

# Sequence Stratigraphy of Paleocene Sediments of Pondicherry area, Cauvery Basin, South India, Tamil Nadu

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**Abstract:** *The present study focuses on understanding the sequence stratigraphic framework of Ravathamkuppam pond section to analyze the micropaleontological - ichnological aspects in order to determine the depositional environment and sea level changes during the Lower Tertiary period in the Cauvery Basin. The Ravathamkuppam pond section consists of fine grained calcareous sandstone with abundant foraminiferal assemblage and rare ichnofossils indicating marine flooding event representing the Transgressive Systems Tract and High Stand Systems Tract assemblage indicates a gradual upward increase of Palaeobathymetry*

**Keywords:** Sequence stratigraphy, Foraminifera, Trace fossil, Pondicherry, Cauvery Basin

## 1. Introduction

The Lower- Tertiary sediments of Cauvery basin occurs as isolated patches in Pondicherry, Vridhachalam and Ariyalur area. The pioneer work on the area was carried out by Blanford (1862); his work provides a frame work for all future reference. After his work, many attempts have been made on the area to study faunal aspects like Bryozoans, algae, ostracodes and foraminifera by many workers. There are hardly any work has been made to study the depositional sequence analysis of the Lower-Tertiary sediments of the Cauvery Basin. The present study focuses on understanding the significance of microfossil and trace fossil assemblages within the transgressive-regressive cycles and to analyze the micropaleontological sedimentological- ichnological aspects in order to determine the depositional environment and sea level changes during the Lower Tertiary period in the Cauvery Basin. This integrated study helps in understanding the transgressive and regressive cycles in the T-R sequence stratigraphic paradigm.

The concept of sequence stratigraphy, originally developed by the Exxon research group in the 1980s (e.g., Donovan et al., 1988; Haq et al., 1987;) emerged as an important tool over the past few years and the integrated studies on the micropaleontological, sedimentological and ichnological aspects have helped immensely in understanding the depositional environment. Microfossil biostratigraphy have proved to be pragmatic tools for recognizing various sequence parameters, particularly in monotonous lithologies generally encountered in deep water basins (e.g., Simmons and Williams, 1992). For example, sequence stratigraphic boundaries (SB) can easily be identified based on erosional surfaces (hiatuses), which can be recognized based on the interruption of successive biozones in a stratigraphic column. The missing biozones reveal the magnitude of erosion and/or non-deposition. In contrast, the maximum flooding surface (MFS) and first marine transgressive surface (TS) reflects the rising sea level. Sediment deposition can be identified and dated based on microfossil

assemblages. Biostratigraphy and sequence stratigraphy are thus excellent tools for the analysis of sediment deposition in marine basins (Vail et al., 1977; Van Wagoner et al., 1988; Sturrock, 1996; Zellers, 1995; Armentrout, 1996; Reddy et al., 2000; 2005).

## 2. Sequence Stratigraphic Interpretation of Ravathamkuppam Pond Section

The Ravathamkuppam pond section consists of fine grained calcareous sandstone with abundant foraminiferal assemblage and rare ichnofossils indicating marine flooding event representing the Transgressive Systems Tract and High Stand Systems Tract assemblage indicates a gradual upward increase of Palaeobathymetry (Fig. 7). The Ravathamkuppam pond section with the thickness of about 2.85 m thick rock exposed behind the village in a pond section Ravathamkuppam (N12°00'55.7" and E79°46'33.6") of about 2.85m of Pondicherry area, Cauvery basin.

### 2.1 Transgressive Systems Tract (TST)

The calcareous sequence consists of highly fossiliferous calcareous fine grained sandstone and marl are the dominant lithology in this package. Strata of this sequence exposed in the quarry section represents the transgressive surface generated during rapid sea level rise. The Transgressive Surface (TS) and is marked by the presence of benthic & planktic foraminifera and trace fossils assemblages indicating first marine flooding event. The Transgressive Systems Tract (TST) is composed of deeper upward parasequence represented by calcareous fine grained sandstones and marl with benthic and planktic foraminifera. The stacking pattern of these retrogradational parasequences corresponds to intermittent flooding events. Both planktic and benthic foraminiferal *Subbotina triloculinoidea*, *S. trivialis*, *Ps. Variant*, *G. compressa*, *G. planocompressa*, *G. imitata*, *G. ehrenbergi* assemblage indicates a gradual upward decrease in Paleobathymetry.

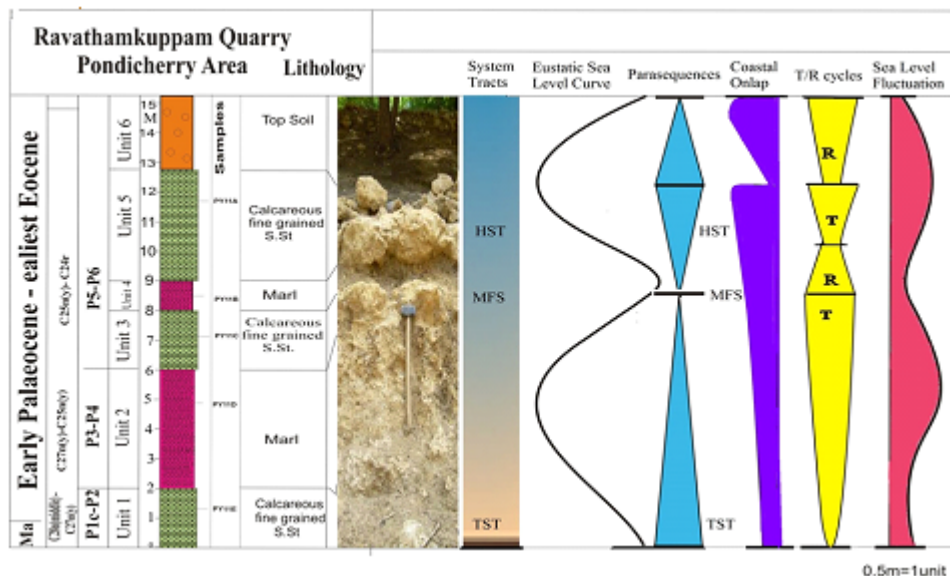


Figure 7: Lithology Sea level curve of Palaeocene-Early Eocene, planktic foraminifera in the Ravathakuppam Quarry of Pondicherry area, Cauvery Basin, Southern India.

### 3. Maximum Flooding Surface (MFS)

Highly fossiliferous limestone and marly bed are observed in the upper part of the Transgressive Systems Tract. The limestone and marl bed were deposited in the oxygenated environment, which experienced sediment starved condition and represent the flooding was not so deep to produce the anoxic environment in the basin. Abundant foraminifera are noticed in the limestones and marl bed in the quarry section. Maximum Flooding Surfaces (MFS) is well documented in the section and are abundant in benthic and planktic foraminifera (*Globanomalina chapmani*, *Globanomalina pseudomenardi*, *Morozovella preangulata*, *Acarinina strabocella*, *Acarinina soldadoensis*, *Acarinina praetopilensis*, *Globanomalina australiformis*) Above this surface, the fossils abundance drastically declines. The maximum flooding surface is sharp located in between the calcareous limestone and marl bed corresponds to the upper surface of abundant microfossil. The abundant microfossil and ichnofaunas suggest their full life mortality in a tranquil environment, generally observed during standstill conditions occurring in maximum flooding event. The Maximum Flooding Surface represent microfossil in the limestones bed represents the upper limit of the Transgressive Systems Tract. The Maximum Flooding Surface is clearly exhibits in Thondaimanattam Quarry section of Palaeocene sediment of Pondicherry area. However, the microfossils are abundant at the top of the uppermost limestones and marl bed where they form a continuous shell pavement. This horizon is interpreted to represent the surface of maximum starvation. The dominant fossils in this region of system tract are benthic and planktic foraminifera along with ostracodes.

### 4. Highstand Systems Tract (HST)

The highstand systems tract is believe to record late stage transgressive and subsequence highstand phases of the sea level cycle. The highstand system tract (HST) is composed of one Parasequence represented by hard calcareous fine grained sandstone, where in the microfossil viz., *Acarinina*,

*Igorina* and *Morozovella* population is drastically declines. The limestone has low fossils content and suggests relative shallowing upwards sequence.

### 5. Discussion

The Ravathakuppam pond section consists of fine grained calcareous sandstone with abundant foraminiferal assemblage and rare ichnofossils, the first marine flooding initiated during the deposition of calcareous limestone which revealed by the presence of benthic foraminiferal assemblage indicating marine flooding event representing the Transgressive Systems Tract assemblage indicates a gradual upward increase of Palaeobathymetry

### 6. Conclusion

The sedimentary sequence of palaeocene sediments of Pondicherry area chiefly comprises of highly bioturbated mixed siliclastic- carbonate sediment and consists of rare Ichnofossils and planktic foraminifera (*Globoanomalina*, *Parasubbotina*, *Subbotina Praemurica*, *Igorina*, *Acarinina*, *Morozovella*, *Pseudohastigerina*, and *Astrorotalia*), Benthic foraminifera (*Anomalina*, *Anomalinoidea*, *Bulumina*, *Cibicides*, *Cibicidoides*, *Dentalina*, *Eponoides* (*E. cribrorepanus*), *Gavelinella*, *Guttulina*, *Gyroidina*, *Lagena*, *Nodosaria*, *Nuttalia*, *Pleurostomella*, *Quinqueloculina*, *Stilostomella*, *Triloculina*, *Spiroloculina*, and *Vaginulinopsis*). Based on the sediment and micropaleontological data, 3rd order T-R cycles were identified and Ichnofossils and microfossils assemblages have helped in understanding their nature of occurrence in depositional system tract.

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