ABSTRACT

The Cretaceous system of Cauvery basin consists of an exceptionally complete shallow marine sequence with rich faunal succession of Albian – Maastrichtian age. These Cretaceous exposures are represented on the coastal plain of Tamil Nadu, in the districts of Ariyalur, Vridhachalam and Pondicherry. Extensive studies have been carried out for more than a century to study the Cretaceous rocks of Cauvery basin, particularly of the Ariyalur area, which affords the best and most complete representation of the succession. Earlier studies were focused mainly on lithostratigraphic classification and description, and biostratigraphic studies. Cauvery basin has horst-graben morphology and comprises of several depressions separated from one another by subsurface ridges. Ariyalur-Pondicherry sub-basin is the northern most depression of the Cauvery basin. It is a linear feature, aligned NE-SW and extends in to the offshore. This research work has been carried out in an attempt to develop the sequence stratigraphy of Late Cretaceous sediments of Ariyalur-Pondicherry sub-basin.

Late Cretaceous well cutting samples at 5m interval have been collected from three subsurface wells, namely, SS-1, SS-2 and SS-3 located in the Ariyalur-Pondicherry sub-basin. Equivalent outcrop exposures around Trichinopoly have been studied for the purpose of correlation with subsurface data.
Detailed foraminiferal stratigraphic work has been carried out that includes biozonation and age determination, paleobathymetry and paleoecological interpretation. Delineation of the sequence stratigraphic surfaces, namely, SB, TS and MFS and identification of systems tracts, namely, TST and HST for the subsurface samples have been done based on foraminiferal data. Well log data for these three subsurface sections have also been studied in order to validate the sequence stratigraphic surfaces as identified from biostratigraphic data. Petrographic studies including diagenesis, clay mineral analysis, and total organic carbon (TOC) content have been carried out to interpret the depositional processes and paleoenvironmental conditions. Sequence stratigraphic interpretation of the equivalent outcrop sections is based on field lithological studies, faunal assemblages and petrographic analysis. A systematic attempt has been made to correlate the subsurface information with the outcrop geological data with the objective to derive sequence stratigraphic model of the Late Cretaceous sediments of Ariyalur-Pondicherry sub-basin.

Correlation of subsurface and outcrop exposures show that three 2\textsuperscript{nd}/3\textsuperscript{rd} order sequences developed in the Late Cretaceous sedimentary sections of Ariyalur-Pondicherry sub-basin. The sequences are named with increasing depth as Sequence A, B and C respectively. Sequence C is partly recorded in SS-1 and SS-2 sections and comprises HST. In SS-3 section, complete Sequence C is documented that comprises of TST, MFS and HST. Lower SB of Sequence C lies at the bottom of *D. asymetrica* biozone and the upper SB lies at the boundary of *G. bulloides - G. ventricosa* and *G. linneiana* biozones.
Sequence B is recorded in all the subsurface sections, SS-1, SS-2 and SS-3 and its age is equivalent to *G. linneiana* biozone. It comprises TST, MFS and HST. Sequence B is partly preserved in outcrop sections, as Sillakudi Formation represents TST of Sequence B. Campanian- Maastrichtian boundary marks the upper SB of Sequence B. In outcrop, Saturbhugam sandstone and Kaller conglomerate bounds the Sillakudi sandstone and defines respectively the equivalent lower SB and upper SB of Sequence B. Sequence A is partly preserved in SS-1 section and comprises TST, whereas in SS-2 and SS-3 sections it is completely represented by TST, MFS and HST. KTB marks the upper SB of Sequence A in subsurface sections. Sequence A is represented by Kallankurichchi Formation and Ottakovil Formation in outcrops. Ferruginous limestone and lower arenaceous limestone units of Kallankurichchi Formation marks the TST of sequence A, top of *Gryphea* limestone unit defines the MFS and the overlying unit of upper arenaceous limestone and Ottakovil Formation represents the HST of sequence A. In outcrop, Kallamedu Formation which is a fluvial sandstone deposit defines the upper SB of Sequence A.

Benthic foraminiferal assemblage suggests that the depositional environment for the subsurface sections was in general outer shelf to slope and paleobathymetry is recorded to be 200m to greater than 500m. In certain depth intervals the paleoenvironment is inferred as inner to middle shelf. The depositional environment for the outcrop sections was inner to middle shelf as suggested by characteristic calcareous benthic assemblage.
Correlation of log data shows KTB lies at the base of bow-shaped gamma ray response in SS-1, SS-2 and SS-3 sections. Petrographic and clay mineral analysis provides the evidence that the source of the marine sedimentation in this sub-basin was a granitic provenance. The area was tectonically stable during Late Cretaceous time and the climate was warm, humid and tropical. With the fluctuation of relative sea level, the variation of oxic-anoxic is recorded, though the fluctuation in oxic-anoxic condition is not constrained by age or paleobathymetry. Sediments of the study area have negligible potential for hydrocarbon deposit, as deduced from low TOC values.