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Planktonic Foraminifera from Vridhachalam area, Cauvery Basin, South India, Tamil Nadu

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Abstract: ***The paper records the occurrence of well-preserved planktic foraminifera from Vridhachalam area of the Cauvery Basin, Tamil Nadu, south India. Preliminary analysis of the samples from Vridhachalam area shows abundant well preserved planktic foraminifera belonging to Parasubbotina, Subbotina, Igorina, Acarinina and Morozovell., Seventeen planktic foraminiferal species recorded in all the outcrop sections indicate Palaeocene – early Eocene age. Reworked late Maastrichtian planktic foraminiferal species (Hedbergella holmdelensis, Globotruncana arca, and Globotruncana sp., Rugoglobigerina rugosa are common suggesting erosion of uplifted Cretaceous sediments. Species are illustrated based on SEM microphotographs.***

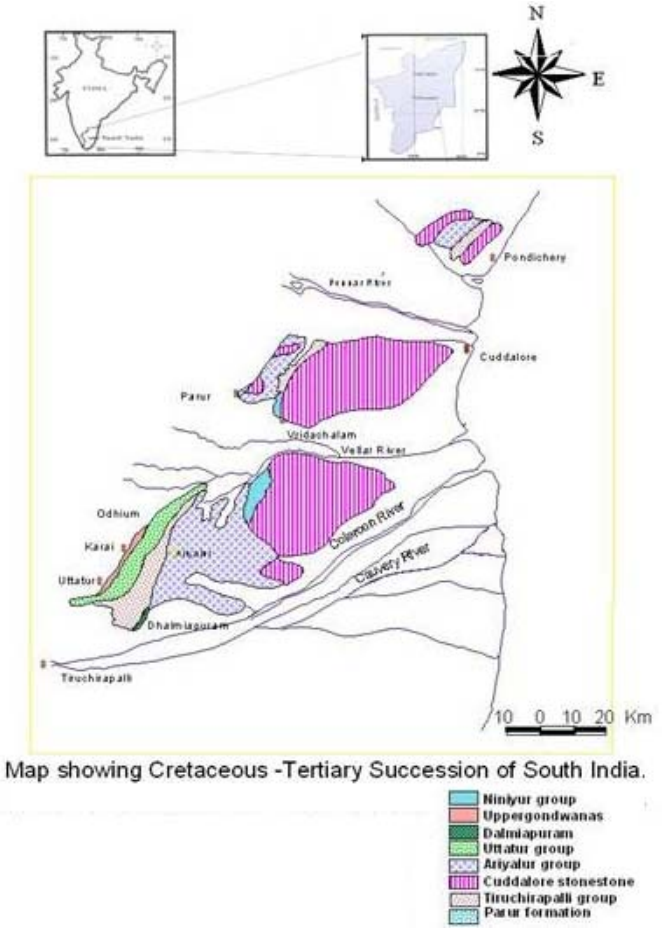
Keywords: Planktic Foraminifera, Paleocene-Eocene, Biostratigraphy, Vridhachchalam, Cauvery Basin

1. Introduction

The Cauvery Basin is located on the south eastern fringe of peninsular India. It covers approximately 25,000 sq km on land and extends from Pondicherryin the north to Tuticorin in the south. The basin extends towards east in the offshore area. Archaean metamorphics and igneous rocks with a NE-SW Eastern Ghat trend to form the basement. Uttatur, Trichinopoly, Ariyalur and Niniyur are functional stratigraphic divisions for marine Cretaceous–Tertiary rocks of the Cauvery Basin [2]. The early account of geology and paleontology of the Vridhachalam area was that of Blanford [1]. He classified the sediments of the area into lower fossiliferous and upper unfossiliferous beds. Based on the lithological and paleontological distinctions, the Paleocene sediments were considered as separate unit namely "Pondicherry Formation" with Pondicherry as its type locality [6]. Since then the area is well known in the geological literature for its variety and abundance of fossils.

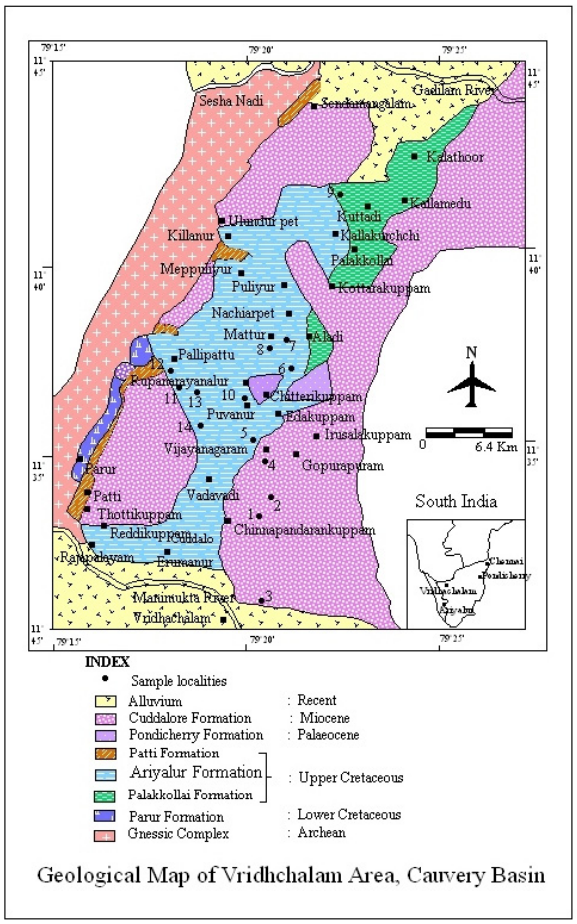
2. Geological Setting and Methods

The Cauvery basin represents a passive margin sedimentary system that developed in response to the separation of the Indian subcontinent from Australia and Antarctica in the early Cretaceous/late Jurassic, contemporaneous with the first phase of seafloor spreading responsible for the formation of the Indian Ocean. The basin forms a half graben morphology trending NE-SW with a regional dip of 5°-10° to the east and southeast due to continental rifting between India, Australia and Antarctica plates [8]. In the Cauvery basin, Cretaceous-Tertiary strata consisting sediments mainly of marls, algal limestone, marly limestones and calcareous fine grained sandstone, claystones, are exposed near Tiruchirapalli, Vridhachalam and Pondicherry area along the east coast of south India (Fig. 1).The sediments of the Vrindhachalam confine to a small area of about 20sq. kms. at the northeastern end of Vrindhachalam sedimentary sequences in the South Arcot



Map showing Cretaceous -Tertiary Succession of South India.

Figure 1: Map showing Cretaceous –Tertiary Succession of South India



Geological Map of Vridhchalam Area, Cauvery Basin

Figure 2: Geological Map of Vridhachalam Area, Cauvery Basin

Vallalar district and are well exposed near Kotteri (11º 35´ 00" N: 79º 23´ 15" E). The limestone beds are intercalated with alternating marl band, a feature observed in well section near Chitterikuppam (11º 34´ 25" N: 79º 21´ 45 "E) and Goupurapuram (11º 33´ 45" N : 79º 23´ 47" N: 79º 23 ´47"E). Paleocene sediments are also noticed at the western side of Irusalakuppam (11º 43´ 30" N: 79º 21´ 12" E) and Rupnarayanalur (11º 37´ 00" N: 79° 18´ 12" E), Verrareddikuppam (N11o 36' 158"; E 79o 21' 138"),Chinnapandarakuppam (N11°33'08.9": E79°20'23.6"),Irusalakuppam (N11°34'35.9"; E79°20'33.6"),The outcrops are also exposed along nalla cutting near Edakuppam Village (N 11°35'09.0";E 79°29'13.0"),Kuruvankuppam (N11°37'04.0": E79°21'13.0"), Kuttatikallankurchi (N11°41'36.0": E79°22'27.0"),Mathur (N11°36'14.7":E79°19'59.5"), Puvanur (N11°36'29.6": E79°18'43.4") and Vijayamanagaram (N11°35'41.5": E79°18'51.9") (Fig. 2).At places, there are some exposures of calcareous siltstones grading into claystone. The lower and upper contact with the unfossliferous Palakkolai Formation and Cuddalore sandstone is unconformable. The contact between the Pondicherry and the underlying Campanian Maestrichtian sediments are mostly covered by the recent alluvium. A critical Examination of the Pondicherry Formation (Vridhachalam) shows that they dip at 4o to 8o in south easterly direction. The striking feature of the two is the sharp contact in lithology. The rich assemblage of lammellibranchs, foraminifera and ostracoda of the Ariyalur Formation (Middle Maestrichtian) are absent in the overlying Pondicherry Formation (Paleocene). This study is an effort in refining the of Paleocene to early Eocene planktonic foraminifera and biostratigraphy of the Vridhachalamarea.Fig.2 shows the geological map of the Vridhachalam area with the distribution of various rock-units and the location of outcrops based on Rajagopalan [7 & 8] with slight modification. The area is a challenge for foraminiferal biostratigraphic studies because there are few rock exposures as most of the area is under cultivation and occupied by irrigation lakes and ponds. The few outcrops show very limited exposures of generally a few meters thickness. Samples were collected from various outcrop sections with the main objective to determine the age and biostratigraphy of the Palaeocene through Eocene sediments based on planktonic foraminifera. These samples have yielded abundant well preserved planktonic foraminifera belonging to *Parasubbotina, Subbotina, Igorina, Acarinina* and *Morozovell* Species are illustrated based on SEM microphotographs. More detailed biostratigraphic work is in progress to identify individual biozones to determine the completeness of the sections.

In the laboratory, samples were processed using standard processing techniques. The samples were disaggregated following Jones [4]. For each sample, about 300 g was crushed into 0.5 cm fragments and disaggregated by alternating heating with 1:1 sodium sulphate anhydrite (Na2So4) and cooling (freezing) as described by Glaessner [3]. The process was repeated several times to free foraminiferal specimens. After disaggregation the samples were washed with tap water to remove the clay fraction and the clean residue was dried. The residue was sieved into different fractions, and each fraction examined under the light microscope. Microfossils were picked, identified and mounted on faunal slides for a permanent record. Selected specimens were mounted on SEM stubs and coated with gold palladium/platinum and microphotographed using SEM (Jeol-JSM 25 and Jeol JSM 810A) and illustrated in Plates 1-3.

3. Planktonic Foraminifera

A total of Seventeen species of planktonic foraminifera belonging to six genera (*Parasubbotina, Subbotina, Igorina, Acarinina ,Morozovella,* and *Pseudohastigerina*) and four families are recognizedin the present study.Of the six genera recorded, the species of the genus *Morozovella* is abundant. The angulo-conical *Morozovella* constitutes the dominant element in the assemblage and represented by eight species, *Morozovella occlusa, Morozovella aequa, Morozovella angulata, Morozovella preangulata, Morozovella acuta, Morozovella acutispira, Morozovella velascoensis,* and *Morozovella conicotruncata,* The *Morozovella conicotruncata* and *M. velascoensis* are the highly specialized angulo-conical forms with large, conical test, wide open umbilicus with prominent peripheral keel. The species of *Acarinina* is common and represented by *Acarinina strabocella*. The genus *Subbotina* is well

represented with two species, *Subbotina patagonica,* and *S. hornibrooki* of late Paleocene – early Eocene age. Genus Igorina is represented by two species (Igorina tadjikistanensis and Igorina albeari) is very distinct and limited in occurrence. The genus Parasubbotina is represented by single species. Parasubbotina varianta of Paleocene age. Pseudohastigerina is represented by a single species of early Eocene in age. The presence of reworked late Maastrichtian species in zone P1a (e.g., Hedbergella holmdelensis, Globotruncana arca, and Rugoglobigerina rugosa, [5] indicates erosion and redeposition under intensified current activity.

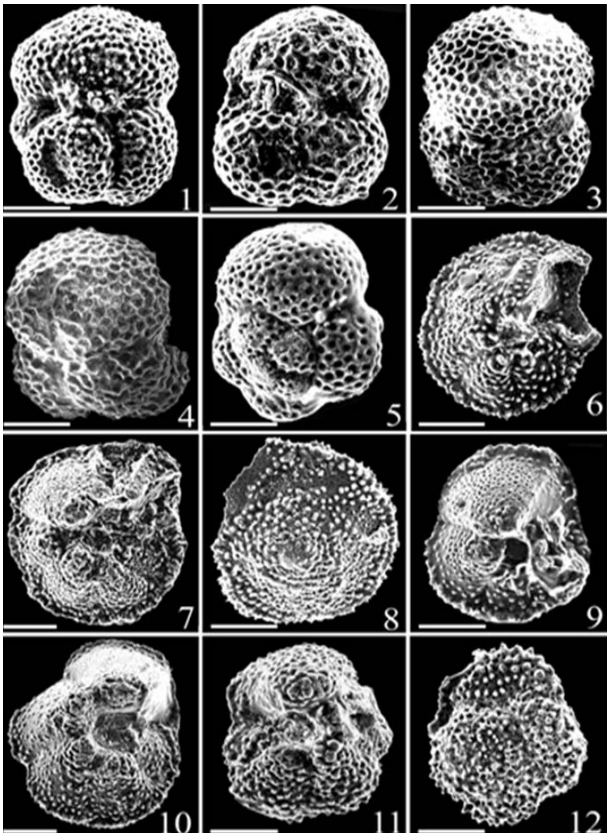


Plate 1 - Planktic foraminifera from Goupurapuram (VR 3),Irusalakuppam (VR4) , and Idakuppam(VR 5) sections . Scale Bar =100um .Figs. 1-4. - *Subbotina patagonica* (Todd and Kniker, 1952), samples (VR 3),(VR 4) ,(VR 5). 5 - *Subbotina hornibrooki* (Todd and Kniker, 1952), sample (VR4), 6 – *8 Morozovella occlusa* (Loeblich and Tappan, 1957), sample (VR 3),9 - *Morozovella aequa* (Cushman and Renz, 1942); sample (VR 3),(VR4) ,10 - *Morozovella acuta* (Toulmin, 1947) (White,1928), sample (VR 3),(VR4),11 - *Morozovella preangulata* (White, 1928), sample(VR 3),(VR 4),12 - *Morozovella acutispira* (Bolli & Cita, 1960), sample (VR 3),(VR 4) ,(VR 5).

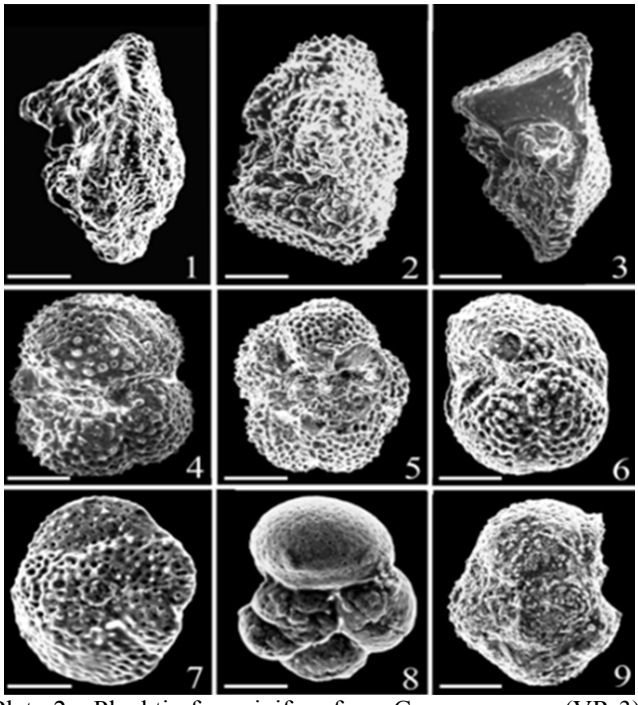


Plate 2 - Planktic foraminifera from Goupurapuram (VR 3), Irusalakuppam (VR4) and Idakuppam (VR 5) sections . Scale Bar =100um .Figs. 1-3 - *Morozovella velascoensis* (Cushman, 1925), sample (VR 3),(VR4), 2 - *Morozovella conicotruncata* (Subbotina, 1947), sample (VR 3),(VR4),4 – *Morozovella aequa* (Cushman and Renz, 1942) ,sample (VR 3),(VR4),5 - *Acarinina strabocella* (Loeblich & Tappan,1957), (VR 3),(VR4) , 6 – *Igorina tadjikistanensis* (Bykova, 1953) sample VR 3, 7 – *Igorina albeari* (Cushman, Bermudez, 1949) sample (VR 3),(VR4), 8 - *Globanomalina ovalis* (Haque, 1956), sample VR3.9 - *Parasubbotina varianta* (Subbotina, 1953), samples(VR 3),(VR4).

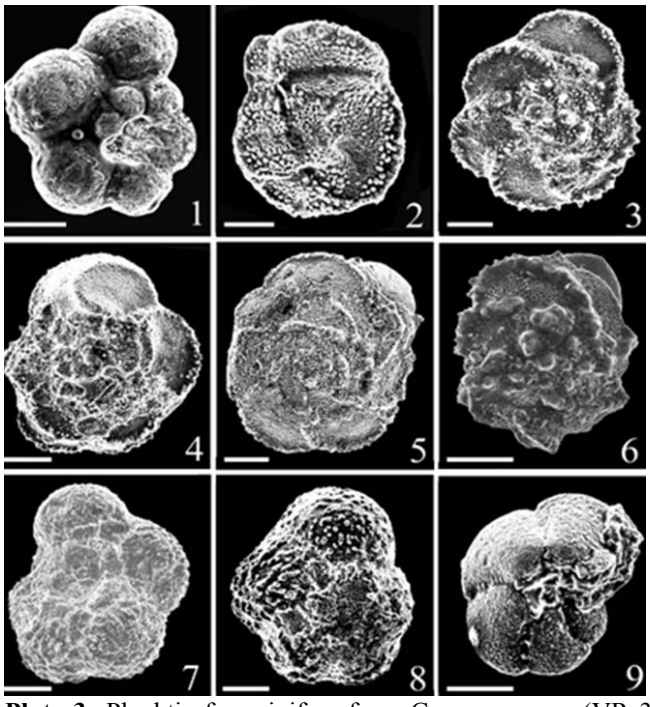


Plate 3: Planktic foraminifera from Goupurapuram (VR 3) ,Irusalakuppam(VR4) Kuruvanakuppam (VR6) and Aladi(VR7), Scale Bar =100um. Figs 1 – *Hedbergella holmdelensis* (Olsson , 1964), Samples (VR6),(VR7), 2 - ?*Morozovella* sp., sample (VR 3),(VR4) ,3-4,5 & 7 –

Globotruncana arca (Cushman 1927), samples (VR6),(VR7),6 & 7 – *Globotrauncana* sp., 8-*Rugoglobigerina rugosa* (Plummer, 1927) samples (VR6),(VR7) , 9 – *M. angulata* (Morozova, 1939),sample (VR 3),(VR4).

4. Discussion and Conclusions

The Paleoecene - early Eocene sequence of Vridhachalam area is important,because well-developed marine outcrops which has yielded richest and well preserved planktic foraminiferal fauna so far recorded from South India. Seventeen species of planktic foraminifera belonging to the genera *Parasubbotina, Subbotina, Igorina, Acarinina* and *Morozovella.* The presence of reworked late Maastrichtian species in zone P1a (e.g., *Hedbergella holmdelensis, Globotruncana arca,* and *Rugoglobigerina rugosa*) indicates erosion and redeposition under intensified current activity. These planktonic foraminiferal species spanning an interval from the early Paleocene to early Eocene Zone (P1b - P9). More detailed biostratigraphic work is in progress to identify individual zones and determine the completeness of the sections.

5. Acknowledgement

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