

# THREATENED COASTAL MONUMENTS AT TRANQUEBAR, TAMIL NADU

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## ABSTRACT

Tranquebar, also known as Tarangampadi, is situated about 15 kms south of Poompuhar and has the habitation of Chola period till date. It had become a principal port during Dutch and Danish periods. The earliest reference to this place in a 14<sup>th</sup> Century inscription, mentioning that the merchants guilds residing at Tarangampadi. The Masilamani temple of 14<sup>th</sup> Century AD is under threat by the sea. The remains of Dutch fort have been submerged in the sea and brick wells of Danish period were completely exposed in the inter-tidal zone.

There are several references suggesting the shift of shoreline at Tranquebar area which may be due to several reasons. In this paper an attempt is made to study the shore line changes by using the satellite images and comparing them with topographic charts of 1972-73 and 1930 with reference to archaeological monuments in the vicinity of Tranquebar.

Keywords: shoreline, archaeological, Tranquebar, monument, erosion.

## INTRODUCTION

A shoreline is the line of contact between water and land along the upper reaches and it extends all along the coast. The study of ancient shorelines is of considerable importance to a variety of disciplines. Archaeologists have long been aware that in the past as well as present the coastline has been a focus for human activity. There are many historical and archaeological structures that have been built in relation to sea level. The existing sea level may be established with reference to the archaeological monuments and its culture may provide an accurate date on the sea level or a means of correlation of shoreline over a wider area (Southerland 1983). The shoreline change happens due to coastal erosion and subsidence of land. Coastal erosion is one of the major problems in India in different locations. It is caused by the forces of nature and very often accentuated by manmade structures of human activity. The natural activities are the rise in sea level, heavy storms and storm surges, littoral drift, blocking of river outlets, removal material during cyclones, by wind drift etc. The coastal monuments at Mahabalipuram, Poompuhar, Vanagiri, Tranquebar etc along Tamil nadu coast are under threat due to coastal erosion.

Many ancient ports that existed on the coastal region got vanished or submerged in the sea may be due to coastal erosion, sea level changes, neo-tectonic activities etc. Many mythological literatures across the country refer to submergence of prosperous cities. The traditions, like submergence of Golden City of Dwarka mentioned in Mahabharata, Sangam literature referring the submergence of Poompuhar (Pillai, 1989) and popular belief of submergence of Temples of Mahabalipuram, 'Kumari Kandan' traditions of Tamil Nadu etc., are well known. Many archaeological explorations have been taken up to study the submerged port towns. Though direct specific traditions and mythology have not been found,

the artefacts found during such land excavations in different parts of the country support the presence of habitation.

Tranquebar, also known as Tarangampadi, is situated in Nagapattinam District, about 15 km south of Poompuhar on Southern Tamilnadu Coast (Figure 1). It has the habitation of late Chola period till date. It had become a principal port during Dutch and Danish periods. The earliest reference to this place in a 14<sup>th</sup> Century inscription, mentioning this place as Sadanganpadi, also refers to merchants' guild known as Pathinen Visha Ayattar (traders of 18 countries) and the families of sailors called Karaiair residing at Tarangampadi. It was a commercial port attracting traders from different countries, including overseas. It was situated on the mouth of Uppanaru River. The Masilamani temple was built by Maravarman Kulasekhara in the year 1305 AD (Nagasamy, 1987) . The Danish fort was built by the Danish rulers during 16<sup>th</sup> century AD.

Geologically the coast is aligned almost north-south without any prominent bays and hills and is covered with recent alluvium. Many small rivers named Nandalar, Uppanar, Virasolanar, Kadalaliyar and Vadiyar join the Bay of Bengal near Tranquebar region. The coastline consists of long narrow and low sandy beaches. The bathymetric charts recorded in the shelf region of Tranquebar reveal gentle topographic variation with fairly smooth ocean bottom. The shelf gradient is slightly more up to 10m water depth, remaining fairly gentle from 10 to 50 m depth and again becomes steeper up to shelf edge. The width of the shelf is about 32 km. The seafloor comprises of medium to fine sand up to 5 m depth, between 5-10m silty clays, and 10-15 m silty clay and clays beyond (Rao and Rao, 1991).

## **METHODOLOGY**

Onshore and inter tidal zone explorations were carried out to collect the information on coastal archaeology followed by offshore explorations, including both geophysical surveys and underwater diving (NIO technical report, 1993). Shoreline change study at a particular place is studied by using topographic sheets, satellite imageries and field data. In our study, we have used topographic sheets and satellite imagery for detecting shoreline change at tranquebar at different years. Topographic sheets of 1932, 1972 were scanned and geometrically registered in image processing software with RMS error less than 1.0. Then shorelines of these years were digitized in GIS environment and displayed over the satellite imagery of Google Earth to know the shoreline shift for the period of last 74 years. The vector maps were converted to keyhole markup language (kml) files which can be opened directly in Google Earth. Google Earth is free online viewing software with latest satellite imageries of the globe and exact geographic positions. The software patch which was used to convert vector files to kml files were downloaded from the website (<http://arcscripts.esri.com>). It allows us to view our field data, vector files, etc, to view in open environment over the recent satellite imagery with very high spatial resolution. In this method, it is possible to detect the shoreline shift over the decades.

## **RESULTS AND DISCUSSIONS:**

During onshore and inter tidal zone explorations terracotta ring wells, brick wells (Figure 2), Coins of different periods, Chinese pottery etc are found between south of Tranquebar and

Chinnavanagiri. A late medieval brick structure with habitation evidences noticed in the trial trench of 5m X 5m northern side of Murugan temple above high water line (Figure 3).

Geophysical surveys were conducted between Tranquebar and Nayakankuppam for a distance of about 25 km with a small grids of 250 m. The survey revealed several isolated objects as rock boulders at a depth of 7-8 m and 11-13 m opposite to Masilamani temple (Vora 1987, Rao 1992, Rao 1991) Further, south of Tranquebar, sonograms and echograms recorded the extension of submerged river valleys of Nandalar and Uppanar (Rao, 1991).

Underwater investigations carried out based on the geophysical survey, revealed rolled boulders of 40-45 cm diameter, a few granite blocks and two bricks and beach rocks between 8 to 12 m water depth. These could be manmade but difficult to ascertain as the underwater visibility was very poor. The exact dimensions of the findings, nature and the abundance are not being able to document them.

Tranquebar has the habitation of late Chola period to till day. The Masilamani temple of 13<sup>th</sup> century AD is under threat as the sea has almost destroyed more than 50% of the temple (Figure 4) and is likely to engulf the entire temple in near future. The remains of Dutch fort have been submerged in the sea. The brick wells of Danish period were completely exposed in the inter-tidal zone. There are also evidences in Tranquebar about the destruction of modern houses due to the encroachment of sea (Sundaresh et al 1997). The coins of Chola, Dutch, and Danish period were collected in the intertidal zone of Tranquebar. The entire Tranquebar was well protected by a fort wall including Masilamani temple and Dansberg museum with a sufficient distance from the shore line as shown in the map prepared by the Danish rulers in mid 17<sup>th</sup> century (Figure 5).

The shift of shoreline from 1932 to 1972 is detected as 32 mts and 200 mts shift is observed from 1972 to 2006 towards the landward. The overall net shift towards the landward is 232 mts from the years 1932 to 2006 (Figure 6). The observations of the narrow strip of beaches confirm the eroding activity at that region. The historic tranquebar fort is just 35 mts away from the present shoreline. It is evident that erosion is high in that region from the big boulders put as barriers by local authorities. The study reveals the truth that the shoreline at tranquebar is migrating rapidly towards landward. After 2004 tsunami, it is reported that wave action and erosion has become very high in east coast. So, it is correct time to take necessary steps to save the Danish archeological monument in tranquebar.

The explorations between Tranquebar and Poompuhar demonstrate that the sea has gradually encroaching the land in greater extent since many years. Many archaeological monuments are destroyed in the vicinity by the wave activity followed by coastal erosion. The coastal erosion has documented at the rate of 3.44m/year by Ramiyan, et al, (1997)

The factors responsible for coastal erosion are the shift of river courses, construction of dams on the rivers, removal of sand and other materials from the beaches and cyclones. More than 42 major cyclones / depressions have been reported from the area between 1891 and 1970. The narrowness of the eastern continental shelf is also another responsible factor for the coastal erosion

The universally accepted sea level rise is 1-2 mm per year. A rise in 1 mm per year could cause a shoreline recession of 0.5 m per year (Qasim, 1999) Heavy storms including severe

monsoons and cyclones cause maximum erosion. This is because these produce high and steep waves which up rush and often break the dunes or coastal platforms and erode the coastline.

Comparison with the Indian Naval hydrographic Charts (Nos. 3006 and 3007) surveyed during 1963 and 1993 indicates that 150 - 200 m wide coastal belt has been eroded during the last 30 years and the erosion is still active along the Nagapattinam-Tranquebar-Poompuhar shoreline (Jena et al, 2001). Recent studies on beach measurements also indicates the erosion on the northern side of Masilamani temple which is the erosion prone area (Suresh PK et al, 2004).

There are specific evidences to indicate that Tranquebar coastline has changed significantly during last 300 years. A study near Tranquebar-Poompuhar indicates remains of a Dutch Fort in Tranquebar now lying in 2 m water depth. Based on the original 250 years old map Sundaresh, et al. (1997) has inferred that shoreline has advanced by about 300 m during last 250 years which in turn, indicates a rapidly advancing shoreline at the rate of about 1 m/year. But the present study says that in last 75 years the shore line changed to 232 m which in turn about 3 m per year. Similarly, the presence of ring wells in the inter-tidal zone confirms retreat of shoreline. The hydrodynamic regime prevailing in the region may be the cause of this severe coastal erosion. In view of above it can be said that shoreline has receded significantly in last 1000 years or so off Tranquebar.

It is interesting to note here that a 12<sup>th</sup> century AD city known as Dunwick in Baltic Sea, Europe, is lying between 5 -16 m water depths as a result of coastal erosion. Besides these, the recent evidences from west coast of India (Nair et al 1997) and Florida (Locker et al 1996), in the Atlantic indicate episodic and on rapid sea level rise and fall of the sea level. The rates reported of 500 to 1000 years. These findings have now dispelled the notion that sea level is a stable and unchanging datum. The inference drawn from the above is that during a period of rising sea level the zone of erosion shifts landward and during a fall in sea level the zone of erosion shifts seaward, resulting in seaward progradation of land.

From the above discussions, it can be attributed that coastal erosion followed by invasion of sea has played a major role in threatening the coastal archaeological monuments and sea level changes might have played a contributory role at Tranquebar region.

## **CONCLUSIONS**

The archaeological evidences in the intertidal zone are confirmed that they belong to medieval period based on the antiquity. Evidences in the inter-tidal zone, topographic charts, and the map of 17<sup>th</sup> Century at Tranquebar confirm the shoreline recession. This suggests that about 232 m recession takes place in 75 years. The relative sea level rise has undoubtedly been taking place on coasts where the land margin is subsiding or due to sediment transport.

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## REFERENCES

Jena, B. K., Chandramohan, P and Sanil Kumar V, (2001) “Longshore transport based on directional waves along north Tamilnadu Coast, India “, *Journal of Coastal Research*, 2001, vol 17, 322-327.

Locker, S.D., Hine, L.P., Tedesco and Shinon, E.A., (1996), “Magnitude and timing of episodic sea-level rise during the last deglaciation in *Geology*”, 24.9, 827-30.

Nagaswamy R, (1987), *Taragampadi*, a hand book, Madras.

Nair, R.R., Hashimi, N.H., Nigam, R., Pathak., M.C., and Kotnala K.I., (1997), “Rapid submergence during Historic Times evidence from Submerged wall of Vijaydurg Fort”, First International Conference on Marine Archaeology of Indian Ocean Countries held at Chennai, 21-22 February, 1997.

NIO Tech. Report, (1993), “Marine Archaeological Explorations in Poompuhar waters”, National Institute of Oceanography, Goa.

Pillai, R. S., (1989), *Cilappatikaram*, Tamil University, Thanjavur. 150 pp

Qasim, S.Z., (1999), *The India Ocean: Images & Realities*, Oxford IBH, New Delhi, 340 pp.

Ramiyan M, Krishna Prasad E and Suresh P K. (1997), *Shoreline Oscillation of Tamil Nadu coast in the proceedings of Second Indian National Conference on Harbour and Ocean Engineering (INCHOE-97)*, Thiruvananthapuram, December 7-10. 1176-1181 pp.

Rao, S. R., (1991), “Marine archaeological explorations of Tranquebar-Poompuhar region on Tamil Nadu coast”, *Journal of marine archaeology*, Goa, 2, 5-20.

Rao, S. R., (1991), “Underwater exploration of submerged towns near Tranquebar Tamil Nadu” *Recent Advances in marine archaeology*, Goa, 60-64.

Rao, T.C.S., (1991), “Marine archaeological surveys off Kaveripattinam for archaeological investigation”, *Journal of Marine Archaeology*, 2, 21-31.

Rao, T. C. S. and Mohan Rao, K. (1991), “Geophysical and Magnetic survey for marine archaeological explorations off Tranquebar, Tamil Nadu”, *Recent advances in marine archaeology*, Goa, 127-129.

Southerland . D.G. (1983), *The dating of Former shore lines in Shorelines and Isostasy*, (ed) Smith D.E. and Dawson A.G., New York, 129-130 pp.

Sundaresh, Gaur, A.S and Nair, R.R. (1997), “Our threatened archaeological heritage: A case study from the Tamil Nadu coast”, *Current Science* 73.7 593-598.

Suresh P.K., Panneerselvam D, Jayapalan M and Nagaraj G, (2004), Shoreline changes along the Poompuhar and Tranquebar coasts of Tamil Nadu, in the Proceedings of the INCHOE-2004, Goa.

Vora, K. H. (1987), "A note on the geophysical explorations for marine archaeology of Tamil Nadu coast, India" International Journal of Nautical Archaeology, London, 16(1).159-164.