Archaeological Sites as Indicators of Ancient Shorelines

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Abstract

During the late Holocene, coastal configuration has undergone continuous changes due to various reasons like sea level fluctuations and shoreline shift. Several reasons are attributed like global warming causing polar ice melting, change in sedimentological regime in near shore region resulting in emergence or submergence of coast and neotectonic activity altering the elevation. Archaeological sites, when they elucidate marine connection and are presently away from shore, provide an unambiguous evidence of such phenomena. Our investigations at Bet Dwarka suggests, at least two historical period sites get submerged during high tides, indicating shore line shift in last 2000 yrs. One such site indicated liquefied layer in trench at about 2 m depth and the event is dated to 2000 yrs BP. Chilika region in Orissa is a classic case where shore line shift is observed. Tranquebar, also on the east coast, is another site depicting drawn coast.

Time has come to carry out systematic investigations of the coastal archaeological sites that have proven maritime connections to decipher the scientific cause of their being defunct. Such investigations may provide an additional tool to understand complex jigsaw puzzle of shoreline shift in time and space.

Introduction

Coastal areas of the continents have been the focal points of the emergence of the civilization. For instance, the Indian Ocean witnessed the rise of 3 major the Bronze Age Civilizations around it during the mid-Holocene period. Ocean has played an acknowledgeable role by providing food security and water routes for the overseas trade and commerce. However, sea level fluctuations have played a significant role for the coastal settlement. Since the earliest time, study suggests, shoreline and sea level have never been static. Several workers have investigated sea level fluctuations along the west coast of India (Agrawal, et al., 1973, Nair, 1974, Gupta, 1977, Bruckner, 1989, Hashimi et al 1995, Gaur and Vora, 1999, Rao, et. al., 2003). There are well-defined observational data on quaternary sea level oscillation. However, these researches are based on the geological proxies like study of corals, limestone, foraminifera and other marine organism. Also these studies focus on large time frame and consequently high degree of error bar due to paucity of data, with different methods in measurement of date due to various factors.

Many archaeological sites with evidence on maritime activities either from the excavation or from literary references were important port towns during their heyday. In the course of time they get either submerged or are now land locked due primarily to siltation, though sea level change and tectonic activity also may be important at times. Such sites provide vital clues with dates to infer the shoreline changes in the recent past. The present paper, therefore deals with the coastline changes around Indian coast based on archaeological evidences during the historical periods.

Methodology

The present study is mainly based on data collected from marine archaeological explorations along the Gujarat and Tamilnadu coast during last 5 years. The important sites included are Bet Dwarka, Dwarka and Porbandar in Gujarat and Poompuhar and Mahabalipuram on the Tamilnadu coast. Besides above sites, a few already excavated sites on the both sides of Indian coast were visited and mapped to correlate with the shoreline.

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Protohistoric sites in Gujarat (Mid to late Holocene period)

A large number of sites have been discovered along the Gujarat coast dating back to the mid 3rd millennium BC to the mid 2nd millennium BC. These are believed to be the ancient ports or centres busy in exploiting the marine resources and clearly suggest a migration of shoreline. Several studies have reported the changes in sea levels and shoreline with special reference to Gujarat and Maharashtra coasts, and suggested a sea level fluctuation during the mid-Holocene period between 2 and 6 m, which is higher than the present (Merh, 1992).

The important archaeological sites providing information of the sea level fluctuations are Lothal, Dholavira, Padri, Kuntasi, Bet Dwarka in Gujarat and Poompuhar, Mahabalipuram in Tamilnadu (Figure 1).

Lothal, situated presently about 23 km away from the shoreline, and has yielded the remains of overseas trade and commerce during the Harappan period (Rao, 1979). A massive brick structure identified as dockyard and some stone anchors in the vicinity suggest that Lothal was an important maritime trading centre in the past. Boats might have been reaching the dockyard through a channel of the river Bhogawa and Lothal must have been one of the major Harappan trading centres. Lothal thus provides a clear evidence of southward shifting of shoreline by about 23 km.

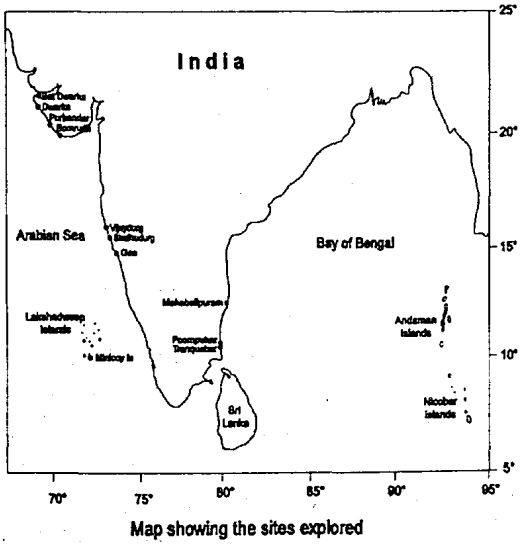

Figure 1. Map showing the important marine archaeological sites along the Indian coast.

Another important site on the southern Saurashtra coast is Padri, which is situated presently about 60 km southwest of Bhavnagar town and a km from the shoreline. According to the excavating team, the site belongs to a mature Harappan period (Shinde, 1992), and there are numerous evidences indicating the exploitation of marine resources. One of the major findings is a large Harappan copper fishhook, which is 14 cm long with a barbed point and loop on the other end and weighs 45 g (Shinde and Thomus, 1993). Such large fishhooks were probably used to catch large marine fish weighing more than 50 kg. This evidence indicates that the Harappans at Padri had perhaps mastered the technique of deep-sea fishing. The excavator of site also inferred that the people were producing salt and supplying it to the surrounding Harappan settlements.

Yet another, an important and one of the biggest Harappan sites is Dholavira in the Rann of Kachchh (Bisht, 1990). At present the Rann is a dry area but during monsoon and the highest high tide, it gets inundated. Dholavira is supposed to have witnessed the earliest habitation of protohistoric period in Gujarat. The base of the Rann of Kachchh might have been less than 10 m deep water before 3000 years (Merh, 1995) and the Khadir Bet could have served as an island rather than on the mainland. The inference is that Dholavira was an active port and the Harappan must have found that this was a safe harbour for overseas trading.

Kuntasi is another Harappan site located on the northern shores of Saurashtra. A large stone structure measuring 9.5 m X 4.1 m outside the fortification, according to Dhavalikar et al. (1996) was used as landing platform for going down to the creek for loading-unloading cargo in boats. They further suggested that it was not an agricultural settlement but was a centre for acquiring and processing raw materials for manufacturing articles for export. Discovery of two cylindrical stone anchors with tapering sides, and large holes bored vertically throughout the length and the overall geomorphology of the area corroborate that Kuntasi could have been a port situated on a tidal river during the Harappan period.

Bet Dwarka Island is an interesting site at the mouth of the Gulf of Kachchh. Onshore excavations at Bet

Dwarka Island yielded the remains of lowering of sea level during the historical period (Gaur and Sundaresh, 2003). Radiocarbon dates from Bet Dwarka Island suggest that the oldest habitation is dating back to 3470± 80 years BP, i.e. to a late phase of the Harappan civilization. The archaeological material is similar to that found at Rangpur and many other late Harappan sites of Saurashtra (Rao, 1962-63). After a long hiatus the Island was habitated during the early historical period and remains were noticed on the south eastern coast of the Island. The oldest ^{14}C date of this phase is 2590±100 BP. The material from this trench is corresponding to those with the early historical sites of Saurashtra (Ghosh, 1989) and Deccan (Thapar, 1985). The absolute dates are in agreement with the cultural deposits and verified by the discovery of coins and pottery. Interestingly, the early settlement is traced a meter below the present high water line.

It is evident from the above findings that the lowest habitation in BDK-I and II is lying below the present high water line by about 1m, which is an indication of a rise in sea level after the settlement at the Island. Similarly, the site near Khuda Dost Dargah is presently also flooded during the high tide. And these sites (BDK-I, II and V) have a time span between 2nd century BC and 4th century AD. It is during early phase of the historical period (5th to 2nd century BC) settlement when habitation was extended towards present offshore and gradually extended landwards during a later phase. However, the sea also destroyed the remains of the later phase. This suggests that till the 4th century AD sea level was lower than the present.

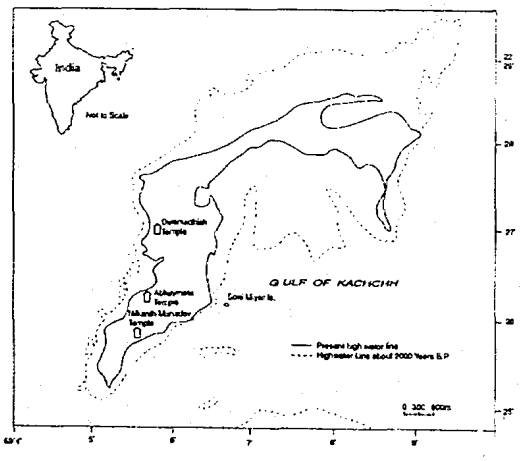

Figure 2. 2000 years before a possible shape of the Bet Dwarka Island.

As discussed that sea level was lowered around Bet Dwarka island by 2-3 m, a vast area would have been exposed towards the northern and eastern parts of the island (Figure 2) and a land bridge would have functioned during low tide towards the eastern side of the island, which is close to the mainland and even presently depth is very shallow. A large area would have been exposed even in the southern area where early historical period habitation took place. A large number of archaeological artefacts can be collected during low tide as far as 500 m from high water line.

Poompuhar, situated on the east coast, provides the evidence of a shoreline shift based on archaeological finds. Onshore and offshore explorations since 1989 have revealed a large number of terracotta ring wells (Figure 3), brick structures in inter tidal zone and submerged structures and early historic pottery in shallow waters. Two temples of the 12th–13th century AD at Varanagiri and Tranquebar have severely affected by the sea. The important reason for submergence of an ancient township and disturbance of coastal structures has been attributed to the coastal erosion. It is worth to mention here that in 1973 the Kannagi statue was installed on the shore of Poompuhar about 200 m away from the high waterline and in 1994 it was shifted about 150 m inward because the structure was destroyed by the sea. Similarly, the sea also destroyed other monuments.

Tranquebar is a unique site providing a clear case of the shoreline retreat. A mid-17th century map of Tranquebar, displayed in the Dansborg Museum at Tranquebar, shows a complete plan of the town along with the then shoreline. A careful study of the map suggests that Tranquebar town was well protected by a seaward fort wall and a *Siva* temple was sufficiently landward within the fort wall. It is estimated that during the 17th century AD the 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 (Sundaresh et al., 1997). Mahabalipuram, the famous centre of Pallava art and

architecture is situated on the coast of Tamil Nadu. The local traditions and the foreign accounts vividly refer to the submergence of six temples out of seven that existed here. Only one of these temples existed today. 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 due to strong underwater currents and swells (Figure 4). Due to thick biological growth, engravings on the stone blocks, if any, could not be noticed. Based on its alignment and form, they are considered to be of man made in origin and may be the part of temple complexes. Based on the archaeological evidences on land, the earliest possible date of these structures is estimated to be around1500 years BP (Sundaresh, et al., 2004). The major cause of the submergence of these structures is severe coastal erosion prevailing in the region.

Conclusions

Coastal areas have been the focal point of human activities since the earliest time and disturbance in coastline directly affect the settlements. Underwater archaeological sites and sites located on the coastal belt could be the authentic evidence in determining the ancient shorelines. During the mid Holocene period (Indus Civilization) the shoreline was advanced as sea level was higher by 2 to 6 m than present, however, later on, the shoreline receded at several places along the Indian coast and again shoreline advanced around 1000 years before which led the submergence of several historical period sites.

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