BENTHIC FORAMINIFERAL AND ITS ENVIRONMENTAL DEGRADATION STUDIES BETWEEN THE TSUNAMIGENIC SEDIMENTS OF MANDAPAM AND TUTICORIN, SOUTH EAST COAST OF INDIA

M. SURESH GANDHI, A. SOLAI AND S. P. MOHAN
Department of Geology
University of Madras
Guindy Campus, Chennai- 600 025

surgan@yahoo.co.uk

Corresponding author: Dr. M. Suresh Gandhi

ABSTRACT

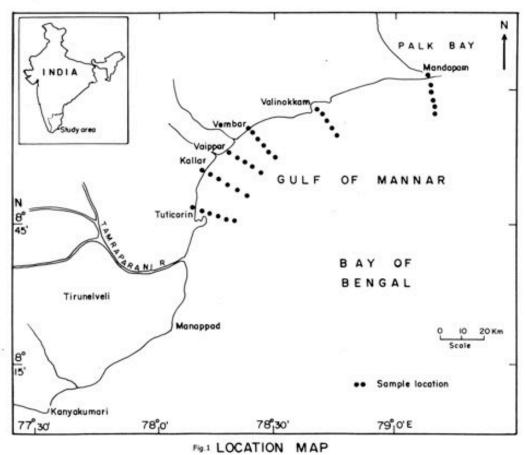
The Gulf of Mannar is a transitional zone between the Arabian Sea and Indian Ocean proper and is connected with the Bay of Bengal through a shallow sill, the Palk Strait. The study area extends from Mandapam to Tuticorin on the southern coast of Tamil Nadu (India) over a distance of 120 km. It is bound in the northeast by Rameshwaram Island, in the east by the Bay of Bengal, in the west by the Eastern and Western Ghats, and in the south by Tuticorin. A total of 36 sediment samples were collected from the beach (6) and the offshore (30) area in the study region. The offshore samples were collected at six transects keeping the stations at Mandapam (5 nos), Valinokkam (5 nos), Vaippar (5 nos), Vembar (5 nos), Kallar, (5 nos) and Tuticorin (5 nos). Totally, 77 benthic foraminiferal species (Post-tsunami) and varieties belonging to 39 genera, 13 families, 10 superfamilies and 4 suborders have been reported and illustrated. The following species are widely distributed in the pre and post-tsunami samples namely Spiroloculina communis, Quinqueloculina elongatum, Q.lamarckiana, Q. seminulum, Triloculina trigonula, Cibicides lobatululs, Ammonia beccarii, A. dentata, A.tepida, Elphidium crispum and Assilina ammonoides. Grain size studies shows the frequency curves vary from unimodal to bimodal in places of river discharge from the Vembar, Kallar, Vaippar and Tamiraparani, as a result of which an additional sub-population is deposited. At Mandapam and Tuticorin, the total species are increasing in the deeper depths whereas in Kallar there will be reverse trend which decreases with depth. Similarly, the living species also have the same trend at Vallinokkam. The scatter plot of salinity versus living species shows a positive correlation. The scatter plot of organic matter versus living species shows strong negative correlation and positive correlation with dead species showing a negative relation with the biomass. Further, the trend of organic matter vs. carbonate indicates that the littoral drift of sediments brought foraminifera from the inner shelf regions and has played a great role in the contribution of dead species, as well as microfossils. The present study indicated that the sediments were brought from the inner shelf.

Science of Tsunami Hazards, Vol. 26, No. 2, page 115 (2007)

1. INTRODUCTION

Micropaleontology is a discipline well suited to the study of environments, environmental changes, and environmental monitoring of present day contaminated and polluted areas. Of which, foraminifers, almost exclusively marine, unicellular protists, generally consisting of a hard covering of calcium carbonate called a test, have extensively been used for studies related to paleoclimatic reconstruction, sediment transport, archaeology, etc.

After the 26th December 2004 earthquake, a major tsunami wave train traveled with tremendous velocity and transported large quantities of water and sediments, including microfossils. The present study used environmental characteristics and foraminifera distribution to determine the impact of tsunami sediments. The Gulf of Mannar receives input through a number of rivers and streams, of which the Tamiraparani followed by Vaipar River, are the major sources. The coastal area between Mandapam and Tuticorin that was studied was affected by recent tsunamis. The outcome of the tsunami sediment studies of this area based on micro fauna, particularly foraminifera, will give a clear picture about the impacts of tsunami and environmental degradation in this region.



Science of Tsunami Hazards, Vol. 26, No. 2, page 116 (2007)



Mandapam South - Pamban bridge

Marine terrace at south of Mandapam



Marine calcareous sand stone at Valinokkam



Sand dunes at Kallar region



Shurbs at Vaippar beach



Beach ridge at Vembar beach

Fig. 2 Coastal landforms of the study region

Science of Tsunami Hazards, Vol. 26, No. 2, page 117 (2007)

2. STUDY AREA

The present study area is along the southern coastal tract of Tamilnadu. The coastal stretch between Mandapam and Tuticorin, in the southeastern part of the Tamilnadu State in India, extends over a distance of about 150 km in length. This area is located between 8° 45' to 9° 15' N 78° 35' to 79° 15' E covering the districts of Ramanathapuram and Tuticorin (Fig.1). The study area is situated on the northeastern side near Rameswaram Island, in the east of the Bay of Bengal, bounded in the south by the port of Tuticorin. The study area includes marine terraces, sand dunes, beach ridges, estuaries, floodplains, beaches, mangroves, peneplains, uplands, sea cliff, etc. (Fig.2). The coastal stretch of Tuticorin was extensively studied due to the presence of a major port. Between Tuticorin and Sippikulam, the beach is flat and narrow. The islands of Pandyan Tivu, Van Tivu, Kasuvari Tivu, Vilangu Shuli Tivu and Kariya Shuli Tivu are present within 5 km of the coastline along this segment and offer protection from wave action and erosion.

Three types of beaches are observed in the study area. They are rocky beaches, pocket beaches and sandy beaches. Rocky beaches exist at the Valinokkam and Terukkumukkaiyur coastal region, whereas sandy beaches can be found along Valinokkan, Bay, Keelmundal, Kannirajapuram, Vembar, Vaippar and the Tuticorin coastal areas. A pocket beach was observed near Narippaiyur. The beaches are normally gentle in slope and their width ranges from about 20 to 70 meters. In the Valinokkam, Vaippar and Tuticorin coastal region a well-defined beach ridge system has been recognized that is discontinuous and varies in length and width. The beach ridges are distributed a few kilometers away from the Tuticorin coastline. Spit formation was identified in Valinokkam and Tuticorin. The formation and distribution of spits suggest seaward progradation of the coast in the study area. The drainage pattern of the area is mainly controlled and influenced by the presence of perennial rivers like Gundar, Vembar, Vaippar and Kallar.

3. MATERIALS AND METHODS

Before sample collection, a base map in the scale 1: 50,000 was prepared using the toposheets (NO. 58L/13, 58L/1 and 58M/16). The fieldwork was done during the month of March 2006. Using a private motor launch, a unit volume of 100 ml of wet sediment sample taken from the top 1 cm of the substratum was preserved immediately in 10% neutralized formaldehyde. A total of 36 sediment samples were collected from beach (6) and Offshore (30) in the study region. The offshore samples were collected at six transects keeping the stations at Mandapam (5 nos), Valinokkam (5 no), Vaippar (5 nos), Vembar (5 nos), Kallar, (5 nos) and Tuticorin (5 nos). In the same locations, samples have already been collected by earlier workers (S.M.Hussain – Tuticorin region and Suresh Gandhi, Mandapam region, Rajesakhar – Manappad Region)) has been utilised for comparisons studies.

Global Positioning System (GPS) was used to locate the sample sites in the offshore region. At each station, bottom water samples were also collected and were preserved by adding 10 ml of chloroform. Temperature, pH and Eh were measured in the field immediately after the

Science of Tsunami Hazards, Vol. 26, No. 2, page 118 (2007)

collection of each sample. In the present study, following Walton's (1952) technique, the sediment samples preserved in neutralized formalin were subjected to laboratory treatment. The preserved samples were washed over an ASTM 230 mesh sieve (0.063 mm) to remove the silt and clay. The sieve with the residue was kept for about an hour in a tray containing an aqueous solution of rose Bengal (1 g of rose Bengal dye in 1 liter of distilled water) ensuring that the residue on the sieve mesh was fully covered by the solution. Then, the material on the sieve was washed to remove the excess stain and dried. The foraminiferal tests were then separated from the residue by floatation method using carbon tetrachloride (Cushman, 1959). As a check, the residue after floatation was re-examined under a binocular stereo-microscope for the presence of any foraminiferal tests left unconcentrated. They were handpicked using `00' Windsor Newton sable hairbrush.

4. RESULTS AND DISCUSSION

4.1 Grain Size

In the present study 24 samples from 6 beach stations have been analyzed. Table. 1 shows the various textural parameters for beach samples (24) obtained through graphic and moment methods. In order to facilitate interpretation of statistical data in the study area, the different sub-population has been identified. In the Valinokkam zone, the frequency pattern point towards the presence of polymodal distribution having peaks at 1.5 φ , 2.25 φ and 2.75 φ . The coarser population of sediments is indicative of the influence of open sea conditions and strong winnowing action that in turn results in the removal of fines. It is supplemented by the presence of rocky beaches around the region. In the Vaippar zone of the study area, the frequency curves have peaks at 2.25 φ , 2.75 φ and 3.75 φ . The characteristic presence of two populations may be attributable to the role of multi sources, probably the contribution of oceanic as well as the rivers like Vembar, Vaippar and Kallar of the study area. Despite the prevalence of high-energy conditions here, the continuous presence of fine sediments may be ascribed to the prolific supply through the rivers as well as from the shelf. The Tuticorin zone also indicates a polymodal distribution. The dominance of coarse size grade in the total population indicates the high-energy conditions that result in the removal of fines. The presence of rocky beaches and convergence of wave pattern near Tamirabarani river mouth accentuate the coarsening of sediments.

The mean reflects the overall average grain size of the sediment as influenced by source of supply and environment of deposition. In the Mandapam zone mean values ranging form 1.48 ϕ to 1.84- ϕ indicating with medium sand. In the Valinokkam zone, mean value ranges from 1.46 ϕ to 1.95 ϕ indicating a prominent distribution of medium sand in the study area. The mean values demonstrate a gradational increase in the Terkumukkaiyur region of the zone. In the Vaippar zone, mean value fluctuates from 1.28 ϕ to 2.6 ϕ and it's characterized by medium sand and fine sand. The lack of winnowing action due to the protected nature of bay leads to the accumulation of the fine sediments. The mean values of Tuticorin zone ranges form 1.35 ϕ to 1.95 ϕ indicate the presence of medium sand. It indicates the northerly movement of Tamirabarani riverine sediments by littoral currents. In addition to this, the high-energy

Science of Tsunami Hazards, Vol. 26, No. 2, page 119 (2007)

environments can also alter the nature of the sediments.

4.1.1 Standard Deviation

The Mandapam and Vallinokkam zones shows more or less similar sorting. The Valinokkam zone sorting value ranges from 0.32 ϕ to 0.69 ϕ indicates very well sorted to moderately well sorted nature. The sorting value in Vaippar and Kallar zone ranges from 0.25 ϕ to 0.80 ϕ . It indicates a very well sorted to moderately sorted nature. In the Tuticorin zone, sorting value varies from 0.34 ϕ to 0.62 ϕ . It indicates a very well sorted to moderately well sorted nature. In the Vaippar zone, the very well to moderately sorting nature may be due to the addition of sediments of different grain size from the reworking of beach ridges or by fluvial action and the prevalence of strong wave convergence throughout the year.

4.1.2 Skewness

The range of skewness values of Mandapam to Vembar, Vembar to Kallar and Kallar to Tuticorin are -0.39 to 0.95, -0.78 to 0.77 and -0.27 to 0.74, respectively. In general, based on the classification of Folk and Ward (1957) the skewness values of these beach sands vary from very negatively skewed to very positively skewed.

In the study region, the sediment skewness varies from near symmetrical to positively skewed. This is probably due to the presence of numerous coastal creeks In the Valinokkam zone, the sediments show coarse skewed to fine skewed (-0.39 to 0.95). It implies the prevalence of high and low energy environments in different wave directions, entailing a mixed distribution of coarse and fine sediments. In the Vaippar zone the sediments show a near symmetrical to negatively skewed nature, suggesting a high-energy environment. Due to washing and backwashing of waves, coarser sediments are retained and get entrapped amidst finer sediments. In the Tuticorin zone, the sediments show very negatively to very positively skewed nature indicative of the prevalence of mixed energy environment.

4.1.3 Kurtosis

The graphic kurtosis varies from 0.51 to 1.26 in the Valinokkam zone. In other words, the Valinokkam zone is very platykurtic to leptokurtic, whereas the Vaippar zone is very platykurtic to very leptokurtic and the Tuticorin zone is very platykurtic to very leptokurtic. The leptokurtic to platykurtic nature indicates multiple environment i.e., one derived from riverine/aeolian environment and the other primarily derived from marine environment. The moment kurtosis values are found to vary from 1.83 to 3.69, 1.65 to 5.46, and 1.60 to 3.68 in the Valinokkam, Vaippar and Tuticorin zones of the study area, respectively. In the Vaippar zone, a strong variation in the Kurtosis value reflects relict sediments along the beach.

4.2 Distribution and Ecology of Foraminifera

The widely utilized classification proposed by Loeblich and Tappan (1987) has been followed in the present study. A total of 77 benthic foraminiferal species (Post-tsunami) and varieties belonging to 39 genera, 13 families, 10 superfamilies and 4 suborders have been

Science of Tsunami Hazards, Vol. 26, No. 2, page 120 (2007)

reported and illustrated. All the illustrated specimens have been deposited in the Department of Geology, University of Madras, Guindy Campus, Chennai $-600\ 025$. The present study includes the results of the distribution of foraminiferal assemblages in the study area. The *Milionina* and *Rotalina* occupy the dominant place in the post tsunami samples of the study area.

4.2.1 Beach

Forty-nine species are identified from the analysis of 6 beach samples. Among them the species, *A.beccarri* shows a higher abundance in all the stations, barring one or two, followed by *A.dentata* and by *Q.seminulum* and *Elphidium crispum* in all the stations. In general, the beach sample shows that pre-tsunami species are lesser in amount compared to the post-tsunami species. In the study area due to tsunami, the distributions of species are slightly higher in number on the beaches

4.2.2 Offshore

Out of the 76 taxa identified, only 18 represent the living crop at the time of post-tsunami sample collection. Among them, most of the species are sparingly distributed. The actual number and distribution of total and living foraminiferal species in the offshore region is shown in the Table.2. The significant variation in the distribution of total and living species assemblages may be due to sedimentation as well as due to the wave actions and tidal currents (Murray, 1973). Since the samples are collected after the tsunami, due to the wave actions, the living dead populations also varied in this region.

The general trend in modern shallow water foraminiferal assemblages is the increasing species diversity with increasing salinity gradients and environmental stability. The genus Ammonia, Elphidium, Pararotalia, Quinqueloculina, Triloculina and Spiroloculina are dominates the total assemblages in the study region. The following species are widely distributed in the pre and post-tsunami samples namely Spiroloculina communis, Quinqueloculina elongatum, Q.lamarckiana, Q. seminulum, Triloculina trigonula, Cibicides lobatululs, Ammonia beccarii, A.dentata, A.tepida, Elphidium crispum and Assilina ammonoides. The following species are found in lesser amount in all the stations, namely, Elphidium discoidale, Rectobolivina raphanaus, Cribrononion simplex, Cymbaloporetta bradi, Eponoides rapandus, Spiroloculina aqua and S. inca. Specimens of all species are abundant in the deeper depths.

4.3. Offshore – Pre- and Post- Tsunami

At Mandapam and Tuticorin, the total species increases in the deeper depths whereas in Kallar there is a reverse trend that decreased in deeper depths. The assemblage living species display the same trend at Vallinokkam.

The genus *Ammonia, Elphidium, Quinqueloculina, Triloculina* and *Spiroloculina* dominates the total assemblages followed by *Amphistegina, Globigerina* in the study region. The following species are widely distributed in the post-tsunami samples namely *Spiroloculina communis, Quinqueloculina elongatum, Q.lamarckiana, Q. seminulum, Triloculina trigonula,*

Science of Tsunami Hazards, Vol. 26, No. 2, page 121 (2007)

Cibicides lobatululs, Ammonia beccarii, A. dentata, A.tepida, Elphidium crispum and Assilina ammonoides.

4.3.1 Station-wise distribution of total and individual foraminiferal species

The distribution of total foraminiferal species according to the different stations shows an appreciable variation among the stations. At Mandapam and Tuticorin, an increasing trend in the total number of species is noticed in the deeper depths. The stations, Kallar and Vallinokkam show the similar trend but increasing trend is noticed from shallow to deeper depths, followed by a sudden decrease. The individual species distribution shows that diversity is greatest towards the shallow regions than the deeper. Even though, the individual species are more abundant in the shallow regions the total number of foraminiferal species are more abundant in the deeper regions with depths ranging form 8 to 12 m.

4.3.2 Station-wise total diversity of Living species

Total number of living foraminiferal species in the offshore region shows (fig.4) that an increase in the number of living foraminifera is observed in post-tsunami samples at the Tuticorin region at deeper depths than the other regions. The lowest diversity is noticed in the shallower depths at Vallinokkam and Kallar region and more or less a close similarity in the trend is noticed. Disturbance in the seabed resulted in low living diversity. Wherever the total species is high, the number of living species is increasing.

4.4. Ecology of the Foraminifera

The salinity measured during the present studies varies from 30.16 ‰ to 31.07 ‰. In all the stations, the salinity shows little variation due to mixing of water within the bay. Furthermore, the river mouth areas like Vaippar, Kallar, and Vembar, etc. display similar salinity. The scatter plot of salinity vs. living species shows a positive correlation (Fig. 3). At Tuticorin salinity values increased towards the deeper depths as did the number of living species. The correlation between depth vs. living species is positive. In the study region, the beach sands are coarser. In the offshore region, the sand is dominant over silt in most stations. Silty sand predominates in the deeper portion. Living foraminiferal populations are more abundant in the silt and silty sand region of the study area. At Vembar silt and silty sand are dominant.

4.4.1 Organic matter

In the study area, organic content ranges from 1.232% to 0.123% are noticed. In the near shore region the organic matter does not shows any variation. The scatter plot of organic matter of living species shows strong negative correlation (Fig.3) and positive correlation with dead species (Fig.3) shows a negative relation with the biomass. Further, the trend of organic matter

Science of Tsunami Hazards, Vol. 26, No. 2, page 122 (2007)

vs. carbonate (Fig.3) suggests littoral drift of sediment brought from the inner shelf regions have played a significant role in the contribution of dead species as well as carbonate shells. The rise in total amount of living species in deeper portion at Tuticorin may be due to oxygenated conditions in that region

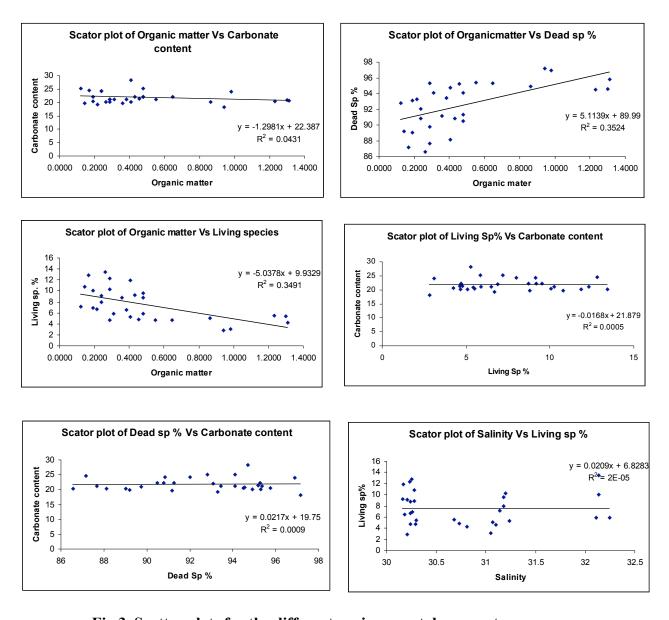


Fig.3. Scatter plots for the different environmental parameters

Science of Tsunami Hazards, Vol. 26, No. 2, page 123 (2007)

4.4.2 Calcium Carbonate

In the study area higher carbonate content in the shallow depths in all the stations is observed. In Kallar it is decreased in the deeper depths. The scatter plot of carbonate content vs. living species and organic matter shows the negative correlation (Fig.3) and positive correlations with dead species (Fig.3). It means that weak and strong relation is being maintained between carbonate and living dead species. But, now carbonates must have been the product originated from the other factors, probably the drifted shells from elsewhere or from the coral reef region in the in situ. It indicates that the carbonate present in this region is *in situ*.

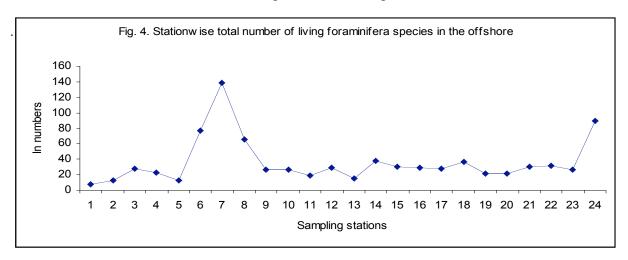


Fig.4. Station-wise total diversity of Living species

4.4.3 Morphological Deformities

In the present study, morphological abnormalities were observed in the species *Osangularia* and *Pararotalia* having abnormal and overgrowth apertures. The broken specimens were found in the beach, offshore and inland region. It may be due to the tidal actions, and strong current activity and industrial wastes at thermal power stations, and harbor, Tuticorin.

4.5. Comparisons with Pre-Tsunami

The comparison of post-tsunami and pre-tsunami data is possible due to earlier workers like S.M.Hussain and Rajesekhar and Suresh Gandhi (2000). The study reveals that in the offshore region at the shallow depths, the fossil enrichment is more in post tsunami sediments than the pre-tsunami samples. Due to the tsunami activities, large amount of sediment were transported from the deeper depths and deposited near the shore

Science of Tsunami Hazards, Vol. 26, No. 2, page 124 (2007)

regions, hence higher species diversity is noticed near shore region. Table.3. shows the checklist of pre-tsunami and post-tsunami fossils.

The fieldwork carried out in the coastal belt, indicates that the topography has been smoothened as the tsunami overtopped the dune, ridges and transported the material into the low lying areas. It is difficult to estimate where the material is transported unless the dune material is lithologically different from the soil inland. Sand deposits over mudflats, and alluvial flats clearly reveal that a considerable amount of beach deposit have been transported inland. While the eroded features provide insight into the transport of the sediments, how much material has been brought from the deep sea and continental shelf is not clear. Clasts of clay and rare coral debris indicate that the tsunami brought sediments from the sea.

A considerable amount of sediments are transported into the sea via carved channels as much as 5 m wide and 30 m long during the tsunami drain back. So, it is evident that transportation from sea to land, transport of beach material to inland and transport back to the sea have taken place. The erosion appears to be more in the northern part of the area investigated; on the other hand deposition dominates over erosion in the southern part of the area, which is characterized by flat topography (Sanjay Gandhi, 2005).

The total distribution of foraminifera is higher at Mandapam and Tuticorin sector, than in Kallar and Vallinokam. The configuration of the beach may control the distribution of foraminifera species from offshore to the beach. The arcuate nature of the bay and wave energy conditions is the major controlling factors for the distribution of foraminifera.

The study area receives inputs from many small channels and rivers like Vembar, Vaippar, Kallar and Tamirabarani. The land areas through which these rivers and channels flow are well known for agricultural activities. Tsunami sediments entered through the rivers and were deposited inland. The total populations of foraminiferal species are very low in the beach region probably due to erosion. Living populations are also found to be low to moderate in number in the study area.

Several authors, (Yassini and Jones, 1995; Murray, 1991; Nigam et al., 1979; Haig, 1988) have studied and reported the distribution of foraminifera in various regions and concluded the distribution of species reflect different environments. Kamalakanan et al (2005) have studied the tsunami sediment from the Nagapattinam coast and inferred that the majority of foraminiferal species are inhabit coastal water and hence the sediment would have been removed from the near shore coastal water zone by tsunami waves and spread over the coastal line. Rao et al., (2005) have studied the tsunami laid sediments along the North Chennai coast and suggested that the fossils distributed in these areas have been transported from the inner shelf region, probably at depths less than 30 m. From the overall studies of foraminiferal distribution in this region, it may be inferred that the species distribution in the offshore region is mainly derived from the inner shelf region. Due to tsunami activities the offshore species are deposited in the beach, accompanied by transport of beach material to inland and transport back to the sea.

5. CONCLUSIONS

The study of a composite cosmopolitan fauna of 76 species belonging to 39 genera, 24 families, 16 super families and 5 suborders from the samples collected from post-tsunami

Science of Tsunami Hazards, Vol. 26, No. 2, page 125 (2007)

beaches and offshore samples is reported here. Grain size studies shows the frequency curves vary from unimodal to bimodal in the proximity of river discharge from the Vembar, Kallar, Vaippar and Tamiraparani. The offshore region of Mandapam and Tuticorin receives higher species diversity than the Kallar in post tsunami samples. In general, the distribution of pretsunami fossils is less than the post-tsunami distribution. This may be due to the impact of tsunami action. Furthermore, salinity and carbonate content are the controlling factors for the distribution of foraminifera in this region. A thorough review of literature of foraminiferal research from the Indian subcontinent reveals that the foraminiferal species distributed in this region were brought from the deeper depths particularly form the inner shelf region due to tsunamigenic activities. It will be essential to track the source of sediment in the deeper part by carrying out a detailed investigation on the microfossil studies.

ACKNOWLEDGEMENTS

The first author grateful to the Department of Science and Technology, Government of India for extending financial support for the DST- SYS FAST TRACK PORJECT SCHEME (SR/FTP/ES-31/2003, dated 12th September, 2005) to carry out the study under this program. The authors express sincere thanks to Dr.Rajiv Nigam, Director, Geological Oceanography Division, Dona Paula, and Goa-4 for his encouragement and extending logistic support.

Science of Tsunami Hazards, Vol. 26, No. 2, page 126 (2007)

REFERENCES

Boltovskoy, E., and Wright, R. (1976) *Recent Foraminifera*, Dr. B. V. Junk Publishers, The Hague, The Netherlands, 515 p.

Haig, D.W. (1988) Miliolid foraminifera from inner neritic sand and mud facies of the Papuan lagoon, New Guinea. Jour. Foram. Res., v. 18, pp. 203-236.

Kamalakkannan,B.V., Sajith,C., Nagendra,R., Nallapa Reddy,A., Gargisen and Srinivsalu,S. (2005)Effect of December 26th Tsunami on the distribution of foraminifera along the Nagapattinam coast, TamilNadu In XX Indian Coll. Micropal. and Strati, held at Andhra Univ, Abs.vol. p37.

Kathal, P. K. (2002). Distribution and ecology of Recent foraminifera from littoral sediments of Eastern India. *Journ. Geol. Soc.* Ind., v. 6, pp. 429-454.

Murray, J. W. (1973) Distribution and ecology of living benthic foraminiferids, Crane, Russak and Co., New York, 274 pp.

Murray, J. W. (1991) Paleoecology of benthic foraminifera. Longman Group, London, 397 pp.

Nagendra, R., and Dayamalar, D. (2000). Distribution and Abundance of Recent Foraminifera and its relation to trace elements of Chennai coastal sediments. *Journ. Ind. Ass. Sedimentologists*, v. 19, pp. 191-199.

Nigam, R. (1984) Living foraminifera in a tidal environment: Gulf of Khambhat (India). *Mar. Geol.*, v. 58, pp. 415-425.

Nigam, R., Setty, M.G.A.P. and Ambre, N.V. (1979) A checklist of benthic foraminiferids from the inner shelf of Dabhol-Vengurla region, Arabian Sea. *Jour. Geol. Soc. India*, v. 20, pp. 244-247.

Rao, N.R. (1998) Recent foraminifera in the inner shelf of the Bay of Bengal, off Karikattukuppam, unpublished Ph.D thesis submitted to the University of Madras, 273 p.

Rao, N.R, Khare, N., Periakali, P., Mohan, S. P. (1998 a). Lagena foraminifera from the inner shelf sediments of Bay of Bengal, off Karikattukuppam, near Chennai, India. *Proc. XVI Indian Micropal. Stat, Goa, Abs. v...*, p.121.

Rao, K.N. Charled, D. and Srinivasalu, S. (2005) An integrated approach towards discerning the provenance of December 26, 2004 tsunami laid sediments along the coast of Chennai coast, *In XX Indian Coll. Micropal. and Strati*, held at Andhra Univ, Abs.vol. p85.

Science of Tsunami Hazards, Vol. 26, No. 2, page 127 (2007)

Sanjai Gandhi.K (2005) Impact of tsunami on geochemical characteristics of sediments off southeast coast of India, Bay of Bengal, M.Phil Dissertation submitted to Univ. of Madras, pp.72.

Suresh Gandhi. M (1999) Micropaleontological (Benthic foraminifera) study on the depositional environment of Palk Strait, East coast of India. Unpubl. Ph.D. Thesis., Tamil Univ., Thanjavur,192 p.

Walton, W.R. (1952) Techniques for recognitions of living foraminifera. *Contr. Cush. Found. Foram. Res.*, v. 3, pp. 56-60.

Yassini, I. and Jones, B. G. (1995) Recent Foraminifera and Ostracoda from Estuarine and Shelf Environments on the Southeastern Coast of Australia, University of Wollongong Press, Wollongong, 484 p.

Science of Tsunami Hazards, Vol. 26, No. 2, page 128 (2007)

LIST OF TABLES (Tables divided because of size)

Table-1 Results of grain size analysis for beach samples

Table.2. Distribution of total and living foraminiferal species between Mandapam and Tuticorin (offshore)

Table.3. Comparison of pre-tsunami and post-tsunami species in the study area.

			UN SIZE AN									
Stations	s.no	ME-Q	MSD-Q	MCD-Q	MSK	MKU	MED-Q	M-Q	SD-Q	SK	11.10	FP-Q
	-			Moment	methods				G	raphic meth	od	
MANDAP/	AM				100							
BERM		1 1.8										-0.99
HIGHTIDE		2 1.8										-0.98
MIDTIDE			0.29									0.98
LOWTIDE	- C - F	4 1.4	0.26	2.75	0.84	1.74	1.48	1.4	0.25	0.15	0.82	0.97
VALINOR	KAM				145		100	- 4				- 45
BERM		5 1.0							0.42			
HIGHTIDE		6 1.8										
MIDTIDE		7 1.4	0.28									
LOWTIDE		8 1,4	0.24	2.71	0.85	1.7	1.42	1.41	0.22	0.13	0.79	0.95
VEMBAR.												
BERM	1	9 2										
HIGHTIDE		0 20						2.03				
MIDTIDE		1	2 0.57									
LOWTIDE	1.5	2 1.1	0.32	0.64	0.06	1.12	1.93	1.91	0.32	0.3	0.45	-0.98
VAIPAR												
BERM			.1 0.78									0.99
HIGHTIDE	1	4 2.0										
MIDTIDE		5 2.0										
LOWTIDE	1	6 1.5	92 0.51	-0.42	-0.28	1.26	1.92	1.9	0.5	-0.92	0.49	-0.98
KALAR						7.00	1111111		100			
BERM	- 1	7 2.6										
HIGHTIDE	- 1	8 1.	57 0.43									
MIDTIDE		9 1/										
LOWTIDE	- 3	0 1.	56 0.27	0.59	0.71	1.88	1.56	1.53	0.22	0.61	0.45	0.96
TUTICOR												
DERM		1 13										
HIGHTIDE		2 1.5										
MIDTIDE		3 1.										
LOWTIDE	1 3	4 1.	52 0.31	0.90	0.38	2.21	1.62	1.6	0.5	0.45	0.73	0.90

Science of Tsunami Hazards, Vol. 26, No. 2, page 129 (2007)

Table.2. Distribution of total and living foraminiferal species between Mandapam and Tuticorin (offshore)

	Station Manifests	-	-	-			dapun	-	int .	-	See		in .	-	No.	ohhan	-		Sas.	- 4	
M.Ho.	Depth is sen	·			T	1	Y.	L	T	L	T		T	1	Y	-	T	L		L	1
	Name of Species		T.	L	- 10	_		_		B	3	-	1	-	100	-		-	-	-	-
1	dissolved in cryss					0	1	9	1		3	8.	1			0	20				H
1	Trondana aggrantate		-	0	1				, 2						-		87		-	-	H
3	Therefore comes					-					725	0.	1		100		-				
4	Egyphatias system			0	2	0.	1	6	2	- 0	. 1	0	2	8	1	0	4	1	4	1	1
5	Edinosamos (sidrota	-2	1	.0	-2						10.1							0.	1.	.0	
-6	Addison burgets	0	3	0	7	6.		Ę.	1	0	13										H
Ť	Spiroloculine sesperi.			0.	2	4	1														
1	Spredicules office	4	1.5	.0												-		_			
9	Aproloculos communis		4	0	-1-	0	3	U.	-14	1	10					0	1	0	1.	1	2
10	Spiroloculeus complete					-	1	0	1												L
11.	Spendoculous depressor		1	0	2	10.	1	0	1	.0	1										L
12	Approductations service:					0	2	0	1	-	-1			.0	1						L
33	Spiredocadou spil	0.	1									0	11								L
38	Spendiscular sp2	4.	1																		L
35	Absoline access (regressive					0.	2.	0	2		T										L
16	Foredrollos series					0	1	0	.1							. 10	-2	9.	1		L
12	Quesqui locadino appronues				2	0	4	1	.12		1.5										
19	Quinquetrostine Nontate	ů.	1	.1	5	.0	1		.5	. 0	-2										L
19	Quapelosine contro	0.	1.	. 0	- 3			0	3												L
20	Quantificative stepher			. 0	2.	0	3	0	. 3		1										
21	Quagarlicative ismarchina	0	-1	1	1	2	12	1	2	. 0	5	0.	3		.2	0	1.	0	3	0	
21	Champarise wines protogona	0	3	0.	7	.0	4	4	1		7										Г
23	Quinqueleculine simunium	0	12	.2	12	1	8	0	12	0.	1	10	2		14.	.0	A.	10.0	-6.	- 0	
24	(Nonpuriositas eleganes			0	3	0	2	+	1			0.	4	0	1.6	0	1			437	Г
25	Quequelacidas regresolis			6		0.	4	0.	3			0.	- 3								Г
ža.	Christmelication of I											П									Г
23	Quapelicalne in J.																				Г
16	Addustrally covalate			0	1		3		1				1	0	.1						Г
26	Delocalina oblama								_												Г
30	Televalne regne	0	2	0	2									- 10	2	. 0	1				Г
21	Trebusalina schristwiana		1	11	4																Г
32	Policialna Arquestana	0	1	0	1					П		Т									Г
33	Viologalina inscarrenza		-	T	11		16	0	3.	$\overline{}$			2								Г
34	Prolocultus intermele	0.	2	0	18	1	22	2	32	-1	29	+	0.1	0	4	4	14.	0	2	3	
35	Hauring Irahi					1	1	0.	0	.0	-1										Г
M-			2	.0	-1						-11		-								Г
17	Artisalne perglice	0	.1	0	3	0	1	0.	4	0	1			0	-2	.0	1				Г
38	Aspertancle reportions					0	1	0	1	1	1										Г
59	Santa mirgosile							0	1	0	-1										Г
40	Proceedit plantes									0	3									9	t
41	Lagerna retriera							0.	1		5										t
	Noticina nobile		-	-				1			-		-	-							f

Science of Tsunami Hazards, Vol. 26, No. 2, page 130 (2007)

Astronomical proposals	Aistrocondia pringinates	Asservation triginates 0 4 0 2	Asternovable programs	A	61							-							-		-		-	_		-	- 10
63 Prendire color schrowersame 0 7 0 1 0 2 0 2 0 64 65 Epitalism activation 0 2 0 4 0 2 0 65 Epitalism activation 0 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 16 1 1 1 1 1 1 1	Pseudorocolie schroeveriums	63 Pseudirevolus schrusteriums 64 Edentissumma rutirum 65 Epitalium akreesum 66 Epitalium akreesum 67 Epitalium akreesum 68 Epitalium akreesum 69 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 2 68 Epitalium akreesum 60 1 0 1 0 1 0 1 1 2 0 1 0 1 0 1 0 1 68 Epitalium akreesum 60 1 0 1 0 1 0 1 0 1 69 Execuration 60 1 0 1 0 1 0 1 0 1 60 Execuration 60 1 0 1 0 1 0 1 0 1 60 Execuration 60 1 0 1 0 1 0 1 0 1 60 Execuration 60 1 0 1 0 1 0 1 0 1 60 Execuration 60 1 0 1 0 1 0 1 60 Execuration 60 1 0 1 0 1 0 1 60 1 0 1 60 1 0 1 60 1 0 1 60 1 0 1 0 1 60 1 0 1 0 1 60 1 0 1 0 1 60 1 0 1 0 1 60 1 0 1 0 1	Description of the confidence of the confidenc	Association physician Association Association physician Association physician Association physician Association As	61	Amerorosolia inflana															0	1		0	2		
63	Panulmontalis schroweriums	63	63 Paesaleroscolie schroeteriums	A	62	CONTRACTOR OF SHIP AND ADDRESS OF THE SHIP ADDRESS OF					0	4	0	2									1				
	Edinistramina culturary	64 Edinfortum substance 0 2 0 4 0 2	64 Edintosiumina cultrato	A	-				0	3									.0	2			1				-
60 Elphidium salvenum	Elphidium entrecolatum	66 Ephildren salvenum 0 2 0 4 0 2 0 2 0 2 6 6 6 Ephildren extraculation 0 2 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 2 6 6 6 Ephildren extraculation 0 4 0 2 0 1 0 2 0 1 1 2 15 2 14 1 2 6 6 6 Ephildren extragram 0 0 1 1 14 2 14 0 1 0 2 0 1 1 2 0 1 0 1 0 1 0 2 0 4 0 6 6 Ephildren extragram 0 3 3 0 2 0 4 0 6 Ephildren extragram 0 3 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	66 Epitulum advenum 0 2 0 4 0 2 0 2 0 1 0 2 0 1 0 1 2 15 2 14 1 21 68 Epitulum croquam 0 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 21 68 Epitulum adventulum 0 3 0 1 0 1 0 2 0 1 1 2 0 1 0 1 0 1 0 2 0 4 0 2 0 4 0 2 0 4 0 2 0 1 1 2 0 1 0 1 0 1 0 1 0 1 0 1 0 1	Application of the properties 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 4	-																		-				-
66. Egitulum crossculatum 67. Egitulum crossculatum 68. Elphidum crossculatum 68. Elphidum crossculatum 69. 4 0 2 0 1 0 2 0 1 1 2 15 2 14 1 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Elphidum crusiculatum	66. Egitulum cranculatum 67. Egitulum cranculatum 68. Elphidum exercum 68. Elphidum exercum 69. 4 0 2 0 1 0 2 0 1 1 2 15 2 14 1 2 0 4 0 6 6 0 6 0 11 2 15 2 14 1 2 0 6 6 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	60 Epitulum extensiolatum 0 2 0 2 0 2 0 1 2 15 2 14 1 2 16 1 0 1 0 4 0 4 0 1 2 15 2 14 1 2 16 2 16 1 2 16 2 17 2 18 1 2 18 2 18 1 2 18 2 18 1 2 18 2 18 1 2 18 2 18 1 2 18 2 18 1 2 18 2 18 1 2 18 2 18 1 2 18 2 18 1 2 18 18	Appendix proposed			6	2		-	0	2.					0					14	+				
67 Egishidum croquam 0 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 1 6 8 Elphidum croquam 0 0 1 14 2 14 0 1 0 2 0 1 1 2 0 1 0 1 0 2 0 1 0 1 0 2 0 0 1 0 1	Eighidium croquum	67 Ephildram croquem 0 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 2 6 8 Elphildram strongum 0 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 2 6 8 Elphildram strongum 0 3 0 1 0 2 0 1 1 2 0 1 0 1 0 2 0 4 0 2 0 4 0 2 0 4 0 2 0 1 1 1 2 0 1 0 1 0 1 0 1 0 1 0 1 0	67 Ephildran cropum 0 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 21 6	49 Rosselma phobalaris 0 8 2 7 1 9 1 11 2 12 0 0 4 0 2 2 5 2 5 2 4 6 1 Disconhinella herbeloti 0 2 2 12 12 0 2 0 4 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	-		0	2					0	4			-	_					-				
68 Eighalism absorbidate	Elphalism discretable	Applications absorbed	68 Eighidism shovedide	45 Resealency globalistris 46 Discontinuo globalistris 47 Cohecules lubonales 48 Cassidulina liarvepta 49 Cymbalisporente broader 40 0 2 2 12 12 0 2 0 4 0 1 0 1 0 0 1 0 1 0 0 0 1 0		Elphodum cranculatum					-	2															
Comparison Institution Comparison Comp	Expiration recovers 0 3 0 1 0 1 0 3 0 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Comparison Incomparison Comparison Com	Explainman increases	45 Resident globalistis 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 6 4 6 1 10 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	67	Elphodism croquen	0	0	1	14	2	14	8	.1.	0.	4	0	4	0	-11	2	15	5	2	14	-1	21
Description	Exercision	10	60 Alphidae secreties	45 Resident globalistis 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 6 4 6 Disconhististis 0 2 2 12 12 0 2 0 4 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	(8		0.	4	0.	2		-	0	.2	0	1	1	2	-		-	-	-	_	-1-1		4
20		20	20	Application of the formation Company Com	-		100			- 4	0	1	.0	2.6	0	-	-						-	-		-	
			21 Emercilium	## Binantiar phobalaris		Elpholson Incomes	0	3									0	3	1	- 5	_		-	0	-	0	- 4
72 Eljóndrom spl 23 Eljóndrom spl 74 Parrellina hopadular 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0	Eighidean spd	72 Effektion spl 73 Effektion spl 74 Parrellon hopistela 0 1 0 1 0 1 0 1 0 1 0 1 0 2 0 1 0 1 0 1	72 Eljándrum spl 23 Eljándrum sp2 74 Furrellinu hapidulu 0 1 0 1 0 1 75 Hocadolium Raphanum 0 3 0 1 0 1 0 2 0 1	## Binester phobalisms	70	Economies	1				0	1	0	1	0	1					0	1	I	0	1		
72 Elphalton.npl 73 Elphalton.npl 74 Farrellon hopalata 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0	Eighinhom sp1	72 Elphalton spl 73 Elphalton spl 74 Parrellon hopidula 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0	72 Elyhidian spl 23 Elyhidian sp2 74 Furrillini hapidulu 0 1 0 1 0 1 75 Hecoholomi Raphmu 0 3 0 1 0 1 0 2 0 1	Ammotise Information Ammotise Information	71	100000000000000000000000000000000000000					0	-	0	-1	b.	1							-	-			
23 Eightscham sp2	Expression reported	23 Eightscham.np2	23 Elphishum sp2	## Ammental angular							-	-	4	,	-	-						4	+	0	-		
74 Preventional hospitalistes 0 1 0 1 0 1 0 1 0 1 0 1 0 1 7 0 1 0 1 0	Pierrelline hopeshile	74 Parrellina hopolatur 0 1 0 1 0 1 0 1 0 1 75 Accordations Rephania 0 3 0 1 0 1 0 1 0 2 0 1 76 Accordations Rephania 0 3 1 5 4 26 2 12 0 2 0 1	74	1																			1				
75 Accordations Replaces 0 3 0 1 0 1 0 1 0 2 0 1 76 Accordations Replaces 0 3 1 5 4 26 2 12 0 2 0	Reconstitution Republic Reconstitution Reconstituti	75 Associations Asphanus 0 3 0 1 0 1 0 2 0 1 76 described associates 0 3 1 5 4 26 2 12 0 2 0 1	75 Accordance Supherus 0 3 0 1 0 1 0 2 0 1	Administration of the content of t	23	Elphidum.yr2																					
79 Accordationary Regulations (20 3 0 1 0 1 0 1 0 2 0 1 76 Accordance (20 3 1 5 4 26 2 12 0 2 0 2 0	Recorded transcription	73 Becodestrouse Raphanus 0 3 0 1 0 1 0 2 0 1 76 76 Associant association 6 0 3 1 5 4 26 2 12 0 2 0 1	75 Recordadrinus Rephania 0 3 0 1 0 1 0 2 0 1	1	74		0	1	0	1							0	1					1				
76 Assistant assessmentales 0 3 t 5 4 26 2 12 0 2 0	Antina announcides 0 3 1 5 4 26 2 12 0 2 0 1	76 Assilving armonosides 0 3 t 5 4 26 2 t2 0 2 0 t	ACCURATION CARPERSON	1			-	-	-				0		0	1	-	-	0.	-	- 6		-				
		20000	70 Acribus ammonisties 0 3 t 5 4 26 2 12 0 2 0 1	1					200				-						0.	5	0	1					
77 Quantulary variety 0 12 0 17 2 96 1 48 2 62 2 141 12 120 2 17 21 147 5	Osangalarus venustu 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7			1	70	Antina annountles			0	- 3	1	5	4	26	2	12								0	2	0	- 1
		77 Ournalizer virtuite 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7	77 Openanting counts 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	77	Osomoulovar versesta	0	12	0	17	2	26	1	48	-2	62	2	141	12	120	2	17	T	21	147	3	75
				1				224	11		-	-	-	450		1							-	-			
		2021 2 20 11		1			-				man					rutines (-		_					-	
Number of Genus 2 16 7 25 8 23 10 20 9 11 3 13 4 15 4 10 6 12 3 Individual species 4 34 10 41 10 43 12 48 9 32 5 24 5 24 6 28 8 34 15						Number of Course	1 6 1	10	1.0	43	. 6	43	10	20		44	3.1	2.3	4.	2.5	4.	79	P		12	. 5	13
		77 Osungalarsa sensata 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 3 7	77 Osangalarus venusta 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	77	Osangularsa sumusta	0	12	0	17	2	26	1	48	.5	62	2	141	12	120	2	17		21	147	3	75
		77 Osungalarus variatio 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7	77 Ossegularus versatis 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	17	Osongularsa sumunta	0	12	0	17	2	26	1	48	.5	62	2	141	12	120	2	17		21	147	3	75
		77 Osungalorar viviento 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7	77 Osungalarar varianta 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	17	Osongolorse semeste	0	12	0	17	2	26	1	48	.5	62	2	141	12	120	2	17		21	147	3	75
		77 Ossegularus venustu 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7	77 Ossegularus verseste 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	77	Osongalarsa sumenta	0	12	0	17	2	26	1	48	.5	62	2	141	12	120	2	17		21	147	3	75
		77 Osongolovo variata 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7	77 Osangalarar venusta 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	17	Osongalorse seneste	0	12	0	17	2	26	1	48	.5	62	2	141	12	120	2	17		21	147	3	75
		77 Ossegulares venusta 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7	77 Osungalarar varianta 0 12 0 17 2 26 1 48 2 63 2 141 12 120 2 17 21 147 5 75	1	17	Osongolarsa semesta	0	12	0	17	2	26	1	48	.5	62	2	141	12	120	2	17		21	147	. 3	75
		77 Osungalorus venestu 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 .5 7	77 Osongalarsa varianta 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	17	Osongalarsa sumenta	0	12	0	17	2	26	1.	-65	-2	62	2	141	12	120	2	17		21	147	3	75
		Companion virginia 15 28 28 141 LA 100 Z 17 21 147 3 7	Company with the 100 21 147 3 75	1				-	-		-	-	-										-	-			
				1			7	226	26	369	44	-	43	455	34	44	7	247	10	350	18	475		15	487	18	333
TOTAL 7 226 26 360 44 657 43 488 34 88 7 347 19 350 18 425 35 687 18	TOTAL 7 226 26 360 44 657 43 458 34 89 7 247 19 350 18 425 35 487 18 33			1		TOTAL	7	226	24	369	44	657	43	455	34	AV	7	247	19	350	18	425	5	35	457	18	327
TOTAL 7 226 26 360 44 657 43 488 34 88 7 347 19 350 18 425 35 687 10	TOTAL 7 226 26 360 44 657 43 458 34 80 7 247 10 350 18 425 35 487 18 32			1		TOTAL	7	226	24	369	44	657	43	455	34	AU	7.	247	19	350	18	425	5	35	457	18	327
TOTAL 7 226 24 369 44 687 43 488 34 88 7 247 10 380 18 425 35 687 10	TOTAL 7 226 24 369 44 687 43 488 34 88 7 347 19 389 18 425 35 487 18 37			1		TOTAL	7	226	26	369	44	657	40	455	34	44	7	247	19	350	18	425	5	35	487	18	337
TOTAL 7 226 26 369 46 657 43 458 34 88 7 247 10 369 18 474 10 687 11	TOTAL 7 226 26 369 46 657 43 455 34 88 7 247 00 360 18 476 55 487 18 37			1		TOTAL	7	226	24	369	44	657	43	455	34	44	7.	247	19	350	18	475		35	487	18	337
TOTAL 7 226 24 369 44 687 43 488 34 88 7 247 10 380 18 425 35 687 10	TOTAL 7 226 24 369 44 687 43 488 34 88 7 347 19 389 18 425 35 487 18 37			1		TOTAL	7	226	26	369	44	657	40	455	34	44	7	247	19	350	18	425	5	35	487	18	337
TOTAL 7 226 26 26 369 44 697 43 486 34 88 7 247 19 389 18 425 35 687 17	TOTAL 7 226 24 369 44 657 43 488 34 88 7 247 19 350 18 425 33 687 18 37			1		TOTAL	7	226	24	369	44	657	43	455	34	AU	7	247	19	350	18	425	5	35	487	18	337
				1		TOTAL	7				man				34	AV	7	247	19	350	18	425	5	35	487	18	327
TOTAL 7 226 26 369 46 657 43 486 34 89 7 247 19 380 18 425 35 487 19	TOTAL 7 226 26 26 369 46 657 43 458 34 88 7 247 19 350 18 425 33 487 18 37			1		TOTAL	7	226	24	369	44	657	43	455	34	AV	7	247	19	350	18	425	5	35	487	18	327
TOTAL 7 226 24 369 44 657 43 458 34 88 7 247 19 359 18 425 35 657 II	TOTAL 7 226 26 369 46 687 43 488 34 88 7 247 19 350 18 425 35 487 18 37			1		TOTAL	7	226	24	369	44	657	43	455	34	AU	7	247	19	350	18	425	5	35	487	18	337
				1			7	226	24	369	44	657	43	455	34	44	7	247	100	350	18	475		15	487	18	333
				1			2	226	24	262	44	-	43	466	24	44	1	2.02	00	100		474			400	10	
		Line Special Street, Street, Special S	10 manual mining 1 m 1 m 1 m 1 m 1 m 1 m 1 m 1 m 1 m 1	1				-	-		-	-	-										-	-			
		11 Osungalarar somette 0 12 0 17 2 26 1 48 2 02 2 141 12 120 2 17 21 147 5 7	17 Osungsilarus sumusta 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	17			-	-		-	-	-		2	62	2	141	17.	120	2	17		21	147	.5	75
		77 Osungalarus venesta 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7	77 Osungalarar varianta 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 75	1	77	Osongolorse semeste	0	12	0	17	2	26	1	48	.5	62	2	141	12	120	2	17		21	147	3	75
		77 Occupations connects 0 12 0 17 2 94 1 48 2 62 2 141 12 120 2 17 31 147 4 7	77 Committee water 0 12 0 17 2 36 1 48 2 63 2 141 12 120 2 17 31 147 4 24	1	77		0	12	0	17	2		1	48		62	2	141	12	120	2	17		-		-	-
1 COMPANIES WHITE THE TAX THE	Constitute Annual	77 0 12 0 17 2 44 2 43 2 141 15 15 15 15 15 15 1	77 0 1 0 12 0 17 2 4 1 48 2 43 2 141 12 190 2 17 11 142 1	1	-		0	12	-					-		170	2	141	12	120	3	17		-		-	-
Characteristics W 14 W 17 26 1 90 4 10 12 17 21 147 3	Champatoria sensitio 14 15 16 17 28 1 10 2 16 16 16 17 21 147 3 7	77 1 20 1 21 1 21 1 21 1 21 1 21 1 21 1	77	1	-		6	12	-					-		170	*	141	12	120	-	14		-		-	-
Champilaria variatio 0 14 9 11 2 26 1 60 2 50 2 141 12 120 2 17 21 147 3	Osungalarus vanusta V 14 V 17 2 26 1 68 2 62 2 141 12 120 2 17 21 147 3 7		0 12 0 13 3 1 1 20 3 10 10 10 10 10 10 10 10 10 10 10 10 10	1	-		-	12	-					-		170		145	12	190	-	14		-		-	-
1 Champallery venute	Osungalarus vanusta V 14 V 17 2 26 1 68 2 62 2 141 12 120 2 17 21 147 3 7		9 0 19 0 19 1 1 10 19 10 10 10 10 10 10 10 10 10 10 10 10 10	1	-		-	12	-					-		170		145	12	190	-	14		-		-	-
77 Quantalizar varianta 0 12 0 17 2 96 1 48 2 62 2 141 12 120 2 17 21 147 5	Otompolarus venustu 0 12 0 17 2 26 1 48 2 62 2 141 12 120 2 17 21 147 5 7			1	-	Antina ammonoides			0		-	5	4	26	2	12								0	2	.0	-
		20000		1	76				200		-		-										-	0	- 2	0	-
Activity attentions		2000	76 Acolou assessmentes 0 3 1 5 4 26 2 12 0 2 0 1	1	75	Recrobolisma Raphanus			0	3			0.	11	0	1			0	2	0	1.					
76 Annihola ammonisales 0 3 1 5 4 26 2 12 0 2 0	Antina announcides 0 3 1 5 4 26 2 12 0 2 0 1	76 Acordinar announcedes 0 3 t 5 4 26 2 12 0 2 0 1	ACCURATION CONTRACTOR	1			U	4	-								0	1					1				
Particular Inspiration	Reconstitution Republic Reconstitution Reconstituti	Particular Impaired	75 Ascendalimana Raphaman 0 3 0 1 0 1 0 2 0 1	1			0	1	.0	-1								1					+				
74 Nurrollina hopadula: 0 1 0 1 0 1 75 Recordulation Regulation 0 3 0 1 0 1 0 2 0 1 76 Accellula: ammonisales 0 3 1 5 4 26 2 12 0 2 0 2 0	Pierrelline hopeshile	74 Pierrellina hopidului 0 1 0 1 75 Recondulumus Raphanus 0 3 0 1 0 1 0 2 0 1 76 Accilina anamonides 0 3 1 5 4 26 2 12 0 2 0 1	74 Nurretteur teopulatur 0 1 0 1 0 1 0 1 0 1 75 Auctohalmuna Raphamun 0 3 0 1 0 1 0 2 0 1	1	23																						
23 Efgetalium 192	Expression reported	23 Eighteutham 192	73 Algebruitum sp.2 74 Prarreitum hopulatur 0 1 0 1 0 1 0 1 75 Recobalmens Raphanus 0 3 0 1 0 1 0 2 0 1	## Ammental angular	72 -	Elphodom.sp1																					
To	Expression reported	To Applications represented by To To To To To To To T	73	Ammotise Information Ammotise Information	71	Emacelon		4			0	1	0	4	0.	1					.0.	4		0	.1		
72 Elphishum.grl 23 Elphishum.grl 24 Purrellina topishula 0 1 0 1 0 1 0 1 0 1 0 2 0 1 76 Assilvas ammonishles 0 3 1 5 4 26 2 12 0 2 0	Eighidean spd	72 Elyhishum spl 23 Elyhishum sp2 74 Purrellina hapishla 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0	72 Elyhishim spl 23 Elyhishim sp2 74 Purrellins hopishla 0 1 0 1 0 1 0 1 0 2 0 1	Ammotise Information Ammotise Information		E excension					0	1	0	1	0	1					0	1		0	1		
				## Binester phobalisms			-	-			-				-			-	-		_		-	-	-	. 97	- 4
0 0 1		20	20	Application of the formation Company Com	60		0	3									0	3	Y	3	0	3		0		0	. 4
10			10	## Businer globalistis 0	(8)	Elphalism discordate	0	4	.0.	2	0	1	0	. 2	0	1	1	2	0	1	0	1		0	2	0	4
Description incomment Description Desc	Expiration recovers 0 3 0 1 0 1 0 3 0 3 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Description increases	Description incompany Description Desc	45 Resident globalistis 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 6 4 6 Disconhististis 0 2 2 12 12 0 2 0 4 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	-							-	_						-		-	-	-	_	-1-1		-
68 Ephalam describe 0 4 0 2 0 1 0 2 0 1 1 2 0 1 0 1 0 2 0 0 0 0	Elphalton discretate	68 Ejphidism discordale 0 4 0 2 0 1 0 2 0 1 1 2 0 1 0 1 0 2 0 0 0 0	68 Elphidram discordate 0 4 0 2 0 1 0 2 0 1 1 7 0 1 0 1 0 2 0 4 0 2 0 4 0 2 0 4 0 0 0 0 0 0 0 0	45 Resident globalistis 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 6 4 6 1 10 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	67	Elphodrum croquum	0	0	1	14	2	14	8	.1.	0.	4	0	4	0	11	2	15	5	2	14	-1	21
68 Eighalism absorbidate	Elphalism discretable	Applications absorbed	68 Eighidism shovedide	45 Resident globalistis 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 6 4 6 1 10 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1			0	0	1	14	-		0	1	.0	-			-0	- 11	7	14		2	200	-	-
Applications absorbidate	Elphalism discretable	Application absorbed	Column C	45 Resealency globalistris 46 Discontinuo globalistris 47 Cohecules lubonales 48 Cassidulina liarvepta 49 Cymbalisporente broader 40 0 2 2 12 12 0 2 0 4 0 1 0 1 0 0 1 0 1 0 0 0 1 0	66	Elphobum cronculatum					0	2					0	2									
67 Egylidium croquam 0 0 1 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 6 6 Ejylidium croquam 0 0 1 1 14 2 14 0 1 0 2 0 1 1 1 2 0 1 0 1 0 2 0 6 6 Ejylidium discordade 0 4 0 2 0 1 0 2 0 1 1 1 2 0 1 0 1 0 2 0 6 6 Ejylidium macritum 0 3 0 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0	Eighidium croquum	67 Egishidum croquam 0 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 2 6 8 Elphidum croquam 0 0 1 14 2 14 0 1 0 2 0 1 1 2 0 1 0 1 0 2 0 4 0 2 0 4 0 2 0 4 0 2 0 4 0 2 0 1 1 2 0 1 0 1 0 1 0 1 0 2 0 4 0 1 0 2 0 4 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	67 Ephilium cropum 0 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 21 68 Ephilium cropum 0 0 1 14 2 14 0 1 0 2 0 1 1 2 0 1 0 1 0 2 0 4 0 2 0 4 0 2 0 4 0 2 0 1 1 1 2 0 1 0 1 0 1 0 2 0 4 0 2 0 4 0 2 0 4 0 2 0 1 1 1 2 0 1 0 1 0 1 0 1 0 2 0 4 0 2 0 4 0 2 0 1 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0	49 Rosselma phobalaris 0 8 2 7 1 9 1 11 2 12 0 0 4 0 2 2 5 2 5 2 4 6 1 Disconhinella herbeloti 0 2 2 12 12 0 2 0 4 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	-		-	-			0		-	-		-	-	_					-				
	Elphidum crusiculatum	60 Epitodium extensionalment 0	60 Epitelium existratum	Appendix proposed	65		6	2					0	4			0	2									
60 Elphislum astronom	Eightultum artecesam	66 Elphidium salvenum 0 2 0 4 0 2 0 2 0 0 2 0 0 0 0 0 0 0 0 0	66 Elphidium advenum 0 2 0 4 0 2 0 1 0 2 0 1 0 1 0 1 0 1 0 1 0 1 0 1	Application of the properties 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 4	64						0																
65 Elphidium advenum 0 2	Elphidium entrecolatum	65 Elphidium salvenum	65 Elphidium advancem 0 2 0 4 0 2 0 0 0 0 0 0 0 0	Application of the properties	63	Pseudonnalia schroeteriuna			0	3	0	1							-0	2		-					
Description of the property	Edwinstamma calculation	Autobase and Automatical Contents	September Suprement Culture	Assessment of the properties		Amerorotalia trispinusa						4	0	2													
September properties September properties	Pseudorocolie schroeveriums	Description of the confidence of the confidenc	Description of the confidence of the confidenc	A		CONTRACTOR OF SHIP AND ADDRESS OF THE SHIP ADDRESS OF															0	1	4	0	2		
62 Asservoolulu trispinusu	Aistrocondia prignana	62 Asservonable trippesses 63 Paradirocolle schriverrans 64 Edinissumma radirote 65 Ephilium advenum 66 Ephilium artenum 67 Ephilium croque 68 Ephilium idenoide 69 4 0 2 0 1 0 2 0 1 1 2 15 2 14 1 2 68 Ephilium idenoide 69 3 0 1 0 1 0 1 1 2 0 1 0 1 0 1 69 Espisibum croque 60 1 1 1 2 0 1 0 1 0 1 60 Ephilium idenoide 60 3 1 0 1 0 1 0 1 61 Emarcilum 62 0 1 0 1 0 1 0 1 63 Ephilium idenoide 64 0 2 0 1 0 1 0 1 65 Ephilium idenoide 66 Ephilium idenoide 67 Ephilium idenoide 68 Ephilium idenoide 69 1 0 1 0 1 0 1 0 1 60 Ephilium idenoide 60 1 0 1 0 1 0 1 60 Ephilium idenoide 60 1 0 1 0 1 0 1 60 Ephilium idenoide 60 1 0 1 0 1 0 1 60 Ephilium idenoide 60 1 0 1 0 1 0 1 60 Ephilium idenoide 60 1 0 1 0 1 0 1 60 Ephilium idenoide 60 1 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 2 0 1 0 1 0 1 60 Ephilium idenoide 60 Ephili	Astronomials programs	A	-			- 100	-			2		-			-	100		112	-		-	_		- 1	13
Asserverospilar inflata	Asservosalia inflata O 1 0 1 0 2 O 2 0 1 Edynatium astronom O 2 0 4 0 2 Edynatium astronom O 0 1 14 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 2 Edynatium astronom O 1 1 4 2 14 0 1 0 4 0 4 0 11 2 15 2 14 1 2 Edynatium astronom O 3 1 0 1 0 2 0 4 Edynatium astronom O 3 1 0 1 0 1 0 1 0 1 0 1 Estatoristica O 2 0 1	Asservoidale influes	Asternovalia inflata	A	60	0.13	1	10	0	2	0	_	0	4	0	8	-	24	2	-			-		0.000		-
Ammonia registe	Ammonia seguido 1 10 0 2 0 2 0 4 0 8 2 26 2 112 7 141 2 54 1 7 Asservorable influss 0 4 0 2 0 0 0 0 1 0 2 Frenchirocolle strugenous 0 3 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Ammonia registe	Ammonia tepide	A	59		1	12	0	4	0		0	4	0	14	1	8	0	10	2	18	8	2	24	2	17
Ammonia regular	Amminia sepada 1 10 0 2 0 2 0 4 0 8 2 24 2 112 7 141 2 54 1 7 Anteriorada influes	Ammonia registre	Ammonia teplate	A	58	Ammonia heccarii	3	68	-6	92	21	290	4	.28	12	159	1	18	2	16	2	154	4	2	174	1	79
Second control Seco	Ammenta diretata 1 12 0 4 0 3 0 4 9 14 1 8 0 10 2 18 2 24 2 1 2	Second and according to 1 12 0 4 0 3 0 4 9 94 1 8 0 10 2 18 2 24 2 1	Second	A		Рагопилію пуропки	-	-		-	-	1.50	-	-	-	102	0.		2	41		24	4	2	14	2	14
Second	Ammenta hoccurs 3 68 6 92 21 290 4 28 12 159 1 18 2 16 2 154 2 174 1 7 Ammenta devicts 1 12 0 4 0 3 0 4 0 14 1 8 0 10 2 18 2 24 2 1 Ammenta epicle 1 10 0 2 0 2 0 4 0 8 2 24 2 112 7 141 2 54 1 2 Asservorodia inflitta Asservorodia schroweriuma 0 4 0 2 Edinistramina cultura 0 3 0 1 Edinistramina cultura 0 0 1 14 2 14 0 1 0 4 0 11 2 15 2 44 1 2 Eliphidum antecidate 0 1 1 0 2 0 1 0 1 0 2 Eliphidum antecidate 0 1 0 1 0 1 0 2 0 4 Eliphidum antecidate 0 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and Estimatellum and Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 0 1 0 1 Estimatellum and Estimatellum and Estimatellum and Estimatellum and Estimatellum and O 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1	Section Sect	Second	43			-	-	-		-	_	-			-						-	-	-		2	17
Section Parametric angles Section Sect	Parametala sepponera 2 28 6 68 12 150 25 164 12 102 0 12 2 41 1 24 2 14 2 1 4	September Sept	Section Sect	43	-	THE RESERVE OF THE PARTY OF THE		22	-	-				100		-	-			-						-	
Paramatalia colorer 0 22 2 17 1 28 1 18	Parametala colcor 0 22 2 17 1 28 1 18 0 7 0 5 2 18 1 24 2 1 Farametala colcor 1 2 28 0 08 12 150 25 164 12 102 0 12 2 41 1 24 2 14 2 14 2 1 Ammetala neggonius 2 28 0 08 12 150 25 164 12 102 0 12 2 41 1 24 2 14 2 14 2 1 1 7 Ammetala neggonius 1 12 0 4 0 3 0 4 0 34 1 8 0 10 2 18 2 154 2 174 1 7 Ammetala neggonius 1 12 0 4 0 3 0 4 0 34 1 8 0 10 2 18 2 24 2 1 1 7 Ammetala neggonius 1 10 0 2 0 2 0 2 0 4 0 8 2 26 2 112 7 141 2 54 1 7 141 2 7	Paramatala calcior	Paramatha color 0 22 2 17 1 28 1 18 0 0 7 0 5 2 18 1 24 2 17 1 28 1 18 0 0 7 0 5 2 18 1 24 2 17 1 28 1 18 1 20 0 12 2 41 1 24 2 14 2 14 1 24 2 14 1 24 2 14 1 24 2 14 2 2 3 3 3 3 3 3 3 3	43			-		-	-			-	-			B	-	-	-			+				
10	Peneroplis planeaue	10	18 Penersphia planeaum	43	54		1		0	3			0	-3									-				
1	Nossionalitie chargarium	1	Monte Mont	43 Besselling globalisms	53		0	2																			
Noncionalitic homeunum	Nonconstain françairam	Nonconstating housestation from the programs	Nonconsider from continue 0 2	43 Besselling globalisms	12		0	3	0	4	0	_															
Nontropolitie Roseument 0 2	Novisionistic françaises	Nonconsider Announcement 0 2	Montenesidia Folgorium 0 2	45 Beauting photosisms 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 4 46 Decemberable hershelver 0 2 2 12 0 2 0 4 47 Chicades behavior 0 2 2 12 0 2 0 4 48 Cassidalina largesta 0 1 0 1	31	Anghosegou resilata					0	12	2	24	1	17									0	1	0
Nonconclusion Information	Nansonellini fobresionica 0 3 0 4 0 2	Nonsonchine labraterian 0 3 0 4 0 2	22 Nonsorchise labrateriar 0 3 0 4 0 2	45 Beautinar globalisms 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 4 46 Decemberable benkelon 0 2 2 12 0 2 0 4 47 Checides lobatedus 0 2 2 12 0 2 0 4 48 Cassidalina languala 0 1 0 1 0		Amphiniegina lemanii					-	1	-	-										0	2	0	1
3	Application residents	3	3	45 Beauting photosisms 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 4 46 Decemberable benkelon 0 2 2 12 0 2 0 4 47 Checides behavior 0 2 2 12 0 2 0 4 48 Cassidalina langua			1	-		-													-	-			
30	Amphitistegena ferenani	30 Amphitisepina listenami	30	45 Associator globalaris 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 4 4	40		0																-	0	1		
Amphitisepine Internation of Control Contr	Amphitisegene femanical	Amphitiseppine Internation O 1 O 1 O 1 O 2 O 1	Amphitisepine literanism Aministration Amin	45 Brasileur globalaris 0 8 2 7 1 g 1 11 2 12 0 4 0 2 2 5 2 4 46 Discerbinelle hershelser 0 2	48	Cassidaliza laevgata							0	- 1													
Amphisingma tensmi	Combathus artificial Annihilating and An	Amountain franchis 0 1	Amphisispensis knowledge	45 Brasileur globalaris 0 8 2 7 1 g 1 11 2 12 0 4 0 2 2 5 2 4 46 Discerbinelle hershelser 0 2			+	-	-	100	-	-	-				Н						-	0	-	0	
Amountain function	Combathus artificial Annihilating and An	Authorization from Comband promise from Comband promise Co	Amphisispense Intensity	45 Associary globalaris 0 8 2 7 1 g 1 11 2 12 0 4 0 2 2 5 2 4 46 Discorbinella Aeribelari	47	Cibicido lobando	0	2	2	12	0	2	.0	4										0	1	0	
Amount of the control of the contr	Cascindifican lacegopla Cynchologopareciar bracket O 1 0 1 0 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 1 0	Association lace upgale	48 Considerate largespale 49 Cymhathgoraeth Aroche 40 Cymhathgoraeth Aroche 41 Cymhathgoraeth Aroche 41 Cymhathgoraeth Aroche 41 Cymhathgoraeth Aroche 42 Cymhathgoraeth Aroche 43 Cymhathgoraeth Aroche 44 Cymhathgoraeth Aroche 45 Cymhathgoraeth Aroche 46 Cymhathgoraeth Cymhathgoraeth 47 Cymhathgoraeth Cymhathgoraeth 48 Cymhathgoraeth Cymhathgoraeth 49 Cymhathgoraeth Cymhathgoraeth 40 Cymhathgoraeth Cymhath	45 Rosaling globalaris 0 8 2 7 1 9 1 11 2 12 0 4 0 2 2 5 2 6			+	-	-	4					-				-				-				
## Checkele Abbanker 0 2 2 2 12 0 2 0 4	Chescide Johanhar 0 2 2 12 0 2 0 4	## Colocide Abbanker	## Consideration 0 2 2 12 0 2 0 4	spenso appears		TOTAL STREET STREET	-	-	-	-	-	1	-		-	14			-	-	100		9	-	- 2	4	٠.
10	Discombinetifie formischier 0 2 2 0 2 0 4 0 0 1	Disconhardia horitolist	Anisonality Registration Color C	48 Especial property	45		0	1	2	9	1		1	-	2	12						2		. 7	. 4	-	١.
1	Disconfuncific hershelver	15 Something plobabaters	1	Cancris invisibles 9 2 9 3	4.6						0	4	.0.														

Science of Tsunami Hazards, Vol. 26, No. 2, page 131 (2007)

43	Casero asriculos										
44	Eposido repardo										
45	Rosalina globularis	0	3	1	. 5	0	4	0	2	0	- 3
46	Discorbinella hershelser	0	1	.0	.1						
47	Cibicales lobatulos			0	3				9 11	0	2
43	Casadulina bevgata										
47	Cymhelopurota Irrady.										
50	Amphintegina Securio	1		100					V		
51	Josephistogona radiona	0	.6	0	. 9			0	.1.	1	1
52	Nunimelline labratorics		3	0	2			0	1	0	7
53	Nonmontes bourseum		2	0	. 3	0	3	0	2	1	-
54	Nonumenter elongarum		48	5	7.2	4	24	4	4.7	14	4
55	Pymyropite planatus										
56	Pararotalus calcar										
57	Purorusalio nipponicir	0	24	0	12	1.	6			0.	2
58	Ammunia becam	3	20	6	26	2	12			2	- 1
59	Amounts donuts	3	38	5	33	4	34	3	54	3	3
60	Ammunia regista	- 4	48	6	32	6	41	2	78	4	. 5
65	Asseronatio officer		100	- 0	6	0	4			1	1
62.	Autororosolia tragvinosa										
63	Psychirotalia schrontrana	0	- 1	0	2						
64	Edentostoming cultimas										
65	Elphabus adversor										L
66	Elphulrum cronculanum										
67	Elphidum crispum			0	1	0	2			0	
68	Elphodium discondule										
69	Elphidum incertum										
70	Entonotym										
71	E-macethem										
.72	Elpholium spl	0	2	0	T						
23	Elphalum.sp2										L
74	Parrellina hispidala					1	5			0	L
25	Paraskalivina Raphorius			0	2		-				L
76	Antina promonada	- 8	1	0	L	1	.1				
77	Osangsdania venerita	5	14	1	15	0	14	0	12	-0	
	TOTAL	21	263	28	236	22	204	11	233	27	1
	Number of Genus	- 4	7	7	24	1	14	-6	13	6	
	Individual species	36.	26	. 9	.24	10	37	5	16	9	9

Science of Tsunami Hazards, Vol. 26, No. 2, page 132 (2007)

43	Casero asricular										
84	Eponides repordes		-								
45	Rosalma globularis	0	2	1	3	0	4	0	2	0	3
46	Discorbinella hershelser	0	1	.0	.1						
47	Cibicales lobatulos			0	3					0	2
41	Casadolina bevgata										
47	Conheliquestar Irradir					135					
50	Amphinegous Securio	1		7.6					-		
51	Anghistopina rudiana	0	.6	0	. 9			0	.1.	1	1
52	Navionallina labradorica		3	0	. 2			0	1	0	2
53	Nonemoules bourseum		2	0	3	0	3	0	2	1	4
54	Nonmondes elongarum		48	3	7.2	4	24	4	4.7	14	41
55	Prographs planetus										
56	Pararotalus calcar										
57	Puravusalia nipponica	0	24	0	12.	1.	6			0.	12
58	Ammunia becam	3	26	6	26	2	12			2	-18
59	America descrita	3	38	5	33	4	34	3	54	.3	.34
60	Ammonia regista	4	48	6	32	6	41	2	78	4	54
61	Assertination inflator		1100	-0	6	0	4			1	6
62.	Autororosolia Imprinosa										
63-	Psychirotalia schrontrume	0	- 1	0	2						
64	Edentosiomina cultrara		1								
65	Elphobus subsystem										
66	Elphulrum cronculation										
67	Elphidism crispum			0	1	0	2			0	-1
68	Elphidium discoulule										
69	Elphidum incertum										
70	Kentunutum										
71	E-macethers										
.72	Elpholium spl	0	- 2	0	1						
23	Elpholum.sp2										
74	Porrellina hispidula					1	5			0	-1
25	Parcsokolivour Raphorus			0	2		-				
76	Author promoted to	- 8	1	0	1	1	.1				
77	Osangsdaria veneria	5	14	1	15	0	14	0	12	0	15
	TOTAL	21	263	28	236	22	204	11	233	27	215
	Number of Gener		. 7	7	24	1	14		13	6	- 15
	Individual species	6.	26	. 9	.24	10	37	5	16	9	24

Science of Tsunami Hazards, Vol. 26, No. 2, page 133 (2007)

	Table 7.1 Distribution of Solo			200			144		0.24			NO.					1				r
	Station Numbers	-	Total I	-	and the same of		ipper	Capea	(AME)	Auto	na (Ott	L			-		-	-	-	-	H
	Dispris in sate	100	De		Sec.	_	in.		lm .		Total Contract of the Contract		_	-	8.	affail		-	-	-	H
-	Name of Species	L	T	L	7	1	T	6	Y	I.	T			-	in_	-	- fam	-	tan .		Ş
7		0	1	+	2	0	1	0		-	1	L	T	L	T	L.	1	L	T	1.	L
1	demolucables erigner		-	+	1.12	0	-	-	-2	10	1	-	-	-	-	-	-	-	-		L
3	Testilenie agglement	-	-	1	2	1"	3	0.	- 2		-	0	2	-0	-1	0	40	- 15	11		H
4	Transferite concre		2	+	1	8	- 4	Н.					-			-	-	-			H
-	Firstholiscatule	-	1	-		1 "	2	0	-	-		0.	1	-	1						F
+	Edinocenso calmas	1	1		1	.0.				0	1	1	-2	1	1.	8.	1	+	-	-0	H
-	Adelantis lampas	0		0	3	0	1	0	-	10	-	-	-			0.	3.	7	.2	-	H
	Spirate street proper	0	1	+÷	17.	H	1	-		-	1	\vdash	-	-		-	-				L
-	Spredenskin effor	-		10	-	-	-			0	1	-	-	-							ш
16	Spreaduration communica	1	2	0	1	1	- 0	0	1	1		1	3	-0	-2	13.	2 -				L
	Special regions contilled	Н	-		4	4.			-	1	3	-				-	_		1	.0.	L
17	Special colors digressor		-	4	4		2														
13	Spiratocaline eritir		-		1		- 2	1	2	Н						-	-				L
14	Springle selling up 7	0	2	-						-											L
11.	Special culture of J.		3					Н		Н	-				-	-	-	-			L
34	Mostline soons trigricals	-	-	1	1	8.	-1			Н	-	-									L
17	Versitraliar arms	-	-	-	-	-	110		-	-	-	-									L
18	(Jerepathodres applicates		-2	9	-1	0	2	-	- 2		1.	.0	-1			0	3	-			
	(hitspolesiina hiconau											9	4	0	3	0	2				
29.	Originischini contr		-														-	-			
20	Chempacha belino plegant		-		-																
21	Quegeriscolina lateroloma	0	1	- 0	2	0.	1			- 8	3	0.	4	1			1	. 0	.1	1	
22	Overgoriscoline politypine	0	- 1			0	- 2			.0	1	1	0	1	4		2	0			
28	Demperoxime assessment	9	4	1		9	-1	1		- 0	3	0	2	.0	2	0	1		. 9		
26	Quinquetrositus eterganer	0	-	0	T	0	- 1			0	3										
29.	Quinquelis solvei impressile	0	2	- 0	1	1	4			0	4										
28	Quinquelequileur qu.l	- 0	-1									-									
211	Chrispolicialina qs.2																				
.29	Attheberla produce	0	-1	0	2	8	1			0	1	1	.(2)		1	.0.	1				
29	Televalesi ohlanga																				
.30	Delicalno insper		1		2	9	.1														
31	Tributalise schoolerspea	4	1	1	. 9 .																
M	Delicates requirement			-		15	7.				-										
33	Zolaydas tricentuis	9	1	1	7	0	0	. 3	- 1	2	12	2	12	2	14	0		4	11		
34	Zirlinia line irriponale	1		2.	12	1	36	0	- 1	2.	28	1	X	0.	3	0.	4	.0	A.		
77	National Inside																				
Je.	Attacles parfin																				
30.	Approximation representa-	0.	.1							1	4	9	3		-			. 9	1		
18	Sootes marginalis	.0	1																		
34	Poscreplis planetes																				
40	Lagran strang						1			0.	2			1	2.	+	11	8	4		
	Andrew mobile																				
-61	Brooker enimals																				
43	Central annuals																				
40	Sponidos reputados					0	- 2				1										

Science of Tsunami Hazards, Vol. 26, No. 2, page 134 (2007)

- 44	Renalises phyloderia	Te	3									0	6	0	17	0	1 3	1 .	1	-	-
-0	Discontinuità tempotori					0	1			+		1	-	+	1	1	1	۰	1.		-
46	Citizales Inhanites	0.	1	0	2	0				0	4	8	1	8	1			8	2	-	
47	Cassifeline bergata								+	+	-	-	1	-	-			1.	+-	+	\vdash
43	Conhiloporatic Analys	0	1					+				+	_	-		Н	-	+	-	+	-
	Anghintopna kennai									+		+	+	-					-	+	\vdash
49	dephinispen radius	1	12	1 2	24	0	1	+		12	10	Н	3	0	1	0	1	0	- 5	-	-
- 50	Attenueline Advadence	0.	1	0	2	1		_		1	1	1	11	0	1	-	1	-	-	-	
- 19	Nationalis National	0.	2	1	3	1						1	1	0	2	-	1				
32	Nationals degree			2	12	1	4			8	3	3	16	1	12	0	3	0	7		
	Pencrophi planetos														-			-			
- 31	Percentalis colcar		2	т			$\overline{}$	=	-	†						-					
88.	Description appropries	0.	3	0	2								1	0	4						
36	America horozeni	1	20	3	91	21	187	18	210	III	108	3	28	12.		11	108	14	122	- 25	101
.57	Annessa demote	1	6	2	12	- 5	_	-			7	2	14	4	24	4	39.	3	38	1	13
.58	American Aspello	3	11	T	4	0	3	_				2	24	1	63	4	32	3	28		-19
39	Asymmetria syllina	1	2	0	2	0		-	1	1	1	0	4	0	7	1	2	0	2	-	
60	Anteriorable response					10	2	1	-	0	1	-	-	-	-	-	1		-	Н	
61	Pseudorotalia schronoripus			10	2		2			1	-	0	3							Н	
62	Crofmoson singles			1	1	0	2			\vdash		-	-							-	
63	Epholum odonum				-3					\vdash		0	2	1	1						
68	Ephalus concalmas			0	1	0	2					-	-	-	-						-
65	Elphotom cropus	1		1	7	1	1	0	1	1	10	0	14	2	21	2	19	2	25	2	14
66	Elphotium absorbable	1	3	1	4	0	2	_			-		4	. 0	3	0	1	0	1	-	10
41	Epholus morres	0	3	0	1			Н					2	0	1	0	1		-		
68	Expression					-						-	-	-	÷	-	-				
69	Empolium																				
70	Klybidan qr J			D	1	=															
11	Hybridian or Z	0	1													_					-
72	Parrellma kopudata	0	71		1							0	-2	0		1	6	. 0	4		-
23	Epitabolisma Esphanur			0	3					0	1		-		-	-	-	-	-		
74	Antitus arenoscules					.0		0	3	0	2	0	2	0	2	0)	0	2	0	ï
25	Ourgelong speaks	12				-		- 0	-	-	2	2	134	4	248	2	796		297		
- 7	TOTAL	12	124	**	***	-	-		-		-			_		_		2	-	3	334
	Number of Green	6	78	22	239	28	306		241	4	100	IT.	79	30 6	613	16	585 76	25	120	28	492
	Individual species		46	11	37	7	39	1	15	1	38		All	,	31	-	27	6	11	3 8	16
	A CONTRACTOR OF THE PARTY OF TH			-		-	-				-	-		-	- 24	-	41	-	76		10

Science of Tsunami Hazards, Vol. 26, No. 2, page 135 (2007)

Table, 7.1 Distribution of living and total foruminifers between Mandapam and Tuticorin (Offsborr) Dispris in sen-. Name of Species immitaculars coppu-1 a 3 10 1 Spirolisatine compre-11 Specification dynamic 24 (perolocatine orbit Sperodoculous sp. 1 14 Approfession yr.7. 15 Champache without applications 18 × 12 28 2 0. ži. 0. 12 34 25 þ. Quespecimalina sp. / 21 (Datequelicultur sp.) 28 Afrikelmette sprouters 29 0 Problember obligge M Treferonbest treasure. 31 0. 32 31 Triboachie propumie 3.1 34 1 10 35 Attoring profess Ingentierelle agenties 38 A ø Jordan marginalis 29 40 4 AL. Distribute sensorula. 41

Science of Tsunami Hazards, Vol. 26, No. 2, page 136 (2007)

.43	Epondes repundus					0	2				
44	Ronaling globularis										
45	Discorbinella bershelisi			0.	1	0	2				
46	Cibicides Inhatulus	.0	2	1	-6	.0	2	0	-4	11	8
47	Cassidulina laevgata		11								
48	Cymhaloporesia brushii										
	Amphintegina Sessinis			17.17							
49	Amphistopna radiata	0	.1	0	:2	0	3			0	- 5
50	Nonionellina labradorica										
51	Novomoides boweatum					0	3			.0	2
52	Nanconoides elongatum	0	1	0	1						
	Peneroplis planaria										
54	Pararotalia culcur	0	12	2	15	- 5	45	-2	14	3	28
55	Pararetalia nippanica	1	34	3	47	2	12	2	18	2	14
56	Ammonia beccarii	- 3	18	0	2	.1	4	5	- 58	11	42
57	Ammonia demota-	0	2	1	8	8	48	2	18	20	98
58	Ammonia sepuda	.0	4	0	8	1	12	5	-17	0	2
59	Asterorotolus inflatu	2	26	0	-3	1	4	0	1	12	58
60	Asteriorospha trogramma					0	2	0	4	0	2
61	Pseudorotolia schroeteriana										
62	Criticononion amples				1	0	2.				
63	Elphidium advenum	-1	12	3	14	1	12			0	3
64	Elphidum croticulatum	-1	8	0	8	0	2			- 0	1
65	Elphidium crispum	-1	4	0	4	- 2	5	0.	- 6	0	5
66	Elphidrien discordate		2			0	1				
67	Elphodum incertain.					.0	2				
68	Extoremen										
69	E-macellum							.0	1	0.	2
70	Elphidism.sp 1										
76	Elpholism sp 2										
72	Parrellina kopulula					0	1.			0	- 2
73	Recubolisma Raphanas										
74.	A exiling ammonoides	.0	4	0	15	0	12	1	12	1	12
75	Osangsilaria venusia	.0	4.	1	11	- 2	14	2	10	.1	15
	TOTAL	13	221	13:	281	27	268	23	224	.54	402
	Number of Genus	11	12	11	22	8	20	6	16	8	18
	Individual species	17.	27	23	33	11.	42	10	.10	-11	37

Science of Tsunami Hazards, Vol. 26, No. 2, page 137 (2007)

	Post tsunami species		Pre-tsunami species
41	Bolivina nobilis	41	Siphonina philippinensis
42	Brizalina striatula	42	Sorites marginalis
43	Cancris auriculus	43	Spirolina arietinus
44	Eponides repandus	44	Spiroloculina communis
45	Rosalina globularis	45	S. costifera
46	Discorbinella bertheloti	46	Textularia agglutinans
47	Cibicides lobatulus	47	T.aura
48	Cassidulina laevgata	48	T.conica
49	Cymbaloporetta bradyi	49	T.pseudotrochus
50	Amphistegina lessonii	50	Triloculina oblonga
51	Amphistegina radiata	51	T.schreberiana
52	Nonionellina labradorica	52	T.terquemiana
53	Nonionoides boueanum	53	T.tricarinata
54	Nonionoides elongatum	54	T.trigonuia
55	Peneroplis planatus	55	Uvigerina hispido-costana
56	Pararotalia calcar	56	Vertebralina striata
57	Pararotalia nipponica	57	Globigerina bulloides
58	Ammonia beccaril	58	Globigerinoides trilobus
59	Ammonia dentata	59	Globorotalia mennardii
60	Ammonia tepida	60	A. dentata
61	Asterorotalia inflata	.61	E.hispidulum
62	Asterorotalia trispinosa	62	F.labradoricum
63	Pseudorotalia schroeteriana	63	Glabratella australensis
64	Edentostomina cultrata	64	Globigerinodes trilobus
65	Elphidium advenum	65	Haplophragmoides emaciatum
66	Elphidium craticulatum	66	Miliolinella circularis
67	Elphidium crispum	67	orbulina universa
68	Elphidium discoidale	68	pseudomassilina macilenta
69	Elphidium incertum	69	Q.bicostata
70	E. excavation	70	R.virgula
71	E.macellum	71	Reussella spinulosa
72	Elphidium.sp1	72	Rupertianella rupertiana
73.	Elphidium.sp2	73	Sorites orbiculus
74	Parrellina hispidula	74	S. orbis
75	Rectobolivina Raphanus	75	Triloculina terquemiana
76	Assilina ammonoides	76	Assilina ammonoides
77	Osangularia venusta	77	Osangularia vemusta

Science of Tsunami Hazards, Vol. 26, No. 2, page 138 (2007)

Table. 3. Comparison of Pre-tsunami and Post-tsunami foraminiferal species in the study area

Post tsunami species		Pre-tsunami species
Annsobaculites exiguus	1	Alveolinella quoyi
Textularia agglutinana	2	Ammonia beccarii
Textularia conica	3	A.beccarii var.tepida
Vertebralina striata	4	Amphistegina lessonii
Edentostomina cultrata	5	Buliminella millettii
Adelosina laevigata	6	Cassidulina laevgata
Spiroloculina aequa	7	Chrysalidinella dimorpha
Spiroloculina affixa	8	Cibicides lobatulus
Spiroloculina communis	9	Crefulgens
Spiroloculina costifera	10	Elphidium crispum
Spiroloculina depressa	11	E. crispum var. crassa
Spiroloculina orbis	12	E. excuvatum
Spiroloculina sp1	13	E.incertum
Spiroloculina sp2	14	E,macellum
Massilina secans tropicalis	15	Fissurina bod jonegoroensis
Vertebralina striata	16	Floritus bowanus
Quinqueloculina agglutinans	17	F.grateloupi
Quinqueloculina bicostata	18	Hauerina bradyi
Quinqueloculina costata	19	H.fragilissima
Quinqueloculina elegans	20	H.hwoluta
Quinqueloculina Iamarckiana	21	Heterostegina suborbcularis
Quinqueloculina polygona	22	Lagena striata
Quinqueloculina seminulum	23	Operculina ammoides
Quinqueloculina elongatum	24	Opercullinella cumingii
Quinqueloculina tropicalis	25	O. venosus
Quinqueloculina sp 1	26	Osangulariria vemesta
Quinqueloculina sp 2	27	Peneroplis planatus
Miliolinella circularis	28	Planorbulinalla mediterranensis
Triloculina oblanga	29	Planorbulinella larvata
Triloculina insignis	30	Poroeponides lateralis
Triloculina schreibertana	31	Pseudotriioculina rupertiana
Triloculina terquemiana	32	Pyrgo subsphaertica
Triloculing tricarinata	33	Quinqueloculina agglutinan
Triloculina trigonula	34	Q.inca
Hauerina bradyi	35	Q.lamarckiana
Articulina pacifica	36	Q.polygona
Rupertianella rapertiana	37	Q.pseudoreticulata
Sorites marginalis	38	Q.undulose-costata
Peneroplis planatus	39	Rectobolivina-raphanus
Lagena striata	40	Sigmavirgulina tortuosa

Science of Tsunami Hazards, Vol. 26, No. 2, page 139 (2007)