

## First Report of the Benthic Foraminifera from Kasampir Ridge, Gulf of Kachchh, Gujarat, India

Sanjida Abdulmugni Khan\*

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### Author's Affiliations:

Department of Geology, Nowrosjee Wadia College, Pune-411001, India.

**\*Corresponding Author: Sanjida Abdulmugni Khan**, Department of Geology, Nowrosjee Wadia College, Pune-411001, India.

E-mail: [drsanjidakhan2017@gmail.com](mailto:drsanjidakhan2017@gmail.com)

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### Abstract:

Benthic foraminifera have been systematically studied from a 2-meter ridge segment that is situated next to the Kasampir mosque in Kasmpir. Twenty sediment samples in all were collected. In all, 52 species of benthic foraminifera belonging to 10 genera have been identified namely *Ammonia*, *Quinqueloculina*, *Elphidium*, *Spiroloculina*, *Bolivina*, *Triloculina*, *Loxostomina*, *Cancris*, *Rosalina* and *Textularia*. *Ammonia beccarii* forma *tepida* was common in all sampling stations. The sediment samples were primarily composed of silt, clay, and very fine sand.

**Keywords:** Benthic foraminifera, Grain size, Kasampir ridge, Gulf of Kachchh.

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## INTRODUCTION

Benthic or planktonic in their life cycle, forams are helpful in the search for natural gas and petroleum resources. Understanding the earth's paleo-environmental conditions was made possible by a number of studies comparing ancient forms to more recent ones (Moghaddasi *et al.*, 2009). Common in marine sediments, benthic foraminifera are cosmopolitan, have good fossil preservation, and are a valuable tool for palaeoceanographic and oceanographic research (Murgese and De Deckker, 2005). Their fossil remains can also be used to reconstruct past environments palaeoecologically (Murray, 2001).

Intertidal foraminifera can reveal paleoenvironmental and palaeoecological conditions (Debenay *et al.*, 2002; Horton *et al.*,

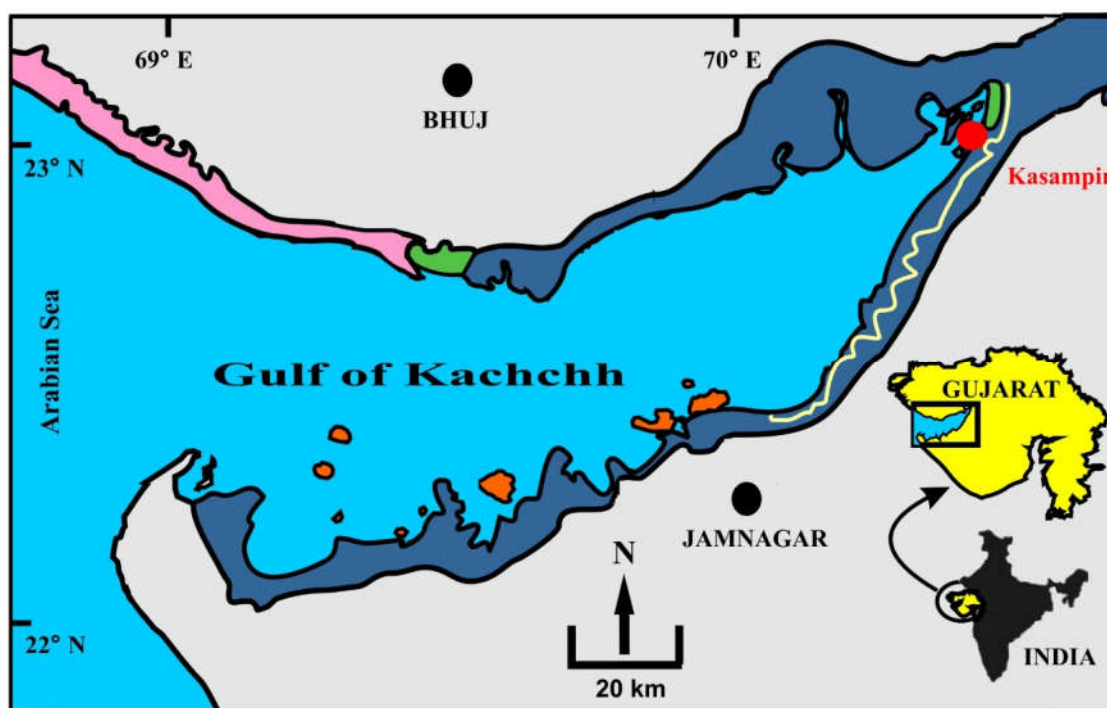
2005; Woodroffe *et al.*, 2009; Shaw *et al.*, 2016; Avnaim-Katav *et al.*, 2017). Sediments can reveal depositional, climatic, and environmental changes through foraminiferal assemblages (Horton *et al.*, 2005; Yanli Lei *et al.*, 2016). According to Murray (2002), three significant groups of benthic foraminifera are typically found in these relatively shallow water environments: the rotalina (hyaline), the miliolina (porcellaneous), and the textularina (agglutinated). The Late Quaternary epoch's key components are the same groups of fossils. In order to illustrate the environmental circumstances that prevail in this region of the Gulf of Kachchh, an effort is made here to differentiate between the Fundamental Niche and the Realized Niche, as well as the total population assemblage and species diversity.

An attempt is made here to analyze the modern foraminiferal diversity and the fossil assemblage. Since the Gulf of Kachchh is associated with port activity and therefore oil pollution must have some imprints on fauna. A comparison between the modern one and the fossil one would highlight the distinction between the two, if any, in this region.

The main objectives of this recent study are to identify benthic foraminifera communities in the Kasampir ridge, Gulf of Kachchh for the first time and study their abundance in relation with the environmental conditions.

#### Geological setting and Geomorphology of Gulf of Kachchh

The geology of the Gulf of Kachchh is very interesting as it shows the presence of complete sedimentary sequence from Paleocene to Recent. The Gulf of Kachchh has a distinct geomorphology since it is a crucial component of the Pericratonic Mesozoic-Tertiary sedimentary basin (Biswas, 1980). Its average width is between 10 and 15 km, and the total area is roughly 7325 km<sup>2</sup>. It is 180 km long in the E-W transect. The Okha is situated at the mouth of the gulf, facing the Arabian Sea, while the Navlakhi-Kasampir tract forms one of its most landward ends. It is between the Kachchh mainland uplift in the north and the Kathiawar uplift in the south. The coastal plain in this area is made up of the northern and southern shores.



**Figure 1: Location map showing Kasampir ridge sampling site.**

In contrast to the flat northern coastline, the southern coast is significantly indented. Pleistocene limestone, beach sand, rocky shorelines, and extensive clay and silty clay deposits make up the majority of the coastal sediments. It shares genetic ties with the Arabian

Sea's continental shelf margin and the Cambay basin. As a result, both the oceanic and continental environmental footprints are highly intriguing in its coastal deposits. The Gulf's mouth, close to Okha in the west, is its largest point. It progressively narrows toward the east,

then suddenly narrows around Navlakhi, where it seems that the northern and southern shores converge. Several dead coral reefs interrupt the Gulf.

In general, the geographical areas that border the Gulf of Kachchh are low-lying, level plains that dip gently toward the coast. The macro-tidal environment of the Gulf is characterized by waves that are about 4 meters high at the mouth and 7 meters high as they go toward the landward end of the Gulf. Moreover, surface currents range from 1.5 to 4.5 knots. There are sandstones, dead corals, rock fragments, and algal limestones on the uneven bottom surface topography. In the Gulf's core, the tidal influence is greater (Rao and Wagle, 1997).

## **MATERIALS AND METHODS**

### ***Foraminifera Analysis***

Sediment samples were soaked in water for 24 hours prior to wet sifting in order to identify foraminifera in the lab. For the sediments to properly dissolve, a tiny bit of hydrogen peroxide was applied. A 63  $\mu\text{m}$  mesh sieve was used to wet sift the materials. To prevent the destruction of the samples' fragile microfossils, a gentle pressure of tap water was used during the sifting process. Following sifting, the samples were stored in glass or plastic vials and dried in an oven set at a temperature no higher than 50° C. The processed fractions were labeled and stored with care. A stereomicroscope and (Loeblich and Tappan, 1988) were used for studying and identifying foraminifera.

### ***Grain Size Analysis***

To disaggregate the sediment, 100 g of dried sediments (70°C, 8h) in an oven were combined with 250 ml of tap water and 10 ml of sodium hexametaphosphat (6.2 g/L). The sediment was then mechanically mixed for 15 minutes, left to soak for 8 hours, then swirled for another 15 minutes and dried again at 70°C for 24 hours, as per Moghaddasi et al. (2009a). The topmost of a stack of graded sand sieves of 4, 2, 1, 0.5, 0.25, 0.125 and 0.063 mm mesh was filled with 50 g of dried material. After that, the material that was still on the sieves was taken out and meticulously weighed. Ultimately, each particle's proportion was determined.

## **Samples and studied section**

### ***Kasampir ridge***

Twenty sediment samples are taken at 10-cm intervals to measure a 2-meter length directly at the Kasampir mosque. In terms of lithology, clay predominates across the area. The lithology ranges from soft, greyish to brownish-yellow clay to fine to coarse silt, and from mildly plastic to plastic. There are quartz grains and shell fragments in every sediment interval. Numerous mica grains, foraminifera, common ostracods, pteropods, bivalves, bryozoans, sponge spicules, and subrounded sand grains are found in the fine sediment portion of 212  $\mu\text{m}$ . Every microfossil is thick, well-preserved, and heavily calcified. Despite having a damaged apical portion, *Chara* remains present throughout the entire gap.

## **Faunal assemblage zone**

A total of 52 foraminiferal species belonging to 10 genera have been identified and listed in Table 1. There are five layers in the faunal composition investigated at the Kasampir Mosque section, with the total number of foraminifera ranging from a minimum of 19 to a maximum of 716. The total microfossil number (TMN) is low in the upper portion of the section, which is between 110 and 190 cm. The level 190 cm displays the lowest microfossil numbers, which is zero. The overall foraminiferal number counts exhibit the same pattern at concentrations where microfossils are present in significant numbers. It indicates that the foraminiferal group is dominant and that microfossils have relatively little diversity. A rich diversity of foraminifera is common off the GoK (Nigam and Chaturvedi, 2000).

There is also very little diversity in the foraminiferal composition, with no more than ten genera. There are ten genera at level 90 cm, compared to a minimum of three genera at levels 40, 110, 140, 150, 160, and 180 cm. When comparing the total number of genera (TNG) with the total foraminifera number (TFN), it is found that the latter has more or less consistent counts across the section, whilst the former has significant swings in counts. The percentage abundance of the calcareous, porcelaneous, and agglutinated groups of foraminifera is plotted against each sectional level in the histograms. At

level 110 cm, the individual counts of Porcelaneous forms do not surpass 16, while the individual counts of Calcareous forms are similar to those of TFN. Thus, the histograms (Fig. 2) shows that the calcareous group of foraminifera is dominant. Agglutinated forms can be regarded

as insignificant ones because they are observed at very few levels. The predominant Calcareous group in this part is followed by a small fraction of Porcelaneous ones, which likewise follow the same pattern.

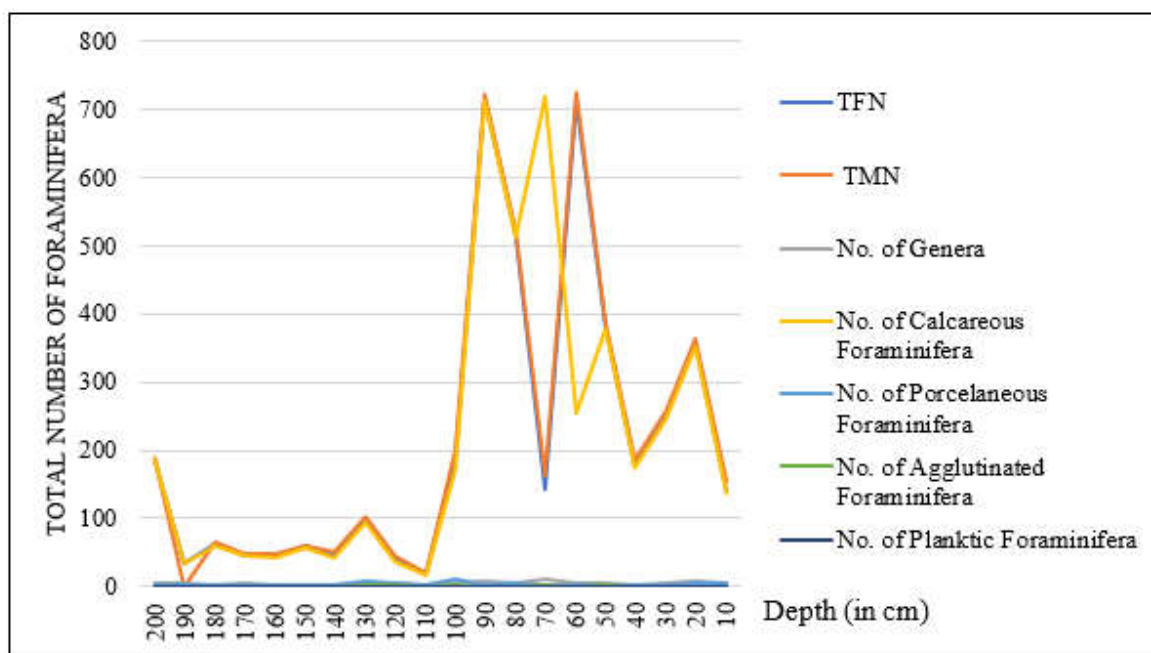


Figure 2: Quantitative faunal analyses of the Kasampir ridge section

Table 1: Foraminifera genera and its dominance in Kasampir ridge sediments of Gulf of Kachchh, Gujarat.

Sr. No.	Genera	No. of species	Dominance (%)
1	<i>Ammonia</i>	11	21.2
2	<i>Quinqueloculina</i>	7	13.5
3	<i>Elphidium</i>	7	13.5
4	<i>Spiroloculina</i>	6	11.5
5	<i>Bolivina</i>	5	9.6
6	<i>Triloculina</i>	4	7.7
7	<i>Loxostomina</i>	4	7.7
8	<i>Cancris</i>	3	5.8
9	<i>Rosalina</i>	3	5.8
10	<i>Textularia</i>	2	3.8

## CONCLUSION

In all 52 foraminiferal species are reported for the first time from the Kasampir ridge sediments. The ridge may be purely marine in the

environment and must have formed in an environment of shallow marine conditions where the occasional flooding by tides was common in the lower part. In general, the calcareous forms emerge as the most dominant group followed by

minor constituent of the porcelaneous forms. The Ridge fauna is characterized and shows the dominance of *Ammonia beccarii* forma *tepida*.

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