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# The Urbanisation of Arikamedu and its Sub-Industrial Centres

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## Abstract

The Western world during the early Common Era was highly dependent upon Indian commodities. In the accounts of Strabo, hundreds of Roman cargo ships sailed to the Indian East Coast to upload commodities like textiles, beads and ivory objects produced from India, and spices collected from India and Southeast Asia. The bulk of goods manufactured for export in a specific time could not possibly be manufactured at one centre like Arikamedu. It seems that there were many centres to produce the goods and keep them ready to upload in time to all ships. The recent archaeological finds in the vicinity of Arikamedu now state that there were many rural and semi-urban centres close to Arikamedu that acted as subunits for textile production. Along with other products, the beads and the textiles were the major commodities at Arikamedu exports. The archaeological findings at the newly discovered sites are now adding new answers to basic questions like its pre-Periplus trade phase and Arikamedu urban development. Excavations of the Iron Age burials and the findings from other Iron Age habitations, and early historical sites located on the same riverbed in the vicinity of Arikamedu are now put together for this study as the sources to understand its relations and the role of inland centres in the bulk of goods manufactured for export.

**Keywords:** Arikamedu, Archaeology, Burials, Excavations, Export, Habitation

## 1. Aim of the Research

The main objective of this research work is to know the urbanisation of Arikamedu from its pre roman trade and industrial phase. The second objective is to find out the inland trade route to link Arikamedu for the supply of raw materials to manufacture the textiles and beads for export. However, the research also aims to identify the sub-stations that facilitated the mass production of goods to quickly be loaded onto the Roman Cargo ships that arrived at Arikamedu in a short span of time.

## 2. The Methodology

Archaeological investigation at Arikamedu and its vicinity was carried out to know the above objectives. The study primarily analysed the Auroville burials excavation of grave goods to understand the lifestyle and economic condition. In connection with ancient urbanisation, the study examines early excavated sites dating to pre roman trade phase culture around Arikamedu. Artefacts from this early phase are compared to understand the diffusion of technology, trade and culture.

Remote sensor images were used to identify the paleo channels, which were used to link the inner land centres and Arikamedu. Based on the paleo channel traces, the survey study found a number of previously unrecorded sites on or associated with Arikamedu, and have dated activities at them through the studies of surface artifacts, mainly pottery. The study carried out three trial excavations at the newly discovered sites and collected the data of artifacts, structures and ring wells.

## 3. Introduction

Arikamedu, commonly known as an Indo-Roman trading station due to its Mediterranean findings, was excavated by eminent archaeologists with different methods and framed different chronologies in every excavation. However, the chronology of Arikamedu serves as the datum point for the archaeological findings

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at early historical sites in South India. Over the years, the excavations at Arikamedu have focused on Indo-Roman trade commodities, chronology, and industrial activities in connection with artefacts only. Beyond the Indo-Roman trade commodities, the materials for the daily use of ceramics, bricks, food materials, and raw materials for the manufacture of beads and textiles were possibly taken from various inland and coastal centres of the Indian sub-continent. Recent archaeological investigations into Arikamedu and its vicinity are now adding new answers to basic questions like its pre-*Periplus* trade phase, urban development, and the occupations that followed the decline of its international trade network.

## 4. Previous Studies on Arikamedu

An archaeological mound named Arikamedu (in Tamil, "*Arika*" means "eroding," and "*medu*" means "mound"), located on the eastern bank of the upper outlet (river Ariyankuppam) of the river Gingi in the south of Puducherry (Figure 1), was a centre of Indo-Roman trade during the early common era. In 1770, Guillaume le Gentil first made a note of the traces of ancient remains at Arikamedu[1]. However, it went unnoticed until G. Jouveau-Dubreuil found the Roman artifacts at Arikamedu in 1930. He described it as a Roman settlement (*ville romaine*) and concluded that ancient Arikamedu was *Puduke* emporia, a trading centre referred to in the "*Periplus Mare Erythraei*" (60:20.6a) and Ptolemy (VII.1.14) classical works, based on some artifacts such as a profile of a Roman emperor and fragments of Roman shipping jars from Arikamedu[2]. He carried out archaeological digging with the support of Fr. Faucheux and R. Surleau, the head of the Pondicherry Public Works Department. The team marked two grids as two sectors in Arikamedu[3] to unearth the artifacts[4]. Their two grids became the northern and southern sectors of Wheeler's excavations. In 1945, a brief excavation was conducted by Mortimer Wheeler[5].

After Wheeler, Casal excavated Arikamedu in 1947-49[6]. Almost forty years after these two major excavations at Arikamedu, an Indian-American team under the direction of Vimala Begley excavated Arikamedu in the 1990s[7]. In 2003, the Archaeological Survey of India bought about 33 acres of land along the bank of the Ariyankuppam river due to its archaeological potential and fenced it for protection[8].

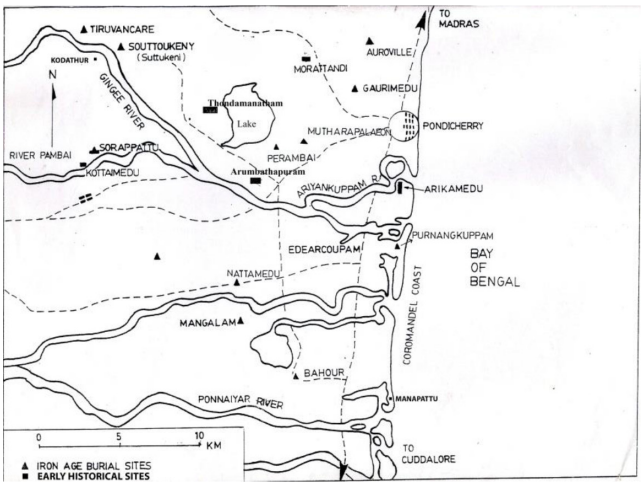



**Figure 1.** Locations of Iron age and Historical Sites.

## 5. Early Habitation of Arikamedu

Prior to the Roman trade or urbanisation, the southern sector of Arikamedu was inhabited by Iron Age people[9]. Jean Marie Casal excavations exposed that the early phase of Arikamedu was associated with megalithic pottery known as the Black and Red ware (Figure 2). He suggested that the first settlement was a fishing people who used megalithic pottery in the southern sector of Arikamedu. They brought the Mediterranean trading ships to the northern sector of Arikamedu, which later imposed the Indo-Roman trade[10]. The perception of Wheeler after Casal was that the trading network in this region was from a nearby fisher folk village to a Roman trading station[11]. This perception made the vernacular readers and publishers promote the neighbouring modern villages like Virampattinam



**Figure 2.** Iron age pottery from Arikamedu

and Murungapakkam near Arikamedu as *Viraiyar Pattinam* (village for Roman guards) and *Marurpakkam* respectively, as mentioned in *Silapathigaram*[12]. However, Begly described that the earliest known habitation of Arikamedu was the Iron Age, and she elucidated that the stone axes had been used by the Iron Age settlers of Arikamedu[13].

## 5.1 The Lifestyle of Iron Age Culture around Arikamedu

Between the 5th and 3rd century BCE, the Iron Age black and red ware culture people were not settled at Arikamedu. However, in the vicinity of Arikamedu, the Iron Age people first settled at Auroville, Thondamanatham, Perimbe, Mutrapalayam, Suttukeni, Thiruvakkarai, Sengamedu and Sorapattu near Arikamedu (Figure 1). The distribution and cultural pattern of the Iron Age society in the vicinity of Arikamedu had a different occupational background. The Iron Age people largely settled in areas such as Suttukeni, Muthrapaeaon[14], Perambi[15], Thiruvakkarai[16] and Auroville[17] around Arikamedu, and practised the Cist and Urn burials prior to the Iron Age habitation at Arikamedu.

The lifestyle of the megalithic people around Arikamedu is known principally through their grave goods[18]. Close to Gorimedu, at Morattandi-Auroville, the study found some proto-historic artifacts on the surface and a terra cotta ring well[19] in the cliffs of red soil/laterite hills (Figure 3A), which could be dated to the 4th or 3rd century BCE, and perhaps used by the Iron Age people of the Auroville region to reach other contemporary sites. Recently, the study found an archaeological mound at Thondamanatham, located along the river Gingi near Arikamedu, which has deposits of the Iron Age and early historical period. A terra-cotta ring well dated 4th–3rd century BCE is unearthed at the Iron Age deposit (Figure 3B).

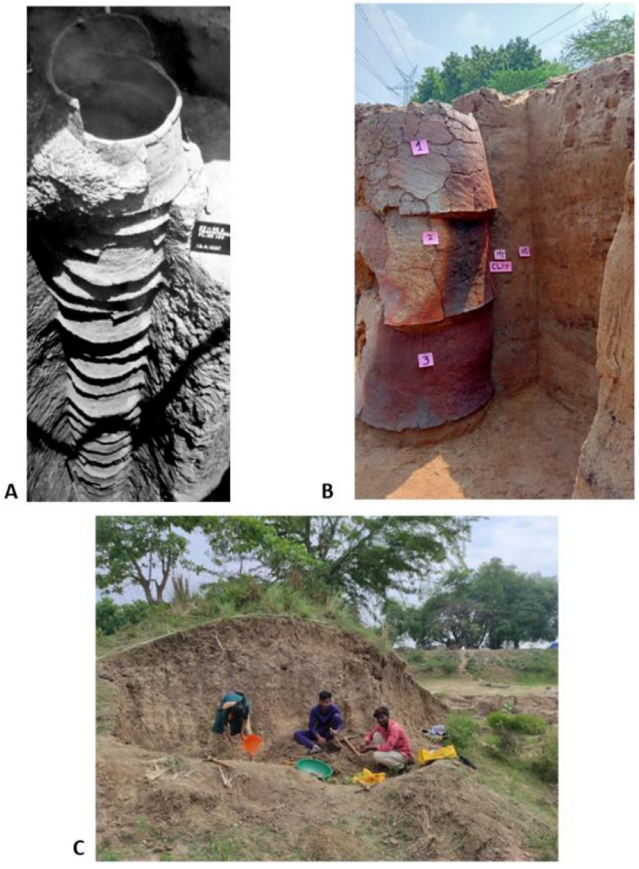



**Figure 3.** A. Ring, Iron Age from Morattandi-Gorimedu villages in Auroville. B, Ring well, Iron Age, Thondamanatham. C. Section view of archaeological mound at Thondamanatham.

## 5.2 The Beginning of Trade and Industries at Arikamedu

In the mid-3rd century BCE, Iron Age people with a good knowledge of both land and sea trade networks arrived and established a new settlement on the southern side of Arikamedu. They imported raw materials like carnelian, chalcedony, agate, and crystal from various centres of India and Sri Lanka, as well as Lapis Lazuli from Afghanistan[20], to manufacture




**Figure 4.** Gold ornaments and Lapis Lazuli from Iron Age Burials of Suttukeni and Auroville

both glass and stone beads as well as shell bangles. The Iron Age people who already existed in the Puducherry region developed their economy due to the industrial and trade development brought by Arikamedu Iron Age Sea traders. Arikamedu Iron Age people exchanged imported and manufactured goods, like beads and metals, for cattle and agricultural products[21] with the Iron Age communities already settled in the Puducherry region.

### 5.3 Economic Development of Inland Iron Age Habitations

Grave goods from Suttukeni and Auroville burials are now attesting to the economy and trade relations with other megalithic and non-megalithic centres through the Arikamedu Iron Age people. Casal and Casal dated the Suttukeni burials to the mid-second century BCE. Pendants like the gold lotus flower ear ornaments (Figure 4A), and the base of a bronze vessel with concentric circles and a central knob[22] found in the Suttukeni depict the relationship in technology and economy with Arikamedu Iron Age or the period prior to Roman trade.

Beads, both glass and stone, are found largely in the Auroville burials. Glass beads are non-translucent red, blue and black. Stone beads are like carnelian, banded agate and etched carnelian. There is no trace of ancient bead-making industries either around Auroville or beyond. The only bead-making industry so far as we know, apart from Arikamedu in this region, is Kudikadu, 40 km south of Arikamedu[23]. The Iron Age people of Auroville and other megalithic Age communities in the Puducherry region acquired the beads in exchange for their agricultural products from the bead-making centres of Arikamedu.




**Figure 5.** Iron age pottery from Thondamanatham.

Beyond stone and glass beads, Lapis Lazuli beads in various shapes have also been found at Iron Age burials of Auroville. The Arikamedu excavations yielded a small piece of lapis lazuli[24], whereas the Auroville burial yielded a handful of lapis lazuli beads (Figure 4B and C). These findings suggest that during the Iron Age, Arikamedu was actively engaged in the sea trade, possibly with the Indian east coast and inland trade centres. This trade activity likely preceded Mediterranean contact and drove them to expand maritime trade across the Bay of Bengal. They imported beads, minerals, gold, copper, and raw materials such as stones and lapis lazuli for the manufacture of beads and metal objects, sourcing them from various trade centres located along coastal and inland trade routes.

The findings, like ring wells and pottery like vases, plates, and dishes (Figure 5) from Thondamanatham[25] state that they manufactured pottery, the tools for textiles like spindle whorls and dipping wares, and metal works. The spindle dipping ware, Neolithic type tools, TC lamps and spindle whorls from Sorapattu[26], an Iron Age site located along the river Gingee, seem to be supplied with sub-materials for textile activities.

## 6. Industry Expansion and Roman Trade Contacts

During the second half of the second century BCE, a new ethnic group of a white-slipped/grey ware society[27] came and established its habitation in the north of Arikamedu, along with early settled Black and red ware culture Iron Age in the south of Arikamedu. This newly arrived society extended the Arikamedu sea trade beyond the Bay of Bengal and the Indian Ocean. The Indian east coast and the East Asian coastal centres. They possibly brought the rouletted ware to Arikamedu either with them or later when they developed sea trade with other centres on the Indian-Sri Lankan coast[28].

Based on the presence of the Mediterranean amphorae and the strata chronology from the Arikamedu excavations, it can be interpreted that the commercial contact between Arikamedu and the Mediterranean

began as early as the late second century BCE[29]. This is due to the direct sea trade of Arikamedu with the Indian coast and was extended to the Mediterranean when the white-slipped grey ware society established their settlement at Arikamedu, which may have begun in the early second century BCE[30]. Arikamedu phase A is the Iron Age people who developed bead industries and Trade. During phase B, Arikamedu developed the inland and Indian coastal centres' trade relations and developed textile industries, rouletted and stamp ware culture when a new ethnic people of the White slip grey ware society settled along with the Early settled Iron Age society. During phase C, Roman commodities like Koan and Knidian wines arrived and developed structural work for port activities, which led the Roman ship to reach Arikamedu directly. During phase-D (finding of sigillata, Arretine layer), the Roman trade ships, perhaps, reached directly and halted to unload and load the commodities, to some extent to repair their ships and masts during the middle of the first century BCE[31].

## 6.1 Development of Sub-Units for Textile Production

Due to the Red Sea and Mediterranean Sea trade contact, Arikamedu was in place to produce goods like beads and textiles on a large scale in a season. The bulk of the goods was to be ready to upload when the Red Sea ships arrived at the Arikamedu port. This made the inland sites, located close to Arikamedu as well as on the Ariyankuppam river, develop from the Iron Age to historical culture and establish the textile industries. The Iron Age habitation sites like Sorapattu and Kottaimedu (PS Palayam)[32] are located along the river Pambai vaikal, which was once the main stream




**Figure 6.** 1st century Ring well and structures found in Kottaimedu (Arumbathapuram)




**Figure 7.** Course and fine Rouletted ware and other first century pottery from Kottaimedu at PS Palayam.

of River Gingi[33], and were developed into major centres of textile production industries. The other Iron Age habitations on the River Gingi, like Thondamanatham, were busy in ceramic production. However, a new settlement of early historical period habitations was also established at Kottaimedu (Arumbathapuram)[34] for textile production.

### 6.2 Thondamanatham

The site Thondamanatham is located between Iron Age burial sites Suttukeni-Thiruvakkarai and Perambi-Mutrapalayam. Three meters thick habitation deposit was completely removed, and at present, a lake is created over the site. At present, the site is left with only a five-meter radius with two meters thick deposits (Figure 3C). The artifacts collected from the mound show that the lower half mound has with Iron Age deposit, while the upper deposit is from the early historical period. No brick fragments are found on this site. Six terra cotta ring wells are found in the natural deposits. One of these ring wells (Figure 3B) was rescued and preserved by the Museum, Tagore Government Arts Science College, Puducherry. Based on the artifacts that are recovered, the site appears to have primarily produced ceramics during the Iron Age.

### 6.3 Kottaimedu (Arumbathapuram)

The site named Kottaimedu is located in the colony Muthupillai Palayam, in Arumbathapuram village. It has many ring wells dating back to the first-second centuries CE. The fabric and body of the ring wells are much stronger than the ring wells found at other contemporary sites like Arikamedu, PS Palayam, and Kadathur in the vicinity. The base of the ring well is strengthened with a clay rope. A large number of ring wells, brick floors, and brick walls were exposed when the mound was levelled for real estate promotions, and in the foundation trenches made for new construction. The exposed architecture, ring well, and the artifacts clearly show that this site carried major production for textiles (Figure 6).

### 6.4 Kottaimedu (PS Palayam)

Kottaimedu (PS Palayam) is located on the north bank of the River Pambai Vaikal, a northern outlet of the River *Thenpennar*. The archaeological remains extended in the site are about 800 by 300 meters. The site has early historical artifacts like coarse rouletted ware, conical jars and other Arikamedu types (Figure 7). Massive brick architectures were exposed and removed during the mound levelling for agricultural activities. The piles of bricks were deposited along the river banks. Based on surface findings, there was a major town existed for textile production during the early common era, and we find no sources for the bead-making industries. Location and finding of the Kottaimedu (PS Palayam) stating that inland trade transport was carried along the river Pambai vaikal to reach the Thirukovilur and other centres in present-day Tamil Nadu and Karnataka.

Apart from textiles, there is no evidence of Bead industries in the inland centres or at the newly found sub-sites of Arikamedu. However, a bead-making industry was discovered at Karaikadu, near Cuddalore in Tamil Nadu, located 40 km south of Arikamedu on the Indian east coast[35]. Karaikadu possibly acted as a sub-bead industry for Arikamedu.

## 7. Arikamedu: A Port for Roman Cargo Ships on the East Coast

The massive Roman cargo ships from the Red Sea sailed to the Indian East coast and anchored at Arikamedu to upload the textiles and beads that were produced at Arikamedu and its sub-centres. However, the other

products like wood and spices were collected from Southeast Asia and other Indian literal centres. The collected spices were stored at Arikamedu for export.

### 7.1 Establishment of Port/Warf at Arikamedu

Casal Group IV excavated a thick wall, traced over a length of 10 meters long and five meters wide, with a massive post hole, possibly a *quai*. Findings such as timber and rope from Wheeler's excavations at the warehouse (northern sector) trenches and the architecture from all three excavations in the northern sector attest that there was a port. However, artefacts such as wastage of beads and bangles, and spandrel whorls all over the site suggest that craft activities were carried out in both sectors. From the architecture, as interpreted by the excavators, and from the observed distribution of the artifacts, it appeared at first that the Northern and Southern sectors might have been areas that were either naturally developed or designated for different types of activities. The northern sector is generally regarded as the port area. Many of the amphora fragments found at Arikamedu are covered with pieces of cement resembling Roman pozzolana. Like similar finds at Roman ports in Italy, these cement-covered fragments suggest that amphorae had been broken after being emptied and the fragments were then reused as building materials in such underwater installations as wharves, piers, and jetties.

### 7.2 Roman Presence at Arikamedu

The Fish *garum*/dry fruits (Dressel Forms 7 and 8, as well as the fragment of type 17 amphorae jars originally manufactured as containers for fruit but later reused for *garum*) and olive oil (type 20) found at Arikamedu were possibly brought not as commodities, but used by the Roman trade ship crew, traders, and agents. However, the Roman cargo ships sailed to Pattinam on the western coast to upload the pepper and wood. The vessel sailed to Pattinam was possible on the way to Arikamedu or to the Red Sea after Arikamedu.

There are many archaeological and literary references to the Indo-Roman trade all over the Indian subcontinent, but these two centres, Arikamedu on the East coast and Pattinam on the west coast, are proving sources of Roman personal table wares such as Terra Sigillata and amphorae in large numbers. The fragments of amphorae type 17 and 20 state that the Romans brought the fish sauce and olive oil in smaller quantities. Moreover, the socked fish is generally not familiar with Indian food practices. Spanish amphorae for fish sauce were also brought to Arikamedu in a small number. Will E.L. said that seven fragments almost certainly came from the same amphora of Dressel Form 22/Will type 17, which were counted as one object. This shows that they did not import the fish sauce and olive oil for Indian markets, perhaps for their personal use. The findings of these types and Roman table wares, such as terra sigillata, suggest that the Romans used them when they were on the ship and stayed at Arikamedu for a season until they unloaded and loaded the goods and repaired the ships.

## 8. Conclusion

In the previous studies, the researchers concluded that the Megalithic Iron Age settlers at Arikamedu practiced fishing brought the Roman trade ships to Arikamedu, which changed the fishing village into a port city. However, a recent study on Arikamedu and other Iron Age burials states that the Arikamedu Iron Age society was somehow different from other megalithic groups in the vicinity.

The length of occupation at Arikamedu began with the bead-making industries of the Iron Age and had commercial activities with other contemporary Iron Age people and the Eastern world. They extended their sea trade to the western and eastern world when a new society that used white slipped/grey ware, fine-rouletted, and stamped ware was settled with them at Arikamedu in the early second century BCE. This trade was made to develop other inland Iron Age habitation to sub-industrial centres to supply the bulk of goods to upload Roman cargo ships within a short period. The newly discovered sites on the *Pambai Vaikal River* are now opening new light on Arikamedu trade traffic over the upper outlet of the *Thenpennar* River, named *Pambai Vaikal River* and not over the river Gingi. Very recently, Dr. Ramesh from Villupuram College discovered two new sites, *Annaimedu* at *Thennamadavi* and *Ayyingkovil Pattu*, located on the north bank of *Pambai Vaikal* river in Villupuram, Villupuram district, Tamil Nadu, clearly stating that the ancient Arikamedu inland trade traffic was on the Pambai river to reach Thirukovilour and other centres in present-day Tamil Nadu and Karnataka.

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26. Ravitchandirane P. "Kottaimedu: A Settlement in the Gingee Valley Contemporaneous with Arikamedu" in *PILC Journal of Dravidic Studies*, 5:1: 1995. pp 115-126.
27. Begley excavated Arikamedu and identified white-slipped/grey ware culture at early levels of the Northern Sector as phase B of her chronology. She found white/grey slipped ware in Phase B, associated with Rouletted ware (Begley V, "Chronology" in Begley V et al, *op. cit*., 2004a. p 4.). The difference between the pottery of the Northern and Southern Sectors is that no sherds of coarse ware 2a with white/grey slip ware were found in the trenches of the southern sector (Begley V "Pottery from the 1992 Excavations in the Southern Sector" in Begley V et al, *op. cit.,* 2004b. p 106). Krishna Deva describes that the pottery is predominantly grey, usually treated with a "greyish chalky" slip which is not infrequently polished or salt-glazed (Wheeler et al. *op. cit*., 1946. p 51). In addition, he clearly mentioned a bluish chalky slip in this group is absent in later deposits, but the grey coarse ware continued in the Arretine layer (*ibid*.). The new excavations at Arikamedu found a white slipped grey ware in AV92-VII, context 094, near Wheeler Ware house in the northern sector of Begley's phase-B level, dated ca. 50 BCE to 25 CE (Begley, "Pottery from 1989-92 Excavations: Northern Sector" in Begley et.al., *op. cit.,* 1996b. p 121 and fig. 4.5).

    The forms and the core of white-slipped/grey-ware society are different from the early Arikamedu megalithic society to the south. The X-ray diffraction examination of coarse 1a and 2a from Arikamedu phase-A and B showed that the mineral contents of the pottery in both coarse wares were similar, and also similar to the regional clays (Gogte, V.D. "The Chandraketugarh-Tamluk region of Bengal: Sources of the early historic Rouletted ware from India and Southeast Asia" in *Man and Environment,* 22/1: 1997. p72). This result suggests that the coarse ware 1a 'megalithic' from the southern sector of Arikamedu phase-A, and coarse ware 2a "white/grey slipped ware" from the northern sector of Arikamedu phase-B, were made from regional sources. However, coarse ware 1a of the megalithic phase of Arikamedu core paste is finer than the paste of coarse ware 2a (Begley and Sidebotham, "Archaeological Excavations at the Indo-Roman Trading Port at Arikamedu, India: 1989-92" in M. Taddei &G. De Marco, *South Asian Archaeology 1997*, SOR, XC, Vol. II. Rome: 2000. p 965). Begley claims that the forms and surface treatments of pottery in coarse ware 2a differ significantly from those in the Arikamedu megalithic phase of coarse ware 1a. The pottery in the two wares belongs to two different groups and the users of two types of pottery appear to have come from two different cultural back-grounds (*ibid*: 965-66, and Begley, *op. cit.,* 1996a. p 18. see Begley, *op. cit.,* 1996b. pp 132-33, and see also Begley, *op. cit.,* 2004b. pp 106-108).
28. The firing technique of the rouletted was derived from the inverted firing technology of black and red ware culture. However, the technique of inverted firing was used in the rouletted ware by placing the plates in vertical order as one above one instead of placing horizontal order one by one. The exterior side of the shoulder and the external side of the beaked rim are red, and the remaining half of beak rim surface interior side, the interior body and the exterior base are black. This shows that it was fired inverted, much like black and red ware, and it was placed one on one during inverted firing technology. This type of rouletted ware is largely found in Alagankulam, Arikamedu and Karikadu. The date of the rouletted ware from Anuradhapura is the second century BCE or even earlier based on carbon dating (Coningham, R.A.E., F.R. Allchin, C. M. Batt and D. Lucy "Passage to India-Anuradhapura and the Early use of the Brahmi Script" *Cambridge Archaeological Journal* 6. 1: 1996. pp 73-97.). It seems, the rouletted ware from Sri Lanka is little earlier than the Arikamedu, but the minerals and clay content analyses of samples from Arikamedu, Karaikadu, and Sembiran (Bali) rouletted and type 10 are from the same sources (Ardika, I.W., P.S. Bellwood, R.A. Eggleton and D. J. Ellis "A Single Source for South-Asian Export Quality Rouletted Ware" in *Man and Environment* 17. 1. 1993. pp 101-109). Gogte believes that the Chandraketugarh-Tamluk area was the epicentre of production of all Rouletted ware and reached other centres through Buddhism sometime between 250 and 200 BCE (Gogte V.D., "The Chandraketugarh-Tamluk region of Bengal: Sources of the early historic Rouletted ware from India and Southeast Asia" in *Man and Environment* 22/1: 1997. pp 69-85). To consider this perception (for a detailed discussion, see Begley V., "Critique of V.D Gogte's Interpretations of X-Ray Diffraction Analyses of Arikamedu Pottery" in Begley et al, *op. cit*., 2004c. pp 631-642). The technology and forms of rouletted ware and type 10 vary by location (Begley V., "Pottery from the 1992 Excavations in the Southern Sector" Begley V et al, *op. cit.,* 2004c. pp 254-55). However, half of the Arikamedu mound was destroyed during the French mission house construction

(Ravitchandirane P., "Arikamedu Excavations: Principles and its Problems" *Proceedings of Tamil Nadu History Congress,* 22. Tirunelveli: 2015. pp 360-366.). This confused the upper half part of Arikamedu to date the rouletted ware. This can be confirmed only after the excavations below the Wheeler'Arretine layer in the northern sector of Arikamedu. The rouletted ware and its technique, as well as Arikamedu types 10 and 141, despite being widespread all over the Bay of Bengal coastal sites through trade, cannot be attributed to direct Roman maritime conduct.

29. Begley V., *op. cit.,* 2004a. p 3.
30. The peak period of Indo-Roman trade at Arikamedu is conformed with the Koan and Knidian type amphora jar fragments discovered in the early context of trench AV91/92-VII and amphora fragments from French excavations now in the Pondicherry Museum are dated to the first century BCE (for Knidian catalogue 23-27 and for Koan, see catalogue 1-22 in Will., E.L., "Mediterranean Shipping Amphoras from Arikamedu, 1941-50 Excavations" in V. Begley et al., *op. cit.,* 1996. pp 321-31 and for 91-92 excavations, see catalogue 1 to 180 in Will., E.L., The Mediterranean Shipping Amphoras from the 1989-92 Excavations in Begley et al., *op. cit.,* 2004. pp 326-27.
31. Comfort H. "Terra Sigillata at Arikamedu" in Begley V, & De Puma, R.D., eds. *op. cit*., 1991. pp 135-40: and Slane K A., "Other Ancient Ceramics Imported from the Mediterranean" in Begley V, et al., *op. cit.,* 1996. pp 366-68.
32. Ravitchandirane P, *op. cit*., 2017b. pp. 185-196.
33. Ravitchandirane P, *op. cit*., 1995. p. 126.
34. Ravitchandirane P, *op. cit*., 2017b. pp. 185-196.
35. Karaikadu (Kudikadu) was excavated by Madras University in 1990. The excavation found the sources of industries like, shell bangles, beads (both glass and stone), and textiles. However, the architectural features from the excavation are not sufficient to understand other than the industrial activities (Raman K. V *op. cit*.,.1991. p128).
36. Begley V and Sidebotham SE. Field Investigations 1982-92" in Begley V., *et al*., *op. cit*., 1996. Fig.2.1.
37. *Ibid*., p.41. for further discussion see Ravitchandirane P, *op. cit*., 2007. pp 205-233.
38. Wheeler *et al*., *op. cit.,* 1946. p. 26, see also Casal and Casal, *op. cit.,* 1956. pp 9, 11-12 and fig. 3.
39. Begley V. *op. cit*., 1996a. pp 15.
40. Will E.L., *op.cit*.,1996. pp 317
41. Will EL., *op.cit*.,1996. pp 319-20 and Will, E.L., *op. cit*., 2004. pp 330-32.
42. Ravitchandirane P. Amphora in Pondicherry Museum from Arikamedu" in *Proceedings of South Indian History Congress*, 37. Salem: 2017c. pp 794-95.
43. Will EL. *op. cit*., 2004. p 382, catalogue number 273. See also Will, E. L., *op. cit*., 1996. fig.6.65.