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# Nannoplankton from Recent Sediments Off the Andaman Islands

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Sixteen sediment samples have been investigated for the distribution of nannoplankton. Of the total 38 species encountered, 14 are modern and remaining 24 are reworked fossils ranging in age from Eocene to Pliocene. Majority of the reworked fossils indicates that they are of Miocene age. Modern nannoplankton reveals their affinity to the tropical conditions. It is concluded that the source of reworked fossil may mainly be the outcrops of Miocene occurring on the Andaman Sea floor and in part from the turbidites resulting from deposition of the sediment transported by river Irrawaddy.

The Andaman and Nicobar Islands separate the Bay of Bengal from the Andaman Sea. The Islands are fairly straight and gentle on the western side comprising coastal plains, whereas the eastern coasts are strongly indented and steep and in many places coral reefs and raised beaches as high as 20 m above sea level are reported[1]. Narrow channels separate the Andamans into north, middle and south Andaman Islands which are collectively known as the Great Andamans.

The Paleogene Andaman-Nicobar trough was folded and reverse faulted westward resulting in the emergence of the Andaman Islands during the Oligocene and Late Miocene. The Andaman-Nicobar ridge is formed of serpentinite basement overlain by distorted Paleocene to Miocene and flat lying Pliocene to Recent sediments[2]. A sequence of Paleocene through Upper Miocene rocks including over 3000 m of Upper Eocene and Oligocene graywackes have been deposited over the Andaman serpentinites under fluctuating shallow to deep water conditions[3].

Nannoplankton from the Ritchies Archepelago, south Andaman[4,5], and from the Niell Islands, south Andaman[6,7] has been studied. Besides these studies on the nannoplankton from the Islands, no work has been carried out on the nannoplankton of marine sediments of this area. Bukry[8] and Gartner[9] have studied the nannoplankton biostratigraphy from the DSDP Leg 22, site 217 to the south of Andaman Islands.

This paper reports the results of the distribution of nannoplankton in sediments collected from the vicinity of Andaman Islands.

## Materials and Methods

During 51 and 52 Cruises of *RV Gaveshani* in the Bay of Bengal in 1979, 20 snapper samples were collected in the vicinity of Andaman Islands (Fig. 1). The samples were largely clays except 4 which are terrigenous sands. Smear slides of the clays were prepared and scanned under a Reichert polarising microscope and relative abundance of nannoplankton was estimated following Boudreaux[10].

## Results and Discussion

The microfossil assemblage in the sediment is a complex mixture of calcareous nannoplankton, foraminifera, diatoms silicoflagellates, radiolarians, ascidians, holothurians, chrysomonad, etc. Table 1 shows the presence in the sediment of 38 species of coccoliths and discoasters which is an admixture of modern and fossil flora of 14 and 24 species respectively.

Of the 14 modern flora encountered, *Gephyrocapsa oceanica* is the most abundant in all stations. Owing to the limited magnification of the light microscope and the close affinity of various species with each other it is not possible to identify the different species of *Gephyrocapsa* and therefore, all the Gephyrocapsiids are grouped together. Following *Gephyrocapsa oceanica*, other species such as *Cyclococcolithina leptopora*, *Helicosphaera carteri* and *Ceratolithus cristatus* are also present in the sediments of all the stations in varying proportions. The relative

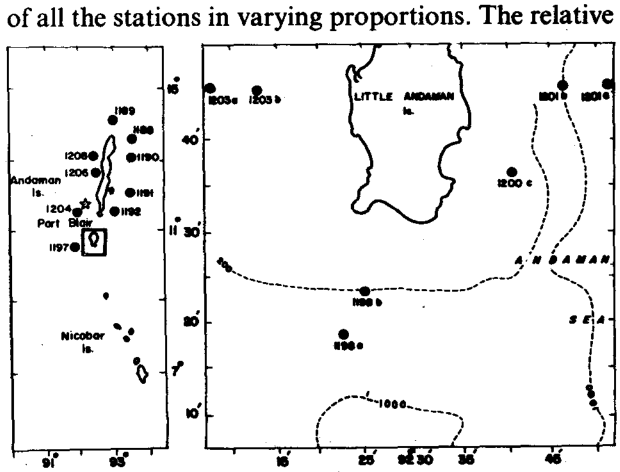



Fig. 1—Sediment sample locations

Table 1—Distribution of Nannoplankton in the Sediment

| | Sample Number | 1188 | 1189 | 1190 | 1191 | 1192 | 1204 | 1206 | 1208 | 1197 | 1198A | 1198B | 1200A | 1201A | 1201B | 1203A | 1203B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Depth (m) | 1300 | 1380 | 2150 | 1650 | 650 | 1200 | 80 | 85 | 1300 | 850 | 470 | 1500 | 1440 | 1225 | 800 | 140 |
| | Nannoplankton Species | | | | | | | | | | | | | | | | |
| MODERN FLORA | Braarudosphaera bigelowi | | | | | | | | | | | | | | R | | |
| | Ceratolithus cristatus | C | R | C | R | R | R | R | R | R | R | R | R | R | R | R | R |
| | Coccolithus pelagicus | | | | | | | R | R | R | | | | | | R | R |
| | Cyclococcolithus leptopora | C | R | C | A | R | C | R | R | C | R | R | R | C | R | R | R |
| | Emiliania annula | C | R | | | R | R | | | | | | C | R | | | |
| | E. huxley | C | | | | C | C | R | | | C | | | R | C | | C |
| | Discolithina japonica | R | R | | R | | R | R | | R | R | R | R | R | R | R | R |
| | Gephyrocapsa oceanica | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A |
| | Helicosphaera carteri | A | C | C | C | C | A | A | R | C | C | R | C | A | A | A | C |
| | Rhabdosphaera sp. | R | | | | | R | R | | | | | | | R | | |
| | Scyphosphaera apsteini | | | | R | | R | | | R | R | | | | | R | |
| | Syracosphaera sp. | R | R | R | R | R | R | R | R | | R | R | R | R | R | R | R |
| | Thoracosphaera sp. | R | R | R | R | R | R | R | R | C | R | R | R | R | R | R | R |
| | Umbilicosphaera sibogae | | R | R | | R | R | | R | R | R | R | | R | R | | |
| FOSSIL FLORA | Discoaster aulakos | | | | | | | | R | | | | | | | | |
| | D. barbadiensis | | | | | | R | | | | | | | | | | |
| | D. berggrenii | | | | R | R | | | R | | | | | | | | |
| | D. bollii | | | | | | R | | | | | | | | | | |
| | D. brouweri | R | | R | R | | R | | R | R | R | | R | | | R | R |
| | D. calcaris | | | | | | | | R | | | | | | | R | |
| | D. challengeri | | | | | | | | R | | | | | | | R | |
| | D. deflandrei | | | | | | | | | R | | R | | | | | |
| | D. exilis | | | | | | | | | R | | | | | | R | |
| | D. intercalaris | | | | | R | | | R | | | | | R | | | |
| | D. levinii | | | | | | R | | | | | | | | | | |
| | D. lodoensis | | | R | | | | | | | | | | | | | |
| | D. pentaradiatus | | | R | | | R | | R | R | R | R | | | | R | |
| | D. quinqueramus | | | | | | R | | | | | | | | R | | |
| | D. saipanensis | | | | | | R | | | | | | | | | R | |
| | D. surculus | | | | | | | | | | | | R | | R | | |
| | D. tamalis | | | R | | | | | | | | | | | | | |
| | D. variabilis | | | | | | R | | R | | | | | | | R | |
| | Coccolithus miopelagicus | | | | | | | | | | R | | | | | | |
| | Reticulofenestra pseudoumbilica | | | | | R | | | R | | R | R | R | R | R | | |
| | Sphenolithus abies | | R | R | R | R | | | | | | | | | | R | R |
| | S. dissimilis | | | | | R | R | | | R | | R | R | R | R | | |
| | S. neoabies | | | | | | | | | | | | | R | R | | |
| | S. obtusus | | | | | R | | | | | | | | | R | | |

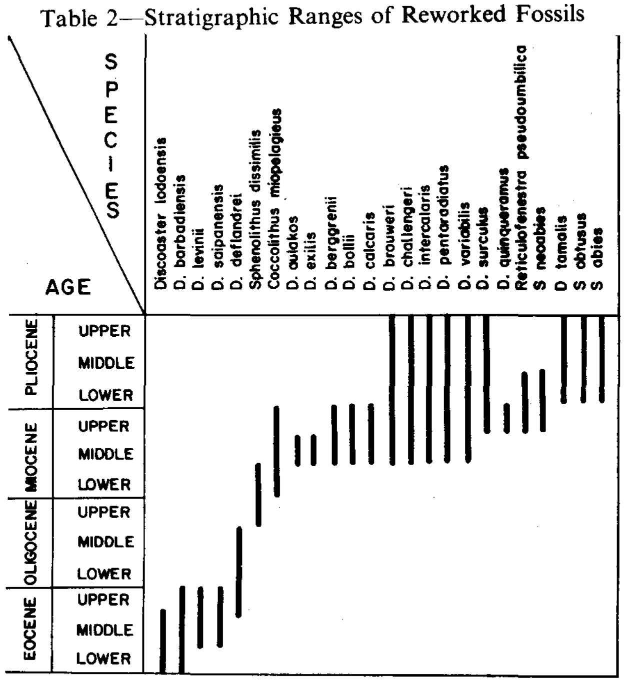
abundance of *H. carteri* increases with depth. *Thoracosphaera* sp. *Umbilicosphaera sibogae* and *Discolithina* sp. are rare. The remaining 7 species, *Emiliania huxleyi*, *E. annula*, *Coccolithus pelagicus*, *Rhabdosphaera* sp., *Syracosphaera* sp. and *Braarudosphaera bigelowi* occur in small quantities in a few samples (Table 1).

Majority of the modern flora in the assemblage indicates their tropical affinity, among which *E. huxleyi* and *C. leptopora* are eury-thermal, and the overall assemblage indicates a temperature range 18-28°C.

Table 2 reveals that in addition to the 14 modern species of nannoplankton, 24 reworked species were also encountered which range in age from Eocene through Pliocene though the majority belongs to Miocene. It is possible that these might have been derived from the erosion of the Miocene formations in this region.

It is a well established phenomenon that owing to their minute size, the nannoplankton is more

Table 2—Stratigraphic Ranges of Reworked Fossils



susceptible for reworking into younger sediment without sustaining any sign of mechanical damage. This poses a problem in differentiating and delineating the biostratigraphic zonation and in assigning precise age of the sediment. Similar phenomenon of redistribution of nannoplankton has been encountered in the Arabian Sea sediment. Guptha[11] has reported from the slope region off Bombay that Cretaceous and Tertiary fossils are being mixed up with the Recent sediment deposited by the Indus river into the Arabian Sea. Besides, it has also been reported in the Gulf of Kutch and SE Arabian Sea[12,13]. The Gulf of Kutch is yet another example of the presence of reworked fossils. They range in age from the Cretaceous to Quaternary and the mixing is mainly caused by the very strong tidal currents prevailing in the Gulf of Kutch. Furthermore, it is inferred that the Gulf is one of the contributors of reworked fossils to the western slope, and perhaps to the deeper regions.

Frerichs[14] reported that the Pioneer dredge 8 sampled is radiolarite shale with Upper Miocene fauna. In addition, Pioneer 12 and 13 have recovered Miocene calcarenite and calcilutite from 2 sites at a depth of 1000 m on the eastern slope of the Invisible Bank to the east of Andamans. As suggested earlier, the source of reworked fossils is mainly from the Late Neogene submarine outcrops in the Bay of Bengal and Andaman Sea regions which might contribute the older floral components and get mixed up with the Recent sediment. Also there is every possibility that the Andaman Islands which are of Tertiary formations would have for some extent act as a provenance in supplying the older fossils through degradational processes. However, the supply may not be regular/continuous for want of any drainage system properly on the Islands. In addition, the coral reefs present along the coasts are to some extent act as barriers to the transport of sediments to deeper regions. The Andaman and Nicobar Islands are insignificant provenances for the basin[2]. Therefore, as an alternative it is felt that the turbidity currents and/or submarine slumping must have played a major role in bringing about the processes of mixing. The processes of slumping transports, accumulate often strata on top of younger formations causing stratigraphical reversals[15]. In the present instance the turbidity currents appear to be prominent. Because, one of the major rivers such as Irrawaddy to the north of Andaman Islands flushes out enormous terrigenous material into the sea which generally generate turbidity conditions. The increased detrital sedimentation that might have resulted by the turbidity currents is the dominant effect on the *G. oceanica* abundance. Brohm[16] attributes abundance of *G. oceanica* to the decreased sedimentation rate in the sediments of North Florida shelf. The LANDSAT imageries of this region also indicate that the area is influenced by turbidity[17]. This is also substantiated by the presence of ascidians found very commonly in all stations. Occurrence of fossil spicules of genus *Micrascidites* indicates the turbidite deposits[18]. Edwards reported from a DSDP hole 210 (Leg 21) from the Coral Sea that the turbidites of Miocene to Pliocene are good examples of a well preserved redeposited nannofossil assemblages.

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