Ancient anchors off Tamil Nadu coast and ship tonnage analysis

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The coastal region of Tamil Nadu played a major role in maritime activities even before the Christian era. In the course of such activities some of the ships which visited this coastal region, lost their anchors made of stone or metal. This paper presents the details of a few of such anchors recovered by the Centre for Underwater Archaeology of Tamil University, Thanjavur. An attempt is made to find the possible dates of these anchors and to calculate the approximate tonnage of ships served by these anchors. Information on a few stone anchors found in the west coast region is also used in this analysis. Our study suggests the need of further analysis of the anchors that are found in the Indian coastal waters. This can provide interesting results regarding the characteristics of ships that floated in Indian waters.

TO the archaeologist, anchors and other pierced stones found on the seabed are comparable with potsherds, because they serve as evidence in systems of deduction[1]. Until the advent of iron, ships were anchored with the help of stones of different shapes. Later, iron anchors replaced the stone ones gradually. Even today a few of the traditional boats of Tamil Nadu coast use small stone anchors. Several studies have been undertaken to study the types and evolution of stone and metal anchors.

In the Indian context, a number of stone anchors have been found and studies related to them have been attempted[2,3]. But they are mostly restricted to the west coast. Only an intensive exploration can reveal such anchors in the east coast. Surveys conducted in Tamil Nadu coast, particularly Ramanathapuram region, yielded five medieval period stone anchors and two metal anchors of about a century and half old (Figure 1)[4].

Description of anchors

Metal anchor 1

In 1986, a stock type iron anchor was salvaged off Thondi at a depth of 10 m (Figure 2), which weighs about one tonne. The length of the shank is about 2.0 m. The submerged portion of the teeth in the seabed is eroded. One side of the stock and the shackle that connected the chain are broken. The broken portions of the stock and shackle suggest that the anchor was detached on hitting the ship-side while it was hauled up. On cleaning the top layers, engravings were found on one side of the shank and near the crown of the anchor (Figures 3 and 4). From the engraving it can be inferred that 1864 stands for the year of manufacture. The name Guerigny may imply the company that moulded the anchor. The significance of the other letters is not clearly understood.

Metal anchor 2

A stock type stone anchor, similar to anchor 1, in heavily rusted condition was salvaged off Mullai Thivu Island near Rameswaram coast at a depth of 8 m (Figure 5). The length of the shank is about 1.5 m. Entire parts of the anchor are highly corroded but the shapes are intact. No engravings were found on this anchor.

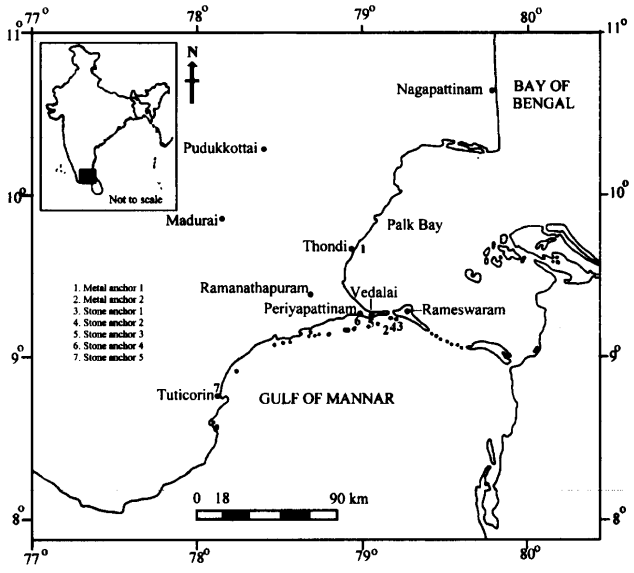

Figure 1. Map showing the places where the anchors were found.

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Stone anchor 1

A grapnel-type anchor made of greywacke sandstone was salvaged from a depth of 2.4 m off Kursadi Island, south-west of Rameswaram Island. This is one of the biggest and heaviest stone anchors reported so far (Figure 6 and Table 1). This has two rectangular fluke holes at the lower section one above the other and positioned at right angles to each other. A circular rope hole is found at the top section. The anchor was lying *in situ* in the north–south direction, the rope hole side facing towards the northern side. The seabed was of coral reef and during low tide the wave action was considerable up to the seabed. On examination, no trace of wood specimen or shipwreck was noticed in the nearby area. Marine organic matter of about 3 cm thick was found adhered to the anchor on all sides except the bottom. After salvaging, the cleaned surface was found weathered and showed no chisel marks, indicating either the frequent use of anchor in the sea or its use underwater for a long duration. An interesting feature of this anchor is a groove of 2.5 cm × 2.5 cm on the lower side of the lower-most fluke hole, intentionally provided to stop the wooden fluke at some length (Figure 7).

Figure 2. Iron anchor recovered off Thondi.

Figure 3. Engravings on the shank of anchor.

Stone anchor 2

Similar to the first anchor, a second grapnel-type anchor (Figure 8) made of greywacke sandstone was found at a depth of 10.5 m off Poomarichan Island, west of Kursadi Island. This was lying in an east–west direction over the coral bed. This has two rectangular fluke holes similar to anchor 1. However, the hawser hole is missing. There is no evidence of the existence of the hawser hole and the top portion tapers like a chisel edge. The lowermost section is broken at the edges implying frequent use of anchor. An unnatural inundation measuring 15 cm by 10 cm and about 8 cm deep is found at a surface near the top edge of the upper fluke hole. On cleaning, after salvaging, the surface looked similar to that of the first anchor and the micro-organism adhered to it was about 2 cm thick. No trace of any wood material was found nearby.

Stone anchor 3

The third anchor, made of black granite (Figure 9) found on shore, about 100 m from the sea, was used as a fencing stone near a mosque at Vedalai, 5 km west of Mandapam village. Two finely shaped rectangular fluke holes are positioned similar to the second anchor and the rope hole is missing in this anchor also. It is interesting to note that some traces of marine organisms are found adhered to

Figure 4. Engravings on the crown of the anchor.

the stone, implying the use of anchor in the sea and could have been brought to shore after some time. Since the stone is granite, the chisel marks are seen fairly running normal to the longitudinal axis. The edges of the fluke holes and sides are fairly sharp.

Figure 5. Iron anchor salvaged off Mullai Thivu.

Figure 6. One of the biggest stone anchors recovered off Kursadi Island.

Stone anchor 4

The fourth anchor, made of sandstone, trapezoidal in shape (Figure 10) having only one circular apical hole 15 cm from the top is found lying *in situ* near the backwater area called in Tamil as *kappalaru* (*kappal* > ship, *aru* > river) at the coastal village of Periapattinam. The name *kappalaru* and its topographical feature suggest that this river must have once been connected to the sea and ships would have navigated through a channel. As this anchor was exposed to sunlight, the surface is weathered and no chisel marks are seen. The wider portion is highly weathered. The rope hole does not have any rope groove.

Stone anchor 5

A mooring stone, looking like an anchor, made of greywacke sandstone found at Threspuram, a suburb of Tuticorin, planted vertically in the beach about 15 m from the shore line, is even now used for mooring the fishing boats (Figure 11). From the exposed portion, it is found similar

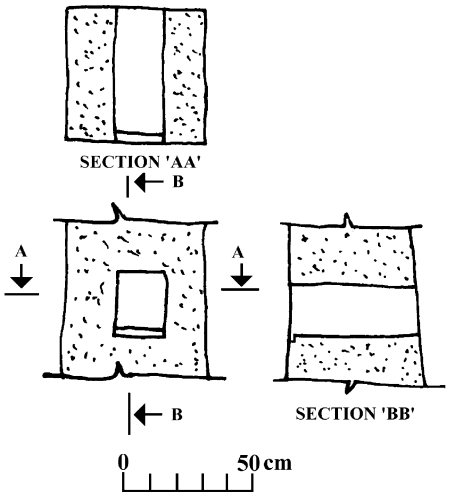

Figure 7. Groove in one of the fluke holes of stone anchor No. 1.

Table 1. Dimensions of the anchors from the Gulf of Mannar region, India

Anchor type	Material	Length (m)	Base (m)	Top (m)	Rope hole type and size (m)		Fluke holes (m)
Grapnel	Graywacke sandstone	2.97	0.50 × 0.61	0.36 × 0.32	Circular	0.14 dia	Upper 0.18 × 0.25 Lower 0.19 × 0.27
Grapnel	Graywacke sandstone	1.40	0.30 × 0.31	0.50 × 0.21	–	–	Upper 0.10 × 0.12 Lower 0.10 × 0.10
Grapnel	Black granite	1.81	0.37 × 0.38	0.20 × 0.21	–	–	Upper 0.11 × 0.18 Lower 0.10 × 0.17
Trapezoidal	Sandstone	0.52	0.60 × 0.12	0.45 × 0.12	Circular	0.11 dia	–
Grapnel?	Graywacke sandstone	?	?	0.30 × 0.30	Circular	0.11 dia	?

to anchor 1 salvaged off Kursadi Island. The projected portion, slightly inclined towards the sea, measures about 90 cm high and 30 cm × 30 cm at the top section. A rope hole of 11 cm diameter is found below 35 cm from the top portion. At the ground level, the section measures 50 cm × 50 cm. The local fishermen, due to their superstition did not allow the author to dig under the stone to see the existence, if any, of rectangular fluke holes. From the material and shape, it is very likely that there exist fluke holes similar to anchor 1. It is interesting to note that even today anchor stones of very small size weighing about 10 kg are used in Tuticorin and Rameswaram areas.

Figure 8. Stone anchor recovered off Poomarichan Island.

Figure 9. Stone anchor found on land at village Vedalai.

Figure 10. Trapezoidal stone anchor found at Periapattinam.

Discussion

Despite the sporadic occurrence of anchors, which is statistically insignificant for any detailed analysis, they adduce knowledge on the maritime history of this coast. Besides, these anchors provide information on the technical aspects of the stone anchors, to compare with anchors that are found elsewhere.

The two metal anchors salvaged are very recent compared to the stone anchors. Information provided by these anchors is meagre when compared to the available archival sources. Except for the name engraved on the first anchor, not much information could be provided and therefore it has only antique value.

Anchor 1 is the biggest of the stone anchors reported so far. Its huge size and weight may lead one to assume that it was used as a mooring stone rather than an anchor stone, as it involves difficult operations of lowering and hauling. However, the existence of rectangular fluke holes cannot be justified for the mooring stone[5]. Moreover, this anchor corroborates the account on Indian anchors given by the 16th century traveller Varthema. He mentions that the Indian anchors were made of marble, of single piece, eight *palmi* (feet?) long and two *palmi* each otherway[6]. Anchors recovered from other regions like Red Sea, east African coast and West Coast of India are similar in shape and other features, but are smaller in size[7]. The groove in the lowest fluke hole is an interesting feature, so far unreported in other anchors. Perhaps this is provided to stop the wooden fluke at some distance, when driven. From the existence of the groove, it can be presumed that a linch pin would have been fixed in the fluke at the other end to secure the log permanently. Nevertheless, the reason for the absence of similar groove in the upper fluke hole could not be ascertained. For the anchors 2 and 3, the technique of mooring the rope with anchor can be compared to that of double-stocked mooring killicks at Kathaluwa–Ahangama of Sri Lanka[8].

Figure 11. Mooring stone (stone anchor ?) found at the Threspuram near Tuticorin.

Stone anchors 2 and 3 are identical in shape and the fluke holes. While the former is made of sandstone, the latter is of granite, suggesting different provenance. The absence of the rope hole at the top section is significant.

The single-holed stone anchor 4 made of sandstone, trapezoidal in shape, is the first of its kind so far found in this region and only a few more findings similar to this may help in any comparative study.

The shape and the presence of rope hole of the mooring stone found at the Tuticorin beach provide strong evidence for the existence of fluke holes at the lower section. The dimensions of the top section suggest that this would be one of the biggest stone anchors found so far, next only to stone anchor 1.

Out of five stone anchors noticed in this region, four are of grapnel-type. Fundamentally, grapnel-type anchors seem to be made for safer anchorage in the coral bottom[9]. Most of the shallow waters of the Gulf of Mannar region are full of coral reef and hence the grapnel-type anchors would have been extensively used by the ships, which were built here or visited this region.

The discovery of a large number of these grapnel type anchors in recent days in Middle East seas and in India forces one to rethink the evolution of anchors proposed by Kapitan. At the time of his proposition, not many of grapnel type anchors were recovered and hence one could see no place for these anchors in the evolution chart. He mentions that the occasional attempt to transform the stone into a sort of shank had to fail since stone is not a suitable material for forming shank which works as a lever when the anchor is lifted and its gripping arm breaks out of seabed[10]. Later, he changed his opinion as many more anchors of grapnel type were found in Indian waters[11].

Four of the above discussed stone anchors are made of sandstone for which the raw material is nowhere found in this coastal region. Thus, one can infer that the anchors were not indigenously made. The nearest region where the black granite is available is Pudukkottai, which is 100 km away from the place where anchor 3 was found. However, on the basis of the availability of raw material alone, one cannot presuppose that anchor 3 would have been made in the Pudukkottai region.

Maritime activities

Like other coastal regions of India, port towns of Tamil Nadu also played a major role in the maritime trade with the countries of Mediterranean region during the Christian era (Figure 12). The Sangam literature (3rd century BC–AD 3rd century), travellers' accounts right from Megasthenes and the archaeological excavations conducted at Arikamedu, Poompuhar, Alagankulam and Korkai provide ample evidence of the trade with Mediterranean region by the port towns of this region.

Maturaikanci (375–379), one of the Sangam literature alluded to the ship (*navay*) anchored with the stone anchor (*kal*), over the sea, where the chank (*xancus pyrum*) shells tread around. It is said that the ship, which was caught in the cyclone, was circling around and that due to the heavy wind the sail mast broke down[12]. It is interesting to note that the Gulf of Mannar is the only region where the chank shells are abundant. *Civakacintamani* (2231), a 10th century Tamil work leaves a passing remark on anchor without any description as to its shape and size[13]. Though it mentions about the stone anchor, the descriptions of their shape and size are not found in it.

Epigraphical and archaeological evidence and travellers' records also prove that during the medieval period (AD 9–14th century) places like Kayalpattinam, Periapattinam, Devipattinam and Nagapattinam were important port towns on this coast. These ports had maritime relation with the Arabian countries, Southeast Asia and China. It is interesting to note that during this period there was active horse-trade with the Arabian countries by the merchants of West Coast of India[14].

Ancient ports

The ancient port town Alagankulam is situated at the confluence of the river Vaigai, where it joins the Palk Bay. It is interesting to note that this town is placed on the northern side of the promontory, which is in the Palk Bay, while all the anchors recovered are from the southern side, which is in the Gulf of Mannar. During the excavation at Alagankulam, many antiquities were found testifying to the trade relations of this port with the Mediterranean countries right from the 3rd century BC. The remarkable evidence is a ship motif collected from the fifth season (1997) of the excavation. The ship engraved as a graffiti

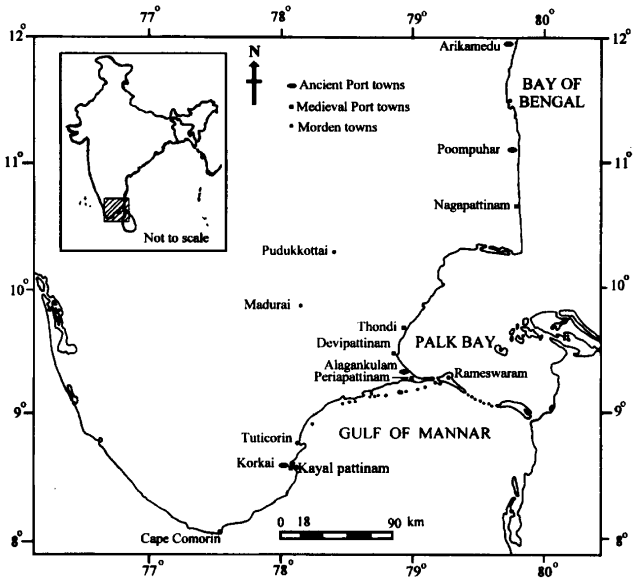

Figure 12. Some of the important port cities of ancient and medieval period.

mark on the shoulder portion of a rouletted ware has been identified as one of the largest type of three-masted Graeco-Roman ships used in the transoceanic voyage[15]. This suggests that this port town served as a well-established node of the maritime trade network during the Christian era. The connection between the Palk Bay and the Gulf of Mannar region is very shallow and the big ships arriving in Palk Bay must come around Sri Lanka. So the ships from the Arabian Sea would have anchored in the Southern side, that is, in the Gulf of Mannar and the goods would have been transferred through land as the distance is only about 10 to 15 km.

During the medieval period the port town Periapattinam where stone anchor 4 was found, was a flourishing port, trading with Arabia and China. The discovery of large quantities of Chinese and Islamic potsherds and also of old coins, in the exploration and excavation conducted by the Tamil University, suggests that the village was once a big commercial town that flourished within an international trade network which connected East and West[16]. Only fragments of white porcelain datable to the 9th or 10th century were recovered in the village. Judging from the chronological concentration of the later Chinese potsherds, the date of its flourishing as an international port should be ascribed to the 13th and 14th centuries, more precisely, the 14th century[17].

Dating of anchors

From the literary and archaeological evidences it can be presumed that the usage of stone anchors would have prevailed from the 3rd century BC until the advent of iron anchors possibly until the colonial period. The long survival of these stone anchors makes difficult the probable dating of the anchors under discussion. However, from the accounts of Varthema, anchor 1 can safely be assigned to the 14–16th century AD. Akin to anchor 2 and 3, two more are found in the National Museum at Mogadishu on the eastern coast of Africa[7]. Since these are dated to the 11th century AD, anchors 2 and 3 can be assigned to this period. Anchor 4 found at Periapattinam can be assigned to the 13–14th century AD, as this port town played a major role in the maritime activity of this period. Approximate dating for anchor 5 can be done only when this anchor is excavated and studied further.

Tonnage analysis

The data for three anchors of this study and those six other anchors, two from Vijaydurg[18] and four from Sindhudurg[19] of Maharashtra have been used to calculate the probable tonnage of the vessel these anchors could have served. This may give some idea on the fleet characteristics. Other anchors reported so far for these regions are not of grapnel type and the original dimensions also could not be found[20].

The weight of the anchors is calculated based on the computation of the volume of the anchor, deducting the hole portions and multiplying it with the density of the anchor. Kolunski has given the following equation for computing tonnage of vessel from the anchors recovered (assuming they served as the main anchor of the respective vessel)

$G = 9\,D^{2/3}$, where G is the anchor weight in kilograms and D is displacement in tons.

However, the equation applies to modern anchors made of iron or steel. As the wooden flukes will have lesser capacity, the tonnage could be marginally adjusted to 3/4th of the actual value. Based on the above equation the tonnage of the vessel and other information are computed (Table 2).

Though anchors analysed are statistically insignificant, one can see from Table 2 that most of the grapnel type anchors found in Vijaydurg and Sindhudurg are nearly 1.80 m in length unlike the anchors found in the Ramanathapuram coast. Perhaps the anchor found in the Ramanathapuram coast could be compared with the anchors found in the West Coast region. It is possible that for certain size of ship, the height of anchor was fixed based on some criteria as the length close to 1.8 m (i.e. 6 feet) is

Table 2. Tonnages according to Kolunski equation

Site	Anchor no. as quoted	Material	Height (m)	Weight (kg)	Calculated tonnage
Ramanathapuram	1	Sandstone	2.97	1522	1650
Ramanathapuram	2	Sandstone	1.40	178	70
Ramanathapuram	3	Black granite	1.81	520	330
Vijaydurg	1	Beach rock	1.80	419	240
Vijaydurg	2	Sandstone	1.85	645	460
Vijaydurg	3	Sandstone	1.75	579	390
Vijaydurg	5	Sandstone	2.00	770	590
Vijaydurg	6	Sandstone?	1.50	512	320
Vijaydurg	7	Sandstone?	2.18	799	630
Sindhudurg	4	Sandstone	1.80	623	430
Sindhudurg	5	Laterite	1.55	439	260
Sindhudurg	6	Laterite	1.10	254	110
Sindhudurg	as Lintel	Sandstone	1.75	385	210

more frequently found. As the height of anchors is about 1.80 m the calculated tonnage of the vessel of the anchors is between 300 and 600 and this would be the tonnage range vessels that called on these ports. This variation could be due to different stones that are used to make anchors. Perhaps a correlation analysis of the height and tonnage would reveal the exact relationship between the anchors and tonnage of ship. The present study is only a preliminary study in this direction. If a proper ethno-archaeological study is made on the traditional wooden goods carriers which sail between Lakshadweep and the Kerala coast, it may be possible to find the length, beam, and draft of the medieval period ships.

Conclusions

We have studied only a few stone and metal anchors which are found on the coastal areas of Tamil Nadu. An intensive search would reveal a large number of antiquities including shipwrecks of historical importance along the Tamil Nadu coast. The tonnage analysis shows that the fleets of 300 tons to 600 tons were frequenting the coastal region of India. Perhaps a detailed study in this line would throw much light on fleet characteristics.

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