



SEA LEVEL CHANGE AND LOSSES THROUGH NATURAL DISASTER: SOME REMARKS FROM EXPERIENCE IN THE PORT CITIES DURING ANCIENT TAMIL NADU

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ABSTRACT

Historically, human settlements followed land terraces and banks close to watercourses, but avoided main riverbeds because of flood risks. Especially during recent decades, enlarging human settlements like cities broke this habit and extended themselves within riverbeds, with the help of grand works of river regularization. In the same period, intense local and regional deforestation changed the flow regimes of large river basins, in the sense that rivers increased basic and flood volumes of waters. By the time human settlements and agglomerations already went a long way in incorporating riverbeds, changes in hydrological regimes determined that river systems found their old natural course and flooded the primary river beds. Of all natural disasters, floods and Cyclones are the most devastating in Tamil Nadu. They often involve loss of human life and extensive material damage. This paper explains Sea Level Change and Losses through Natural Disaster- Some Remarks from Experience in the Port Cities during Ancient Tamil Nadu.

Key words: Kollam Eyirpattinam, Arikamedu, Kaviripoompattinam, Thondi, Marunkai, Korkai,

Proto-Continent Gondwanaland , Sangam literature , Disasters, Floods and Cyclones.

INTRODUCTION

The south Indian state of Tamil Nadu is one of the important maritime states of India. Tamil Nadu coast is dotted with several ancient ports. Ancient Tamilagam has a rich tradition of sea going culture. Ancient literature furnishes rather meager evidences directly bearing on Indian Shipping and ship building; it abounds with innumerable reference to sea voyages and sea borne trade and the constant use of the ocean as the great highway of international trade and commerce. The deluges had usurped vast area of the land in the Bay of Bengal, had taken away many ports. The Kollam Eyirpattinam, Arikamedu, Kaviripoompattinam, Thondi, Marunkai, Korkai are the port cities that had been lost under water But the coastal belt between Kodikkarai and Thoothukudi usually does not experience such calamities regularly. As the force of the north- east monsoon was not severe in this belt, due to a natural barrier in the form of Srilanka, and the water depth is so shallow to allow the deluge to occur. An onshore exploration was carried out along the southern Tamil Nadu coast and located several ports near Nagargoil and in Rameswaram Island which include Puttanthurai, ManaKudi and Ariyagundur. The survey was carried out at well-known ports at Korkoi, Alagankulam, Tranquebar and Poompuhar. Presently, Korkai and Alagankulam are located far hinterland while remaining ports are situated right on the coasts and partly submerged under the sea. The assessment of the coastal erosion hazard and mitigation is an estimation of a coastal area susceptible to erosion, based on a number of factors such as shoreline changes, geology, geomorphology, rate of sea level rise, waves and current pattern, human impact on coast etc. Sea level rise is expected to increase the vulnerability of coastal areas to flooding for several reasons. A rise of 1 metre provides a higher base for storm surges and would increase the frequency of flooding associated with storms. This paper explains sea level change on the east coast of India with reference to Tamil Nadu ports.

Proto-Continent Gondwanaland

Alfred Wagener, a German meteorologist in his notable book “The origins of continents and oceans” has observed that the Indian subcontinent had get drifted from a very big continental mass. The deposits of plants, insects, fishes, amphibians reptiles found in the most ancient crust of India had striking resemblances with that of varieties found in Souh Africa, South America and Australia. Mr. Maharaj Chopra, when telling about India and the Indian Ocean, points out that the sub-continent was nothing but a part of a proto-continent Gondowana land. “Once India lay much farther south, part of a Proto-Continent Gondwanaland, when this primordial land mass sundered, Antarctica, Australia and Africa moved apart. India split from Malagasy drifted northward till it collided with the Eurasian land mass. Scientists say that the Himalaya Mountain was pushed up as a result of the collision, with ‘prodigious outburst of igneous and plutonic action’ as the Gazetteer of India puts it carrying along the deposits of the sea. Some striking resemblances have been found between these deposits and those in Bay of Bengal brought down by the Himalayan Rivers. The land movement has not halted: and the subcontinent is said to be still moving at the rate of 3 cm-a year pushing China up.”

Sangam period

Ancient literary sources exist that provide possible explanations for the loss of these littoral settlements: like the Sangam literature which refers to the submergence of Poompuhar; or the popular beliefs regarding the submergence of the temples of Mahabalipuram; and the “KumariKandam” traditions of Tamil Nadu. There are references to cyclone which resulted in the submergence of large tracts, in ancient Tamil literature. The ancient Tamil land had witnessed several deluges the result of which vast and expansive landed area had submerged under the sea. Tollkappiam, the age old grammar, the first available treatise of Tamil grammar and other eighteen monumental literary works of the Sangam period and Silappathikaram and Manimegalai the twin epics, the date of which is established beyond doubt as the second century AD substitute ample evidences for the sea-level changes that had changed the southern peninsula to a very big level. The coastal tract from Visakappattinam to Kodikkarai [Nagappattinam district] regularly faces cyclones.

The early Sangam verses pointed out the great loss and many poets lament over this. But this phenomenon was not uniform throughout the coastal area of Tamil Nadu, but was confined to some parts of the Coromandel Coast only. The first Sangam or Mudalsangam was held at Southern Madurai (Then Madurai). The first Pandya capital city existed in legendary Kumari Kandam was submerged into sea. And the southern part of the Pandian Kingdom was eroded and obliged the southern king to seek a new capital. The king did not learn by experience and chose to make another coastal town (Kapatapuram on the east coast near Korkai) his new capital Kapatapuram. The second Pandya capital city was existing in legendary KumariKandam (Lemuria) and was submerged into sea. The second sangam called Idaisangam was also engulfed by the sea. The capital was then shifted to Madurai. Most of the historians are of the view that the dates of early two Sangams periods as mythical. The legendary dates mostly are not in accordance with the historical dates. Scholars find it very difficult to fix the exact date of the Sangam period.

Poompuhar:

Ancient ports are the source of information to understand the strategic locations of ports, maritime trade, routes, material exchange and the socio-economic conditions of the contemporary period. Poompuhar one of the most notable ancient Chola port played a vital role in maritime history of Tamil Nadu specially, during Sangam period. Poompuhar or Kaveripoompattinam is located at the point where the river Kaveri joins the Bay of Bengal. Sangam period texts such as Silappatikaram, Pattinapalai and later ones including Manimekhalai, Ahananaru vividly describes Poompuhar as the capital port city of the Early Cholas. There was a heavy loss of land in the south, the grand old port city of the Cholas, ‘Kaviripoompattinam’ otherwise called ‘Poompuhar’ was hurt by another deluge and had carried away Poompuhar. Kaveripattinam in Tamil Nadu are noted not only for brisk maritime trade but also for the spread of the Indian culture in foreign land from the beginning of the Christian era up to the 11th century A.D. Sattanar the author of Manimekalai has recorded this catastrophic deluge thus:

The city forget Indira's festival Goddess Manimekala

was angered She cursed: 'Let the beautiful city be

destroyed by the sea' Puhar was ruined .

As the sea flowed over the large city like

Indra with long lance-wielding hands,

The king departed from thence all

alone uprising waves engulfed noble Puhar.

Manimekalai, the famed , Tamil epics of 2nd century A.D. mentions that then Poompuhar was swallowed and destroyed by sea, due to the wrath of God Indra whose festival had not been celebrated by the city. The marine archaeological explorations around Poompuhar brought to light the remains of terracotta ring wells, brick structures, storage jars in the inter tidal zone and brick structures, stone structures, pottery from offshore explorations strongly support the habitation sites. There are several references suggesting the shift of shoreline at Poompuhar and Tranquebar, which may be one of the reasons of its submergence. The main process directly responsible for shoreline change is influenced by the waves. Cyclones during northeast monsoon would considerably increase the volume of sediment transport towards south with a short spell. It is noticed that for the occurrence of every cyclone there was a permanent loss of beach due to erosion.

Tranquebar

Tranquebar is situated about 15 km south of Poompuhar and has the habitation of late Chola period. The Masilamani temple of the 10th century AD is under threat as the sea has almost destroyed more than 50% of the temple 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. They are located 100 m away from the present day shoreline. This is partly exposed during low tide.

A mid-17th century map of Tranquebar has been displayed in the Dansborg Museum at Tranquebar. It shows a complete plan of the town along with the shoreline. A careful study of the map suggest that, (i) the Tranquebar town was well protected by a seaward fort wall, and (ii) the Siva temple was sufficiently land ward within the fort wall. It is estimated that during the 17th century AD shoreline was at least 50 m away from the fort wall and temple located around 250 -300 m from the shoreline .This observation unequivocally suggests that the shoreline has transgressed about 300 m in the last 300 years infringing at an average rate of one meter per year.

Alagankulam

A famous ancient port town at Alagankulam is situated about 3 kms from the shoreline on the bank of river Vaigai. Presently, a channel which is about two km from ancient site is joining with sea which could have been near to the site in bygone age must have been used for plying the boats. The word Argalou of Periplus of Erythrean Sea also suggests the very location of Alagankulam. It is said that it is lying inland and celebrated for a manufacture of muslin adorned with small pearls. An archaeological excavation at Alagankulam suggests that Alagankulam had active trade contacts with Romans.

Korkai

Ancient site is located at the mouth of the Tambraparani. The site is referred in the early Tamil Sangam literature and also mentioned in the notices of the classical geographers as an important port for pearl fishery. Korkai was an important for pearl fishery is confirmed by the find of innumerable pearl oysters in the various levels of the site Kolkhoi, an emporium described by Ptolemy and an emporium of the pearl trade, mentioned by the author of the Periplus of Erythreanean Sea, as situated on the seacoast. The site has been identified with present Korkai which is situated 7 kms inland. Mc.Crindle says that "originally Korkai was situated on the sea coast and later the sea regressed and it was not suitable for carrying out the trade". Presently, Korkai is located about 25 km south of Tuticorin and about 7 km from the shoreline. This was the ancient capital of Pandya king. The excavation at the site revealed the evidence on the trade between India and Mediterranean countries in 3rd century BC to 3rd century AD.

Rameswaram Island

Northeast shore of the island was surveyed where the Department of Archaeology, Government of Tamil Nadu, recently located an archaeological site. The archaeological site is spread over 2 km along the coast and very badly is being destroyed by the sea. The sea waves are hammering the section. One can collect a large number of potsherds from the site. A few potsherds consolidated with beach rocks were also observed. A huge deposit suggests that site was occupied for a long period. The location of the site suggests that site must have served as safer harbour. The discovery of Chinese pottery suggests trade relations with east. Here a clear indication of advancement of shoreline.

Periyapattinam

The village Periapattinam is situated about 20 km southeast of Ramanathapuram in Tamilnadu. The literary evidence and archaeological excavations prove that this port served as an important trading station of Arabs and Chinese during the medieval period. The antiquity of place suggests that Periapattinam was once a flourishing port particularly in the 12th-14th century AD. Recently a stone anchor near the Kappalaru was noticed near this place which is situated between present village and sea. The name and topographical feature suggest that this river must have been once connected with the sea by a channel through which ships must have been navigated to this port. The present location of site suggests that a lot of sedimentation has taken place in this area, because now there is no connection with sea and it is about 3-4 km interior.

Mahabalipuram

It came to the glory only after the Pallava started building the structural and monolithic temple architecture in this area. Mahabalipuram was dotted with "Seven pagodas" once upon a time as referred by the earlier mariners ('pagodas' refer to the top-most part of a temple, i.e. *kalash*). Now all but one, Shore Temple' is standing tall overlooking the Bay of Bengal, rest all believed to have been submerged in the sea as per the local traditions and the foreign accounts. It is generally believed that out of a total of seven temples originally constructed, all but one have submerged in the sea over a period of time and what is now known as 'Shore Temple' is remaining. European travellers in the 18th and 19th century have recorded this folk tradition. Mahabalipuram was also a famous centre of Pallava art and architecture and is said to have been a seaport right from the beginning of the Christian era. Mahabalipuram was a place of pilgrimage even before the Pallava period and the Pallava king Narasimha Varman built these beautiful temples, including the present Shore Temple, during the 8th century AD. An 8th century Tamil text written by Tirumangai Alvar who described this place as KadalMallai, 'where the ships rode at anchor bent to the point of breaking laden as they were with wealth, big trunked elephants and gems of nine varieties in heaps'. Some of these structures are observed on raised platforms of existing natural rocks. The structures were noticed mainly in the area close to the reef and are thickly covered with marine growth. These structures may be remains of huge complexes or the temples of seven pagodas. As Pallavas encouraged the temple architecture at Mahabalipuram during 8th century AD, these structures may be assigned to be belonging to the same period. Mahabalipuram has served as a port during the Pallava period. Part of earlier Mahabalipuram town may have been submerged in the sea. The possible causes for submergence of these structures may be shoreline changes owing to erosion. Further, investigations are required to understand the nature of the submerged structures and their dates. Mahabalipuram was famous for its architecture in the past and will continue to be so as a centre for art and architecture, if it will survive nature's fury. Recent underwater archaeological explorations in the area have revealed many structural remains including fallen walls, scattered dressed stone blocks, a few steps leading to a platform and many other structural remains. The structures were badly damaged and scattered owing to strong underwater currents and swells.

CONCLUSION

Climate change threat is no more a fiction. The earth's climate changes on global and regional scales have already affected hydrological systems and terrestrial and marine ecosystems, wetland eco-systems including mangroves and in a large measure the socio economic life of people who depend upon these eco-systems for their livelihoods.

The length of its Coastline is about 1050 km with its significant portion on the east coast bordering Bay of Bengal. The coast line starts from Pulicat along the east coast and extends up to Erayamanthurai in Kanniyakumari District and consists of Estuaries of ecological importance, Major and Minor ports, Fishing harbours, Monuments of international heritage, Tourist locations, Pilgrimage centers, etc. A coast is said to

be eroding when the loss of sediments exceed the supply. Accretion is the process by which there is deposition of sediments. The shoreline is observed to be shifting land ward or towards the sea depending on a number of parameters like, prevailing wave climate, geomorphology, sediment characteristics, presence of natural or manmade obstructions, inlets, presence of outcrops, promontories or headlands.

The five coastal districts, Nagapattinam, Thiruvarur, Thanjavur, Pudukottai, and Ramanathapuram, the area along the coast that is below 10m above current mean sea level is estimated to be at risk from a 1 metre SLR, because of the very high storm surges that already affect them. For the remaining eight coastal districts, the coastal area that lies below 5m elevation relative to current mean sea level is estimated to be at risk from a 1 metre SLR. A 1m rise in average sea level would permanently inundate about 1091 square kilometres along the Tamil Nadu coast, but the total area at risk would be nearly six times as much.

Scientific study of the natural hazards and coastal processes of the Indian coast has assumed greater significance after the December 2004 tsunami because the country learned lessons on the impact of natural hazards in terms of high damage potential for life, property, and the environment. The nation's rapidly growing population of coastal residents and their demand for reliable information regarding the vulnerability of coastal regions have created a need for classifying coastal lands and evaluating the hazard vulnerability.

The dynamics of coastal landforms is mainly controlled by near shore processes, beach morphology and anthropogenic activities. The unusual natural disasters and continuous engineering activities near a coastal region are effective in inducing rapid changes on coastal landforms resulting coastal hazards. Development activities, global warming, climate change and sea-level rise not only introduce any new types of coastal hazards, but they also stimulate the existing hazards. The southern coastal Tamil Nadu of India faces severe such threats due to rapid changes in geology and geomorphology, sea-level change, tropical cyclones and associated storm surges. Furthermore, global climate change and the threat of an accelerated sea-level rise exacerbate the already existing high risks of storm surges, severe waves, and tsunamis. Over the last 100 years, global sea level rose by 1.0–2.5 mm/y. Present estimates of the future sea-level rise induced by a climate-change range from 20 to 86 cm for the year 2100, with a best estimate of 49 cm. It has been estimated that a 1-m rise in sea-level could displace nearly 7 million people from their homes in India.

Recommendations

- Coastal protection measures should be carefully assessed and carried out ;
- Implementation of Early warning systems;
- Better understanding about the role of coastal ecosystems acting as a guardrail;
- Plan for and implement shoreline protection measures;
- Climate Change considerations should be integrated into all coastal infrastructure development;
- It appears that people quickly forget that floodplains are not suitable places for building and other localised human activities. Lack of foresight in the utilisation of such areas increases material damage during floods.

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