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Late Quaternary climatic record from ODP Site 705 in the Northern Indian Ocean

Ashish Sarkar[a]* and Neil Ogle[b]

[a]*School of Petroleum Technology, Pandit Deendayal Petroleum University, Raisan, Gandhinagar, Gujarat, India. PIN 382007*
[b]*Environmental Engineering Research Centre, School of Planning, Architecture and Civil Engineering, The Queen's University of Belfast, Belfast, BT9 5AG, Northern Ireland.*

Abstract

The uppermost 500cm sedimentary core from ODP site located at the Eastern flank of Najareth bank in the Northern Indian Ocean has yielded altogether twenty four species of planktonic foraminifera. Among all these species, *Globorotalia menardii* has been found to be consistently dominant in the faunal assemblages from most of the samples. The $\delta^{18}O$ measured on the tests of *Globorotalia menardii* from all levels help in precisely working out the sediment accumulation rates at different isotopic stages, and deciphering the change in climate in the Late Quaternary as well.

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Keywords: Planktonic foraminifera; temporal distribution; last glacial maxima; Interglacial maxima; $\delta^{18}O$; $\delta^{13}C$; isotopic stage.

Introduction

Planktonic foraminifera, an immensely productive group of microorganisms, have extensively been used as the proxy for the past climate and oceanographic changes during nearly six decades. In the present work, samples at an interval of 5 to 10 cm each from the upper ~550 cm of ODP core # 705A (13°10.02', 62°23.02' E; water depth 2307.5 meter below sea floor) at the Eastern flank of Najareth bank in Indian Ocean (Figure 1) have been studied. Lithology of the studied core is homogenous coarse grained foraminiferal ooze with a foraminiferal content of about

* Ashish Sarkar. Tel.: +91-9428218684; fax: +91-79-23275030.
E-mail address: ashish29s@yahoo.co.in

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95%, which yielded twenty four species of planktonic foraminifera belonging to three families and ten genera. Based on the foraminiferal and calcareous datum levels, the average sediment accumulation rate has been worked out to be 5.2 m/Ma. Dissolution of the microfossils has been very insignificant in the studied section[1], which shows that the change(s) in the abundance of planktonic foraminiferal tests in all the samples at each level are representative of the climatic and/or water mass change(s) at that time.

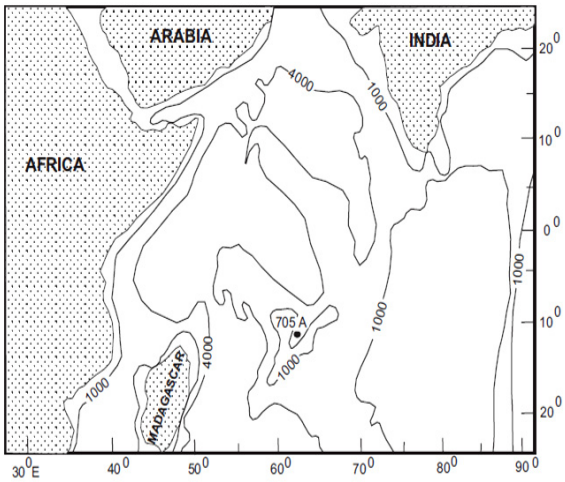

Figure 1: Location map of ODP Site 705

In the present study, understanding the climatic change through the Late Quaternary has been attempted by studying the temporal variations in the abundance of two globorotalid species viz., *Globorotalia menardii and Globorotalia tumida*. While the former is a tropical species, the latter is a subtropical species. These species have been successfully used to decipher the changes in the Quaternary climate in the North Atlantic[2,3] and in the Northern Indian Ocean[4,5].

Results and Discussion

In the present study, planktonic foraminiferal species belonging to Globigerinacea has been avoided as these are upper surface dwelling and hence their abundances may get perturbed by changes in the surface water mass conditions. Therefore, two deeper dwelling planktonic foraminiferal species viz. *Globorotalia menardii and Globorotalia tumida* have been considered to record the 'ice volume effect' only in the isotopic compositions of the tests.

As mentioned earlier, *Gr. menardii* and *Gr. tumida* are planktonic foraminiferal tropical and sub-tropical species respectively, and while a tropical species attains significant abundance peak corresponding to warmer episode, the sub-tropical species attains its peak abundance prior to and later than the peak abundance of the tropical species at the same location. But at the present location a very interesting phenomenon has been observed – trends in abundances of both *Gr. menardii* and *Gr. tumida* are comparable at all levels ($\gamma = 0.74$). All along the studied section abundances of *Gr. menardii* are about 4 to 8 times that of *Gr. tumida* (Figure 2). The rise and fall in abundance of these two species may be because of the following reasons: (i) location being at the boundary of tropical-subtropical provinces, does not witness the extreme of the tropical conditions, (ii) northern branch of colder North Atlantic Bottom Water (NABW) rises near the present location, which probably doesn't allow the significant rise of the temperature of the surface water in the region, (iii) during cool episodes, probably because of decreased productivity, the abundances of both the species is reduced. As the location does not witness the extreme climate, the abundances of both these species are equable and hence there occurs a significant positive correlation coefficient between them.