Title of the thesis: Long-term paleobiological patterns of the Late Cretaceous bivalves from Ariyalur, Tamil Nadu

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ABSTRACT

Understanding the long-term patterns of biological and ecological evolution and the influence of various abiotic factors on these patterns is one of the key aspects of paleobiology. The nearly continuous marine succession of the Late Cretaceous Cauvery Basin, well exposed in and around the Ariyalur region, Tamil Nadu, provides an excellent opportunity to evaluate the interplay between various environmental changes and the evolution of biota. Using the bivalve fossil record of Ariyalur, this study investigates the long-term patterns of morphological, paleoecological, and paleobiogeographic evolution in the dynamic environmental context of the Late Cretaceous. The study reveals a shift in bivalve paleocommunity structure from the Garudamangalam Formation (middle Turonian–Santonian) to the Kallankurichchi Formation (early Maastrichtian), with a decline in diversity and an increase in the dominance of epifaunal taxa, especially oysters. This shift is attributed to ecological factors rather than taphonomic processes, as the soupy substrate of the Kallankurichchi Formation was unfavorable for infaunal taxa, while the epifaunals thrived due to their specialized adaptive strategies. Although predator-prey interaction, an important biotic response to shifting community structures, could not be evaluated throughout the basin, the present study provides the first dataset of gastropod drilling predation on molluscan prey from the Coniacian. While the assemblage-level drilling intensity is 0.27 for bivalves, three common bivalve species exhibit drilling intensities ranging from 0.32 to 0.62. In the case of gastropods, 27 complete drillholes have been found in four species of *Turritella*. Behavioral stereotypy of predators is evident in some prey species, especially bivalves. Additionally, the study documents a significant increase in the body size of Ariyalur bivalves from the Cenomanian to the Maastrichtian, although this increase is not gradual and does not strictly follow Cope's Rule. Instead, a non-directional trajectory of body size increase is observed across various taxonomic ranks. The similarity between the long-term

trends at both higher and lower taxonomic levels suggests congruence of the underlying processes at these levels. Environmental factors, such as decreasing paleolatitudes and cyclic sea-level changes, likely influenced body size variation. The decrease in paleolatitude or the northward movement of the Indian plate may also be responsible for the long-term shift in paleobiogeography of the Ariyalur bivalves. The paleobiogeographic affinity of the Ariyalur bivalves exhibits a shift in affinity from the Austral province (Albian–middle Turonian) to the East African province-subprovince (Campanian–Maastrichtian). This paleobiogeographic pattern is evident across different taxonomic levels and ecological groups and can be attributed to the change in relative distances between the Ariyalur sub-basin and the other provinces throughout the Late Cretaceous.

Keywords: Long-term patterns, Late Cretaceous, Bivalvia, Ariyalur, community structure, body size, predator-prey interaction, paleobiogeographic affinity, environmental changes