ABSTRACT

SKELETAL MORPHOSIS IN THE LIFE HISTORY OF CORALS. ONTOGENESIS OF THE GENERA PORITES AND TUBASTREA: A COMPARATIVE ULTRASTRUCTURAL ANALYSIS.

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Ontogenesis in Scleractinia shows three patterns of skeletogenesis: primary, or larval, whence the corallite has a solitary basal skeletal plate serving as integrator to vertical structures, circumscribing theca and reinforcing sclerosepta; expansive, or bud-offset, which dispenses with basal plate and modifies thecal structures to increase skeletal mass; definitive, or adult, upon which rest traditional taxonomic identification of the species.

To ensure undoubted lineage, coral juveniles were reared in separate aquaria from planulae released by parental colonies. This is the first comparative ultrastructural analysis of the ontogenesis of larval corallites done on the five species of genus Porites from the Caribbean coral reefs, or any genus elsewhere.

Genus Porites, hermatypes, provided interspecific comparison (porites, astreoides, branneri, furcata, divaricata). The species differ in larval corallite sizes, trabecular profiles, spine ornamentations, scleroseptal arrangements and mesenterial organisations. They reveal five distinct structural patterns. All Porites, except for P. furcata, larval corallites have bilateral symmetry. There is an axial scleroseptal plane whereby the free cardinal scleroseptum (C) aligns with the counter (K) scleroseptum. These also align with the polyp's mouth slit. The axial plane is randomly orientated in all Porites colonies, unlike other Anthozoa in which oral slits face the substratum. To form the sclerosepta, long trabecular crystals arise simultaneously and coalesce randomly with short stereome crystals. The order of appearance of the sclerosepta exhibits not cyclic radial, nor cyclic bilateral, nor dorso-ventral sequence. The genetically determined trabecular profile is regulated by epidermal generation of crystal nuclei in an organic matrix. Spatial arrangement of sclerosepta alternate with mesenterial septa at equidistant positions. Porites species follow, with modifications, the life-permanent larval mesenterial-stage model of the burrowing actinian Edwardsia. Instead of Edwardsia's 8 complete plus 4 incomplete mesenterial septa, the Porites species may show either 6 complete plus 6 incomplete, or 7 complete plus 5 incomplete, partitions. The modifications occur at the counter (K) region. Thecal horizontal laminations, made of convex rugae and concave grooves, form by tensile phenomena. Flesh withdrawal reflects elastic stretching after an episode of skeletal accretion, not necessarily a daily one. Rugae depict elastic recoil distances, while grooves are new atachment sites.

The continuous skeletal organic matrix may serve as anchor between soft and hard tissue, and as shock absorber to modulate coral tissue movements with respect to its corallite. Ecological diagnoses of adult, profile of the larvae and taxonomic skeletal characters are compared. The release of the larvae is correlated, here, to environmental conditions.

Tubastrea coccinea, ahermatype, was described because of its clearly defined expansive skeleton and because it allowed a basis for inter-generic analysis when compared with hermatypic genus Porites. Mesenterial organisation shows Tubastrea to be an Edwardsian type with 8 complete and 4 incomplete units. Skeletal malleability is revealed in Tubastrea larval corallite with the formation of two mural structures. Re-modelling occurs also in the adult corallite. The larval skeleton is not a version of the adult, except for the trabecular profile. Skeletogenesis is a continuum ending in an adult stage by a process of gradual remodelling. The coral skeleton is a non-living dynamic entity, capable of accreting and being remodelled. Thus, changes in coral skeletal morphology are environmentally significant Soft tissue organisation reveals mesenterial interaction with basal epithelium at the edge zone.
The new patent stomodeum directs, in the asexual juvenile polyp, mesenterial organisation and scleroseptal arrangement. Embryological bud polarisation is not necessarily confined to the directive mesenteries of the parental polyp. From inception, the bud corallite fails to recapitulate larval skeletogenesis. The bud corallite resembles but is smaller than the adult. A positive correlation established between the corallite size and the degree of maturity shows that the larger corallites hold larger number of planulae, while the smallest, larval, and bud-offset, juveniles have none. The larval corallite represents a solitary coral with a confluent and fragile skeleton. Bud-offsets and adult corallites have fenestrated skeletons. These represent colonial corals sharing skeletal strength, sustenance and reproductive capabilities.

The corallite architecture gives mechanical succour to the mobile needs of its sessile polyp. The skeletal frame of the corallite safeguards the polyp's vital tissues: the mesenteries.