THE VALUE OF CORALLITE SIZE IN THE SPECIFIC DETERMINATION OF THE TABULATE CORALS FAVOSITES AND PALAEOFAVOSITES

by

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Summary

The variation of the morphological characters in the tabulate coral species Favosites gothlandicus Lamarck and Palaeofavosites asper (Twenhofel) from the British Silurian is discussed. In all cases, except that of corallite size, these morphological characters show such a high degree of variation, even within a single corallum, that they can be of little use in specific determination. A detailed examination of the average transverse axes of the adult corallites has demonstrated the possible value of this character in the discrimination of species of favositids. The method of measuring the transverse axes is described in detail.

The earliest comprehensive study of the favositid corals from the British Silurian deposits was that carried out by Edwards and Haime (1855). They considered that among the favositids from the Wenlock Limestone the following species were recognisable: Favosites gothlandica, F. forbesi, F. multipora, and F. aspera. Jones (1936) considered that F. gothlandicus, F. forbesi and F. multipora were in fact variations of the same species, and described them as 'formae' of F. gothlandicus.

During the present investigation of the Silurian tabulate corals, the author has studied the variation of the morphological characters of F. gothlandicus and P. asper in detail. The results of this study, described below, indicate that the division of F. gothlandicus into the three 'formae' of Jones cannot satisfactorily be accomplished, owing to the fact that even within a single corallum the complete variation of the morphological characters used by Jones to distinguish his three 'formae' may be recognised. A similar range of variations may also be seen in P. asper. The morphological terms used in the succeeding sections are explained in the accompanying plate (Plate 16).

Variations in F. gothlandicus from the Wenlock Limestone

The main morphological differences which Jones (1936) employed, in his definition of the three formae of F. gothlandicus, were the abundance of septal spines and the thickness of the corallite walls.

Explanation of Plate 16

Fig. 1. x 6.

Transverse section of Favosites gothlandicus, showing the variation in the number of septal spines and in the thickness of the corallite walls in different parts of the section. At (A) the septal spines are few in number and the walls of the corallites relatively thin, while at (B) the septal spines are very abundant and the walls have increased considerably in thickness.

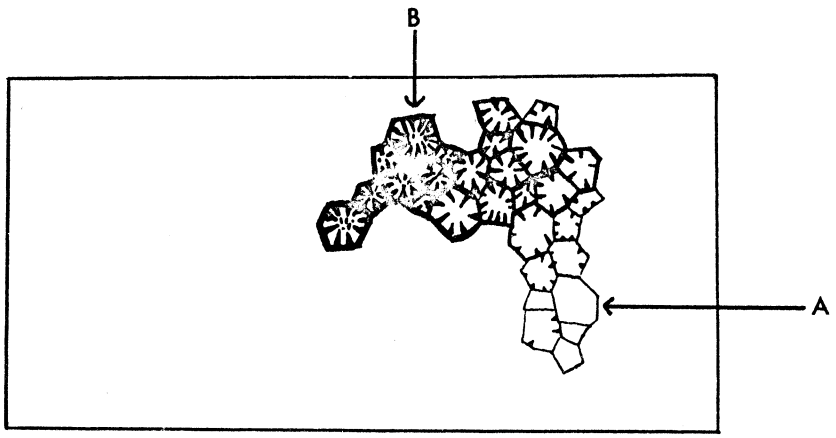
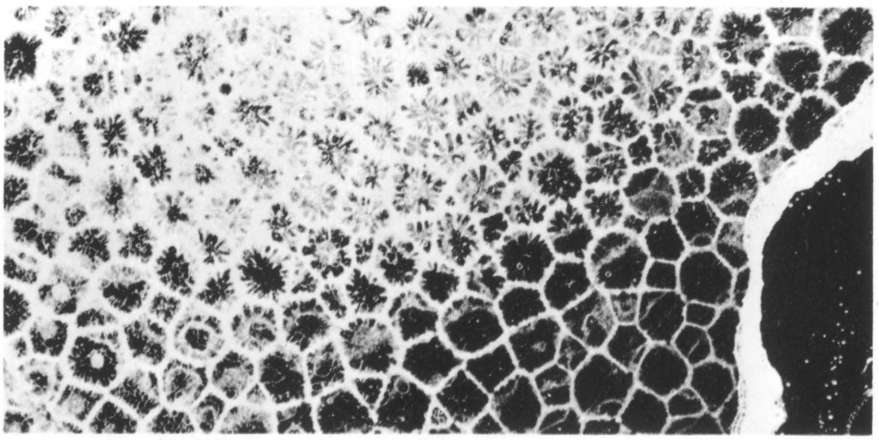
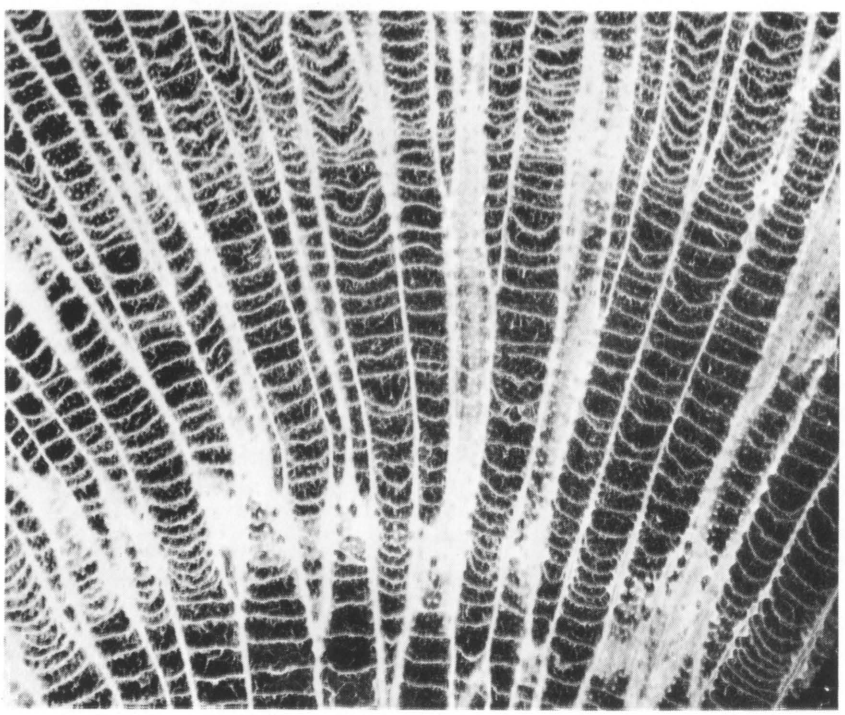


Fig. 2. x 6.

Longitudinal section of Favosites gothlandicus, showing the concentration of septal spines into distinct bands accompanied by an increase in the thickness of the corallite walls and a much closer spacing of the tabulae.





Jones described F. gothlandicus forma gothlandica as forms without, or with very few septal spines, and with thin walls; F. gothlandicus forma forbesi as forms with some septal spines and thicker walls, and F. gothlandicus forma multipora as forms with many septal spines and with relatively thick walls. Jones also described variations in corallite size, and in the spacings of the tabulae, between the different formae.

Septal spines have been noted by the author in all coralla of this species from the Wenlock Limestone. In nearly all specimens examined, longitudinal sections display bands of abundant septal spines, which are concentric with the upper surface of the corallum, separated from each other by areas where the septal structures are relatively sparse (Pl. 16 - fig. 1).

In transverse sections, which inevitably cut through a number of growth levels of the colony, there is often a continuous variation from areas of very abundant septal spine development to areas of sparse development (Pl. 16-fig. 2).

Some coralla in this species are rather more abundant in septal spines than others, but this is insignificant compared with the variation found at different growth levels in a single corallum.

The variation in wall thickness of F. gothlandicus is dependant on the variation in the thickness of the peripheral stereozone of the walls. The amount of stereozonal thickening always shows a close relationship with the abundance of septal spines: where the septal spines are abundant, the walls may reach a thickness of up to 0.4 mm., but where there are few septal spines, the walls are rarely thicker than 0.1 mm.

The spacing of the tabulae in the Wenlock Limestone specimens of F. gothlandicus has a close relationship both with the abundance of septal spines and with wall thickness. In the areas where the septal spines are very abundant, the tabulae are very closely spaced, on the average separated from each other by about 0.35 mm., while in the areas of few septal spines and thin walls there is a much wider spacing, averaging about 0.8 mm.

The observations made in this study have led the author to the conclusion that the development of the septal spines, the thickness of the corallite walls and the spacing of the tabulae are all a result of the effect of environmental conditions. The alternations between areas with sparse septal spines, thin walls and relatively well separated tabulae, and areas of abundant septal spines, thick walls and closely spaced tabulae, suggest that the development of these characters may be related to seasonal variations in sea water conditions.

Jones (1936) considered that the inequality in the size of the corallites in F. gothlandicus was merely an effect of environment, and demonstrated that, where rapid gemmation occurred, the corallites would vary considerably in size.

In the present work an attempt has been made to deduce the variation one may find in the size of the adult corallites in different coralla of F. gothlandicus. The initial difficulties proved to be the selection of a reasonable method for measuring the transverse axes of the corallites, which are polygonal in shape, and the choice of corallites which would satisfactorily be regarded as adult.

As no standardised method for measuring the corallites of favositids has previously been used, it was considered that the most satisfactory procedure to give an indication of the transverse size of the corallites would be to find the average measurements of the longest and shortest transverse axes for each corallite. In each of the specimens of F. gothlandicus used in this study, it was decided that the one hundred largest corallites, in transverse sections which contained upwards of one thousand corallites, could certainly be considered as adult.

First of all, thirty-five specimens were selected from different horizons in the Wenlock Limestone of the Welsh Borderlands; the mean size of the transverse axes of the adult corallites, using the techniques as described above, was 1.56 mm., with a range of the means for all coralla of 1.22 mm. - 1.92 mm. (Table 1). These thirty-five specimens were then divided into three groups, based on the abundance of septal spines and wall thickness in the sections from which the corallites were measured (see Table 1). The results of this experiment showed that, in the coralla measured, there was no significant difference between the size of the transverse axes of those corallites with very abundant septal spines and thick walls, and those with very few septal spines and relatively thin walls (see Table 1).

TABLE 1

Statistics of adult corallite size of coralla of Favosites gothlandicus from the Wenlock Limestone

Character	Mean of Means (mm)	Range of Means (mm)	Var. of Means (mm)	No.
Average transverse axes of the adult corallites from all coralla	1.56	1.22-1.99	0.0365	35
Average transverse axes of the adult corallites from coralla of Jones' forma gothlandica	1.58	1.25-1.99	0.0432	10
Average transverse axes of the adult corallites from coralla of Jones' forma forbesi	1.59	1.22-1.80	0.0247	13
Average transverse axes of the adult corallites from coralla of Jones' forma multipora	1.51	1.28-1.92	0.0469	12

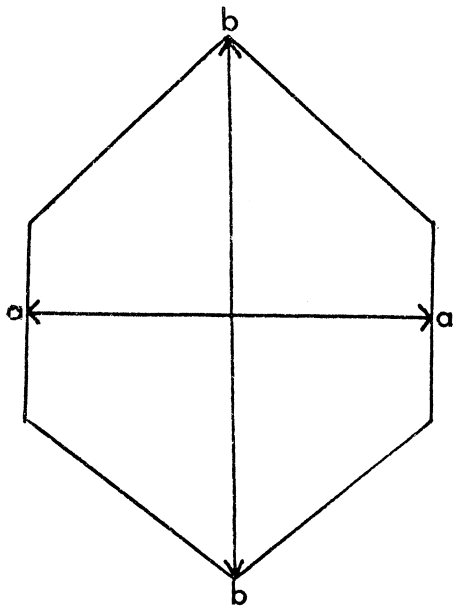
A further eleven specimens were collected from one horizon and locality of the Wenlock Limestone from Shropshire. These were measured in a similar fashion as those described above, and the ranges of the corallite size are very similar to those of the coralla measured from various localities in the Wenlock Limestone (Table 2).

TABLE 2

Statistics of adult corallite size of coralla of Favosites gothlandicus from one horizon

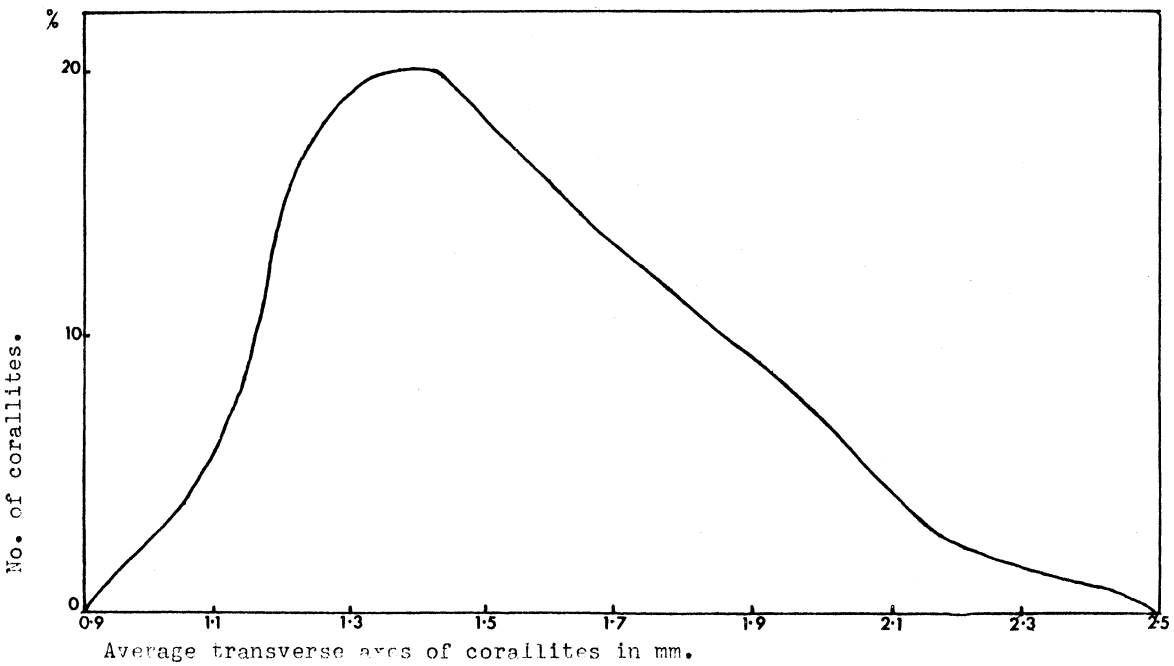
(Crinoidal Limestone, Coates Quarry, Wenlock Edge, Shropshire)

Character	Mean of Means (mm)	Range of Means (mm)	Var. of Means (mm)	No.
Average transverse axes of the adult corallites of all coralla	1.62	1.46-1.92	0.0231	11

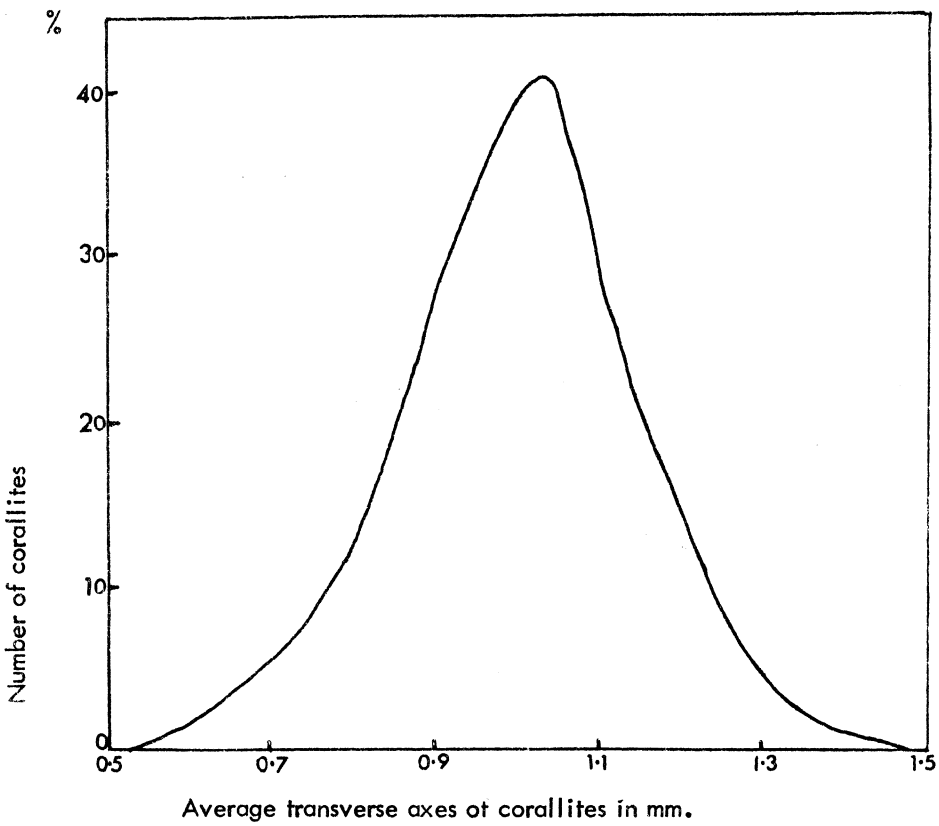


$\frac{a+b}{2}$ Average transverse axis

Text-Fig. 1. Diagram to show the system used for the measurements of the transverse axes of the corallites in the Favositidae.



Text-Fig. 2. Diagram to show the size ranges of all corallites measures of specimens of Favosites gothlandicus from the Wenlock Limestone.



Text-Fig. 3. Diagram to show the size ranges of all corallites measured of specimens of Palaeofavosites asper from the Wenlock and Aymestry Limestones.

The results of this study suggest that the varying environmental conditions which are indicated by the diverse lithologies in the Wenlock Limestone, have little effect on the adult transverse size of the corallites of F. gothlandicus; thus it appears that this character is one of the most stable morphological features of the genus, and may with detailed study prove valuable in taxonomic work on this species.

Variation in Palaeofavosites asper from the Wenlock and Aymestry Limestones

Twenty-three specimens of this species were used in this investigation. Fifteen of these were collected from varying localities and horizons in both the Wenlock and Aymestry Limestones, while eight were collected from a single horizon in the Wenlock Limestone.

The examination of this species has given almost identical results as those described for F. gothlandicus (Text-fig. 2). The septal spines show a variation from being very abundant to sparse in a single corallum; the areas of abundant spines are again developed in bands parallel with the upper surface of the coralla. As in F. gothlandicus, the wall thickness of the corallites shows a very close relationship with the abundance of septal spines, thicknesses of as much as 0.2 mm. being attained where septal spines are very abundant, whereas the average thickness is only about 0.06 mm. where septal spine development is lacking or very sparse. In the areas of abundant septal spines the tabulae have an average separation of about 0.35 mm., but elsewhere the separation averages 0.75 mm.

The comparison of the average transverse axes of the corallites of one corallum with those of another indicates a relatively restricted range for this character. The average transverse axes for all adult corallites measured are 0.9 mm., with a range from 0.80 mm. to 1.21 mm. (Table 3) in the average transverse axes of all coralla.

TABLE 3

Statistics of the adult corallite size of Palaeofavosites asper from (a) different localities in the Wenlock and Aymestry Limestones and from (b) one horizon in the Wenlock Limestone

Character	Mean of Means (mm)	Range of Means (mm)	Var. of Means (mm)	No.
(a) Average size of transverse axes of the adult corallites of all coralla examined	0.99	0.80-1.21	0.0095	15
(b) Average size of transverse axes of the adult corallites of coralla from a single horizon	0.99	0.91-1.09	0.0005	5

In Palaeofavosites asper the transverse size of the adult corallites is again shown to be the most stable morphological character and should be of great value in taxonomic studies of this genus. Specimens collected from the Aymestry Limestone show no significant difference in corallite size from those collected from the Wenlock Limestone . The variation in the development of septal spines, wall thickness and the spacing of the tabulae is so great even within one colony, that they can be of little use in taxonomic work at a specific level.

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