoiced more than he did, when, in February last, the 500th monthly number of this journal was issued from 37, Soho Square.

Notwithstanding the great personal loss which the death of Mr. Justen has caused to us, we are happy to state that the business relations with the firm of Messrs. Dulau and Company will be continued in the same cordial manner as heretofore. H. W.
