DISCOVERY OF MIXED COCCOLITHS FROM MUD VOLCANOES OF BARATANG ISLAND, ANDAMANS, INDIA

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ABSTRACT

The coccoliths of samples recovered from the mud volcanoes suggest the presence of more or less uninterrupted marine Campanian-Danian sequence of rocks containing Cretaceous-Tertiary boundary in Andaman basin. Marker Nannofloral elements for Upper Palaeocene, Lower-Middle Eocene were not found, whereas latest Eocene is confirmed and denotes the youngest element of the assemblage. Significant transgressive event of early Campanian age is suggested for the basins of Assam, Meghalaya, Bengal and Andamans. Palynological productivity of mud volcano material offers for the first time a new tool to exploration geologist for deciphering subsurface data in absence of direct drilling.

INTRODUCTION

MUD volcanoes are fascinating objects being confined to only a few areas of the world and are usually but not always associated with subsurface accumulations of commercial oil and gas. Active mud volcanoes are known in Andamans and adjoining Burma since last several decades[1], and are of non-igneous origin. The present discovery of coccoliths from mud volcanoes, for the first time provides a new tool to exploration geologist for deciphering subsurface data in view of the distribution of mud volcanoes in tropical to subtropical belt of the world with thick forest cover displaying poor to no exposures of rocks.

The Andaman-Nicobar group of islands predominantly consist of sedimentaries ranging in age from Late Cretaceous to Quaternary and are extremely interesting from the viewpoint of hydrocarbon exploration. The origin of these islands is ascribed to the scrapping off of the sediments from the Bengal Fan lying on the subducting Indian-Australian Plate[2].

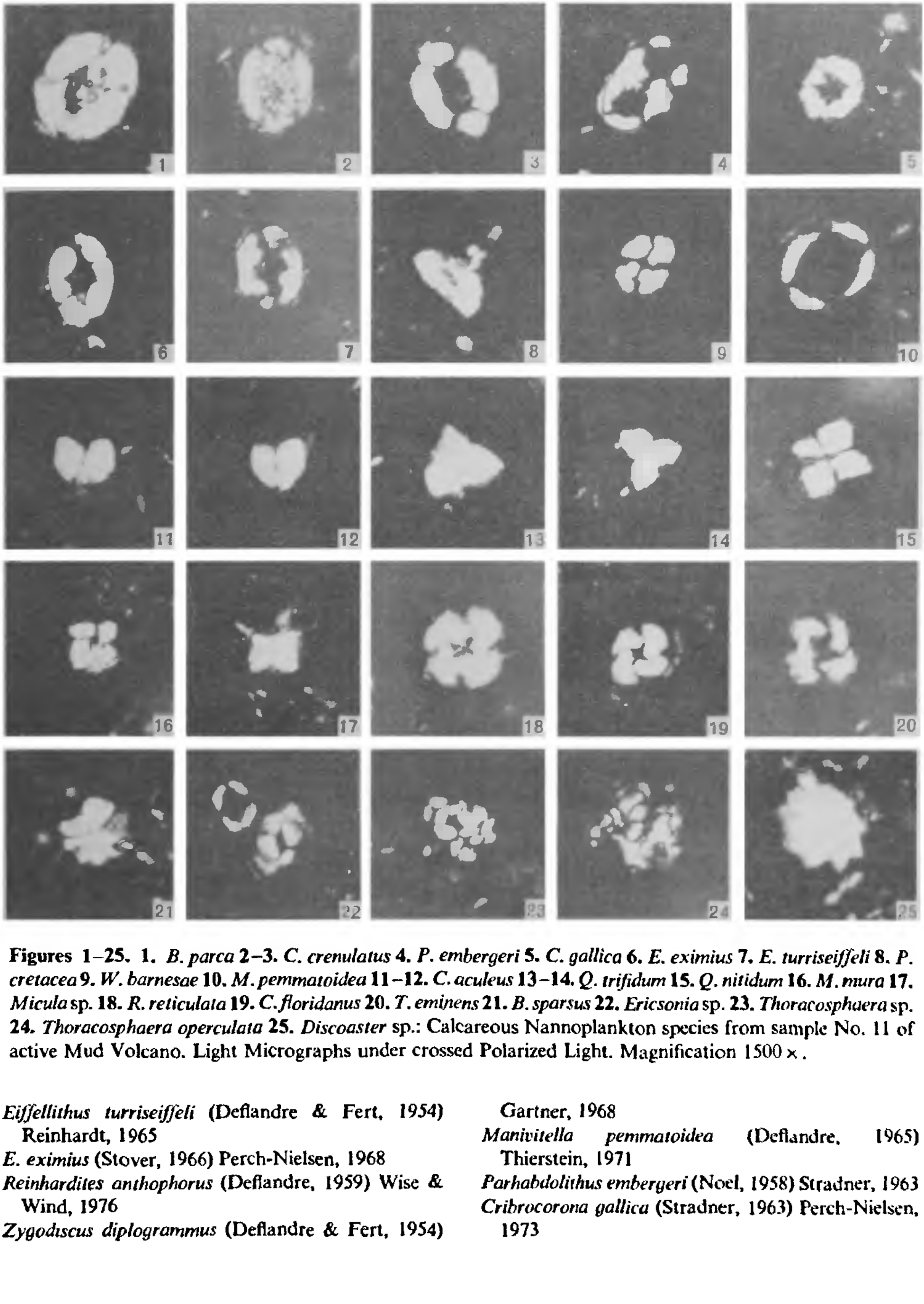
In western part of Baratang Island, several mud volcanoes are distinctly aligned along a prominent and roughly N-S trending Fault, at spacings of about 100 m to 300 m and build a cone of nearly 1 m in height (figure 26). The intermittent eruptions brought thick viscous mud mixed with oil and gas and were observed at intervals of about 2 min. Freshly spewed mud did not show any steam and was cold upon touch. Eleven samples were collected both from fresh mud as well as from dried silty mud deposited on the cones of two mud volcanoes shown in figure 26 (pers. comm. Kar, R. K.).

Conventional smear slides were prepared for eleven dried samples for the study of coccoliths under the light microscope. Seven samples proved barren, three showed bad preservation and a solitary sample (grey silty dried mud; No. 11 in a collection of Dr Kar, obtained from dried crust of the cone) showed moderately good preservation but needed extensive searching, as the coccoliths and other calcareous grains were scarce (figures 1–25).

RECORDED COCCOLITH TAXA

Cretaceous Taxa

Watznaueria barnesae (Black, 1959) Perch-Nielsen, 1968
Ceratolithoides aculeus (Stradner, 1961) Prins & Sissingh, 1977
Micula mura (Martini, 1961) Bukry, 1973
M. prinsii Perch-Nielsen, 1979
M. staurophora (Gardet, 1955) Stradner, 1963
Micula sp.
Lucianorhabdus cayeuxi Deflandre, 1959
L. maleformis Reinhardt, 1965
Quadrum trifidum (Stradner, 1961) Prins & Perch-Nielsen, 1977
Q. nitidum (Martini, 1961) Prins & Perch-Nielsen, 1977
Cretarhabdus crenulatus Bramlette & Martini, 1964
Broinsonia parca (Stradner, 1961) Bukry, 1969
§*Thoracosphaera operculata* Bramlette & Martini, 1964
§*Th. saxea* Stradner, 1961
Thoracosphaera sp.
Prediscosphaera cretacea (Arkhangelsky, 1912) Gartner, 1968



Figures 1–25. 1. *B. parca* **2–3.** *C. crenulatus* **4.** *P. embergeri* **5.** *C. gallica* **6.** *E. eximius* **7.** *E. turriseiffeli* **8.** *P. cretacea* **9.** *W. barnesae* **10.** *M. pemmatoidea* **11–12.** *C. aculeus* **13–14.** *Q. trifidum* **15.** *Q. nitidum* **16.** *M. mura* **17.** *Micula* sp. **18.** *R. reticulata* **19.** *C. floridanus* **20.** *T. eminens* **21.** *B. sparsus* **22.** *Ericsonia* sp. **23.** *Thoracosphaera* sp. **24.** *Thoracosphaera operculata* **25.** *Discoaster* sp.: Calcareous Nannoplankton species from sample No. 11 of active Mud Volcano. Light Micrographs under crossed Polarized Light. Magnification 1500 ×.

Eiffellithus turriseiffeli (Deflandre & Fert, 1954) Reinhardt, 1965
E. eximius (Stover, 1966) Perch-Nielsen, 1968
Reinhardites anthophorus (Deflandre, 1959) Wise & Wind, 1976
Zygodiscus diplogrammus (Deflandre & Fert, 1954) Gartner, 1968
Manivitella pemmatoidea (Deflandre, 1965) Thierstein, 1971
Parhabdolithus embergeri (Noel, 1958) Stradner, 1963
Cribrocorona gallica (Stradner, 1963) Perch-Nielsen, 1973

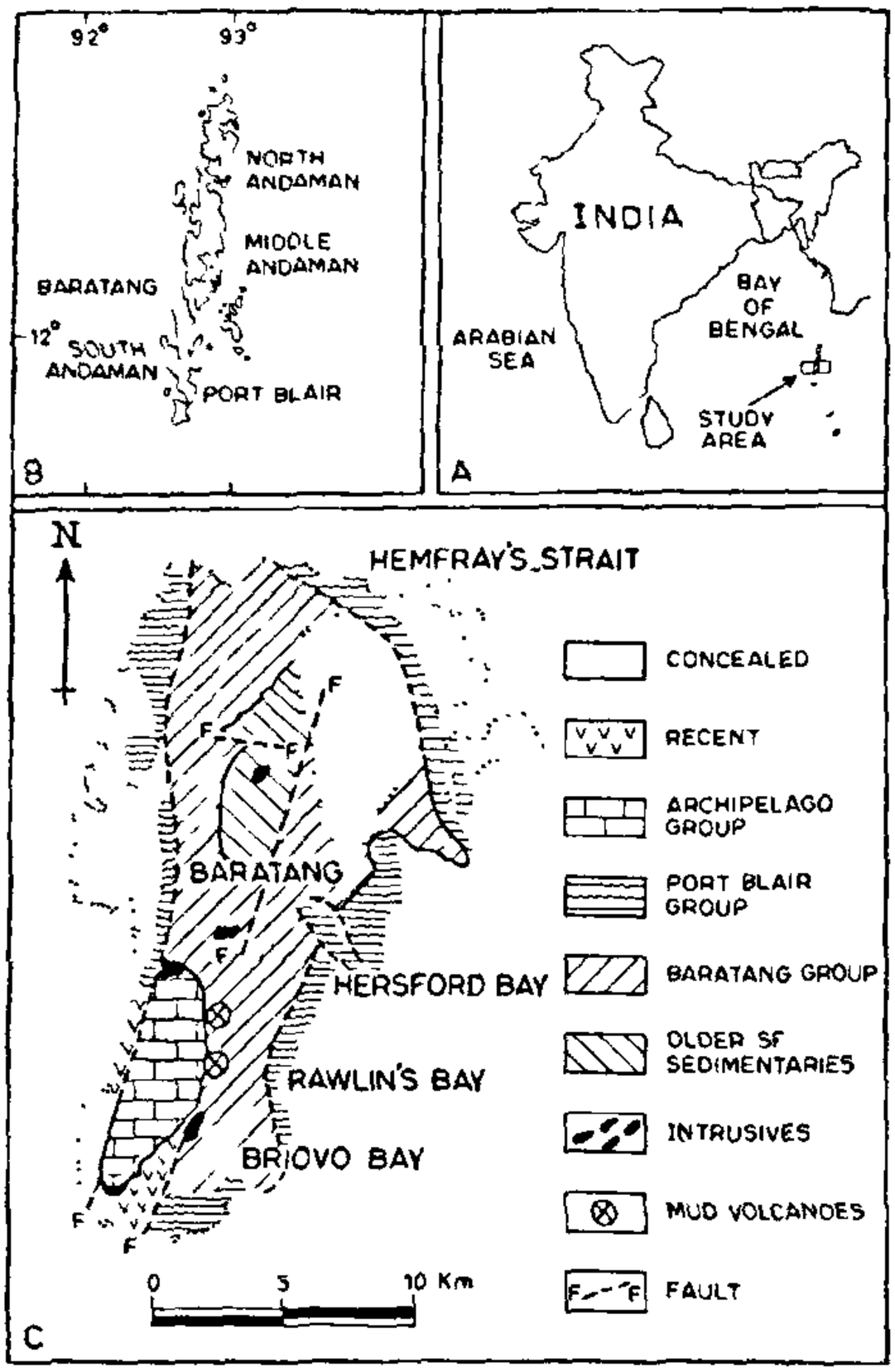


Figure 26 A–C. A. Map showing the study area. **B.** Map showing the position of Baratang Island. **C.** Geological map of Baratang Island, showing structure, mappable units and the location of two active mud volcanoes yielding the study material (After Mukherjee[5]).

§These species survive the major biotic crisis at Cretaceous-Tertiary boundary (C/T)

Palaeogene Taxa

Toweius eminens (Bramlette & Sullivan, 1961) Perch-Nielsen, 1971
Biantholithus sparsus Bramlette & Martini, 1964
Cyclicargolithus floridanus (Roth & Hay, 1967) Bukry, 1971
Reticulofenestra reticulata (Gartner & Smith, 1967) Roth, 1972
R. umbilica (Levin, 1965) Martini & Ritzkowski, 1968
Coronocyclus nitescens (Kamptner, 1963) Bramlette & Wilcoxon, 1967
Micrantholithus parisiensis Bouche, 1962
Ericsonia spp.
Discoaster sp.
Sphenolithus sp.

DISCUSSION AND CONCLUSIONS

The Neogene sedimentaries of Andaman-Nicobar islands are better studied and a variety of microplanktonic groups including calcareous Nannoplankton are reported from scattered localities[3], besides a comprehensive planktonic foram zonation being available on well measured sections[4]. In contrast, the mesozoic-palaeogene sections are largely neglected, owing to the lack of suitable exposures and accessibility in the field[5]. Although several workers through the first half of the present century had suggested the occurrence of Late Cretaceous rocks in Middle Andamans, the first conclusive evidence for the same was based upon *Globotruncana* assemblage[6]; a more refined *Globotruncana gansseri – G. mayaroensis* zonal assemblage of Late Maastrichtian age was later reported[7,8]. Palynological report is known by a solitary publication, wherein Post-Albian age for the Baratang Formation is suggested[9]. Recently, Kar *et al*[10], have reported pollen and spores of Late Cretaceous to Oligocene ages from the same set of mud volcano samples, which forms the basis of this coccolith report, which is the first one from Mesozoic-Palaeogene of Andamans. A few short reports of palaeogene microfauna of these Islands is well reviewed by Srivastava and Goel[3].

Since the sedimentaries of the Island are strongly disturbed, the possibility of mud volcano conduit reaching the basement rocks cannot be totally ruled out; also considering the chances of reworking at primary level of sedimentation, a critical evaluation of marker coccolith taxa present in such a mixed assemblage, nevertheless, suggests undisputable occurrence of the rocks of Campanian to Danian age within Andaman basin encompassing Nannoplankton zones: *B. parca – C. aculeus – Q. nitidum – Q. trifidum – A. cymbiformis – M. mura – M. prinsii – Markalius inversus* (NP–1) as cited in Stradner and Steinmetz[11]. The absence of *M. furcatus*, further suggests the presence of oldest nannofloral elements of Early Campanian age[12]. Frequent presence of *Th. operculata* and *Th. saxea* with *B. sparsus* indicates presence of *M. inversus* zone (NP–1) of earliest Danian age including Cretaceous-Tertiary boundary; in addition the presence of *T. eminens* and *Ericsonia* spp. suggest a part of Lower Palaeocene sequence. Marker species

for Upper Palaeocene, Lower-Middle Eocene were not found. Latest Eocene is suggested by the presence of marker *R. reticulata*, corresponding to *Sphenolithus pseudoradians* zone (NP–20), which contained *C. floridanus*, *Discoaster* sp., *C. nitescens*, *R. umbilica*, *Sphenolithus* sp. and *M. parisiensis*[13].

The Nannofloral data (Tropical, Oceanic assemblage of *Globotruncana* facies), thus supports the presence of uninterrupted sedimentary sequence of Campanian to earliest Danian age in Andaman basin, than hitherto known[6–8]; younger sediments belong to a part of Lower Palaeocene and Latest Eocene. Available data from basins of Assam, Meghalaya, Bengal and Andamans, demonstrate a remarkable similarity in their basinal history and seem to be invaded by a significant transgressive event of Early Campanian age. Additional support comes from DSDP data of Leg 22, site 217, wherein the oldest recorded *B. parca* zone confirms earliest Campanian age[14].

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NEWS

ADIPIC ACID

After several years of pilot testing, West German chemical giant BASF has developed a new manufacturing process for adipic acid. Construction of a 60,000 tonne pa production plant has begun at Ludwigshafen plant. The butadiene in this cut is converted, by a two-stage carbonylation process using carbon monoxide in methanol, into adipic acid dimethyl ester. The latter is converted into adipic acid by hydrolysis. The product manufactured by this process has already been market tested. Adipic acid is an important feedstock for nylon-66 polyamide fibres acid is an important feedstock for nylon-66 polyamide fibres and specialities, plasticisers and synthetic resins. (Perspective, highlights, *Chemistry in Britain*, Vol. 20, No. 9, September 1984, p. 772.)