

**EARLY INTERACTIONS
BETWEEN
SOUTH AND
SOUTHEAST ASIA**

**REFLECTIONS ON
CROSS-CULTURAL EXCHANGE**

EDITED BY
PIERRE-YVES MANGUIN
A. MANI
GEOFF WADE

First published in Singapore in 2011 by
ISEAS Publishing
Institute of Southeast Asian Studies
30 Heng Mui Keng Terrace
Pasir Panjang, Singapore 119614

Co-published for distribution in South Asia only by
Manohar Publishers & Distributors
4753/23 Ansari Road, Daryaganj,
New Delhi 110 002
India

Manohar ISBN 978-81-7304-895-1

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission of the publishers.

© Institute of Southeast Asian Studies, Singapore, 2011

The responsibility for facts and opinions in this publication rests exclusively with the authors and their interpretations do not necessarily reflect the views or the policy of the publishers or their supporters.

ISEAS Library Cataloguing-in-Publication Data

Early interactions between South and Southeast Asia: reflections on cross-cultural exchange /

Pierre-Yves Manguin, A. Mani and Geoff Wade

Papers originally presented at a Conference on Early Indian Influences in Southeast Asia: Reflections on Cross-cultural Movements, 21-23 November 2007, organized by the Institute of Southeast Asian Studies, Singapore

1. Southeast Asia—Civilization—Indic influences—Congresses.

2. India—Relations—Southeast Asia—Congresses.

3. Southeast Asia—Relations—India—Congresses.

I. Manguin, Pierre-Yves.

II. Mani, A.

III. Wade, Geoff

IV. Institute of Southeast Asian Studies.

V. Conference on Early Indian Influences in Southeast Asia: Reflections on Cross-Cultural Movements (2007: Singapore)

DS523.2 E13

2011

ISBN 978-981-4345-10-1 (soft cover)

ISBN 978-981-4311-16-8 (hard cover)

ISBN 978-981-4311-17-5 (e-book PDF)

Cover photo of Candi Senar and Candi Arjuna on the Dieng Plateau, Java,
courtesy of Julie Romain

Printed by Salasar Imaging Systems, Delhi 110 035, India.

10

Marine Archaeological Investigations along the Tamil Nadu Coast and their Implications for Understanding Cultural Expansion to Southeast Asian Countries

Sundaresh
A.S. Gaur

The ancient ports on Tamil Nadu coast have played a dominant role in the transoceanic trade and commerce with the Mediterranean and the Southeast Asian countries since very early times. Important ports such as Kaveripoompattinam, Mahabalipuram, Nagapattinam, Korkai, Alagankulam are noted not only for brisk maritime trade but also for the establishment of the Hindu kingdoms and spread of the Indian culture in the foreign lands from beginning of the Christian Era up to the eleventh century CE. Many such port towns that existed on the coastal region vanished or were submerged by the sea, maybe due to coastal erosion, sea level changes, neotectonic activities, etc. Ancient literary sources across the country refer to the submergence of prosperous cities. These traditions, like the submergence of the Golden City of Dwarka mentioned in the *Mahabharata*, the Sangam literature refers to the submergence of Poompuhar and popular beliefs about the submergence of the temples of Mahabalipuram, the '*Kumari Kandam*' traditions of Tamil Nadu, etc., are well known as they are passed on from father to son as local traditions. It may well be impossible to search for their roots or find proof that such beliefs are based on facts. Nevertheless, many archaeological explorations have been taken up in an attempt to verify the historicity of these traditions.

Sangam literature, one of the richest ancient literary bodies, preserved in Tamil Nadu, gives ample historical accounts of maritime trade and commerce prior to the Christian era. Sangam literature mentions about the flourishing port town of Poompuhar, the capital of the early Cholas. The maritime trade with the Southeast Asian countries through the port of Kaveripattinam was confirmed with the item of Kalakam (*Kalakattu akkam* means 'the goods from the place of Kalakam') (Rajan, this volume). According to Nagaswamy (2007) Hindu images of Shiva, Vishnu along with Tamil inscription mentioning Nangur, Manigramattar, Avani Naranam and Sena mukattars were found at the ancient port town of Takuapa, Thailand; they prove close contact with the Kaveripattinam trade network and with the Pallava kings. The *Manimekhalai* mentions that Poompuhar was swallowed by the sea due to the wrath of goddess Manimekhalai. Though the reference is only to a supernatural incident, it may be taken as an echo of some actual sea erosion due to high tidal wave surge that engulfed the city.

Mahabalipuram, also known as Mamallapuram, is well known for its architectural marvels carved during the Pallava period. This place was still famous among the mariners for its 'Seven Pagodas' during the early seventeenth century CE. Mahabalipuram, 'the city of the great wrestler' was controlled by Pallava kings from Kanchipuram, the capital of the Pallava dynasty from the third to ninth centuries CE (Rabe 2001). Mahabalipuram literally means 'city of the Great Bali' in memory of the tradition when Vamana (Vishnu's dwarf incarnation) humbled the demon king Bali and caused his splendid beachfront palaces to collapse beneath the sea (Rabe 2001). According to the local tradition, six out of seven temples got submerged in the sea and the surviving one is the shore temple.

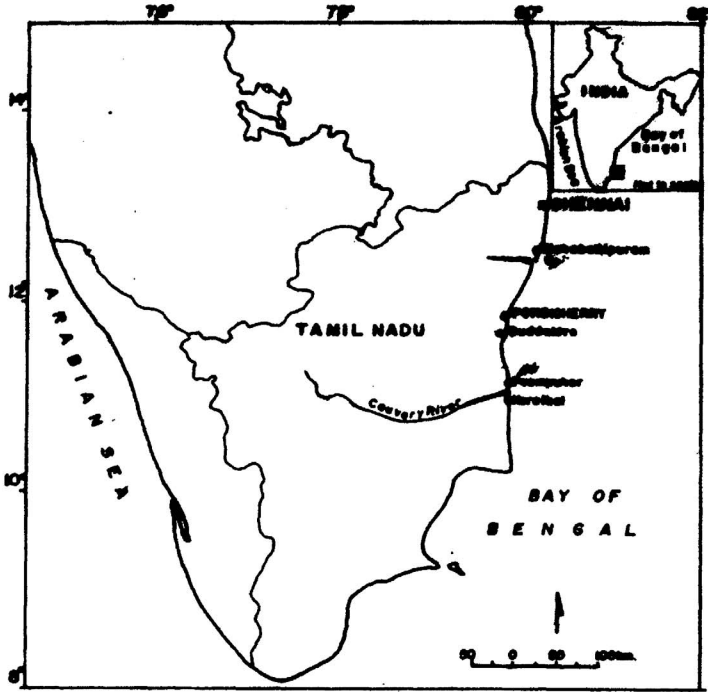
Marine archaeological explorations have been carried out by the National Institute of Oceanography, Goa at Poompuhar and Mahabalipuram (Fig. 10.1) to find out the submerged structural evidences of the famous port towns, which carried out maritime trade with other countries in general and Southeast Asian countries in particular.

These two famous sites are being surveyed to find out the remains of the ancient ports and their locations. Marine archaeological investigations are not only providing the information on submerged structures and cultural expansion, but also provide scientific results regarding coastal erosion, shore-line changes, etc. The details of the findings are described below.

POOMPUHAR

Poompuhar or Kaveripoompattinam is located on the east coast of India, at the point where the river Kaveri joins the Bay of Bengal. Sangam period texts such as *Silappatikaram*, *Pattinapalai* and later ones including *Manimekhalai*

FIGURE 10.1
Map showing the survey area on the Tamil Nadu coast



and *Ahananaru* vividly describe Poompuhar as the port capital of the Early Cholas.

Land excavations at Poompuhar brought to light two brick structures that have been described as wharves (Rao, 1987; Athiyaman, 1999), possibly located on an ancient channel of the river Kaveri.

Coastal Archaeological Explorations at Poompuhar

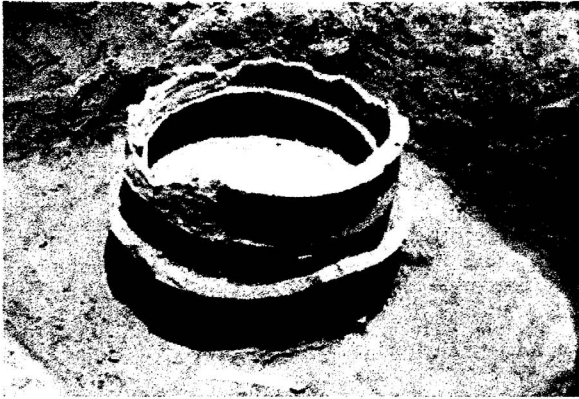
During the course of explorations, a brick structure of eleven courses running parallel to the coast was exposed (it is 1.2 m in width, 1.2 m in height and 4 m in length) (Fig. 10.2). A terracotta ring well with three courses was exposed in the inter-tidal zone at Poompuhar (it is 25 cm high, 4 cm thick at the rim, and has a diameter of 75 cm) (Fig. 10.3).

Four aligned brick structures of 25 m in length, 3.4 m in width were noticed at an under water depth of 1 m, about 60 m from the high water line, opposite to present Cauvery temple. The size of the bricks of the structures is 22 × 13 × 6 cm.

FIGURE 10.2
Brick structure exposed near the Kannagi statue in the
intertidal zone at Poempuhar



FIGURE 10.3
Terracotta ringwells exposed in the intertidal zone at Poempuhar

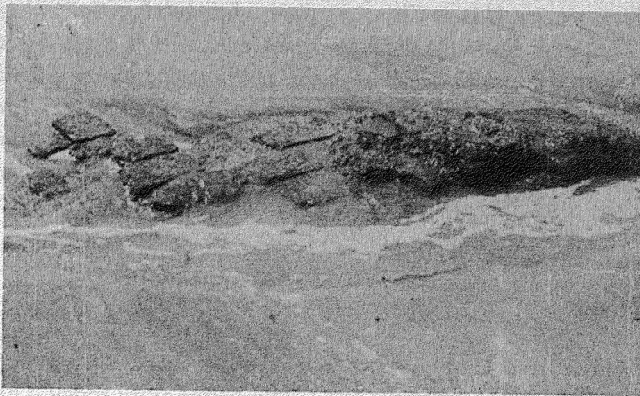


Vanagiri

Vanagiri is located on the coast about 1 km south of Poempuhar. The eleventh century CE Yellaiyamman temple has collapsed and the remains are scattered in the inter-tidal zone. Three terracotta ring wells (75 cm in diameter, 15 cm high and 6 cm thick at the rim) were exposed about 300 m south of the Yellaiyamman temple at Vanagiri. A neatly paved structure made of bricks, probably the floor of a house, was exposed in the inter-tidal excavation (Fig. 10.4).

FIGURE 10.4

Brick paved structure exposed in the inter-tidal zone at Vanagiri

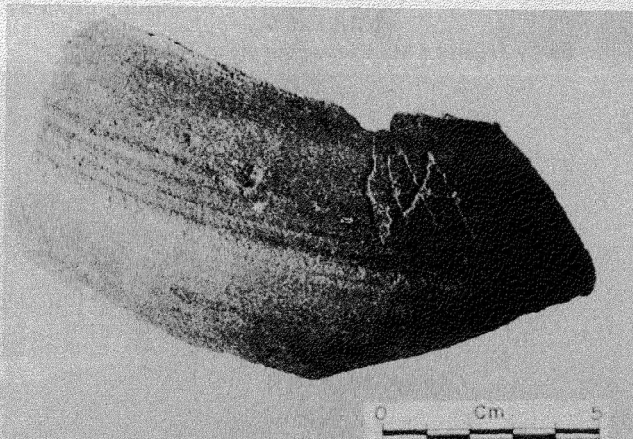


Chinnavanagiri

Chinnavanagiri is located on the coast about 3 km south of Poompuhar. In a trench at a beach site near Chinnavanagiri, a terracotta ring well with rings of 25 cm in height, 5 cm rim thickness and 115 cm in diameter, was found surrounded with burnt bricks, and associated with megalithic black and red ware and other materials like beads of semi-precious stones (agate, crystal, carnelian) and varieties of glass and terracotta. The other important finds from this site are a potsherd with an inscribed Brahmi letter 'Ma' (Fig. 10.5), an early Chola square coin (completely eroded), and a few later Chola coins.

FIGURE 10.5

Inscription on a potsherd found at Chinnavanagiri



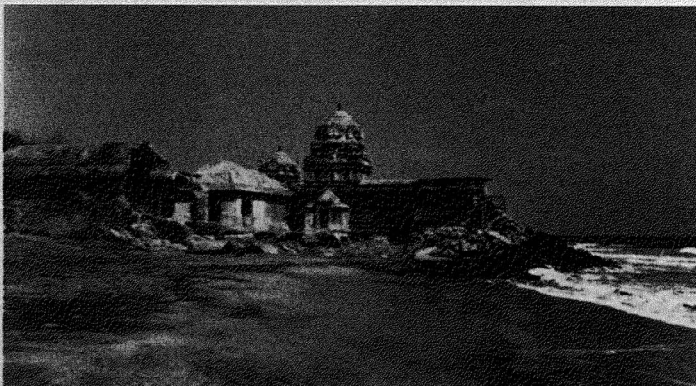
Findings of brick structures, terracotta ring wells, storage jars and brick paved platforms prove the existence of a settlement in the inter-tidal zone. A ring well was excavated near Chinnavanagiri where a habitation site was also noticed. The pottery from the site suggests that the ring well can be dated to the second century BCE, as one of the potsherds is inscribed in Brahmi with the letter 'Ma'. The other ring wells found at Vanagiri and Poompuhar are of the same period. Similar kinds of ring wells found at Arikamedu and Vasavasamudram are dated to the second century BCE to the third century CE (Rao et al. 1995-96). The size of the bricks used is $36 \times 18 \times 6$ cm and closely corresponds to the bricks used in the Buddha Vihar at Kaveripoompattinam.

Tranquebar

Tranquebar is situated about 15 km south of Poompuhar and has a continuous habitation commencing from the late Chola period until today. The entire Tranquebar was well protected by a fort wall including the Masilamani temple and the Dansborg Museum, with a sufficient distance from the shoreline as shown in the map prepared by the Danish rulers in the mid-seventeenth century. The Masilamani temple of the thirteenth century CE is under threat as the sea has destroyed more than 50 per cent of the temple (Fig. 10.6) and is likely to engulf the entire temple in the near future. Two brick wells were completely exposed in the inter-tidal zone. There is also evidence in Tranquebar about the destruction of modern houses due to the encroachment of the sea (Sundaresh et al. 1997). The coins of Chola, Dutch, and Danish periods were collected in the inter-tidal zone of Tranquebar.

A mid-seventeenth-century map of Tranquebar is displayed in the Dansborg Museum. It shows a complete plan of the town along with the

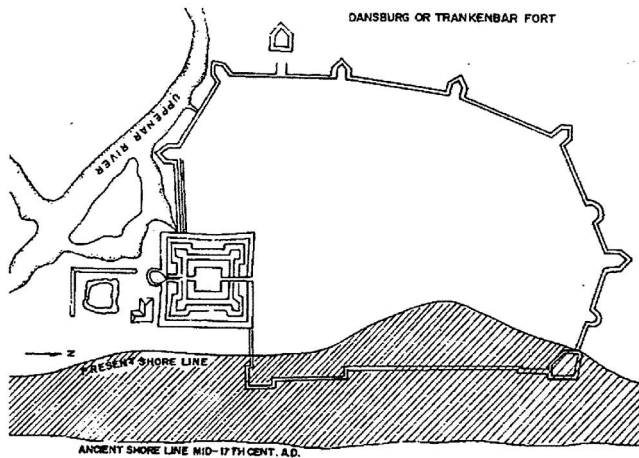
FIGURE 10.6
Partly collapsed Masilamani temple at Tranquebar



then shoreline. A careful study of the map suggests that Tranquebar town was well protected by a sea side fort wall, and that the Shiva temple was situated sufficiently landward from this wall. It is estimated from the seventeenth-century map, that the shoreline was then at least 50 m away from the fort wall. The Masilamani temple located around 250-300 m from the shoreline (Fig. 10.7). This observation unequivocally suggests that the shoreline has transgressed about 300 m in the last 300 years, therefore infringing at an average rate of one metre per year.

FIGURE 10.7

A seventeenth-century map prepared by the Danish rulers where the shoreline and the protection walls are indicated at Tranquebar



Offshore Explorations

Underwater explorations were conducted between Tranquebar and Nayakankuppam for a distance of about 25 km with small grids of 250 m at Poompuhar. The survey revealed several isolated objects such as rock boulders at a depth of 7-8 m and 11-13 m opposite to the Masilamani temple (Vora 1987; Rao 1992; Rao 1991a). Further south of Tranquebar, sonograms and echograms recorded the extension of submerged river valleys of Nandalar and Uppanar (Rao 1991). Off Poompuhar, near the southern bank of the river Cauvery, off Pudukuppam and off Nayakankuppam, between water depths of 5.5 to 10.5 m, the presence of three major sites of interest was observed.

A few dressed stone blocks measuring 90 × 40 × 15 cm, a semi-circular stone with a L-shape cut on its surface and many other irregular blocks of sandstone were noticed in 5 to 8 m water depth off the river Cauvery's mouth. The other findings during airlifting operations are brickbats and the

early historic pottery of black and red ware, red ware, buff ware and grey ware (*NIO Technical Report 1995*).

The airlifting operations in the north of Poompuhar revealed a few dressed stone blocks in three general dimensions (30 × 20 × 5 cm, 65 × 40 × 10 cm and 60 × 35 × 10 cm), and brought to light potsherds of grey ware and huge storage jars at 1 m below the sea bed. The echograms of the sub-bottom profiler revealed a submerged palaeo-channel of the river Kaveri to the north of Poompuhar at 10 to 15 m water depth, with a width of 300 to 500 m, buried 20 m below the sea bottom (*NIO Technical Report 1997*).

Three structures identified with the help of geophysical surveys between 22 and 24 m water depth off Poompuhar were later confirmed by diving (Vora 1987; Rao 1992; Rao 1991). They are lying in a north-south direction. The first structure was located at a water depth of 23 m about 5 km offshore and is oval in shape. The total periphery of the object is 140 m. North-south length of the object is 40 m and east-west length is 20 m. The height of the object on the outer edge is 3 m while on the inner side it has a maximum height of 1 m. The height of the eastern arm is greater than that of the western arm. The width of the arm varies from 3 to 6 m. The middle portion of the object is covered with sediments and rock patches. About 40 m north of the above object, two smaller objects of the same material were noticed. These two objects are lying in east-west direction within a distance of 10 m. The circumference of each object is not more than 15 m and their height is about 2 m. They have a maximum height in the centre and their edges are sloping down. There are a number of wide cracks on the structures. A few blocks are of 2 m in length, 1.5 m in breadth and 1 m in height. A few smaller blocks measure 100 × 60 × 20 cm (*NIO Technical Report 1995, 1997*).

Significance of Submerged Structures

Underwater exploration in shallow water revealed a few well-dressed stone blocks. One of them is semicircular in shape along with a number of eroded blocks. This evidence suggests that stones were also used for construction of buildings, but whether they were used for habitation or some other kind of building is still not confirmed. Sangam literature mentions that buildings were constructed of bricks. Airlift operation suggests that habitation site was buried at least 1 m below sediment. The ceramic evidence suggests that the habitation belongs to the early Christian era. In the Bay of Bengal the high-energy zone can be considered up to a depth of 8-9 m. As this area is much more disturbed by high waves, currents and tides, it is very difficult to presume that some structures particularly of bricks that were mostly used in Sangam Period would have survived in the high-energy zone. Only the stone structures are likely to provide a clue to understand the plan.

The explorations at Poompuhar and Tranquebar demonstrate that the sea has gradually encroached upon the land to a great extent in recent years. It is worth mentioning here that the Kannagi statue, said to have been installed in 1973 about 200 m from the high water line and was shifted for about 150 m landward from its original place after it was destroyed by the sea during 1994; this is a clear indication of the fast advancement of the sea. Similarly, other monuments were destroyed in the vicinity by wave activity.

The erosion on sandy coastlines is due to less sediment supply from the rivers, especially where dams have been built for reservoirs, and also due to the shifting of river mouths (Bird 1984). Subsequently, the sea began to erode the coastline, leading to submergence of several ancient coastal structures at Poompuhar (Sundaresh et al. 1997). The Bay of Bengal is subjected to a large number of high intensity cyclones, causing immense amounts of destruction on the coastline. More than 42 major cyclones or depressions have been reported from this area. The narrowness of the eastern continental shelf is also another factor responsible for the coastal erosion. This shelf is less than 50 km wide. Wave propagation over a narrow shelf results in low frictional loss of energy and thus expends much energy on the coastline, causing great coastal erosion. The removal of sand from the beaches results in destabilization and destruction of coastal structures.

The archaeological evidence recovered in the inter-tidal zone as well as offshore belongs to the Sangam period (third century BCE to third century CE). Evidence in the inter-tidal zone, hydrographic charts, and the seventeenth-century map at Tranquebar all confirm the shoreline recession. This suggests that about 300 m recession of shoreline occurred in last 300 years at an average rate of 1 m per year. If the same rate was continued for the last 2000 years, then ancient Poompuhar must definitely have extended much further towards the sea from the present coastline. Relative sea level rise has also undoubtedly been taking place on coasts where the land is subsiding.

MAHABALIPURAM

Mahabalipuram is situated on the seashore about 55 km south of Chennai and is famous for its architectural marvels such as the Shore Temple, the Chariot Rathas carved out of single rock, Arjuna's Penance bas-relief, and several cave temples built by the Pallava king Narasimha Varman during the eighth century. It is recognised as a World Heritage Monument by UNESCO. A discussion has arisen due to the belief that six temples out of seven may have been submerged. It is to verify this fact that underwater explorations were taken up.

Mahabalipuram is said to have been a seaport right from the beginning of the Christian era. An eighth-century Tamil text written by Tirumangai

Alwar described this place as Kadal Mallai (Ramaswami 1989). A few Roman coins of Theodosius (fourth century CE) suggest that Mahabalipuram then had trade contacts with the Roman world (Dayalan 1992). The epigraphical sources mention that the Pallava Kings had an active contact with Sri Lanka, China and Southeast Asia. Pallava King Sihmavarman led two expeditions by embarking on two ships from Mamallapuram. The Pallava embassy and Vajradanthi, the famous Buddhist monk who introduced Mahayana Buddhism to Sri Lanka sailed to China from the port of Mamallapuram (Ramaswami 1989). Archaeological excavations near Punjeri village, about 1.5 km west of Mahabalipuram, revealed remains of the early historic and medieval periods. The excavator has suggested that this place could have served as an ancient port (Dayalan 1992).

Mahabalipuram was well known to earlier mariners as 'Seven Pagodas' since the seventeenth century. It is generally believed that out of seven temples originally constructed, all but one were submerged by the sea over a period of time, and that only the one known as 'Shore Temple' remains visible. European travellers in the eighteenth and nineteenth century have recorded this folk tradition (Ramaswami, 1989). Carr (1869) refers to the account given by William Chambers (1869) after his second visit to Mahabalipuram in 1776:

according to the natives of the place, the more aged people among them, remembered to have seen the tops of several pagodas far out in the sea, since being covered with copper, probably gilt, they were particularly visible at sunrise as their shining surface used to reflect the sun's rays, but that now the effect was no longer produced, as the copper had since become incrustated with mould and Verde grease.

To confirm the popular tradition, underwater investigations were carried out at Mahabalipuram. The survey comprised geophysical methods and underwater visual inspection by diving.

Underwater Findings

The seabed off Mahabalipuram in depths ranging from 6 to 15 m is highly undulating, with variation in height from 1 to 6 m. Granitic rocks with patches of coarse-grained sand carpet the floor.

Several rectangular and square shaped structures appeared on most of the sonographs, particularly in the northern part, showing groups and clusters of blocks arranged in a systematic pattern, mostly discontinuous short linear structures parallel to each other. Strong reflections of the images suggest that they are massive hard bodies that are well shaped. Some natural irregular rock outcrops are also associated with these linear structures. It appears from the entire sonographs in the study area that some significant parallel

discontinuous rocky structures exist on the seafloor at some places in addition to the dominant occurrence of natural rock outcrops.

The interesting findings were explored by diving on the basis of the sonographs and important archaeological evidence was discovered including structures and sections of walls more than 10 m in length.

Site I: Among many submerged structures, a big structure was found about 700 m east of the Shore Temple under 6 m of water which comprises several small structures. The upper portion of the structure is above sea surface during low tide and is visible from shore or from a boat. The structure covers an area of approximately 75 × 35 m. The structure is broader on the northern side where a heap of stone blocks are also observed, while on the southern side scattered small stone structures of various sizes were observed. The structure has several N-S oriented wall sections (Fig. 10.8).

Dressed granite blocks were used for the construction of this structure. A wall, about 25 m in length and 65 cm in width with two to four courses is noticed. The dimensions of the blocks varies between 95 × 65 × 90 cm and 45 × 50 × 50 cm. Huge rectangular blocks measuring approximately 2 × 1 × 1.5 m were also noticed on the upper portion of the structure along with a few blocks having joinery projections. The structures are covered with marine growth; a few blocks were cleaned and chisel marks were observed. Another wall, measuring about 5.40 m in length was noticed on the northern side along with two parallel walls on the southern side of the main structure, with a stair like structure leading up. There was a small platform along with a wall towards the north-eastern side of the main structure. Further on the

FIGURE 10.8
Underwater submerged structure at Mahabalipuram



northern side remains of a wall extended up to 15 m in length. Some of the stone blocks of the western side were cleaned. One of the blocks shows that it has the joinery projections for interconnecting the blocks. The length of some of these six walls varies from 7 to 32.5 m; other walls are shorter in length. Large sized square and rectangular blocks are noticed in the middle of the structure, which had a height of 4 m above seabed. A floor measuring 2 × 2.5 m was also noticed towards the north-western side of the structure. The entire structure has a thick marine growth of sponges, shells, barnacles and mussels.

Site II: Another site is located about 200 m towards the NNE of the former structure. The water depth varies between 5-8 m. The site has remains of a wall, dressed stone blocks and natural boulders. Some of the stone blocks appear to have figurines carved on them; however, identification was not possible due to thick marine growth. There was a wall 2 m wide and 5 m in length running in an E-W direction and many fallen dressed stone blocks were found scattered around it. One of the most important finding of this location is a wall running more than 10 m, with a width of 2.5 m.

Apart from the above structures there were many more found in the vicinity which includes different types of structures, fallen walls (Fig. 10.9), dressed square and rectangular stone blocks, a square platform reached by stairs (Fig. 10.10), stone figurines, etc.

FIGURE 10.9
Underwater fallen wall of the structures at Mahabalipuram



Significance of Underwater Structures

The underwater investigations off Mahabalipuram revealed the presence of submerged fallen and scattered long walls, structures at various locations, large number of dressed stone blocks of rectangular and square type of building

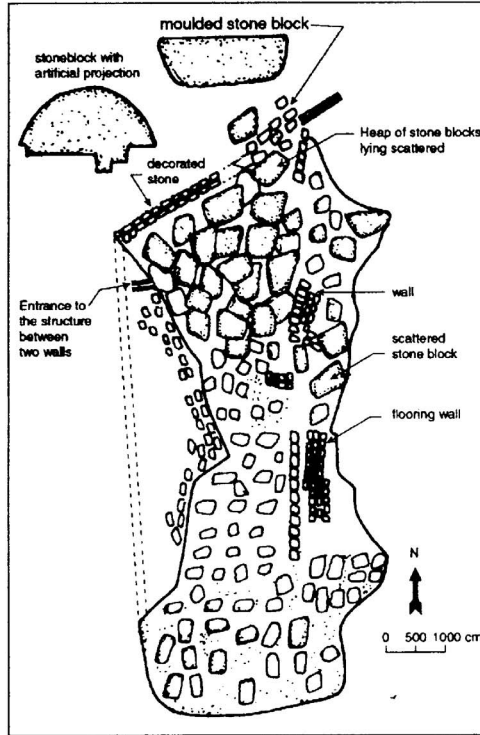
FIGURE 10.10
Steps found in underwater leading to a platform at Mahabalipuram



materials at several places and perhaps a quarry. Many of them are man-made in nature. Sometimes the extension of these structures can be noticed at least a few hundred metres parallel to the shore at various depths between 5 to 10 m. A few continuous remains of walls have been noticed at all the places. Structures running sometime more than 25 m in length suggest that they are part of some building complex. At several places high platforms and steps leading to platforms are also noticed. It is, however, difficult to determine the layout for all sites as the structures have been badly damaged and are covered with a thick biological growth.

The plan of the structures indicates that this construction could be part of a big complex, as the huge stone blocks and several fallen walls were noticed *in situ* (Fig. 10.11). It appears that construction has been carried out on a raised platform with several walls and a floor made of granite blocks. An opening between two walls with steps has been noticed which probably may be an entrance to the complex from the southern side. The natural rock boulders noticed on the SW side are similar in shape and size to those found on land on the hill at Mahabalipuram. Similarly, the construction style observed in the structures underwater is identical to that observed on adjacent land. It was not possible, however, to verify the binding material of underwater structure due to huge marine growth and the damaged condition of structures. There were many wall sections observed at different locations including the 'quarry area' on a huge rock. The dressed stone blocks required for the construction were probably extracted from the quarry found near by. In fact, most of the religious or ceremonial constructions, including the present shore temple at Mahabalipuram, have been built with granite. The stone was extensively used for the construction of temples during Pallava rule.

FIGURE 10.11
Plan of a submerged structure of Mahabalipuram



Dating of Underwater Structures

Ancient Tamil literature does not mention Mahabalipuram but the poem *Perumpanarrupadai*, dedicated to Tondaiman Ilamtiraiyan, a king of Kanchipuram, describes a port called Nirppeyarvu that could either be identified with Kanchipuram or with Mamallapuram. The place has been dated to the end of second century CE (Ramaswami 1980). Similarly, early foreign travellers also do not mention this site, but the author of *Periplus of the Erythrean Sea* (Schoff 1974) mentioned a port called Sopatma, which may be identified with Sadras, situated about 20 km south of Mahabalipuram, and which was a small port during the early centuries of the Common Era. Ramaswami (1980) mentions that the Pallava King Mamalla set his workers working on the rocks for the first time here in the seventh century CE; thereafter, this place became known as Mamallapuram. The name Mahabalipuram, therefore, is of late origin.

The archaeology of Mahabalipuram commences from the early centuries of

the Christian Era as a few Roman and Chinese coins were found (Ramaswami 1980). Two Pallava coins bearing legends read as *Srihari* and *Srinidhi* have been reported in and around Mahabalipuram (Dayalan 1992). One of the inscriptions of Narasimha I mentions that he (Narasimha I) is the first person to introduce the construction of cave temples in granite. The zenith of human habitation around Mahabalipuram was during the Pallava dynasty, therefore, these temples may not be less than 1,500 years old.

Ramaswami (1980) refers to several accounts of the Europeans about the submergence of the city and the tradition that 'a large city and 5 magnificent pagodas have been swallowed up at this place by the sea'. Rabe (2001), Chambers (1869), Hancock (2002), Mohan and Rajamanickam (2002) believe that out of seven temples carved out of granite during eighth century CE only one has survived and the rest have submerged. However, based on the facts that the rock art sculpture was encouraged by the Pallavas at this place and most of them were made during that period, these structures may be 1,200-1,500 years old.

Mahabalipuram as an Ancient Port

On the western side of Mahabalipuram, about 1.5 km within the hill region known as Mallar, at Punjeri, just on the western bank of the Bunkingham canal, Early Historic and Medieval period habitations were discovered (Dayalan 1992). Probably, this Mallar area could have been the ancient harbour situated in the backwaters, an place for safe mooring. The boats might have entered either from Sadras, where there is a channel between the river and the sea, or by the existing canal 3 km south of Mahabalipuram.

Considering this evidence, it may be concluded that Mahabalipuram was a port before the Pallavas. It became the principal port during Pallava rule, from which voyages to Sri Lanka and Southeast Asia were started. The port functioned until the early British period, when there are mentions of British ships anchored at Mahabalipuram (Ramaswami 1980). With this evidence at hand it may be said that Mahabalipuram was an active port for 2,000 years.

Possible Causes of Submergence

Geological studies carried out in the water depths between 20 and 30 m in the central eastern continental shelf of India have indicated the evidences of submerged beaches and beach ridges formed during lower sea level times (Mohan Rao et al. 2001 & 1989; Mohan Rao and Rao 1994). Srinivasa Rao et al. (1990) obtained a radiocarbon date of 8,200 years BP for the carbonate sample recovered at 17 m water depth in the Nizamapatnam bay in the east coast of India. Banerjee and Sengupta (1992) have broadly identified two low stands, one at around 30 m and other at around 100 m depth based on

anomalous sediment, geomorphic, palaeontological and geological criteria. However, the shelf of Tamil Nadu coast is believed to have undergone severe tectonic activities, because of which the sea level history varies from place to place.

It has been observed that many places that were along the shore some centuries ago are now a few miles inland. Coringa, near the mouth of the Godavari, Kaveripattinam in the Cauvery delta and Korkai on the coast of Tinnevely, were all flourishing seaports about 1,000-2,000 years ago, but are now defunct due to siltation or erosion. Their present position some distance inland may be attributed to the gradual growth of deltas of the rivers at whose mouths they lie. Similarly on the Tinnevely coast, in the Valinokkam bay, a submerged forest has been noticed, with numerous tree trunks of about 0.6 m diameter at the base, getting exposed at low tide over a bed of black clay containing oyster and other marine shells, a clear indication of earlier prevalence of marine environment (Krishnan 1968).

These references clearly indicate the violent fluctuations in the sea levels and shoreline in the last few thousand years and a clear trend of changing shorelines at places in Tamil Nadu.

Sea level and shoreline changes and the tectonic history of the region are very critical in determining the dates of the structures. The sea level has fluctuated between 2-6 m about 2-3 times during the mid-Holocene period on both the coasts of India (Merh 1987). The history of sea level fluctuation has been documented on the East Coast of India for the last 5,000 years (Banerjee 2000). Krishnan (1968), Mahapatra and Hariprasad (1999) also point out that the major and important factor affecting the Mahabalipuram coast is erosion: severe erosion at Kalpakkam, south of Mahabalipuram, due to long shore sediment drift, has also been reported (Mahapatra and Hariprasad 1999). A recent study suggests the rate of coastal erosion in and around Mahabalipuram is 55 cm/year (Ramiyan et al. 1997). If the same rate has prevailed since the last 1,500 years, then the shoreline at that time might have been around 800 m eastward and all the structures noticed underwater would have been on the land. If the rate of coastal erosion derived for Poompuhar, located 125 km to south, were applied for Mahabalipuram, then the structures in -5 to -8 m must have been on land 1,500 years ago (Sundaresh et al. 1997).

Interestingly, due to the recent construction of semi-circular breakwater, the shoreline over a stretch of 3 km north of the Shore Temple is experiencing accelerated erosion (Subramanyam & Selvam 2001). There is evidence of tectonic activity around Mahabalipuram during the early Quaternary period (Murthy et al. 1995). However, there is no evidence of tectonic activity on the coast during the past 1,200 years, as the Shore Temple has not been affected (Mohapatra and Prasad 1999).

From the above discussions, it can be concluded that coastal erosion has played a major role in the submergence of these structures and sea level changes might have played a contributory role.

The underwater structures, especially the long walls having 2 to 3 courses, the scattered dressed stone blocks of various sizes, and the stones with projections considered to be man-made may well be the remains of huge complexes or the temples of the so-called 'Seven pagodas'. As the Pallavas encouraged temple architecture at Mahabalipuram during the eighth century, these structures may be assigned 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. Further investigations, however, are required to fully understand the nature of these submerged structures and their dates.

CONCLUSION

Poompuhar and Mahabalipuram flourished as port towns and led maritime activities with Rome, China, Sri Lanka and South East Asia. The potsherds of Rouletted ware, the Chola coins, Brahmi inscribed artefacts were also found in Southeast Asian countries and were probably carried through Poompuhar, from which similar coins were reported. Glass beads were also exported to Southeast Asia during the early historical period from Poompuhar through the Kaveripattinam ports, as the Manigramam was located in the vicinity. The maritime archaeology evidence is further confirmed by the findings at Kalakattu. The gopurams of temples of Kampong Prea of eighth century CE and Prasat Bayang of Cambodia are said to closely resemble the Mamallapuram temples. The early sculptures of Cambodia of the ninth century also resemble Pallava sculptures at Mamallapuram (Nagaswamy 2007). Based on all this evidence, it is clear that cultural expansion through maritime trade started during the early historical period, if not earlier.

The marine archaeological exploration off Poompuhar and Mahabalipuram brought to light several underwater remains and the traditions mentioning the submergence of these towns have been partially confirmed.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, NIO for his support and encouragement. Thanks are also due to Dr K.H. Vora for suggestions and critically reviewing the manuscript, to Dr Sila Tripathi, Shri S.N. Bandodker, Shri S.B. Chitari for their help in fieldwork and to Dr Mohan Rao and Shri Prem Kumar for their bathymetric study. And finally to Shri R. Uchil for line drawings. This is the NIO contribution number 4576.

REFERENCES

- Athiyaman, N., 1999, 'Two Wharves at Poompuhar: A Technical Study', paper presented at Second International Conference on Marine Archaeology, held at Thane, 8-10 January 1999.
- Banerjee, P.K., 2000, 'Holocene and Late Pleistocene Relative Sea Level Fluctuations Along the East Coast of India', *Marine Geology*, 167, 243-60.
- Banerjee, A. and R. Sengupta, 1992, *Evidences of Low Stands on the Continental Shelf of East Coast of India*, in Recent Geoscientific Studies in the Bay of Bengal and Andaman Sea, special Publication of Geological Survey of India, Pub. No. 29, 163-70.
- Bird, E.C.F., 1984, *Coasts: An Introduction to Coastal Geomorphology*, 3rd edn., Oxford: Basil Blackwell.
- Carr, M.W., 1869, *The Seven Pagodas*, Madras: Foster Press. Reprinted New Delhi: Asian Educational Services, 1999.
- Chambers, W., 1869, 'Some Account of the Sculptures and Ruins at Mavelipuram, a Place a Few Miles North of Sadras, and Known to Seamen by Name of the Seven Pagodas', in *The Seven Pagodas*, ed. M.W. Carr, New Delhi: Asian Educational Services, pp. 1-29.
- Dayalan, D., 1992, *Punjeri: A Pallava Sea Port Near Mamallapuram*, ed. Natana Kashinathan, Seminar on Marine Archaeology, State Department of Archaeology, Madras, 52-56.
- Hancock, Graham, 2002, *Underworld: The Flooded Kings of the Ice Age*, London: Penguin Books.
- Krishnan, M.S., 1968, *Geology of India and Burma*, 5th edn., Madras: Higginbotham.
- Mahapatra, S.P. and M. Hariprasad, 1999, 'Shoreline Changes and Their Impact on the Archaeological Structures at Mahabalipuram', *Gondwana Geol Magazine*, Spl. vol. 4, 225-33.
- Mahapatra, S.P. and M. Hariprasad, 2002, 'Historical Sea Level Changes in Relation to Archaeological Structures on the East Coast of India', Proceedings of *Four Decades of Marine Geosciences in India: A Retrospect*, Special Publication No. 74, Kolkata: Geological Survey of India, 132-36.
- Merh, S.S., 1987, 'Quaternary Sea Level Changes: The Present Status vis-a-vis Record Along Coast of India', *Indian Journal of Earth Science*, vol. 14 (3-4), 235-51.
- Mohan, P.M. and Victor Rajamanickam, 2002, 'Importance of Studies on the Recent Sea Level Changes in the Southern Part of East Coast of India', in *Proceedings of Four Decades of Marine Geosciences in India - A Retrospect*, Special Publication No. 74, Kolkata: GSI, pp. 77-79.
- Mohan Rao, K. and T.C.S. Rao, 1994, 'Holocene Sea Level of Visakhapattanam Shelf, East Coast of India', *Journal of Geological Society of India*, vol. 44, 685-89.
- Mohan Rao, K., G.V. Rajamanickam and T.C.S. Rao, 1989, 'Holocene Marine Transgression as Interpreted from Bathymetry and Sand Grain Size Parameters off Gopalpur', *Proc. Ind. Acad.Sci.*, 98, 59-67.
- Mohan Rao, K., K.S.R. Murthy, N.P.C. Reddy, A.S. Subrahmanyam, S. Lakshminarayana, M.M.M. Rao, KVLNS Sarma, M.K. Premkumar, A. Sree and M. Bapuji, 2001, 'Submerged Beach Ridge Lineation and Associated Sedentary Fauna in the Inner Shelf of Gopalpur Coast', Orissa, Bay of Bengal, *Current Science*, 81(7), pp. 827-33.
- Murthy, K.S.R., K. Venkataswarulu, and T.C.S. Rao, 1995, 'Basement Structures Beneath the Inner Shelf off Mahabalipuram to Palar River, East Coast of India', *Indian Journal of Marine Science*, 24 (2), 223-24.

- Nagaswamy, R., 2007, 'Migration of Folk and Classical Tradition from South India to Southeast Asia', paper presented at the conference on Early Indian Influences in Southeast Asia: Reflections on Cross-Cultural Movements, 21-23 November 2007 at Singapore.
- NIO Tech. Report, 1993, 'Marine Archaeological Explorations in Poompuhar Waters', National Institute of Oceanography, Goa.
- , 1995, 'Marine Archaeological Explorations in Poompuhar Waters', National Institute of Oceanography, Goa, No. NIO/SP/13/95
- , 1997, 'Marine Archaeological Explorations in Poompuhar Waters', National Institute of Oceanography, Goa, No. NIO/SP/13/97
- , 2003, 'Underwater Explorations of Poompuhar and Mahabalipuram, Tamil Nadu', Goa, No. NIO/SP-2/2003.
- Rabe, M., 2001, *The Great Penance at Mamallapuram*, Chennai: Institute of Asian Studies.
- Ramaiyan, M., E. Krishna Prasad and P.K. Suresh, 1997, 'Shoreline oscillation of Tamil Nadu Coast', in *Proceedings of Second Indian National Conference of Harbour and Ocean Engineering (INCHOE - 97)*.
- Ramaswami, N.S., 1980, *Mamallapuram: An Annotated Bibliography*, Madras: New Era Publications.
- , 1989, *2000 Years of Mamallapuram*, New Delhi: Navrang.
- Rao, S.R., 1987, *Progress and Prospects of Marine Archaeology in India*, Goa: National Institute of Oceanography.
- , 1991a, 'Marine Archaeological Explorations of Tranquebar-Poompuhar Region on Tamil Nadu Coast', *Journal of Marine Archaeology*, 2, 5-20.
- , 1991b, 'Underwater exploration of submerged towns near Tranquebar Tamil Nadu', *Recent Advances in Marine Archaeology*, 60-64.
- Rao, T.C.S., 1991c, 'Marine Archaeological Surveys of Kaveripattinam for Archaeological investigation', *Journal of Marine Archaeology*, 2, 21-31.
- , 1992, 'Marine Geophysical Surveys of Kaveripattinam for Archaeological Investigations', *Seminar on Marine Archaeology*, ed. Natana Kashinathan, Madras: State Department of Archaeology, 17-22.
- Rao, S.R., T.C.S. Rao, A.S. Gaur, S. Tripathi, Sundaresh and P. Gudigar, 1995-96, 'Underwater Explorations of Poompuhar', *Journal of Marine Archaeology*, NIO Goa, 5-6, 7-22.
- Schoff, W.H., 1974, *The Periplus of the Erythrean Sea: Travel and Trade in the Indian Ocean*, Delhi: Oriental Books.
- Srinivasa Rao, P., G. Krishna Rao, N.V.N. Durgaprasada Rao, and A.S.R. Swamy, 1990, 'Sedimentation and Sea Level Variations in Nizampatnam Bay, East Coast of India', *Indian Journal of Marine Sciences*, 19, 261-64.
- Subramanyam, K.S. and T.A. Selvan, 2001, *Geology of Tamil Nadu and Pondicherry*, Bangalore: Geological Society of India.
- Sundaresh, A.S. Gaur, R.R. Nair, 1997, 'Our Threatened Archaeological Heritage: A Case Study from Tamilnadu Coast', *Current Science* 73 (7): 593-98.
- Vora, K.H., 1993, *Marine Archaeological Explorations off Poompuhar*, A Technical Report of National Institute of Oceanography, Goa.
- , 1987, 'A Note on the Geophysical Explorations for Marine Archaeology of Tamil Nadu Coast, India', *International Journal of Nautical Archaeology*, 16(1), 159-64.