

Preliminary Report on the Study of Benthic Foraminiferal Content in the Marine Sediment of Queen Maud Land Shelf, Lazarev Sea, Antarctica

H Sinha¹, R. Nigam¹, N. Khare², B.S. Ingole¹ and D.N. Ghosh³

ABSTRACT

During the 4th and 6th Indian Expedition to Antarctica, surface sediment samples were collected from eight stations in the Queen Maud Land Shelf, Lazarev Sea from the depth ranging from 157 to 785 m. The mean biomass of these samples is $3057 \pm 209.70 \text{ g m}^{-2}$. Out of the total biomass a specific micro-organism namely foraminifera has been the focus for the present study. The relationship between organic carbon in sediments and foraminifera is highlighted in the present study. The ecological interpretation of the foraminiferal population is considered in totality, which is composed of benthic foraminifera as the planktic foraminifera is too meager to be considered for any significant interpretation. The population of benthic foraminifera has been further divided into two morpho-groups namely angular-asymmetrical forms and rounded-symmetrical forms. The results (though preliminary) show an inverse relationship between the organic carbon content and total benthic foraminifera, whereas a direct relation exists between the organic carbon content and angular-asymmetrical forms of benthic foraminifera. Such studies, if further strengthened, may have their bearing on marine environment assessment around Antarctica.

INTRODUCTION

Sea ice of the Polar regions serves as a habitat for a variety of organisms ranging from bacteria, fungi, algae and protozoans to metazoans (Horner, 1985 and Marschall, 1988). Some information on the quantitative distribution of marine benthos production in different sectors of Antarctica Seas are available (Broch, 1961 and Everitt et al., 1981). Among other marine fauna, unicellular micro-organism, foraminifera in the circum-Antarctic region also received the attention of earlier workers (Heron-Allen and Earland, 1922; Uchio, 1960 and Kato and Tai, 1979). It was also suggested that the detailed ecological studies of foraminifera from the polar regions, may give the ideas about the foraminiferal habitat that in which way sea ice serves as a nursery and refuge for juvenile foraminifers, which thrive on the high algal biomass in the ice. Osterman and Kellogg (1979) studied the benthic foraminifera from the surface sediments of the Ross Sea (Antarctica) at the water depth ranging from 26 to 3932 meters. Guptha (1983) made an effort to study the foraminifera from the deeper sediments off princess Astrid Coast, Queen Maud Land, Antarctica (mainly at a depth ranging from 1661 -3580 meters) from the 12° E ridge and reported that planktic foraminifera constitute more than ninety percent of the foraminiferal assemblage in the 63 micron fractions (except at one station at 227 meters depth). Perhaps heavy ice cover around Antarctica limited the early studies of foraminifera in Antarctic Sea to the continental slopes and abyssal plains only (Osterman and Kellogg, 1979) and shelf almost remained unattached and there is need to pay

¹National Institute of Oceanography, Dona Paula, Goa-403 004.

²National Center for Antarctic & Ocean Research, Department of Ocean Development, Vasco-da-Gama, Goa- 403 804.

³Department of Applied Geology, Indian School of Mines, Dhanbad- 826 004.

attention. However, foraminifera provide a long fossil record (Cambrian to Recent). Therefore, on the basis of availability of ecological data, there is some additional advantage to utilize these micro-organisms as proxies for the study of past environment as well as the effect of new environmental regulations. In addition of this, their high species diversities and the environmental sensitivities have marked this group of organisms as the key indicator of marine environment variation in both the space and time domain (Scafer, 2000). No significant attempt has so far been made to study foraminifera, relatively from the shallower depths, off Queen Maud Land region of Antarctica. Hence, the ecological studies of foraminifera in modern marine sediments of shallower regions off Antarctica, intuitively becomes important which aim to determine their relationship with the modern marine environment.

In view of the above, modern marine sediments from the shelf region off Queen Maud Land, Lazarev Sea (Antarctica) have been utilized to study the distributional pattern of benthic foraminifera.

MATERIALS AND METHODS

During the 4th and 6th Indian Antarctic Expedition onboard *M.K Finn polaris*, eight surface sediment samples were collected with the help of La Fond Dietz Snapper in the Queen Maud Land Shelf, Lazarev Sea (Antarctica) from the water depth ranging from 157 to 785 m (Fig. 1, Table 1). In the laboratory, the samples were dried in oven, washed over 63 μ m sieve and dried again. From the weighed +63 micron fraction of the sediments foraminifera were picked using moist brush under binocular microscope. In each sample, the total foraminiferal population was divided into benthic and planktic assemblages. Within the benthic community, based on external test morphologies (Severin, 1983 and Nigam and Khare, 1994), the population was further

Table 1.

Sr. No.	Station No.	Latitude (N)	Latitude (E)	Water Depth
1	P-3	12°53'17"	69°54'25"	270
2	P-5	12°47'47"	69°53'39"	157
3	P-6	12°04'38"	69°57'25"	195
4	P-7	11°42'57"	69°58'05"	194
5	P-8	11°54'54"	69°56'49"	226
6	P-10	12°44'32"	69°53'32"	650
7	P-11	12°05'42"	69°53'08"	785
8	P-13	11°46'	69°54'	328

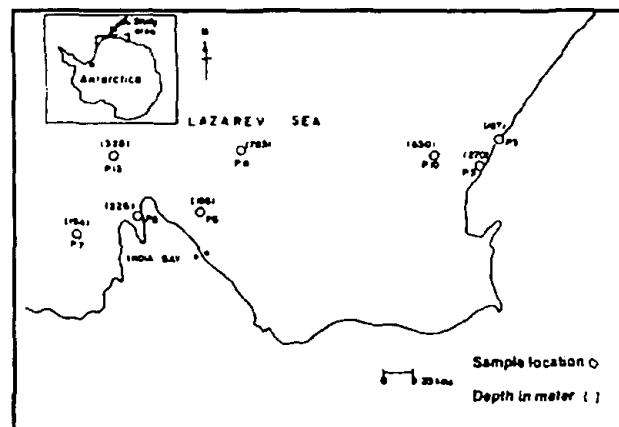


Fig. 1. Location map of the sediment samples in Lazarev sea, Antarctica

classified into two morpho-groups namely rounded-symmetrical and angular-assymerical forms. The organic carbon in sediments was estimated by the method suggested by El Wakeel and Riley (1957).

RESULTS AND DISCUSSION

The preliminary study of foraminiferal fauna has revealed a total number of seventeen genera as follows:

Reophax Montfort, 1/808 *Trochammina* Jones and Parker, 1860

<i>Textularia</i> Blainville, 1824	<i>Lagena</i> Brown, 1827
<i>Globigerina</i> Parker et al., 1865	<i>Orbulina</i> d'Orbigny, 1839
<i>Ammonia</i> Brunnich, 1771	<i>Cibicides</i> Montfort, 1808
<i>Elphidium</i> Montfort, 1808	<i>Nonion</i> Montfort, 1808
<i>Quinqueloculina</i> d'Orbigny, 1826	<i>Marsipella</i> Norman, 1878
<i>Triphotrocha</i> Saunders, 1957	<i>Hyperammina</i> Brady, 1878;
<i>Rhabdammina</i> Sars, 1869	<i>Ammoscalaria</i> Hoglund, 1947
<i>Jaculella</i> Brady, 1879	

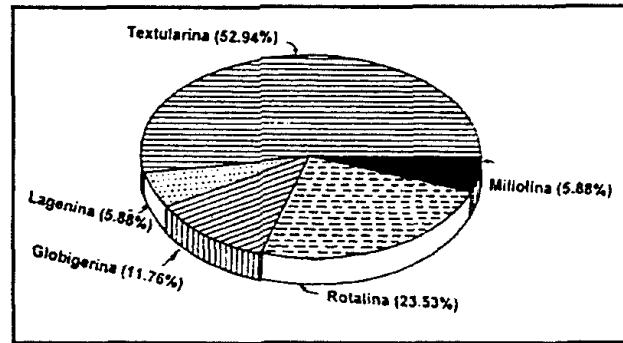


Fig. 2. Pie chart showing percentage distribution of sub orders of foraminifera from the Queen Maud Land, Antarctica.

Jaculella while *Ammonia*, *Elphidium*, *Cibicides* and *Nonion* are the dominant genera of rounded-symmetrical form of benthic foraminifera. Although amongst the planktic foraminifera, *Globigerina* and *Orbulina* show their presence but they are very meager in number to draw any conclusion.

These genera belong to thirteen families, twelve super families and five sub orders (Table 2). Among the suborders, *Textularina* is the most abundant (represented by 52.94%), whereas *Miliolina* and *Lagena* (represented by 5.88% each) are the least abundant. The compositional representations (in terms of total foraminiferal number) of various suborders, super families and families are exhibited in Fig. 2. Among all the identified genera of benthic foraminifera, the angular-asymmetrical forms are mainly represented by the *Reophax*, *Marsipella*, *Rhabdammina* and

The distributional patterns revealed that the total foraminiferal population, which is mostly composed of benthic foraminifera, shows an inverse relationship with organic carbon (Fig. 3). However, within benthic foraminifera, the angular-asymmetrical forms apparently show a direct

Table 2

Sr. No.	Suborders	Super Families	Families	Genera
1	Textulariina	06	06	09
2	Lagenina	01	01	01
3	Globigerinina	01	01	02
4	Rotaliina	03	04	04
5	Miliolina	01	01	01
	Total	12	13	17

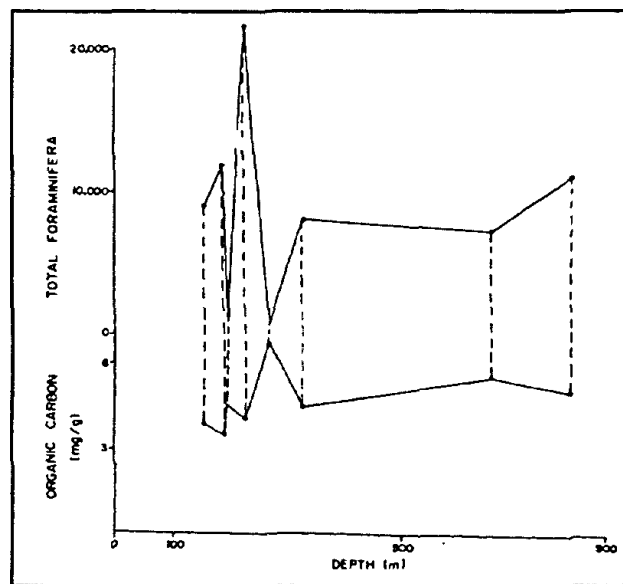


Fig. 3. Inverse relationship of total foraminifera with organic carbon content in the sediments.

relationship with organic carbon content within the marine sediments of Lazarev Sea (Fig. 4). Since, many workers (Demaison and Moore, 1980; Paropkari et al. 1992 and, Rosoff and Corliss, 1992) established that high concentration of organic carbon is associated with the zone of oxygen depletion and reducing environment which is generally coupled

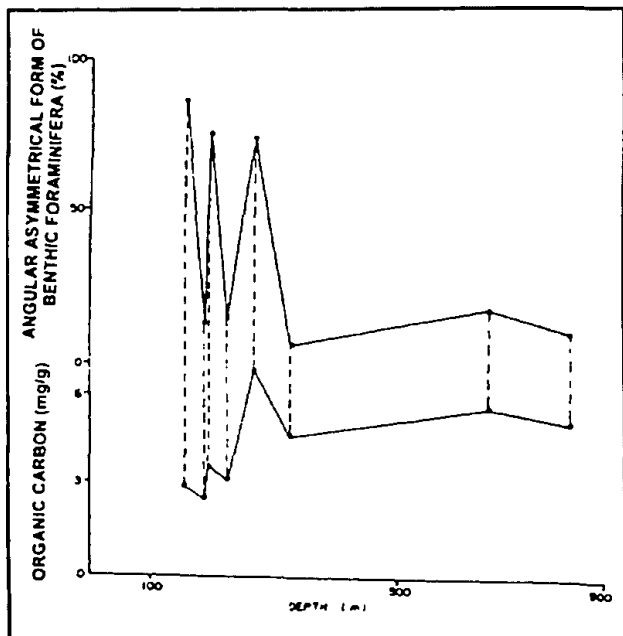


Fig. 4. Direct relationship of angular - asymmetrical form of benthic foraminifera with organic carbon.

with nutrient enrichment and very high productivity.

In view of the above, it may be inferred that the foraminiferal content may be linked with the organic carbon content within the marine sediments of Lazarev Sea. The qualitative assessment of organic carbon within the marine sediments using foraminifera as proxy looks interesting from the point of view of hydrocarbon potential of the Antarctica in the light of the view of SCAR group of experts who have opined that the continental shelf off Antarctica and beneath the Ross and Weddel Sea could attract exploration activities for hydrocarbons some times in the future (Setty, 1983). This assumption lies on the fact that the exploration for hydrocarbons has been active in the offshore regions

of Southern Argentina, South Africa, Australia and New Zealand. Antarctica being erstwhile a part of Gondwanaland should also reveal the existence of similar hydrocarbon bearing strata. The presented results are preliminary in nature and need further strengthening by covering larger area as well as considering various other ecological parameters.

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