

Micro-atolls of the Gulf of Kachchh: Environmental Interactions and Adaptations of the Corals-an Anecdote

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Abstract

The corals and coral reefs exhibit remarkable shapes and size in the marine realm. Any extant morphometric feature of any creature is a reflection of its interaction with the ambient environment and gradual evolutionary processes. The present study has for the first time revealed the occurrence of the panoply which is outcome of the evolutionary fitness mechanism, acquired by the coral colonies in the study area—Gulf of Kachchh, Arabian Sea. The observation note describes the typical growth form of corals which is not commonly found on any other reef area of India. The growth form known as -‘micro-atoll’ arises when certain abiotic conditions like sedimentation or desiccation alters coral growth. The note has explained the condition and species specific response in the study area.

Keywords: Corals, Gulf of Kachchh, micro-atoll, growth form, reef, desiccation

INTRODUCTION

Observation Note

Coral reefs are the underwater wonderlands of incredible biodiversity. The term coral refers to marine, sedentary and mostly colonial animals. The basic unit of the colonies is termed as polyp. It resembles sea anemone *i.e.*, having radial symmetry and a crown of tentacles at the free end and the other end is attached at the hard substratum. The size of the polyp varies from few mm to up to a meter. Taxonomically the animals belong to the phylum cnidaria having the characteristic of tentacles armed with stinging cells (cnidoblast) that is often used to paralyse the prey [1]. The polyps secrete calcium carbonate surrounding its body and form a cup shape in which the soft polyps retract for protection. Numerous polyps together form coral colonies and many such colonies together form coral reefs. India is fortunate to have such a spectacular ecosystem brimming with countless marine invertebrates [2, 3].

The distribution of the coral reefs is found at four major sites on the Indian coast *i.e.*, Andaman and Nicobar Islands, Lakshadweep, Gulf of Kachchh and Gulf of Mannar [2, 3]. The present study is confined to the Gulf of Kachchh (in the state of Gujarat), located between 22°15' and 23°40' N Latitudes and 68°20' and 70°40' E Longitudes. It's an east –west oriented funnel shaped indentation of Arabian Sea [4, 5].

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The present study involves coral-environment interaction and adaptation of coral growth form in the Gulf of Kachchh reefs. The coral reefs of Andaman and Nicobar, Lakshadweep and Gulf of Mannar shows diverse coral colonies with growth forms mostly branching, foliose, plate corals and massive; however, not dominated by massive corals. The major coral growth forms prevailing in the GoK coral reefs are massive, sub-massive, foliose, plate and encrusting (Figure 1). However, it shows dominance of massive and sub-massive colonies in the GoK [6, 7]. Moreover, the massive

coral colonies prevailing at the GoK reefs do not show typical spherical morphology; rather it's an adaptation of massive coral heads. The spherical colony appears live at its peripheral margin and dead at its top which gives it the appearance of a miniature atoll, hence Chappell coined a term '*microatoll*' for such growth form [8].

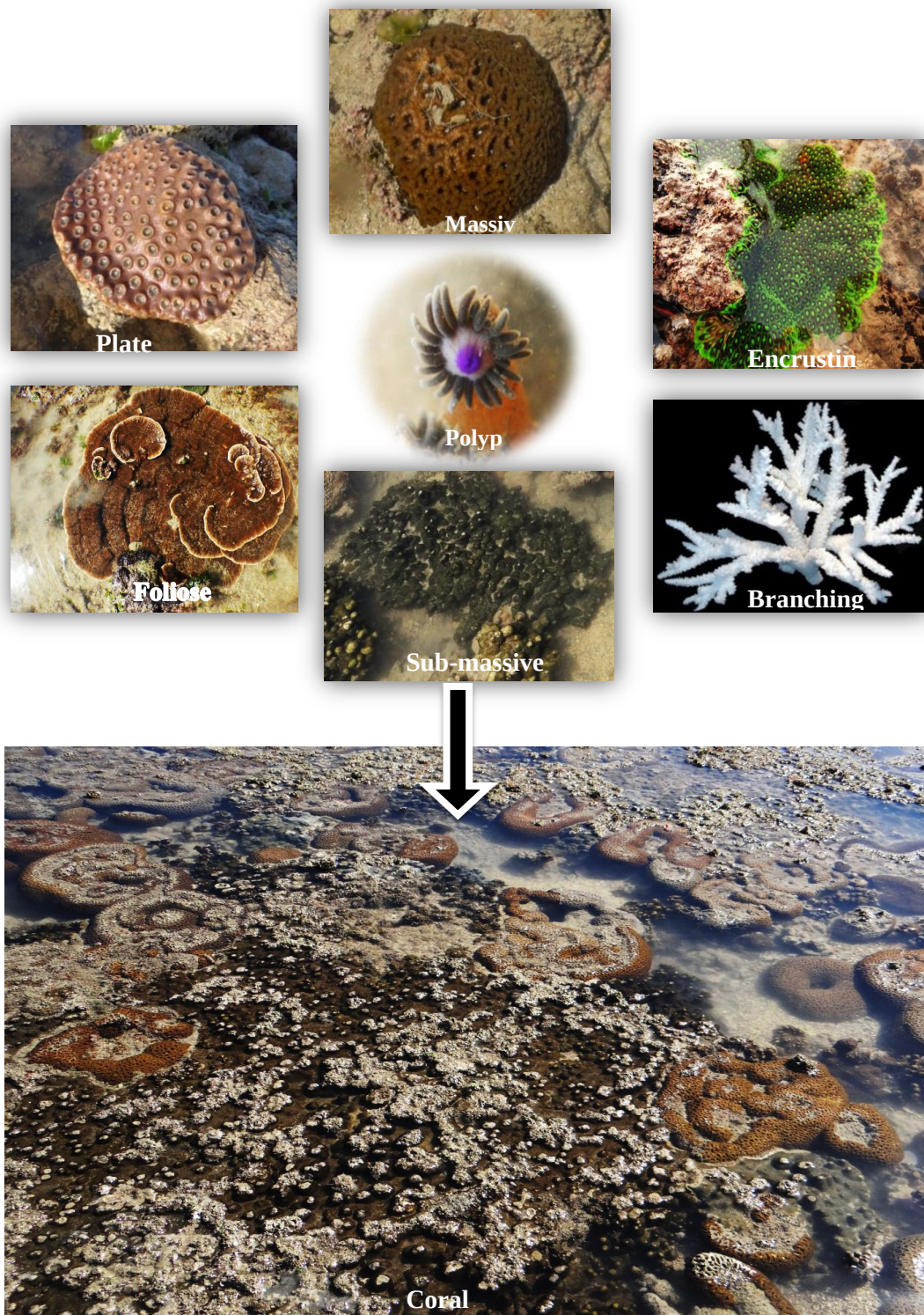


Figure 1. Showing coral reef formation: Polyps together form various types of coral colonies (shown different growth forms) and various coral colonies build up coral reef.

Hence, the coral colony morphology of the GoK can be prominently distinguished from the other three reefs of the country. This typical habit of the GoK coral colonies can be explained as; during low tides the reef flat of the GoK coral reefs gets exposed to air and sunlight. The sub-aerial exposure poses stress on the live coral polyps leading to desiccation and death (Figure 2). Therefore, the coral tops can remain alive till it reaches minimum water level of low tide. Once attaining the water level height, the vertical growth of the coral colony ceases and marginal growth increases. The growth pattern resembles the expansion of a ring *i.e.*, radial expansion (Figure 3). However, it is noteworthy here that, on certain islands of the GoK, the geomorphology of the reefs gives rise to depression of bottom or particularly tidal pools (small in size) which allows water retention even during low tide. Such conditions allow better vertical growth of corals compared to other reef area; hence one can also observe true massive corals (with live tops) in this area. Moreover, at the reef crest and reef edge, the corals neither remain exposed for longer time nor frequently, therefore this zone also supports a variety of growth forms other than microatolls.



Figure 2. A typical photograph showing both the stages *i.e.*, Stage-1: pre-microatoll and Stage-2: microatoll (up to the surface of water, the colony shows ideal massive growth form but once attaining the water surface, the coral top desiccation begins leading to peripheral growth).



Figure 3. Various coral colonies with micro-atoll growth form: (a, b) *Favia sp.* (c) *Porites sp.* (d, e) Reef view.

On the other side, it has been observed that the intertidal areas of the GoK reefs show the presence of dead coral heads measuring about 1 m height and diameter even exceeding the height. Such large colonies date back more than thousands of year *i.e.*, 2000 to 5000 year BP [9]. This proves the prevalence of better environmental conditions which allowed higher vertical growth (higher compared to present day corals) of corals before thousands of years. One of the affecting factors may be the higher sea level of GoK at that time period [10]. Thus, the sea level regression affected the coral morphology which resulted in the adaptation of coral growth form from large massive coral heads to present day microatolls.

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