REEFAL CRYPTOS AND THE ACQUISITION OF PHOTOSYMBIOSIS

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Metazoan reefs have been differentiated into distinct open surface and cryptic communities since their inception, and reefal crypts have often housed a substantial proportion of overall community diversity. Despite their importance, however, ancient cryptic reef biotas are often unrecognised. Indeed, several groups of organisms currently considered as major fossil reef-builders may in fact occur more commonly as cryptobionts. These include chambered sponges such as early Cambrian archaeocyaths and Paleozoic-Mesozoic sphinctozoans. The established nomenclature used to classify reefal fabrics, which describes the dominant morphological form of the open surface community only, must be revised in the light of these observations. In addition, some Paleozoic-Mesozoic stromatoporoid and chaetetid sponges, and rudist bivalves, are better considered as soft-substrate platform dwellers than as framework builders.

In both modern and ancient reefs, solitary calcified heterotrophs (filter- and suspension-feeders) have been more important members of the cryptos than open-surface, framework-constructing communities. Heterotrophs were, however, more common on open surfaces during the Paleozoic-Mesozoic than in the Cenozoic. Yet many open-surface communities have always been dominated by phototrophic organisms: various calcified algae during the Paleozoic-early Mesozoic and mixotrophic metazoans, primarily scleractinian corals, from the late Triassic onwards.

The acquisition of photosymbiosis in scleractinian corals in the late Triassic may have been related to the appearance of dinoflagellates shortly before this time, and the proliferation of photosymbiotic reef-associated corals may have been favoured by increased predation pressure. In particular, it is proposed that the appearance of herbivorous and predatory fish in the Eocene promoted coral domination in the Tertiary. Photosymbiosis imparted novel metabolic capabilities to scleractinian corals allowing them, and hence reef communities, to invade the previously unexploited low-nutrient shallow marine environment. Open surfaces of modern reefs are thus dominated by phototrophic metazoans and heavily calcified algae, with heterotrophs tending to dominate only in cryptic niches.