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THE EVOLUTION OF MODERN SCLERACTINIAN CORALS AND THEIR EARLY HISTORY

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Events of the Mesozoic era were most critical to the early history of scleractinian corals, ancestors of all modern species which populate shallow-water tropical to subtropical reefs. Most reef corals calcify rapidly and their success on reefs is related to a photosymbiosis with zooxanthellae. These one-celled algal symbionts live in the endodermal tissues of their coral host and are thought responsible for promoting rapid calcification. The evolutionary significance of this symbiosis is important for explaining the success of corals. Scleractinia stands out as one of the few orders of calcified metazoans that arose in Triassic time, after a greater proliferation of other calcified metazoan orders during the Paleozoic. The origin of this coral group, so important in reefs of today, has remained an unsolved problem in paleontology. The idea that Scleractinia evolved from older Paleozoic rugose corals that somehow survived the Permian mass extinction, persists among some schools of thought. However Paleozoic scleractiniamorphs also have been presented as possible Paleozoic ancestors. The paleontological record shows that the first appearance of Scleractinia was after the start of the Middle Triassic. Earliest Scleractinia reveal unexpectedly robust taxonomic diversity and high colony integration.

Results from molecular biology support a polyphyletic evolution for living Scleractinia and the molecular clock, calibrated against the fossil record, suggests that two major groups of ancestors could extend back to late Paleozoic time. The idea that Scleractinia were derived from soft-bodied, „anemone-like" ancestors that survived the Permian mass extinction is a viable hypothesis. The 14- million year Mesozoic coral gap stands as a fundamental obstacle to verification of many of these ideas. However, this obstacle is not a barrier for derivation of scleractinians from anemone-like, soft-bodied ancestors. The ephemeral „naked coral" hypothesis presents the greatest potential for solution of the enigma of the origin of scleractinians. It states that different groups of soft-bodied, unrelated „anemone-like" anthozoans gave rise to various calcified scleractinian-like corals through aragonitic biomineralization. It is suggested that this occurred during the mid-Triassic interval, following a lengthy Early Triassic post-extinction interval of marine perturbation. However, it may have occurred at least three other times prior to this interval. How important is a skeleton in classification within the order Scleractinia? Because of ephemeral characteristics, possession of a skeleton may not represent a clade of zoantharian evolution but instead represents a grade of organization. In the fossil record, skeletons may have appeared and disappeared at different times as some clades reverted to soft-bodied existence and these phenomena could account for notable gaps in the taxonomic and fossil record. A fuller understanding and possible solution to the problem of the origin of modern corals may be forthcoming. However it will require synthesis of diverse kinds of data and a integration of findings from paleobiology, stratigraphy, molecular biology, carbonate geochemistry, biochemistry and invertebrate physiology.