# NOTES

## LIVING FORAMINIFERA FROM A TIDAL CREEK AT PUDIMADAKA, NEAR VISAKHAPATNAM, EAST COAST OF INDIA*


ABSTRACT

Core samples of sediments were collected during January, March, April, May, June, July, September and November, 1970 from stations located along the length of a tidal creek near Pudimadaka near Visakhapatnam, east coast of India. Samples of water just above the sediment surface were also collected and analysed for salinity and dissolved oxygen. During sampling of the sediments, the top one centimetre of the sediment core was removed and preserved in 5% formaldehyde and later in the laboratory dead and living foraminiferal populations were differentiated using the Rose Bengal technique. Living foraminiferal populations were counted from a constant volume of the sediment. The sediments were analysed for grain size distribution and organic matter contents.

*Ammonia beccarii*, *Ammonia beccarii* var. *tepida*, and *Quinqueloculina seminulum* dominate among the calcareous species while *Ammobaculites agglutinans*, *Textularia agglutinans* dominate among the arenaceous species.

Among several ecological factors that control the variety and abundance of living foraminiferal fauna, chlorinity of the waters appear to play a determining role in the area under study.


CONSIDERABLE information is available on the foraminifera of the shelf sediments off the east coast of India (Ganapati and Satyavati, 1958 ; Ganapati and Sarojini, 1959 ; Subba Rao and Vedantam, 1968 ; Vedantam and Subba Rao, 1970). Nevertheless, our knowledge of the foraminifera in the shallow water sediments at depths less than 8-11 m is meagre. The few reports of the foraminifera in beach sands of Puri (Bhalla, 1964), of Visakhapatnam (Bhalla, 1968), and of Digha (Ghosh, 1966), very limited in scope, could only provided a partial picture of the faunal assemblages in the nearshore waters. Another conspicuous omission in the foraminiferal studies on the east coast of India is that with the exception of Ramanathan's (1969, 1970), study on the Vellar Estuary, no other investigation has ever been undertaken on the foraminifera of the estuaries, creeks, backwaters, and such other types of environments on the east coast of India.

With a view to acquiring data on the foraminifera in relation to various ecological factors, the authors have carried out systematic investigations on six water bodies that are located over a stretch of 100 miles between Visakhapatnam and Kakinada. In the present report are included the results of one such study on a tidal creek near Pudimadaka.


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*Location*

Pudimadaka, is a small village located right on the coast about 40 kilometres south of Visakhapatnam on the east coast of India. A stream that has its origin at about 16 kilometres northeast of Pudimadaka joins the sea 1 kilometre southwest of the village. It has a tributary stream that originates 10 kilometres west of Pudimadaka and joins it at a point 3/4 kilometre upstream of the confluence. The stream is fed with rain water intermittently in the S-W monsoon season (June-September). The mouth of the creek is always open to the sea. No sand bar is blocking its mouth. The high tide carries seawater about three miles upstream in summer months. The down stream end records an average depth of 2 m in the deepest portion of the channel.

*Field Methods*

Nine stations were established along the length of the stream (Fig. 1). Samples of sediments were collected from each of the stations in January, March,

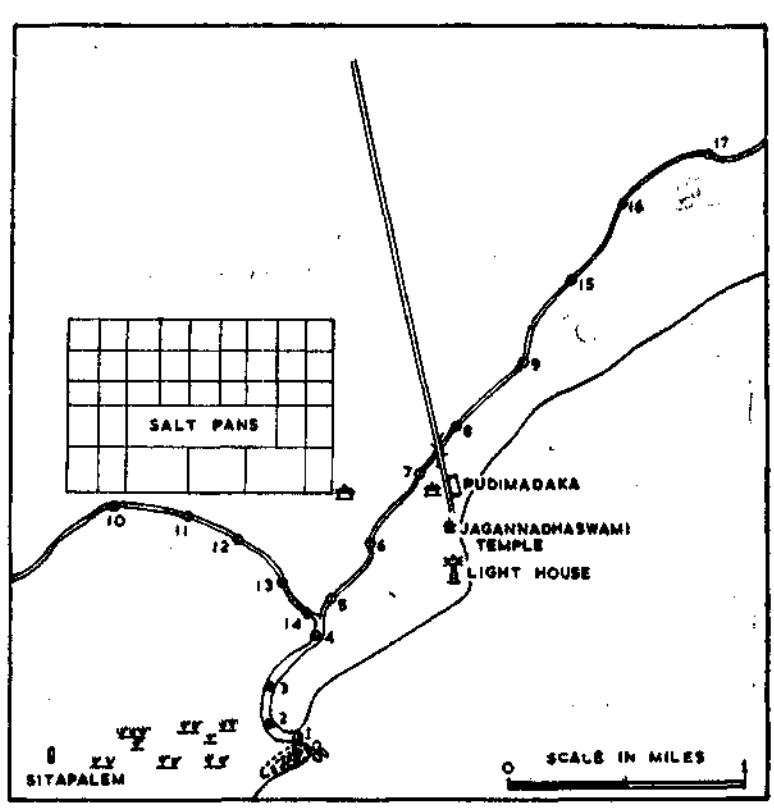


Fig. 1. Stations located along the length of a tidal creek near Pudimadaka.

April, May, June, July, September and November, 1970. A plastic tube having an inner diameter of 4 cm was pushed into the bottom and slowly raised from out

of the water holding the lower end of the tube closed with the palm. Using a core pusher, the core is pushed up from the lower end until the sediment fills a measuring cutter (Phleger, 1960) which holds the upper 1 cm of the core, which was then cut, removed and placed in a polythene bottle. To it was added neutralised formaldehyde. A small amount of calcium carbonate was also added to the sample. Two or three more cores were obtained and top portions were removed in the same way and preserved in plastic bags for size analysis and organic matter content. Samples of water just in contact with the channel bottom were taken in two bottles, one for salinity and another for oxygen determination.

*Laboratory Methods*

The sediment sample preserved in formaldehyde was washed through a 230 mesh sieve (having an opening of 0.062 mm) to free off silt and clay. The residue in the sieve was stained with Rose Bengal (Walton, 1952) and again was washed to be freed of excess stain. The sample was dried and the foraminiferal tests were separated by floatation in Carbontetrachloride. Population counts were done under a binocular microscope.

The dissolved oxygen content of water samples was determined by the method of Strickland and Parsons (1965). The salinity of water was determined by silver nitrate method.

Sediment particle size was determined in accordance with the method described by Krumbein and Pettijohn (1938). The organic matter content of the sediments was determined by Walkley and Black's method (Jackson, 1958).

*Results and Discussion*

Of a total of 60 species recognised in the creek 30 species in 11 families are found living at one time or other during the period of observation. Calcareous foraminifera dominates and constitutes more than 90 per cent of the total population. The Rotaliidae, Miliolidae, and Nonionidae are represented by the largest number of species in that order. *Ammobaculites agglutinans* and *Textularia agglutinans* are the most dominating among the arenaceous forms.

The number of living foraminifera at any station per unit volume of sediment shows great variation from month to month (Fig. 2 a). From January through May, the living populations increase in an upstream direction from the confluence, reaching their maximum abundance at station 7 or 8. In the stations further upstream the populations are very low. In the month of June the populations are drastically reduced at all stations. This may be because the upper layers of the sediment had been flushed out by the increased downstream flow caused by floods. Sudden decrease in salinity of the water brought about by the additions from the drainage basin causes large scale mortality of the fauna. The populations improve in July but in the month of September they declined. This decline in numbers in September may be due to additions of fresh water from the drainage basin and/or due to a general lowering of salinity in the waters of the Bay of Bengal. The situation improves considerably in November and it is likely that it will improve steadily till next May provided no unusual factors like abnormal rains intervene during the period.

Population abundance is not the same at all the stations. The station 4, 5, 6, 7 and 8 located over the middle stretch of the stream generally record maximum populations. The variation in abundance during the observation period along

with variations in such ecological factors as salinity, temperature, dissolved oxygen content and sediment character at station No. 7 is shown in fig. 2 b as an illustrative example. The populations here increase steadily from January through

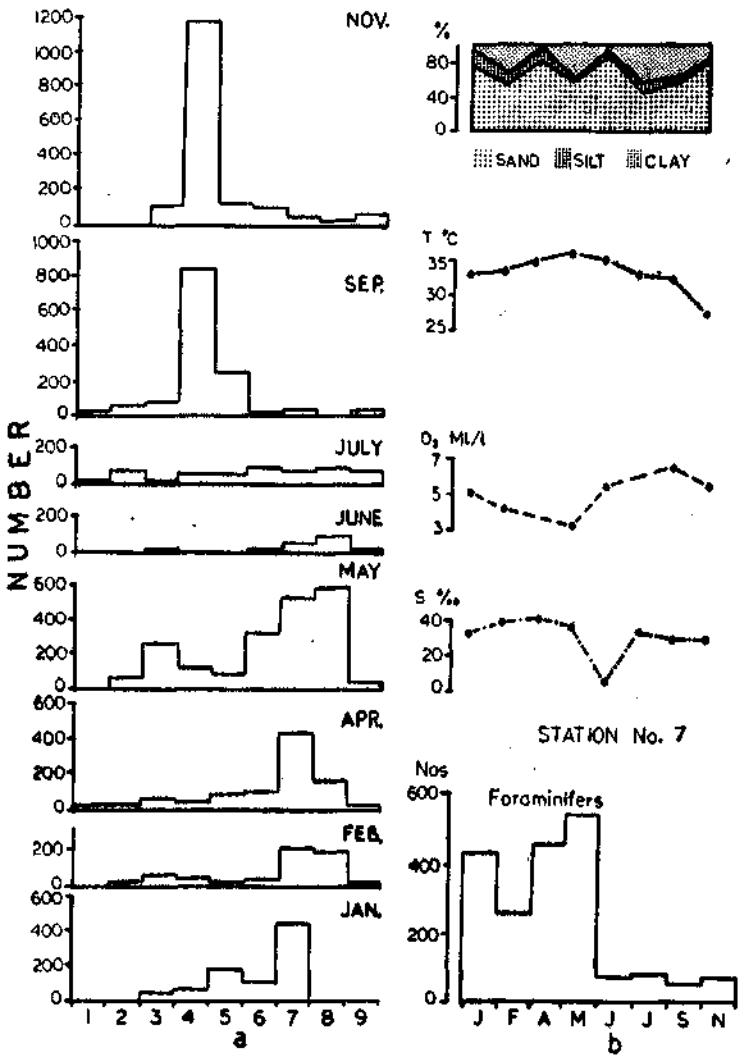


Fig. 2. (a) Monthly variations in the number of living foraminifera at any station per unit volume of sediment. (b) The variation in population abundance at station No. 7 along with variations in ecological factors.

May and from June onwards they are reduced greatly. Increase in populations is accompanied by increase in temperature and salinity, and decrease in dissolved oxygen content. The sudden fall in salinity in June resulted in reduction of foramini-

feral numbers. Dissolved oxygen shows an antipathic relationship with population abundance. The texture of sediment does not seem to have any particular influence on the population abundance.

A brief account of the behaviour of the important species of foraminifera occurring in the area is given below :

*Ammonia beccarii* and *Ammonia beccarii* var. *tepida* constituted about 75% of all the living population. Specimens of both these species increased in number from January to May. During June the populations were drastically reduced. (Probably because the upper layers of the sediments had been flushed out by the increased currents due to fresh water influx and the resulting fall in salinity).

*Quinqueloculina seminulum* found in considerable number throughout the period except in June, with peak numbers during July and September.

*Elphidium discoidale* occurs throughout the collection except in June with peak number in April and May. *Elphidium simplex* behaved the same way as *E. discoidale*, but it is represented by smaller numbers.

*Ammobaculites agglutinans* and *Miliammina fusca* are encountered throughout the period, the former having the peak in January and the latter in November. *Textularia agglutinans* occurred althrough the period but it does not seem to reach a peak any time.

*Ammonia dentatus, Pseudorotalia schroeteriana* and *Pararotalia nipponica* are represented by a few specimens and are at stations 1 and 2 only where the substrate is sandy.

*Bolivina compacta, B. robusta, B. seminuda, B. vadescens, Hanzawai concentrica, Lagena laevigata, Quinqueloculina bicostata, Q. costata, Q. oblonga, Spirillina vivipara* and *Trochommina inflata* are found sparingly. But their occurrence in considerable number has been reported off Viskhapatnam by Subba Rao and Vedantam (1968) and off Pentakota by Vedantam and Subba Rao (1970).

*Bigenerina irregularis, Discorbis floridana, Haplophragmoides fontinense,* and *Reophax dentaliniformis* were also found sparingly.

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