

FIRST RECORD OF ALIVE ASTERIGERINA (FORAMINIFERA: ROTALIIDA) WITH NOTE ON ITS DISTRIBUTION AND ABUNDANCE FROM THE COASTAL AREA OF PAKISTAN, NORTHERN ARABIAN SEA

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ABSTRACT: Foraminifera is an important group of organisms which is widely used as indicators of environmental change. Not much work on foraminifera has been done on the Arabian margin running along the Pakistan coast. Information on the diversity and distribution of foraminifera is very limited and no information is available from the Balochistan coast. This study is an attempt to explore the diversity and dynamics related to foraminifera at the coast of Baluchistan. This very part of the study is designed to collect information about the zonation, vertical distribution and abundance of the genus *Asterigerina* at the beach of Ormara, Balochistan. The fossilized form of *Asterigerina* was previously reported from the sediments of upper Quetta region. This is the first report on the occurrence of alive *Asterigerina* in the coastal areas of Pakistan.

KEYWORDS: Foraminifera, Rotaliida, vertical distribution, coastal sediments, Pakistan

INTRODUCTION

Coastal areas represent a complicated system with a variety of landforms including estuaries, lagoons, marshes, creeks, and wetlands (Munji *et al.*, 2013). The physical composition of these beaches along with organic debris not only interferes with food chain connections but also regulates benthic population dynamics (Jenderedjian *et al.*, 2007; Farooq and Siddiqui, 2020).

Benthos provides ideal measures to environmental disturbances and is an effective indicator of environmental instabilities and contamination levels (Dauvin, 2006; Perus *et al.*, 2007). Foraminifera are the microscopic amoeboid protists characterized by septate, chambered tests, and granulated reticulopodia. About 8991 species with more than 40,000 fossilized forms of foraminifera were reported (Hayward *et al.*, 2023). They are an effective tool due to their pervasive distributions, high abundances, short generation times, the reliable fossil record, and sensitivity to certain environmental factors (Schöenfeld *et al.*, 2012).

Calcareous hyaline perforate tests are used to identify rotaliid foraminifera. Chamber layout, aperture forms, and internal divisions of their tests have long been thought to be essential features in determining taxonomic groupings within the order (Loeblich and Tappan, 1974; 1987). Haynes (1981) identified three foraminiferal orders with hyaline perforate tests: the Rotaliida, the Buliminida, and the Globigerinida. The order Rotaliida (Delage and Hérouard, 1896) comprised of more than 250 taxa that inhabit marine environments ranging from shallow to deep sea (Haynes, 1981; 1992).

Family Asterigerinidae comprises of benthic rotaliid species, featuring bilamellar walls and a carinate periphery. The chambers are organized in a trochospiral arrangement, and the aperture is typically located on the internal border, with secondary apertures located along the sutures. Asterigerinidae is currently characterized by a single genus, *Asterigerina* exhibiting huge diversity (> 65 species).

Reports on the rich foraminiferal diversity in the Indian Ocean is available from offshore waters (Chapman, 1895; Hofker, 1927; Rao, 1970; Setty and Nigam, 1980; Cherif *et al.*, 1997; Kurbjeweit *et al.*, 2000). Not much work on foraminifera has been done on the Arabian margin running along the Pakistan coast. Limited work has been done regarding abundance of foraminifera in the Arabian Sea (Stubbings, 1939; Corliss, 1981; Gupta, 1992, Gooday *et al.*, 1998) and only a few have explored the continental shelf at the coastal belt of Pakistan (Jannink *et al.*, 1998; Schulz *et al.*, 2002; Schumacher *et al.*, 2007; Arshad and Farooq, 2022).

Most recent work on coastal community structure and composition with reference to physicochemical parameters was documented from the Karachi coast (Hughes *et al.*, 2009; Farooq & Arshad, 2010; Arshad *et al.*, 2017; Arshad and Farooq, 2018; Farooq and Siddiqui, 2020). Very little work is documented on the coastal benthic communities of the Balochistan coast and information on the diversity and distribution of alive foraminifera is not available. The records on the occurrence of fossilized *Asterigerina* was available from the middle to late Eocene and Quaternary sediments of upper Balochistan region (Haque, 1960; Baber *et al.*, 2018). But no report on the occurrence and abundance of this genus was available from the recent coastal sediments.

This study is the first attempt to explore the diversity and dynamics related to foraminifera at the coast of Baluchistan. This very part of the study is designed to collect information about the abundance of the genus *Asterigerina* sp. at the beach of Ormara, Baluchistan.

MATERIAL AND METHODS

Study site: The samples for the present study were collected from the beach of Ormara, Balochistan (Fig 1). The Ormara beach is located (25° 16' 29N 64° 35' 10E) in the Gwadar district 360 kilometers west of Karachi and 230 kilometers east of Gwadar. The Ormara is a recreational beach located in the Makran coastal region. It is also an important Ramsar site with reference to turtles.

Sampling and laboratory analysis: The sediment samples were collected by using a hand corer from a vertical transect between high tidal mark (HT) and low tidal mark (LT) at Ormara beach. For the study of vertical distribution, each sediment core sample was sliced at 1 cm interval. The samples for the analysis of foraminifera were analyzed by following standard procedures (Murray and Bowser, 2000). To differentiate alive and dead specimens a portion of sample was preserved in ethanol with Rose Bengal stain. Each sample was washed through 110 and 250 µm mesh sieves. The sample retained on the sieve was examined, sorted and counted using a stereomicroscope. The detailed examination of specimens was done under OPTIKA 290TB and the specimens of

Asterigerina were identified following available taxonomic keys (Cushman, 1933; Milker and Schmiidl, 2012).

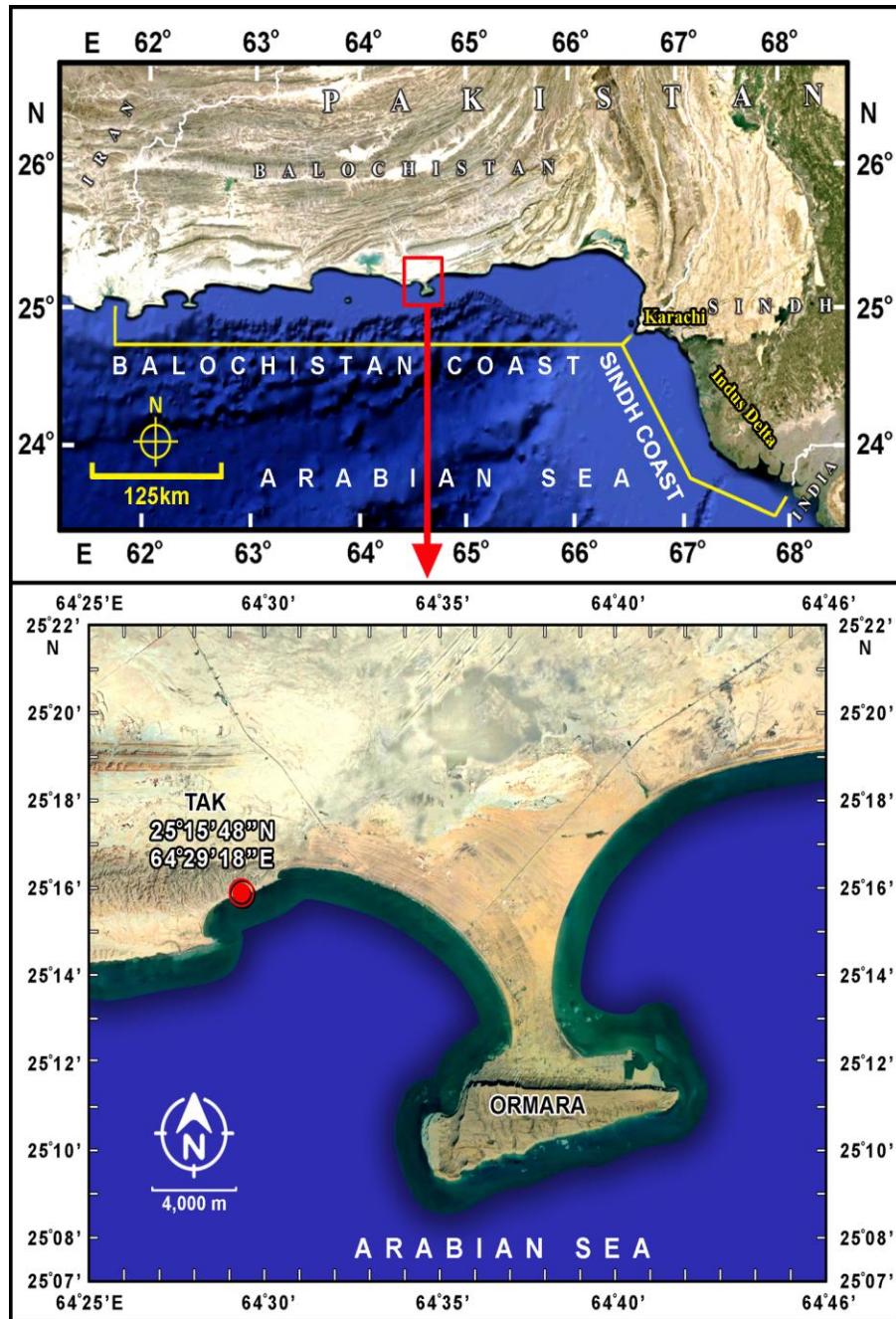


Fig. 1. Map of study site.

RESULTS AND DISCUSSION

SYSTEMATICS

Phylum: Foraminifera d'Orbigny 1826

Class: Globothalamea Pawlowski *et al.* 2013

Order: Rotaliida Delage and Hérouard 1896

Suborder: Rotaliina Delage & Hérouard, 1896

Superfamily Asterigerinoidea d'Orbigny, 1839

Family Asterigerinidae d'Orbigny, 1839

Genus: *Asterigerina* d'Orbigny, 1839

Diagnosis: The test looks to be trochospiral and biconvex. The umbilical side is more convex than the spiral side. The last whorl has ten to twelve subtriangular chambers. A translucent calcite keel with an oblique periphery is present. The umbilical side of secondary chambers has a rosette-like configuration. The test is smooth except for the tuberculated zone in front of the aperture. The youngest foramen is elliptical in form and is located between the perimeter and the umbilicus on the umbilical side. The sutures on the spiral side are oblique and curled. They are level with the surface, except for the central region of the umbilical side, which is slightly elevated and bears little tubercles. The wall's structure is calcitic, perforate, and radiating (Fig 2).

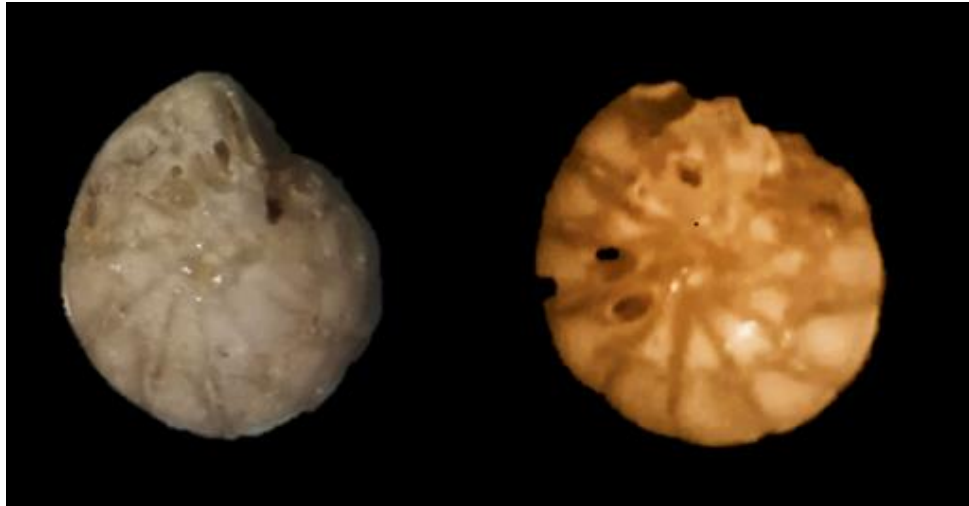


Fig. 2. Images of *Asterigerina* collected from Ormara beach.

The individuals were mostly well preserved. Features of deterioration or abrasion and repair structures were observed occasionally. The majority of *Asterigerina* exhibited regular calcite test, 10- 12 chambers in an outer whorl, round periphery, straight furrows on spiral and trapezoidal furrows the on the umbilical side, typical biconvex trochospiral shell accompanied by no heavy calcite marking and pustules on the umbilical side.

Distribution and abundance of genus *Asterigerina*: The density of *Asterigerina* species ranged between 2 to 40 individuals in all samples. A higher number of specimens were observed in 250 μ m fraction. Very few forms were observed in 110 μ m fraction of all samples (Fig 3 a).

The highest percentage of alive *Asterigerina* specimens was recorded in the topmost layers of high tidal (HT) samples (Fig 3 b). Medium tide (MT) samples reflected low density. Low tide (LT) samples reflected high abundance throughout the layers without any difference in top or deeper layer. The vertical profile of *Asterigerina* abundance indicates comparatively higher abundance in upper layers of sediments (Fig 3 c). The density of *Asterigerina* declines with the increase in the sediment depth.

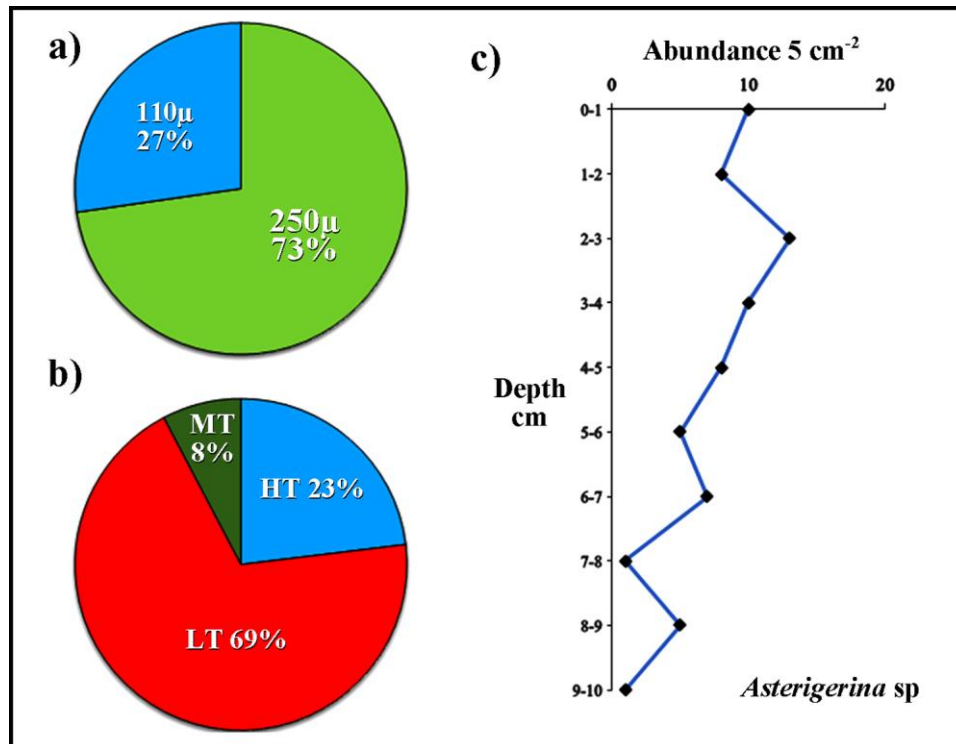


Fig. 3. Distribution and abundance of genus *Asterigerina*. a, Density of *Asterigerina* in studied sediment fractions; b, Distribution of genus *Asterigerina* with reference to beach profile (HT=High tidal zone, MT= Mid tidal zone, LT = Low tidal zone); c, Vertical distribution of *Asterigerina*.

Numerous studies in coastal environment indicates the effects of environmental parameters on coastal environment. The combined effects of these ecological factors and ocean acidification are anticipated to result in significant alterations to coastal ecosystems (Solan and Whiteley, 2016; Farooq and Siddiqui, 2020). The decalcification of hyaline benthic foraminifers, which results in partial or full test dissolution, has been linked to decline in pH (Cotter and Hallock, 1988). Decalcification under acidic circumstances and

recalcification under favorable conditions are prevalent in the natural environment, resulting in morphological abnormalities (Charrieau *et al.*, 2018). Only a few abnormal tests of *Asterigerina* were recorded in the present study suggesting negligible environmental stress. Information on the diversity and distribution of benthic foraminifera is important in the management of coastal ecosystem. The present study enhances the pool of knowledge about the diversity of these tiny, neglected organisms in the coastal waters of Pakistan that can be used as the indicator of environmental change.

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