

## THE RELATIONSHIP BETWEEN GROWTH FORM AND INTERNAL MORPHOLOGY IN FAVOSITID CORALS

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Growth form in Paleozoic colonial corals is commonly used as an indicator of paleo-environmental conditions. However, this character was also influenced by genetic factors, and it must be recognized that aspects of internal morphology were significant in the development of external form. In favositids a primary control on growth form was exerted by rates of corallite divergence, offsetting, and vertical growth, since the shape of the corallum base and growth surface resulted largely from these factors. This relationship worked in both directions; modifications of external shape that were apparently related to environmental conditions are reflected by measurable changes in internal morphology. In any favositid the most efficient packing of corallites is hexagonal, but this arrangement was thrown out of equilibrium by corallite offsetting. Rate of offsetting was largely controlled by internal packing stress and thus by the degree of corallite divergence. Periodic offsetting is reflected by a bimodal corallite size distribution (dimetrisism). The distribution of corallite shapes and sizes in different parts of a corallum is therefore a key indicator of mode of growth; growth form can be seen to have had an influence on characters that are commonly used as species discriminators.

This study is based on analysis of serial sections of *Paleofavosites subelongus* (Savage) from the uppermost Ordovician to lowermost Silurian of the east-central United States. This species is highly variable in internal characters and the size range and type of corallite packing can differ substantially between coralla. The early part of each colony's astogeny played a major role in the development of growth form; specimens at either end of the variation continuum show contrasting modes of growth which generated different growth forms. In one mode, colonies produced broad bases through early axial offsetting and developed patterns of growth in which corallites expanded rapidly to mature sizes. Subsequent rates of offsetting were sufficiently high that dimetrisism is common; such specimens most commonly have domical growth forms. In a second mode, colonies with lower rates of early axial offsetting have conical bases, a lower degree of dimetrisism, and commonly bulbous forms.

Patterns of subsequent growth of all coralla demonstrate the connection between internal and external characters. Periods of increased axial offsetting and higher rates of corallite expansion occurred in conjunction with phases of lateral colony expansion. Elsewhere in the colony, offsetting was also periodic but occurred predominantly at the edges of the axis and in colony margins; this pattern allowed the axial polyps to continue upward growth while shorter-lived polyps were generated to maintain lateral parts of the growth surface. Bursts of offsetting commonly occurred in bands with close-spaced tabulae and thickened corallite walls, and were sometimes associated with intervals of increased corallite mortality. *Paleofavosites subelongus* was apparently unable to produce offsets at the outermost colony margins and was thus confined to upwardly expanding growth forms with outcurved corallites. Serial sectioning of other species of *Paleofavosites* in which tabular forms predominate indicates that coralla with such shapes were able to generate abundant offsets along colony margins and could maintain axial regions with predominantly hexagonal corallites and low rates of offsetting.

Although internal characters apparent early in astogeny set the basic mode of growth of each *Paleofavosites subelongus* colony, the subsequent growth form was influenced by numerous other factors, including reorientation during life, partial mortality of the growth surface, and probable changes in environmental conditions. In most populations one of the two modes of basal growth predominates, but populations with overlapping characters also occur. The growth pattern set down near the base of each corallum may be related to the environmental regime prevailing at and following the time of colony initiation, but may also reflect genetic differences within and between populations.