

## Stone anchors of India: Findings, Classification and Significance

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### Abstract

*Various types of stone anchors have been observed during inshore and offshore explorations along the east and west coasts of India. The earliest stone anchors of India have been recorded from the Harappan sites (3rd millennium BC), but their shape and size do not resemble the anchors found during maritime archaeological explorations since 1986. The stone anchors until now recovered from many sites of India can broadly be classified into four types: namely composite, Indo-Arabian, ring stone (mushroom) and single hole. Among all these types of anchors the Indo-Arabian are largest in number and were associated with the Arab traders who were also involved in the horse trade. Moreover, Indo-Arabian stone anchors have been found in a datable context as well reused as lintels, mooring bits, pavements, etc. Composite and single-hole stone anchors are the oldest ones. Composite stone anchors have been reported from Gujarat and Maharashtra coast; ring stone anchors from Gujarat and Goa coast and single hole and Indo-Arabian anchors from both east and west coasts of India. Evidences suggest that stone anchors were used in Indian waters from the 3rd millennium BC to the mid 20th century along with iron anchors which were introduced by the Europeans. Stone anchors resembling Indian have also been reported from the Persian Gulf, African countries, Sri Lanka and Maldives, which suggest maritime contacts and transfer of knowledge and technology. This paper details the finding of stone anchors, their role and significance in the maritime history of India.*

**Key words:** Stone anchor, Horse trade, Maritime contacts, Technology, transfer of knowledge

### Introduction

It has been stated that man attained the knowledge of nautical skills from the time when he crossed the oceans with the help of crafts made of logs and dugouts during the Stone Age. He must have used stones of some size as anchors. After several centuries, different types and shapes of stone anchors were developed and used for various purposes including inland and overseas trade. In Indian contexts, a great extent of new evidence relating to stone anchors has come to light during inland, coastal and offshore explorations and excavations (Fig. 1). Gujarat is the lone state of India where stone anchors have been recorded during land excavations but those differ in shape and size

from the anchors which were found during maritime archaeological explorations. A



*Fig. 1 Map showing the stone anchor sites in India.*  
(Sila Triпати)

a study of stone anchors of India is the key to understanding maritime trade, overseas contacts and shipping activities of the region. In this paper an attempt has been made to describe the stone anchors of India, their role and significance in the maritime history of India.

### **Anchor finding sites of India**

In India, stone anchors have been observed during land excavations and onshore as well offshore explorations. Lothal and Kuntasi, both inland sites in Gujarat, off the west coast of India, have yielded stone anchors during land

excavations that vary in shape and size from other anchors. Seven stone anchors from Lothal (Fig. 2a) (Rao, 1979) and two from Kuntasi (Fig. 2b) (Dhavalikar et al., 1996) have been recorded. Lothal anchors appear like the composite and single hole types whereas Kuntasi anchors seem like the ring stone type. Since the commencement of maritime archaeological research in Indian waters in 1983 by the CSIR-National Institute of Oceanography (NIO), Goa, (<http://www.nio.org>) their goals are to discover submerged habitation, port sites and shipwrecks in order to understand the relationships between man and sea. Explorations have been carried out along both the east and west coasts of India. During this maritime archaeological research, in addition to habitation and port remains and shipwrecks, numerous stone anchors of composite, Indo-Arabian, ring stone and single hole type have been recovered during both onshore and underwater explorations off Gujarat (Gulf of Kachchh, Bet Dwarka, Aramda, Dwarka, Miyani, Visawada, Somnath, Mithi Viridi, Kodinar); Maharashtra (Dabhol, Vijaydurg, Sindhudurg); Goa (Baga, Grande Island, Sunchi Reef); Kerala (Kannur);

Lakshadweep (Minicoy Island); Tamil Nadu (Gulf of Mannar, Tuticorin and Manapad); Andhra Pradesh (Kottapatnam); Odisha (Kanas, Chilika Lake); West Bengal (Harinarayanpur).



*Fig. 2 (a-e) Types of stone anchors found along the Gujarat coast of India. (Sila Tripathi)* *Fig. 2 (f-k) Types of stone anchors found along the Gujarat coast of India. (Sila Tripathi)*

## Gujarat

In order to locate remains of submerged habitation and port sites of Gujarat, onshore and offshore explorations at Dwarka (Fig. 2c i, ii, iii), Bet Dwarka (Fig. 2d i, ii, ii), Aramda

(Fig. 2e), Somnath (Fig. 2f i, ii, iii), Miyani (Fig. 2g i, ii), Viaswada (Fig. 2h i, ii), Kodinar (Fig. 2i), Mithi Viridi (Fig. 2j), Gopnath, Hatab, Ghogha, Navi Bunder (Fig. 2k) were carried out. During these excavations, composite, Indo-Arabian, ring stone and single hole types of stone anchors were found from different water depths (Gaur et al., 2013, 2008, 2005). Those were documented and some of them were retrieved for study and analysis. These anchors resemble those found in the Mediterranean Sea, Persian Gulf and Red Sea Coast. Petrographic analysis shows that mariners of India used different rocks for making anchors irrespective of their size and variety and sourced the rock from nearby and sometimes from the hinterland (Sila Tripathi, et al., 2010)

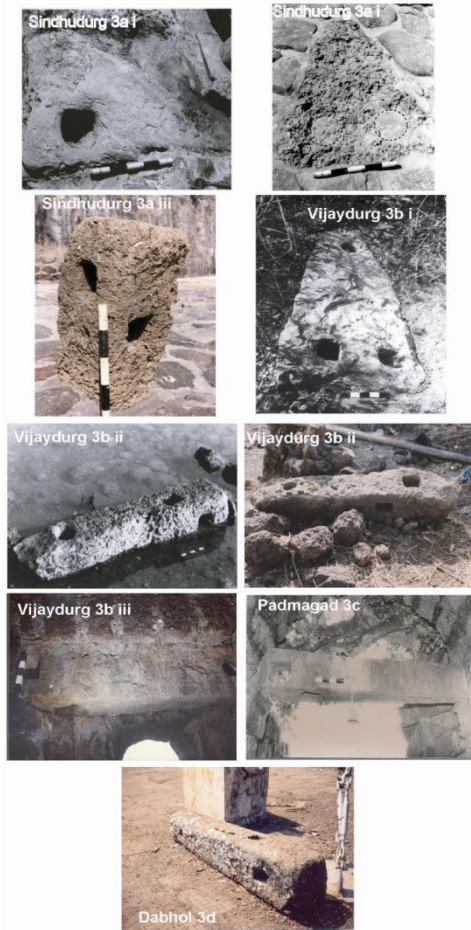
### **Maharashtra**

During maritime archaeological explorations along Maharashtra coast, composite and Indo-Arabian types of stone anchors were discovered at Sindhudurg (Fig. 3a i, ii) and Vijaydurg (Fig. 3b i, ii). These stone anchors have been used as mooring bits and laid on the pavement, whereas Indo-Arabian type of stone anchors have been utilised as lintels (Fig. 3b iii) in the second fortification of the Vijaydurg Fort and mooring bit at the dockyard, which is 3 km away from Vijaydurg Fort (Sila Tripathi et al., 1998). Similarly, one Indo-Arabian type of stone anchor was noticed which has been used as a lintel at Padmagad Fort (Fig. 3c), which is near Sindhudurg Fort (Sila and Gaur, 1997). In 2003, dredging for construction of a passenger jetty at Dhabol port, revealed four Indo-Arabian stone anchors (Fig. 3d) along with wooden flukes Radiocarbon dates of the flukes suggest that the anchors were  $590 \pm 90$  and  $600 \pm 70$  years old (Gaur et al., 2009). In India this is the first instance where stone anchors found along with wooden flukes.

### **Goa**

During shipwreck explorations in Goa waters stone anchors are also recorded: one each of Indo-Arabian and ring stone (Fig. 3e) type of stone anchor from Sunchi Reef, two Indo-Arabian type from Grande Island (Fig. 3f) and a pyramidal type of stone anchor from Baga waters (Sila Tripathi et al., 2013). At first glance, the Baga stone anchor appears like an Indo-Arabian type (Fig. 3g). All these anchors of Goa are chance finds.





*Fig. 3 (a-d) Types of stone anchors found along the Maharashtra, Goa, Kerala and Lakshadweep coast of India. (Sila Tripathi)*

## Kerala

During exploration an Indo-Arabian type of stone anchor was recorded on the southeast corner of Hydross Palli Mosque near the beach of Kannur. The stone anchor is half buried in the ground (Fig. 3h). It has two lower square holes meant for wooden flukes. No marks are visible on its surface; however, a thick coat of grey varnish colour has been applied on its surface. The length and width of the visible portion of the anchor is 0.89 x 0.30 m, but the original length is more than what has been recorded. The anchor has been trimmed neatly leaving prominent straight lines all around on its surface (Sila Tripathi et al., 2005).

## Lakshadweep

An Indo-Arabian type of stone anchor was found lying in the compound of Jama Mosque of Funhilol of Minicoy, which was built in 1344 year of the Hijri. Originally the anchor was used as a lintel at the entrance of the mosque. During renovation of mosque the anchor was removed from the lintel and kept aside (Fig. 3i). Chisel marks are visible on the surface of the anchor. Its upper hole is round and lower holes are square. The anchor is made of sandstone and its maximum length is 292 cm (Sila Tripathi, 2009). Coral growth, noticed on its surface, signifies that the anchor was underwater for some time.

## Tamil Nadu

Onshore and offshore explorations off Rameswaram (Fig. 4a), the Gulf of Mannar and Tuticorin region of Tamil Nadu have yielded one trapezoidal and five Indo-Arabian types



*Fig. 3 (e-i) Types of stone anchors found along the Maharashtra, Goa, Kerala and Lakshadweep coast of India. (Sila Tripathi)*

of stone anchor. These anchors are made of greywacke sandstone, granite and sandstone. The biggest anchor, found off Kursadi Island, measures 2.97 m, has fluke holes at lower end and the upper hole for rope. The anchor is not used extensively and its estimated weight is 1522 kg. The other Indo-Arabian anchor has lower holes and rope hole is missing. It is made of greywacke sandstone and the estimated weight is 178 kg. The Indo-Arabian type stone anchor which was found near the mosque of

Vedalai (Fig. 4b) is made of granite. The fluke holes of the anchor are present whereas the rope hole is missing. Marine growth and chisel marks are visible on the anchor. Its maximum length is 181 cm and weight is 520 kg. The trapezoidal

type of stone anchor found in the backwaters of Periapattinam, is made of sandstone and its rope hole is present. Its total length and weight is 52 cm and 72 kg respectively and it is highly weathered (Athiyaman and Jayakumar, 2004).

During underwater exploration five single hole stone anchors (Fig. 4c) were found off Manapad, Tamil Nadu coast. Among the five anchors four were found in shallow water and one from inland. All these anchors serve as mooring for small fishing boats. These anchors are made of sandstone and chisel marks were visible on some anchors. The quarrying site of these anchors is also noticed close to the church of Manapad. This is the first evidence of a quarry site for stone anchors in the Indian context. Local craftsmen were engaged in making these square shaped single hole stone anchors which they sold to fishermen. Similar types of anchors have been retrieved from Visawada in Gujarat. Moreover, these anchors resemble the Uluburun stone anchors which are recovered from the late 14th century BC shipwreck (Pulak, 2005).

## Andhra Pradesh



*Fig. 4 Types of stone anchors found along the east coast of India. (Sila Tripathi and N. Athiyaman)*

Recently, onshore explorations were carried out at Kottapatnam in Andhra Pradesh to ascertain the antiquity of the site and possibilities of undertaking underwater explorations. In the course of the exploration various types of pottery and a coin belonging to the Vijaynagar period were collected amidst the sand dunes. In addition to these finds, a single hole stone anchor was found lying in an agricultural field close to the navigational canal (Fig. 4d). A major portion of the

anchor is buried and only a little portion is visible on the surface. Soil on one side of the anchor was removed to study its shape, size, presence of marks if any,

etc., before it was documented. Prominent chisel marks are visible on its surface as well in the hole. The anchor tapers upwards and its overall thickness is not uniform. A big piece of rock has been chopped off from the lower side. The maximum length, width and thickness of the anchor are 76x77x27 cm and weight could be about 250 kg. From the archaeological finds of Kottapatnam and a comparative study of stone anchors recorded from other sites of India, the stone anchor of Kottapatnam can be tentatively dated to the medieval period (Sila Tripathi et al., 2014).

## Odisha

Onshore explorations at Kanas on the bank of River Luna in the surrounding region of Chilika Lake, brought to light stone anchors and hero stones. The stone anchors of Kanas are made of sand stone, trapezoidal in shape, having one, two and three holes, an uneven surface and were weathered (Fig. 4e). Moreover, they differ in shape and size from the anchors reported from other sites of India. These stone anchors were

made for marshy and muddy river mouths and lakes. Wooden pegs were inserted in the holes and rope was tied at the upper hole. The stone anchors with one hole were probably used for small boats. The wear and tear marks are distinct and breakage is more because these anchors are made of sandstone. Some of the stone anchors have been converted into hero stones. These stone anchors were found lying with a number of hero stones. However the shape and effectiveness of the anchors can be taken into account in relation to the environment and nature of the lakebed. The possible reason for finding a number of hero stones could be that there might have been some naval battles fought in the region and hero stones were erected in their memory. The making of anchors from the hero stones indicates their alternative use (Sila Tripathi and Patnaik, 2008).

### **Classification**

Stone anchors are classified according to character, shape and region. In general stone anchors have been classified as composite, Indo-Arabian, Ring stone and single hole stone anchor. Frost (1991) indicates that a composite stone anchor used to have more than one hole. Wooden flukes were provided in the additional holes which protrude on both sides of the anchor so that whichever manner the anchor falls on the seabed the flukes will hold the seabed firmly. Triangular anchors are known as composite anchors, these are often made of a flat thin stone block, giving them a triangular shape with a circular upper hole at the apex and two holes at the lower side. These lower holes may be either rectangular or square. Occasionally, some of the composite anchors used to have one, two and four holes. The common feature of Indo-Arabian type stone anchor is that they are trapezoidal or rectangular in shape, used to have two square or rectangular holes at the lower end opposite facing each other for securing wooden flukes and a round hole at the apex meant for cable. The other feature of Indo-Arabian type of stone anchor is that its lower side is thicker than the upper side because it tapers upwards. As the lower side is broader and heavier it provides sturdier, better grip and chances of drifting become less. The distinctive feature of ring stone type of anchor is that they are circular in shape, have a flat base, taper upward to a certain height and have a wide hole. In shape they appear like mushrooms. Single hole stone anchors are made of thick flat blocks of different sizes. The hole is found either at the centre or



upper portion of the block. The size of the hole used to be smaller than that of the stone block.

### **Significance**

Stone anchors are mostly recovered along ports and harbour sites, sheltered bays and shipwrecks. A study of anchors provides evidence of maritime contacts between countries and finding of varieties of anchors suggests visits of ships of various countries. It also helps in understanding the nature of maritime trade and the period. It shows that a larger number of stone anchors have been discovered than shipwrecks have been explored all around the world. In case of composite stone anchors which have been profusely reported from the Mediterranean Sea, they are distinct in their dimensions, typology, period and similar anchors have been found in underwater and in-land regions of the west coast of India. So far there is no direct evidence to conclude that composite stone anchors which were reported from Indian waters were introduced by the Mediterranean mariners in this part of the world. Whereas Arab mariners had sailed in the Red Sea, Persian Gulf and Indian Ocean with varied climatic and physical conditions hence, technically, they had designed their (Indo-Arabian) type of anchors differently to be able to withstand rocky, coral or sandy seabed. From the 8th-9th centuries onwards the Arabs and Persians had sailed to the Indian Ocean region and used Indo-Arabian type of stone anchors for anchoring their ships. Similar types of stone anchors have been reported from Iran, Oman, Saudi Arabia, Kenya and Sri Lanka suggesting maritime contacts between these countries (Sila Tripathi et al., 2013). Unless some new evidence for dating Indo-Arabian stone anchor comes from any other source, the earliest date of Indo-Arabian stone anchors would remain between 8th and 11th centuries AD.

With regard to ring stone anchors those are recorded in Gujarat, Goa, and Minicoy and found along with Indo-Arabian stone, composite and single holes (Sila Tripathi et al., 2013). In India reuse of Indo-Arabian stone anchors has been noticed at the Jama Mosque of Funhilol of Minicoy. Earlier such instance has come to light at Vijaydurg fort where Indo-Arabian stone anchors have been used as lintel in the fortification wall of the fort. Composite, Indo-Arabian anchors have also been used as mooring bits, pavement

and doorsill of Sindhudurg fort. In India a larger number of Indo-Arabian and ring stone (mushroom) stone anchors have been reported than composite and single hole stone anchors. All these types of stone anchors were concurrently in use in Indian waters. Probably composite type of stone anchors were used in Indian waters for a limited period, because, these stone anchors are nowhere reported other than in Gujarat and only one from Vijaydurg along the west coast of India. Indo-Arabian, ring stone, single hole type stone anchors have been reported with and without composite type of stone anchors in Indian context.

### **Date of anchors**

Most of the stone anchors of India have been discovered without any archaeological context and associated findings are too minimal to date them. In the absence of direct evidence, findings such as pottery, coins, inscription, etc in close proximity of the stone anchors have been taken into account to date the stone anchors. In India, there are very few sites where the dating of stone anchors has been correlated with archaeological evidence. For instance in Bet Dwarka stone anchors were found along with amphorae datable to the 4th and 5th centuries AD (Gaur et al., 2005), glazed ware of medieval period were recovered along with stone anchors in Ghogha, stone anchors have been used in the lintel of Vijaydurg Fort of medieval period (Sila Tripathi et al., 1998), the Arabic inscription of the Mosque of the 13th and 14th centuries can be associated with the stone anchor in Kannur (Sila Tripathi et al., 2005), in Chilika Lake the hero stones of the 7th to 9th centuries AD are related to stone anchors (Sila Tripathi., and Patnaik, 2008). In Dabhol, Maharashtra, stone anchors found along with wooden flukes and their Radiocarbon dates show that the flukes are 500 to 600 years old which confirms that Indo-Arabian type of stone anchors were used in Indian waters 500 to 600 years Before Present (Gaur et al., 2009). Such dating of stone anchors confirms that stone anchors were used during those periods, but it is not known exactly when the particular type of stone anchors was introduced and how long those were in use. However, from the shape, size and weight, the evolutionary development of stone anchors can be traced. Although the stone anchors of Lothal and Kuntasi were found during land excavations and dated in archaeological context, there is some ambiguity about their use, identification and context.

## **Conclusions**

It is well recorded that India had along maritime history starting from the Bronze Age civilization onwards if not earlier and the discovery of large number of anchors both from east and west coast confirm the statement. So far there is no clear evidence to suggest that the varieties of anchors recorded were evolved in India or these were introduced by outside mariners in Indian waters. As different types of stone anchors have been found in different parts of the world therefore scholars are keen to study their evolution to development. The type of stone anchors reported from other parts of world is also recorded in Indian waters. It has been observed that all varieties of stone anchors were used simultaneously for long period and continued till the introduction of iron anchors by the European in Indian waters. The recovery of types of stone in Indian water suggests that the mariners adopted all varieties of stone anchors for the safety of their vessels. Once mariners found a type of anchor suitable for anchoring the boats they adopted it for centuries. In many parts of the world fishermen still use their primitive type of stone anchors even today in spite of advancement made in every field and this makes interest to the maritime archaeologist to study the stone anchors.

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## **References**

- Athiyaman, N., and Jayakumar, P., 2004. Ancient anchors off Tamil Nadu coast and ship tonnage analysis. *Current Science*, Vol. 86 (9): 1261-1267.
- Dhavalikar, M. K., Raval, M. R., and Chitalwala, Y. M., 1996. *Kuntasi - A Harappan Emporium on the West Coast*. Post Graduate Research Institute, Deccan College, Pune.

Frost, H., 1991. Anchors sacred and profane; Ugarit-Ras Shamra, 1986; the stone anchors revised and compared. In Yon, M. (Ed.), *Ras Shamra-Ougarit, VI: Arts et Industries de la pierre*: 355-410. ERC Paris.

Gaur, A. S., Sundaresh., 2013. *Maritime Archaeology around Porbandar*. Aryan Books International, New Delhi.

Gaur, A. S., Sundaresh., Sila Tripathi., and Vora, K. H., 2009. Radiocarbon dates of the medieval period stone anchors from Dabhol, west coast of India. *Current Science*, Vol. 96 (2): 299-302.

Gaur, A. S., Sundaresh., Vora, K. H., 2008. *Underwater Archaeology of Dwarka and Somnath*. Aryan Books International, New Delhi.

Gaur, A. S., Sundaresh., Vora, K. H., 2005. *Archaeology of Bet Dwarka Island: An excavation Report*. Aryan Books International, New Delhi.

Pulak, C., 2005. Discovering a Royal Ship from the Age of King Tut: Uluburun, Turkey. In G. F. Bass (Ed.), *Beneath the Seven Seas*, Thames and Hudson, London: 34-47.

Rao, S. R., 1979. *Lothal – A Harappan Port Town*, Part I, Archaeological Survey of India, New Delhi.

Sila Tripathi., Rao, K. P., Kumari, S., Imsong, O., and Vanlalhrualtuangi, V., 2014. A Single-hole Stone Anchor from Kottapatnam: early historic port site of Andhra Pradesh, India. *International Journal of Nautical Archaeology*, Vol. 43 (1): 188-191.

Sila Tripathi., Gaur, A. S., Sundaresh., 2013. *Maritime Archaeology and Shipwrecks off Goa*. Kaveri Books, New Delhi.

Sila Tripathi, Mudholkar, A., Vora, K. H., Rao, B. R., Gaur, A. S., Sundaresh., 2010. Geochemical and mineralogical analysis of stone anchors from west coast of India: provenance study using thin sections, XRF and SEM-EDS. *Journal of Archaeological Science*, Vol. 37 (8): 1999-2009.

Sila Tripathi., 2009. Stone anchors from Minicoy Island, Lakshadweep, India. *International Journal of Nautical Archaeology*, Vol. 38 (2): 406-412.

Sila Tripathi., and Patnaik, A. P., 2008. Stone anchors along the coast of Chilika Lake: New light on the maritime activities of Orissa, India. *Current Science*, Vol. 94 (3): 386-390.



Sila Tripathi., Manikfan, A., and Mohamed, M., 2005. An Indo-Arabian type of stone anchor from Kannur, Kerala, west coast of India. *International Journal of Nautical Archaeology*, Vol. 34 (1): 131-137.

Sila Tripathi., Gaur, A. S., Sundaresh., and Bandodker, S. N., 1998. Historical period Stone anchors from Vijaydurg on the west coast of India. *Bulletin of the Australian Institute for Maritime Archaeology*, Vol. 22: 1-8.

Sila Tripathi., and Gaur, A. S., 1997. Stone anchors from Sindhudurg Fort on the west coast of India. *International Journal of Nautical Archaeology*, Vol. 26 (1): 51-57.

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Find sites	Composite anchors	Indo-Arabian anchors	Ring stone anchors	Single hole anchors	Total
<b>West Coast</b>					
<b>Gujarat</b>					
Bet Dwarka	13	7	1	-----	21
Aramda	1	1	-----	-----	2
Dwarka	35	63	24	1	123
Miyani	2	6	4	-----	12
Visawada	10	2	1	1	14
Kindar Kheda	1	-----	-----	-----	1
Srinagar	1	-----	-----	-----	1
Ghumli	-----	-----	1	-----	1
Navi Bundar	1	-----	-----	-----	1
Somnath	6	2	35	-----	43
Mul Dwarka (Kodinar)	1	-----	-----	-----	1
Gopnath	-----	1	-----	-----	1
Hathab	-----	4	-----	-----	4
Ghogha	1	18	-----	-----	19
Mithi Virdi	-----	4	-----	-----	4
Gulf of Kachchh	-----	1	-----	-----	1
<b>Maharashtra</b>					
Vijaydurg	1	23	-----	-----	24
Sindhudurg	3	5	-----	-----	8
Padmagad	-----	1	-----	-----	1
Dabhol	-----	4	-----	-----	4
<b>Goa</b>					
Baga	-----	1	-----	-----	1
Sunchi Reef	-----	1	1	-----	2
Grande Island	-----	2	-----	-----	2
<b>Kerala</b>					
Kannur	-----	1	-----	-----	1
<b>Lakshadweep Island</b>					
Minicoy Island	-----	1	-----	-----	1
<b>East Coast</b>					
<b>West Bengal</b>					
Harinarayanpur				1	1
<b>Odisha</b>					
Chilika Lake	4	-----	-----	1	5
<b>Andhra Pradesh</b>					
Kottapatnam	-----	-----	-----	1	1
<b>Tamil Nadu</b>					
Manapad	-----	-----	-----	5	5
Kursadi Island		1	-----	-----	1
Poomarichan Island	-----	1	-----	-----	1
Vedalai	-----	1	-----	-----	1
Periapattinam	-----	-----	-----	1	1
Threspuram	-----	1	-----	-----	1

Table 1. Various types of stone anchors observed along the Indian coast (North to South)