ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 5, Issue, 02, pp.293-297, February, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

Study of abnormal benthic foraminifers and its impact in Andaman sea Portblair India

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ARTICLE INFO

Article History:
Received 16th November, 2012
Received in revised form
25th December, 2012
Accepted 30th January, 2013
Published online 14th February, 2013

Key words:

Micro boring,
Benthic foraminifera and
Energy-Dispersive,
X-ray Spectroscopy (EDAX EDS).

ABSTRACT

Foraminifera unicellular protozoan whose high level taxonomical studies are based on shell mineralogy can be categorized into four groups as taxa with organic shell, agglutinated taxa, calcareous perforate taxa and calcareous imperforate and habituating in marine environments such as coral reef and mangrove. For the present study benthic foraminifer fauna has been collected in the Van veen grab sampler in the Sosistris Bay and North Bay of Port Blair India. These reef dwelling foraminifera host algal symbionts have substantial promise as indicators of coral reef vitality because physiological analogies between coral and foraminifera require similar environmental conditions. To study the Shell abnormalities such as stunted foraminifera shells, abnormal wall structures and shell deformation, mineralogical projection, micro borings, pitted surface, calcification anomalies, dissolution and shell deformation in foraminifera the light microscopic SEM and EDAX studies are carried out. The basic finding of the study reveals that shell abnormalities are common in foraminifers' species. More than three morphological anomalous found in the peneroplis genus .The high frequency of morphological anomalies of foraminifera indicates that the abnormities are associated with induction of heavy metals such as Zn, Fe, Pb and Zn into crystalline frame work of foraminifera shell. Heavy metal contamination of the environmental conditions including geochemical habitat or human influence. Pervasiveness of such features indicates that these foraminifera and its impact in marine environment. The main pollutants are chemical like heavy metals, organic sewage, nutrients, and hydrocarbons and physical like thermal, and oil.

INTRODUCTION

Micro boring is a exactingly benthic activity which afflicts the carbon particles after they have settled at the sediment water interfaces. Endolithic micro-organisms (or microendoliths) are boring the foraminifers, algae and fungi and they produce boreholes less than 100 µm wide that correspond in most samples exactly with the outline of the boring organism. Borehole less than 100 µm wide are identified in the benthic foraminifera of *Spirolina arietinus* (Batsch), *Calcarina spengleri Quinqueloculina pulchella, Peneroplis cylindraceus*(Lamark), and *Peneroplis planatus* by algae and fungi. Surface pits in *Spirolina arietinus* (Batsch), *Peneroplis planatus* (Fichtel and Moll) are small as 25 µm and circular in shape with ragged edges. Sinkhole and pockmarks of 100 µm in size with crumbly appearance are evident on the surface of the shells. In *Peneroplis cylindraceus* the boring features are straight, cured and distributed randomly. The length of boring is ranging from 46.87µm to 21.87µm and the width is 3.1 µm. The multiple deformities is more than one abnormal features occur in single species is such as Micro boring, pitted surface, profoundly deforms are occur in the *Peneroplis planatus* (Fichtel and Moll).

MATERIALSAND METHODS

To study the common stress response of reef dwelling foraminiferal assemblages to the natural and human induced disturbances such as temperature, sedimentation, inorganic nutrients and solar radiation samples were collected from the reefs in the North Bay (15m depth) Aberdeen Bay (25 m depth) Sisostris Bay (10 m depth) in Andaman Sea,and Wandoor beach (12 m depth) and Chidyatapu beach (11m depth) in Bay of Bengal South Andaman, India. Samples were collected through Van veen grab sampler subsequently treated with Rose Bengal dye to distinguish living and deceased species. Specimens were collected by hand after sieving and drying of the sediment samples, and preserved in paleontological slides. Using Stereoscopic Binocular Microscope (Nikon – SMZ1500) microscope, species were identified and taken photographs. FEI Quanta 200 Environmental Scanning Electron Microscope (ESEM) with Energy-Dispersive X-ray Spectroscopy (EDAX EDS) system was used to study the variety of anomalous ultra features and chemical characteristic of foraminiferal species. In this system The EDAX is attached with SEM that enables to analysis the elemental composition and also the ultra structure of the foraminiferal samples. For that specimens were rinsed in deionised water and air dried on paleontological slides.

Then the species were mounted on aluminium SEM stubs using double-sided adhesive tabs. In this study the characteristic of an element with atomic structure is identified uniquely from one another in the form in the form of EDX spectrum along with ultra structures of the same species. After scrutinize the foraminiferal species through light microscope, species comes under the order Miliolida, Bulimida and Rotaliida. The species selected for SEM such as *Peneroplis cylindraceus, Spirolina arietinus, Peneroplis planatus, Quinqueloculina pulchella, Siphogenerina striata, Bolivina subspinescens, Triloculina rupertiana, Calcarina spengleri, Quinqueloculina intricate and Elphidium crispum*

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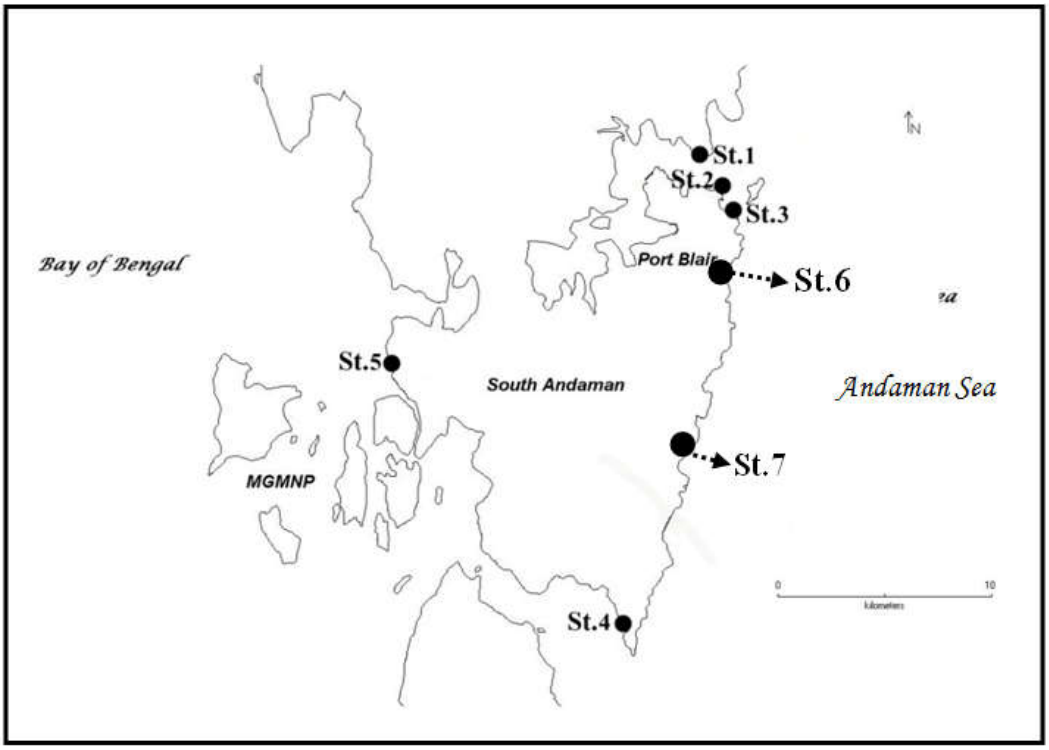
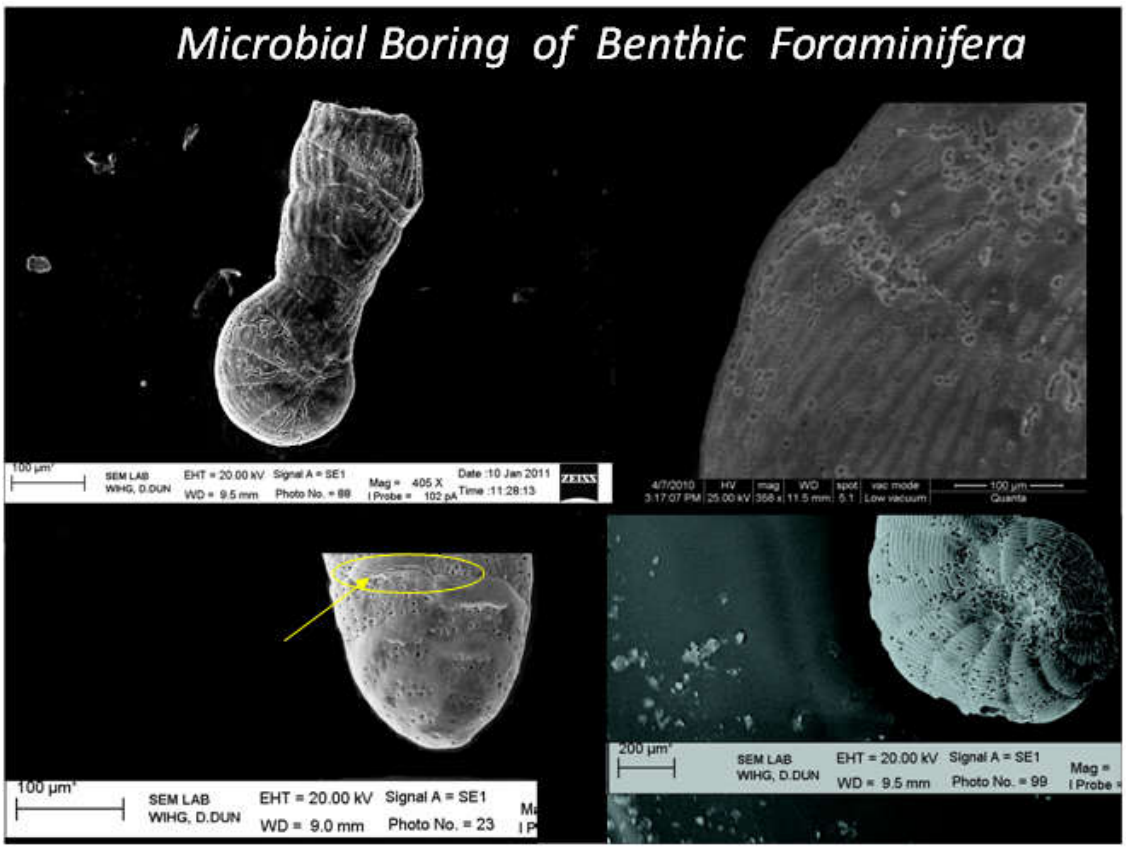
Study area



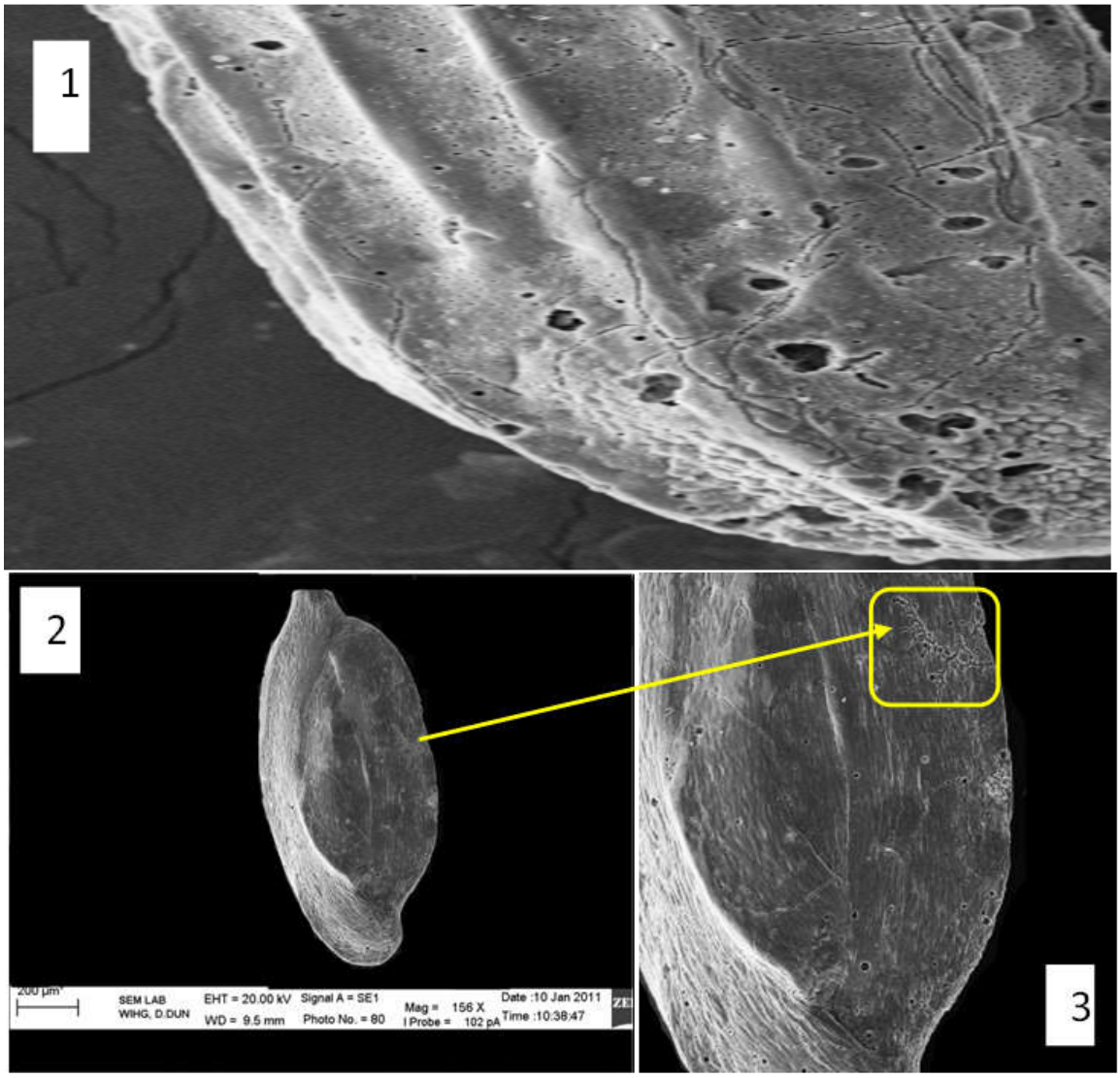
St.1-North Bay (15m depth), St.2-Aberdeen Bay (25 m depth), St.3- Sisostris Bay (10 m depth), St.4- Chidyatapu beach (11m depth)and St.5-Wandoor beach (12 m depth) , St.6- Carbyns Cove(9m depth), St.7- Burmanalla (5m depth).

PLATE: 1



1. Micobial boring of *Peneroplis cylindraceus* (Lamark), 2. Micobial boring of *Peneroplis pertusus* (Forskal), 3.Microbial boring of *Bolivina subspinescens* (Cushman), 4. Micobial boring of *Spirolina arietinus* (Batsch).

PLATE 2:



1. Fig-1. Micro boring of *Siphogenerina striata* (Schwager). 2. Micro boring, pitted surface of *Triloculina rupertiana*(Brady).

TYPES OF ABNORMALITIES FOUND AT EACH SPECIES

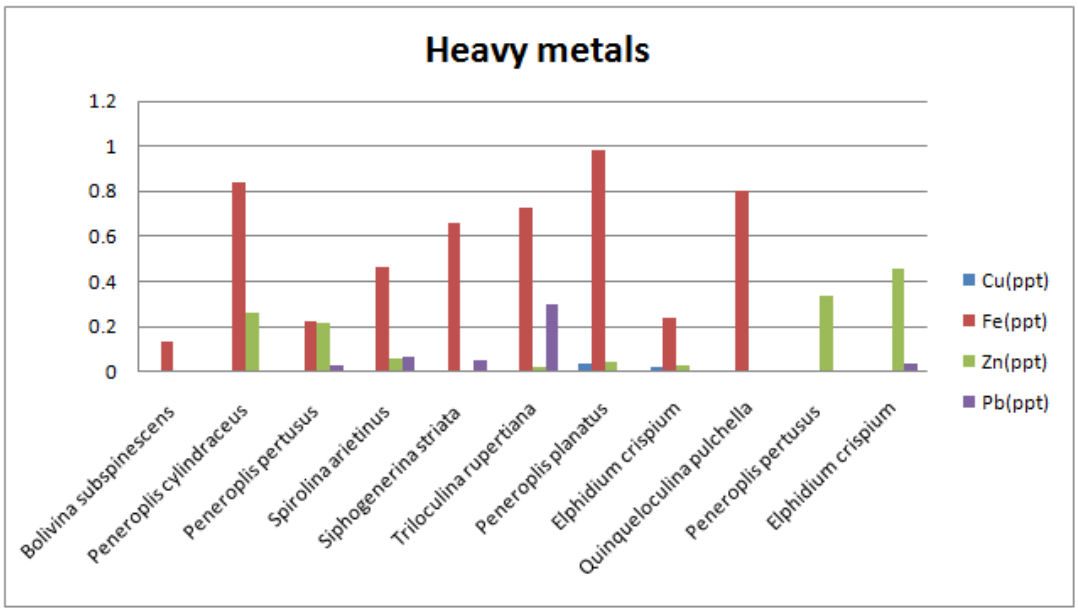
Species	Micro boring	Pitted surface	Profoundly deformed	Uncoiled	Cell repair
Siphogenerina striata	√	×	×	×	x
Peneroplis cylindraceu	√	×	×	×	×
Bolivina subspinescens	√	×	×	×	×
Spirolina arietinus	√	√	×	×	×
Peneroplis planatus	√	√	√	×	×
Quinqueloculina pulchella	√	×	×	×	×
Triloculina rupertiana	√	×	×	×	×
Quinqueloculina intricata	√	×	×	×	×
Elphidium crispum	×	×	×	√	√

√--- Present, ×--- Absent

RESULTS

Micro boring is a process done by endolithic micro-organisms that boring the benthic foraminifers such as *Spirolina arietinus* (Batsch), *Peneroplis cylindraceus*(Lamark), and *Peneroplis planatus* (Fichtel and Moll) *Siphogenerina striata* (Schwager), *Triloculina rupertiana*(Brady) and these endolithic microorganisms produce borehole less than 100µm the wide that correspond in most samples exactly with the outline of the boring organisms. Micro borings are straight, curved and formed dense networks with dendritic appearance. The endolithic micro- organisms colonize the calcareous, siliceous and phosphatic substrate. In *Peneroplis cylindraceus* the boring features were straight, cured and they are randomly distributed. The length of boring is ranging from 46.57µm to 21.77µm and the width of the boring is same it is 1.1 µm.

In *Bolivina subspinescens* the boring features were long, coiled and they are thickly distributed. The length of boring is ranging from 168µm to 32.5 µm and the width of the boring is ranging from 50µm to 4.25µm. *Spirolina arietinus* the boring features were short, cured



HEAVY METAL COMPOSITION OF ABNORMAL FORAMINIFERS

and they are densely distributed. The length of boring is ranging from 60µm to 100µm and the width of the boring is same it is 27 µm. In ***Siphogenerina striata*** *the* boring features were long, cured and they are randomly distributed. The length of boring is ranging from 19µm to 105µm and the width of the boring is same it is 6.8 µm. In ***Spirolina arietinus*** the boring features were straight, cured and they are randomly Adistributed. The length of boring is ranging from 167µm to 133µm and the width of the boring is ranging from 13 µm to 17 µm. *In* ***Triloculina rupertiana*** the boring features were straight, cured and they are randomly distributed. The length of boring is 54µm and the width of the boring is 3 µm. ***Quinqueloculina intricate*** the boring features were straight cured and they are randomly distributed. The length of boring is ranging from 200µm to 120 µm and the width of the boring is 8 µm. Surface pits are the abnormal features were occurred in *Spirolina arietinus*, *Peneroplis planatus*, Some pits were as small as 25 µm and circular in shape with ragged edges. Others looked like sink holes on the surface of the shells, and when they coalesced into large pockmarks 100µm a crumbly appearance was evident. Pitting was often found in combination with dissolution giving a smooth polished look to the pits abnormal features.

Profoundly deformed is one of the abnormal features were occurred in Spirolina *arietinus*, *Peneroplis pertusus*, *Peneroplis planatus* a *Elphidium crispum*, and individuals were highly variable in appearance. They had no planispiral characteristics what so ever and possessed obscured apertures. They were often spheroid in shape. Uncoiled is the abnormal features were occurred in *Peneroplis pertusus, Elphidium crispum*, were characterized by a normal juvenile portion of the shell. However as rows of chamber lets were added, the involute characteristics were lost and the individuals looked long, slender, and uncoiled.

Symbiont-bearing miliolids, such as *Peneroplis pertusus* and *Peneroplis. planatus*, exhibited an uncoiled chamber arrangement, reduction in the size of the last chamber, and protuberances[2]. Smaller miliolids from their study site exhibited multiple apertures, a change in the direction of the axis of coiling, and lateral asymmetry of apertural position. [3]. also documented a similar variety of morphological deformities among miliolids, including *Peneroplis. planatus*. Other studies looking specifically at heavy metal contamination noted stunt foraminiferal shells [4]. as well as low abundance and diversity [5]. Described abnormal wall structures and shell deformation in *Ammonia* due to heavy metal contamination. The "crystal disorganization" they described may have been the result of alien elements, such as Cu and Zn, being introduced into the crystalline framework [6]. The elemental analysis such as heavy metal composition in abnormal foraminifer were carried out by EDAX analysis. SEM ultra structures shows that the *Peneroplis. Planatus* and *Spirolina arietinus* species having multiple abnormal features such as micro boring pitted surface and profoundly deformes. In EDAX analysis shows that heavy metals composition he are the maximum of Fe is 0.8ppt and Zn is 0.2 ppt are present in the *peneroplis planatus*.

Conclusion

Deformed foraminiferal shells were observed in juvenile and adult *Bolivina subspinescens, Siphogenerina striata, Triloculina rupertiana, Peneroplis planatus, Peneroplis arietinus*, *Peneroplis cylindraceus* with algal endosymbionts collected live along the North Bay and Wandoor reef tract. Character considered taphonomic included microborings, pitted surfaces, and growth abnormality evidence of shell repair was also documented. The elemental composition of the abnormal forams having the heavy metal compostion. So I end that forams in rate of such features may indicate that the environmental strain.

Acknowledgment

Authors are thankful to the Head of the Department, Disaster Management, Pondicherry University, and Port Blair for providing facilities and permission accorded by Vice-chancellor of Pondicherry University Prof. J. A. K. Tareen, Director, Dean and Registrar for constant encouragement and support. Authors also thankful to Prof. T.Pradeep, Department of Chemistry, IIT Madras, Chennai. Authors also thankful to Dr. C.Rajshekhar visiting Faculty, Department of Geology, N. Wadia College, Pune.

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