

Planktonic Foraminifera from Core Tops of Western Equatorial Indian Ocean

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ABSTRACT

A set of seven core tops from western equatorial Indian ocean were analysed for planktonic foraminifera, which has yielded 20 planktonic foraminiferal species. Among them *Globorotalia menardii*, *Globigerinoides sacculifer* and *G. ruber* constitute the majority of population.

Distribution of foraminifera suggests that the tropical fauna gradually and progressively decreases from 6° N latitude to 21° S latitude from 98.92 to 58.2% while, the sub-polar fauna shows inverse distributional pattern showing upward trend in its abundance from 38% at 21° S latitude to 0.8% at 6° N latitude. Sub-tropical fauna is sparsely distributed in the Equatorial Indian Ocean. Based on these studies it is interpreted that dissolution has been encountered at about 6° S latitude owing to deeper depth. Occurrence of tropical fauna in abundance at about 20° S latitude suggests either general warming of oceans or the prevailing warm water currents. Lastly, the presence of sub-polar fauna in the same latitude, in considerable proportion also indicates shift in polar/subpolar front during Holocene.

INTRODUCTION

In order to understand the palaeoclimates and palaeoceanography of oceans, earlier workers have used various criteria such as fluctuations in calcium carbonate (Arrhenius, 1952, Damuth, 1975), variation in abundance of cold and warm water foraminifera (Ericson *et al.*, 1954, Phleger, 1953, Blackman and Somayajulu, 1966) and stable isotopes (Shackelton and Opdyke, 1973) of foraminiferal tests resulting in increased understanding of Quaternary climatic events on a global scale. Despite the fact that considerable work has been done in the Indian Ocean, in comparison to Atlantic and Pacific oceans it is very scanty.

However, important contributions on planktonic foraminifera from the western equatorial Indian Ocean include that of Oba (1969), Hutson (1977), Be and Hutson (1977) and Cullen and Prell (1982).

In the present short note, it is intended to study the planktonic foraminifera and their significance to past climates and palaeoceanography from the western equatorial Indian Ocean.

Oceanographically, the area is divided into two regions based on the physico-chemical parameters and currents (Wyrtki, 1973) as follows:

1. Sub-tropical region located between subtropical convergence and south equatorial current.
2. Monsoon region extending north of south equatorial current characterised by a seasonal reversal of prevailing wind system.

Seven core top samples were selected from seven box cores collected from a depth range of 2600-4550 m during the 28th cruise of R.V. *Sonne* in the western equatorial Indian Ocean (Table - 1). In general all the core top samples are mainly composed of silty clay/foraminiferal ooze which were analysed following standard procedure (Guptha and Hashimi, 1985).

RESULTS

Planktonic foraminiferal analysis on these samples has yielded a total of 20 species which are grouped into four (tropical, sub-tropical, sub-polar and polar)

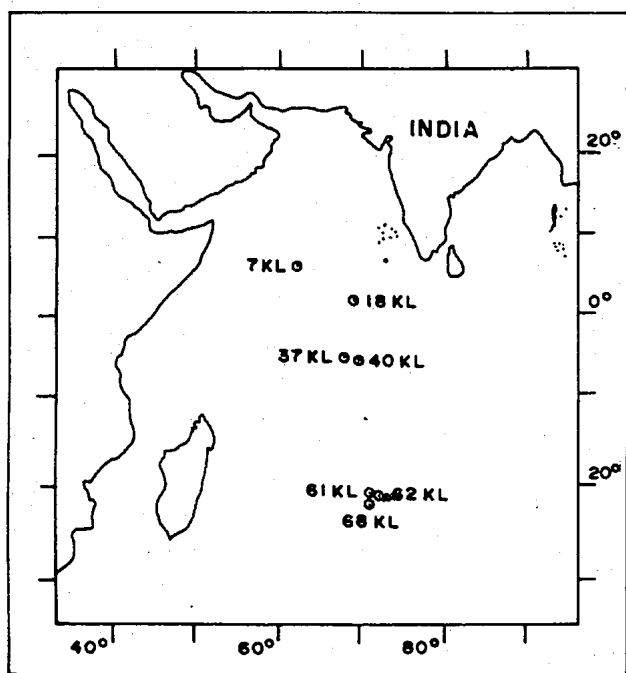


Fig. 1 Location of Cores

based on their ecological characteristic features following Hutson (1982).

The distributional pattern of planktonic foraminifera from north to south shows that the tropical fauna is by far the most abundant (98.92 to 58.2%) in all the cores followed by sub-polar and sub-tropical fauna, while polar fauna represented by *Neogloboquadrina pachyderma* is very sparsely distributed in a few of the stations (KL-37, 40, 61, 62 and 68). Besides, it was also observed that the tropical fauna shows decreasing trend from 98.9% to 58.7% from north (6°) to south (21°). Subtropical fauna was encountered sporadically in a few cores (KL-7, 18, and 37), further south, they are totally absent. Sub-polar faunal assemblage is the second largest group noticed which like tropical fauna show significant trend in their distributional pattern wherein, they gradually increase from north to south.

FORAMINIFERAL DISTRIBUTION FROM NORTH TO SOUTH

The most prominent and ecologically significant species include *G. ruber*, *G. sacculifer*, *G. menardii*, *G. dutertrei*, *P. obliquiloculata*, *G. bulloides*, and *G. truncatulinoides* which are widely distributed in varying proportions as mentioned below:

KL-7: This core top sample shows that *Globorotalia menardii* (23.8%) is the most abundant species followed

by *Pulleniatina obliquiloculata* (12.3%) and *Globigerina bulloides* (11.1%).

KL-18: Like KL-7, this core shows *G. menardii* as most abundant species followed by a sub-polar species *G. bulloides* (15.2%).

KL-37: Here also *G. menardii* continues to dominate which represents 19.5% of total abundance followed by *Globoquadrina dutertrei* (19.2%), *P. obliquiloculata* (15.2%) and *Globogerinoides ruber* (6.5%). The remaining species are very sparsely distributed.

KL-40: In this sample *G. dutertrei* (26.1%) is the most abundant followed by *G. menardii* (25%) also and *G. bulloides*.

KL-61: In this core top sample a sub-polar species *G. bulloides* is most predominant (17.2%) followed by *G. truncatulinoides* (15.9%) of the same group and a tropical form *G. ruber* (12.4%).

KL-62: Again tropical fauna *G. ruber* (29.4%), *G. sacculifer* (12.5%) followed by *G. bulloides* (14.4%) and *G. truncatulinoides* (11.2%) dominate in this sample.

KL-68: Sub-polar species like *G. truncatulinoides* (21.9%) and *G. bulloides* (16.2%) are followed by *G. ruber* (11.2%) and *G. menardii* (11.6%).

The distribution of calcium carbonate shows that it ranges from 54-87%. Except for 6° south where the CaCO₃ is depleted (54-70%) in the south equatorial current region, the rest of the regions which includes 6° north of equator and south of 6° S it remained almost constant. Similarly, although the tropical fauna is abundant in this region the resistant species (RSP) comprising of *G. dutertrei*, *G. menardii* and *P. obliquiloculata* show more abundance unlike other regions. Apparently, these regions where the KL-37 and 40 located have undergone dissolution owing to deeper lysocline depths, rather than the influence of any Antarctic Bottom water incursion.

Although tropical fauna (50-68%) is the major component in stations occupying 20° latitude (KL-61,

TABLE-1

Station No.	Depth (m)	Latitude	Longitude	CaCO ₃ (%)
7 KL	3600	5°55'N	61°38'E	80%
18 KL	3040	1°54'N	67°20'E	86%
37 KL	4100	5°55.2'S	68°10.6'E	54%
40 KL	4550	5°55.4'S	68°10'E	70%
61 KL	2600	21°13.6'S	68°53.6'E	88%
62 KL	2950	21°10'S	68°58'E	86%
68 KL	2600	21°19.1'E	68°56.5'E	87%

62 and 68), the subpolar fauna comprising of *G. bulloides* and *G. truncatulinoides*, (24.6 to 41%) is also in quite significant proportions. This suggests that the sub-polar fauna must have been deposited during the colder periods of glacial ages which have been interspersed by the warm water fauna during warm periods of Holocene. This also further reveals that the polar/sub-polar front must have been shifted with the onset of warmer conditions. On the other hand the abundance of tropical fauna in the same area is attributed either to the presence of warm equatorial current or the general warming of oceans which would have produced them. Similar shifting in polar/subpolar front has earlier been reported by Hutson (1977) in the Indian Ocean and McIntyre (1976) for the Atlantic Ocean.

CONCLUSIONS

1. Dissolution effects have been encountered as evidenced by (i) the presence of radiolaria in large quantities and (ii) also the dominance of dissolution resistant species in the planktonic foraminiferal assemblage.
2. The presence of tropical fauna predominantly in the subtropical region is attributed to the prevailing warm water current or general warming of oceans at the end of Pleistocene.
3. Similarly, the presence of sub-polar fauna which is also encountered in large proportions in the subtropical region may be due to the shift in polar/sub-polar front.

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