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Report on the Excavations at Kuchchaveli, Sri Lanka (2011)

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Abstract

We report the archaeological findings from the historic site of Kuchchaveli in the northeastern coast of Sri Lanka, based on our excavations in 2011. The Kuchchaveli complex revealed features of a Mahāyāna Buddhist centre during the 7th and 8th centuries as indicated by the structures and an inscription as well as a number of Buddhist sculptures and carvings. Archaeological material and a radiocarbon date of 1880 ± 30 BP from a test pit indicate an earlier occupation as well. Our excavations offered insights to the structures built at Kuchchaveli and yielded pottery fragments, glass beads, faunal remains and other artefacts of interest. This report highlights findings from six test pits, where two test pits correspond to the possible bodhigara and water tank of the monastery. The similarity of the Kuchchaveli glass finds to those from other sites in Sri Lanka highlights the internal circulation of glass beads during the period that Kuchchaveli was an active site. The faunal remains suggest that a mix of domesticated and wild animals were part of the diet in the community. Apart from being a monastic establishment linked to the southeast coast of India, Kuchchaveli revealed trade activities with other regions over a long period, particularly in the Middle Historic Period of the region.

Introduction

The archaeological site of Kuchchaveli, located on the northeast coast of Sri Lanka, about 25 km northwest of Trincomalee, is a Buddhist settlement that has been surveyed and excavated several times since the 1950s. Its location between two large bays to the north and south makes it a natural harbour for maritime links with other coastal towns and lands further afield. In addition, its location between the sea and the lagoon also makes it an ideal point of contact with monastic centres in the hinterland, such as Thiriyaya or Welgam Vihara. As part of a combined research project focusing on Buddhist centres as well as on maritime trade, excavations were undertaken on this site between August 24 and September 12, 2011. These excavations took place in collaboration with the Department of Archaeology of Sri Lanka, represented by Dr. Nimal Perera, and the French Archaeological Mission in Sri Lanka (AOROC – CNRS, école Normale Supérieure) directed by Osmund Bopearachchi. The results of this project are presented here.

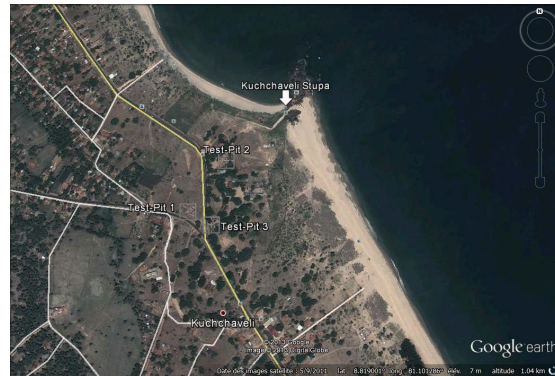


Figure 1. Location of the Kuchchaveli site (Google Earth).



Figure 2. View of the site (left) and stūpa (right).



Figure 3. View of the North bay.



Figure 4. Bay to the South; views from stūpa.

Previous Discoveries

An inscription engraved on a boulder discovered next to the stūpa overlooking the monastery suggests that we are probably facing a Mahāyāna centre of the 7th or 8th century. The inscription consists of eight lines of Sanskrit in an early grantha alphabet and was dated by Paranavitana to the 5th to the 8th century, with a higher probability aligned with the 7th century (Paranavitana, 1933). It is associated with representations of stūpas sculpted in bas-relief and refers to the merit that the donor will obtain as well as the compassion that can lead him to Buddhahood. His desire to become a Buddha and the date of the inscription hint at the Mahāyāna tendencies of the monastery (Bopearachchi, 2014).

The Kuchchaveli complex was in all probability a Mahāyāna centre during the 7th and 8th centuries as indicated by this inscription. The sloping side of the boulder reveals an area of four square feet, which has been partitioned into sixteen compartments of equal proportions, each of which features depictions of a dome-shaped stūpa carved in low relief. The text of the inscription explains that the pious wish of the author is to gain merit by making the representations of stūpas and become a Buddha in the future to free humanity from suffering. S. Paranavita correctly observed: “The Bodhisattva ideal thus extolled and the use of the Sanskrit language may perhaps justify us in believing that its author was of Mahāyāna tendencies.” The desire to become a Buddha is a function of the Mahāyāna conviction that all sentient beings are potential Buddhas and that they win their way to universal salvation through the great compassion that animates the universe.



Figure 5. View of stūpas carved on the boulder.



Figure 6. Inscription.

Several statues of standing Buddhas have also been brought to light in Kuchchaveli, showing the acceptance of an image cult as part of these Mahāyāna tendencies, as well as links to the late Amaravati style of South India. The intense

interconnections between the Buddhists of Sri Lanka and those of the Krishna valley in South India are well known, and the influence of the Amarāvati-Nāgārjunakoṇḍa art on the earliest types of Buddha images in Sri Lanka is commonly accepted. A Theravadi group of Sri Lankan monks was even known in Nagarjunakonda as the Mahavihara-vasins, in sites 38 and 43 (Bopearachchi, 2008, 2012).

In Kuchchaveli, the first Buddha statue was discovered in 1955 during the construction of a Rest House. It is now preserved in the Trincomalee Museum and presents the characteristics of an import from one of the Buddhist centres of the Krishna valley: it is made of limestone from Andhra Pradesh, the left hand holds the hem of the *sanghati* (robe) near the chest, the folds engraved with a double line are following the curves of a slender body, and the *sanghati* is shown with regular schematic folds on the left shoulder. These characteristics are consistent with the style of the late Amarāvati-Nāgārjunakoṇḍa school of the 3rd - 4th century, the rather slender modelling being a later introduced characteristic (von Schroeder, 1990). The head and right hand, probably in the *abhaya mudra*, are missing.

Three other statues were found in 1984 during the excavation of a structure, then interpreted as a pratimāgr̥ha (image house). Two heads and a torso of the Buddha were discovered close to the exterior wall of this structure, to the North-West. They have been preserved in the Kuchchaveli Archaeological Museum (Bopearachchi, 2020). One head has been tentatively restored on the torso but they do not convincingly match each other. They were most probably executed *in situ* using local dolomite stone by sculptors trained in Nāgārjunakoṇḍa. The torso shows the same characteristic features of the late Amarāvati style, with a slightly broader and heavier body. The two heads are showing the *mahapurusha lakshana*, marks of a 'Great Being', such as the *ūrṇā* on the forehead and the *uṣṇīṣa* covered with snail-shell curls. The *ūrṇā* is a feature rarely encountered among images made by Sri Lankan artists. One parallel can be observed in Tissamaharama on a head unearthed in the *bodhigara* of the Sandagiri Dāgāba. Those three heads remind us of the Buddha head from Vijjaderpuram now in the Musée Guimet in Paris, belonging to the Nāgārjunakoṇḍa school and dated to the 2nd c. AD (Bopearachchi, 2020).



Figure 7. and Figure 8. Discovery of Buddha statue *in situ*. (Photos Department of Archaeology of, Sri Lanka).



Figure 9. and Figure 10. Discovery of Buddha statues *in situ* (Photos Department of Archaeology, Sri Lanka).



Figure 11 and Figure 12. Buddha heads from Kuchchaveli.

Excavated structures in the monastic complex

The main structure excavated in 1985 was considered an image shrine (*pratimāgrha*) due to the discovery of the Buddha statues, and was restored as such. However, after further excavation in 2011, evidence makes it possible to suggest another hypothesis, which considers the structure as a *bodhigara* (shrine for enclosing a bodhi tree). In this regard, several arguments can be put forward: firstly, it may be noted that the entrance is located facing the west side, which would be unusual for a *pratimāgrha*, which should face the east. In fact, there used to be a reliquary at the centre of the structure, but it was looted in 1996 and replaced by a one rupee coin preserved inside a brick structure. It could be the foundation offering preserved under the bodhi tree, especially as a pavement of dolomitic stones can be seen regularly arranged in a circle

around it. It may be the base of a circumambulation level, preserved in a single place and made of coral stone. Finally, neither columns nor roof tiles were found during the latest excavation campaign, suggesting a roofless bodhigara-type building. Similar examples of bodhigara architecture with a central square can be seen at Pahalagama and Andagala, for example. The bodhigara on the side of the Sandagiri Dāgāba at Tissamaharama is organised in the same way, with a third level of centrality. It is interesting to note that two Buddha statues, a head and a torso, not matching each other, have been unearthed at Tissamaharama, the style being similar to that of the statues at Kuchchaveli (Bopearachchi, 2020). It is probable that they have occupied the cardinal directions around the bodhi, as shown by the example of Toluville in the 5th century, except that the Buddhas of Toluville are in a samadhi posture. Likewise, the three Buddha statues made locally in Kuchchaveli could have been placed at the four angles of the central bodhi structure. The imported statue found under the Rest House could have belonged to an image house located there.

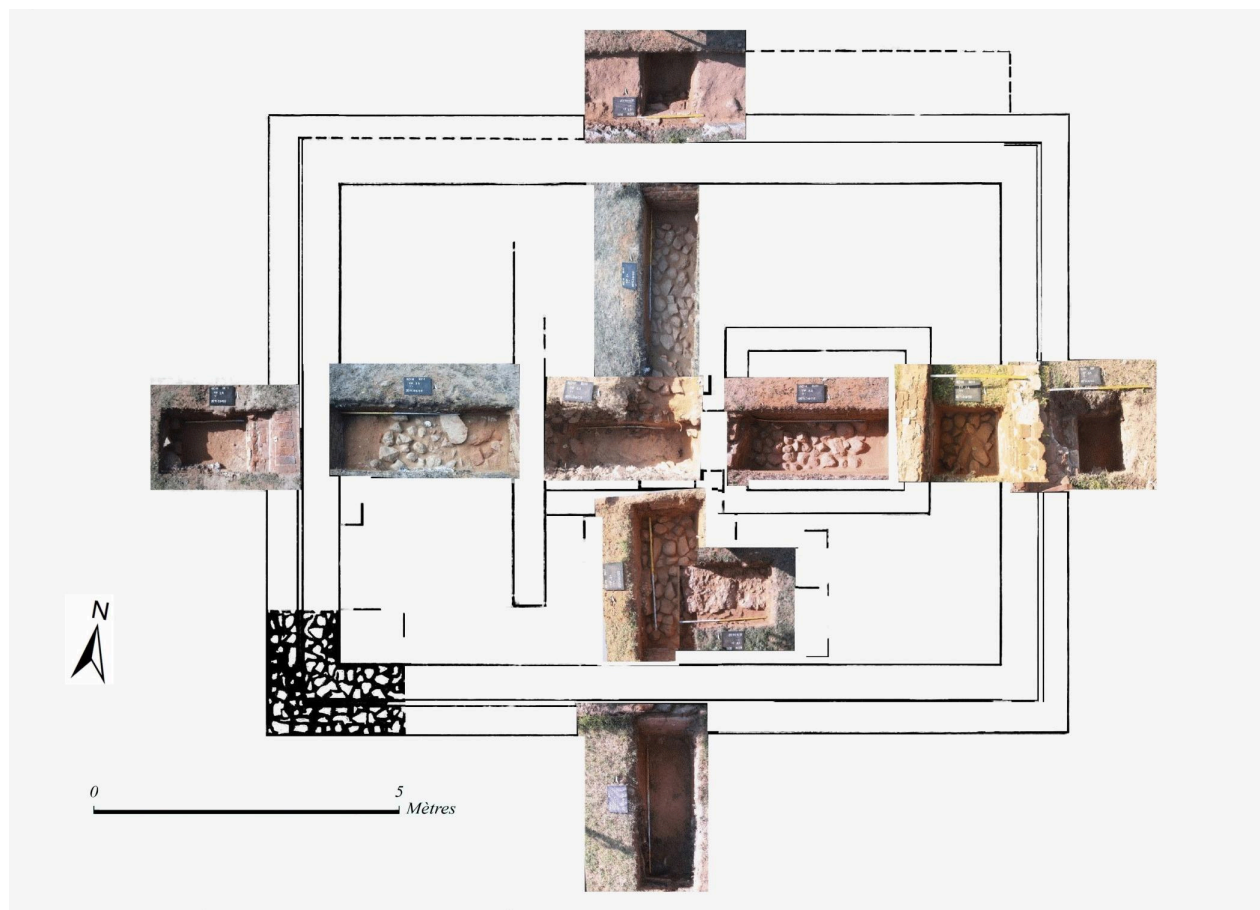


Figure 13. Orthophotos and drawing of the excavated trenches (Map by H. Rakrouki).

The second structure uncovered during the excavations at Kuchchaveli consists of a brick construction corner reaching down 270 cm. The upper part consists of a row of fired bricks laid in 6 courses. The bricks are fragmentary and of various sizes; they may have been recycled from another nearby structure. The lower part of the wall consists of 27 courses of fired bricks laid in a single row. It has been carefully built by superimposing courses of bricks in such a way that each course is slightly detached/offset from the previous one in regular stages. The upper courses of bricks appear to have been laid or reworked at a time subsequent to the structure's first period of use, while the lower courses seem to have been laid in virgin sand, visible in the eastern section. Although only a small part of the structure has been studied, its shape and construction technique suggest that it may have been a water tank for the monks. Several convincing parallels can be observed at other sites such as Sigiriya and Anuradhapura, where water tanks using the same technique to filter water have been exposed.



Figure 14. Water tank

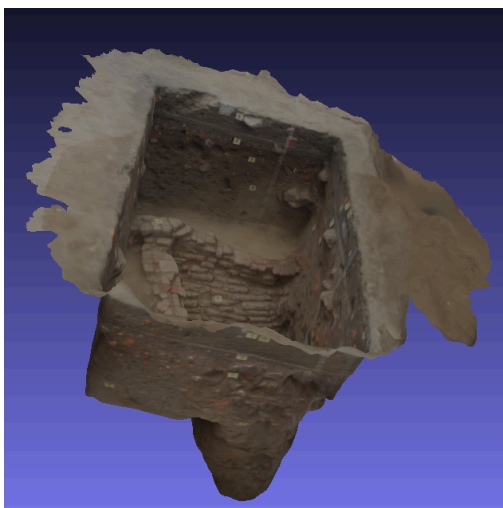


Figure 15. 3D view of the water tank (Reconstruction by H. Rakrouki)

All the main structures signifying a monastery have been uncovered at Kuchchaveli: a stūpa, possibly an image house, a *bodhigara*, a water tank, and possibly even a *poyage* (chapter house), thanks to the discovery of columns in the police station compound, in the same area as the water tank. These buildings coincide with the *pañcāvāsa* (the five main structures), constituted by the stūpa, the image house, the bodhi tree shrine, the chapter house and the *prāsāda* (residential hall). According to the *Mañjuśrībhāṣitavāstuvīdyāśāstra* the five *Mahāyāna* monastic units (*pañcāvāsa*) are usually associated with several ancillary structures such as *bhojanaśāla*, *bhaktaśāla*, *homaśāla*, *gopura*, *parikhā*, etc., (Jayasuriya et al., 1995). It is therefore important to carry out in-depth excavations in the future to bring these components to light.

Habitational deposit and associated material

The Kuchchaveli settlement site was not only a monastic establishment linked to the southeast coast of India, but it also reveals trade activities with other regions over a long period. The survey carried out in 2011 included six test pits. To the east of the road, test pits 2 and 3 correspond to the possible *bodhigara* and water tank. Test pits 4, 5 and 6 located in the same area of the monastic complex did not reveal any structures or particular information. To the West of the road, the test pit excavations were carried out in 1981 by S.U. Deraniyagala, and in 2011 by the Department of Archaeology and the French Archaeological Mission, showing the habitation part of the site. The 1981 excavation consisted of one trench of 13 m by 1 m, orientated North-East – South-West, down to 1.5 m. In 2011, the test pit no. 1 revealed the majority of remains depicting habitation and external contacts.



Figure 16. General view of the site with test pits and structures in red (Map H. Rakrouki).

In contrast to what was observed in the sediments of the *bodhigara* and the water tank, where very few fish bones, animal bones and ceramics were found, testpit no. 1, located on the other side of the road, was very rich in zooarcheological and archaeological material. It included mammalian bones (goats, cattle, deer), fish bones, and shellfish such as oysters, mussels and clams, as well as cowrie shells, indicating an area of habitat deposition. The density of the pottery was high and, despite some disturbances, the study of the ceramic assemblage, through comparisons with the typologies of Anuradhapura and Tissamaharama, indicated the 7th and 8th-9th centuries as the main period of occupation.

The lowest layer (layer 7) yielded a few sherds from the 3rd century BC to the 1st century AD, including ten sherds of plates from the 3rd century BC: this may have been due to soil introduction and mixing from elsewhere, but at the very least it indicates the existence of an earlier settlement somewhere on the site. The radiocarbon date for layer 7 is 1880 BP, i.e., calibrated from AD 65 to 224. After this period, ceramics from the 3rd to 5th centuries were present, but not very common, and occupation resumed from the 6th to 10th centuries. The main types of pottery are a *patra* (shallow eating bowl), a *mutti* (deep globular bowl for storage) and a *mudi* (lid). A period of mediaeval occupation can next be observed based on material dating from the 14th to 16th centuries.

With respect to interactions with the West, it is interesting to note that the excavations yielded two late Roman coins, one in the dwelling deposit and the other in the filling of the water tank. Unfortunately, too damaged to be legible, these coins nevertheless bear witness to contacts between Rome and the east coast, perhaps confirming that the island was circumnavigated after the 2nd century CE. Notwithstanding natural weathering processes, given the state of deterioration of the coins, they may have been in circulation for a long time, since it has been shown that Roman coins were used for trade between the 4th and 7th centuries (Bopearachchi, 2006). Three fragments of torpedo jars attest to links with the Persian Gulf around the 5th or 6th century CE. The types of Red Polished Ware found correspond to phase g1 (6th century CE) at Tissamaharama: a neck and several body sherds were found in the last three layers of the survey. These ceramics may bear witness to links with the Gujarat region of India.

On the eastern side, links with India can be seen in the presence of Rouletted ware, also in limited quantities (less than 10 sherds). Type 62/F/B/2 is a Fine Grey Pottery from the c1 period at Tissamaharama (2nd century BC). The Rouletted ware may indicate contacts with the east coast of India, where it is widespread, with a probable origin in the middle plain of the Ganges or in the delta region (Schenk, 2006). Further east and for the later period, trade with China is attested by a few pottery shards, including an 18th-19th century blue and white bowl base from the kilns of Anxi in Fujian province, found near the surface, and a green-glazed plate rim from Longquan in Zhejiang province, dating from the 14th century.

Among the glass beads, 93% of those from levels 4 and 7 in test pit 1 appear to have been made in Sri Lanka, based on the chemical compositional analyses presented

in the supplementary materials (Data: Glass Analysis KCH). While most of the beads were produced from a mineral-soda, high-alumina glass similar to that found at Giribawa, Mantai and Anuradhapura (Jetavana stūpa), comparisons using PCA and Cluster Analysis suggest that the Kuchchaveli samples are closer to those from Jetavana than to those from Giribawa. Only a minor amount (7%) of the glass has a South Indian composition. In addition, seven of the Kuchchaveli samples, including the cobalt-blue drawn bead in Figure 17, have a composition higher in lime and lower in alumina, suggesting a mineral soda m-Na-Ca-Al composition that is also quite common in samples found near the Jetavana stūpa.



Figure 17. Cobalt blue glass bead from layer 7 (Photo by B. Gratuze).

The site of Kuchchaveli therefore has some very interesting features for the study of Buddhism and trade in the Indian Ocean and the Bay of Bengal. It must have been particularly active as a Mahāyāna complex in the seventh and eighth centuries, in relation to other monastic centres in the region. Its relations with the East and West confirm traveller Cosmas' assertion that Sri Lanka played a crossroads role in the 6th century CE. It would be interesting to carry out a full excavation on the site to and fully survey the region (Figure 18) to understand the continuity of its occupation, the full expansion of its commercial and cultural contacts, and to further explore the link between the organisation of the monastery and the activity of the associated settlement.

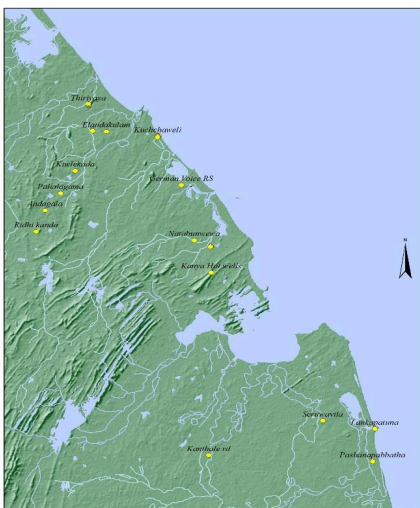


Figure 18. Neighbouring sites surveyed in 2011 (Map H. Rakrouki)

Stratigraphic Report

Test Pit 1

Presentation

The first operation in the area was aimed at analysing the cultural sequences in sections East (1) and West (1bis), which had been highlighted by the illicit work carried out there. The visual clarity of the eastern section led to the opening of an initial test pit in order to precisely define the various archaeological deposits and their chronology, based on the typology of the material discovered. This chronological sequence is a key point of the excavation, as it should reveal the different phases of occupation of the area surrounding the monastery, and help clarify the links between the monastic structures located near the seafront and the hinterland, where the modes of occupation of the territory are unknown.

Methodology

Work on test pit 1 began with a clearing of the eastern section, in order to define the various deposits and the chronological sequence. After this first stage, the excavation of the pit began on the preserved side by opening up a square of 3m x 3m, which enabled the first level of occupation to be uncovered. The 2011 excavation was carried out manually and horizontally, layer by layer (Figure 19). Each layer was systematically photographed, documented and its level recorded. The deposits were sieved in order to collect all the archaeological remains and as much data as possible. The excavation of pit 1 took eight days and the sieving nine days. A detailed and precise excavation was chosen for the layers with a high concentration of material and whenever a structure appeared. At the end of the excavation, each layer, its features and its structures were documented using a database created specifically for the site.

The recording method chosen for the files combined the methodology used by the Department of Archaeology and the methods used in France. The aim is to record all the data from the survey and the excavation (layers, structures, material) in a dynamic system that makes it easy to classify the data, correct or modify fields, and move from one table to another using quick links.



Figure 19. Project Members (top) and Excavation of the first layer in progress (bottom).

Context description

Section 1 shows a sequence of eight archaeological deposits (Figure 20). In order to verify the cultural sequence of the site, it was decided to dig an initial test pit following this section eastwards.



Figure 20. Final section of test pit 1

The first two layers show alternating recent human activity and natural deposits, disturbed by numerous tree roots. Below layer 4, the archaeological deposits are no longer disturbed: they are thicker and contain a greater density of artefacts. Two disturbances are visible in the section: one is located in layer 3 and corresponds to the negative impression of a group of roots; the other is the negative impression of a root starting in layer 4 and crossing layers 7 and 8. The virgin soil is a sandy layer (94% of sand), very loose and with thin layers of shells, that may have been brought from the sea or from the lagoon, both being close to the pit. Analyses of the pottery reveal four periods, from the modern era (layer 1) to the 2nd century BC (layer 7).

Layer 1

This layer is made up of contemporary deposits, disturbed by recent human activity on the one hand and by numerous roots, pockets of sand and thin strips of fluvial sand on the other. The layer is 12 cm thick, moderately loose due to a high percentage of sand (70%), dark brown and very heterogeneous. A yellow-orange stratum is interspersed between the first and second layers: this is a natural deposit probably linked to the December 2004 tsunami that devastated the east coast of Sri Lanka. The archaeological finds consist of modern waste (plastic, glass, iron nails) mixed with common red ware, decorated ware, and a sherd of Chinese ware. All these objects are out of context.

Layer 2

This layer is homogenous, very dark brown and compact, due to the majority of clay in its texture. It is evenly spread over an average thickness of 11 cm. Between this layer and the next is a thin stratum of shells, clearly visible in the eastern part. The archaeological finds include both ancient and modern objects, such as a copper ring, nails and modern glass. However, there are fewer recent artefacts than in the first layer.

Layer 3

This sandy-clay layer has a maximum thickness of 15 cm and is heterogeneous: it is disturbed by numerous medium-sized roots, the negative impressions from a large group of roots and a fine sandy stratum. The deposit also contains a few modern objects. It is less dark than the previous layer and less compact due to a slightly higher percentage of silt. In terms of finds, there are more ancient artefacts and very few modern inclusions compared to layer 2.



Figure 21. Layer 3, view from South (Photo V. Cicolani).

Layer 4

This layer (Figure 22) is very thick (56 cm maximum) and very rich in ancient archaeological material. A few roots have slightly disturbed it, but no modern or more recent objects have been found. Only one very deep root, measuring around 20 cm wide, cut through layers 4, 7 and 8: it was recorded as layer 6f (fill), included in layer 5c (excavation). The whole of layer 4 has collapsed slightly, due to the weight of the third layer, which contained the group of roots. It is more compact than the previous layers and less dark. No modern or recent disturbance was observed during excavation or sieving. The archaeological deposit is very well preserved. The observation of a large quantity of pottery and ancient building materials in the section led to the choice of a fine digging strategy, in order to find possible structures. The excavation of this layer lasted two days and revealed several levels of occupation, presumably three. In the north-east corner, a first level made up of flat, rounded stones and a brick may correspond to a

destroyed domestic structure (depth: 4.66 m). A line of stones, oriented S-SE / N-NW and located deeper (depth: 4.05 m) in the same corner, constitutes a second level. In the same area, there is also a high concentration of large shards of common red ware, some fragments of storage jars, tiles, bricks and a lamp.

The archaeological finds consist mainly of everyday objects and building materials, but also some terracotta and glass beads, two fragments of precious stones and two terracotta dice, one of which bears the same symbol as the one discovered in layer 3.



Figure 22. Layer 4, view from East (Photo V. Cicolani),

Structure 5c_6f

Layer 5c corresponds to the negative form of a large root cutting through layers 7 and 8. Its fill (6f) blends two layers with large sherds of pottery and shells that were naturally carried downwards.

Layer 7

This is a loose, light beige sandy layer, 50 cm thick (Figure 23). No structures were found, with the exception of one brick and one stone, both laid flat. The archaeological finds are mainly flat potsherds, far fewer in number than in layer 4. These include an iron slag, a bronze ring, a garnet fragment, a bone pin, a small tortoiseshell disc and a few glass, terracotta and bone beads. Charcoal samples were taken throughout the layer.



Figure 23. Layer 7, view from South (Photo V. Cicolani)

Layer 8

This light grey-beige sandy layer is very loose (94% sand) and includes a stratum of shells, either from the nearby lagoon or from the sea a few dozen metres to the east. This layer was not excavated extensively, as it turned out to be sterile, so excavation stopped at a depth of 24 cm.

Structures

The only archaeological structures found in the whole of test pit 1 were two small ovoid pits in the western side of the lower level of Layer 4 (Figure 24).

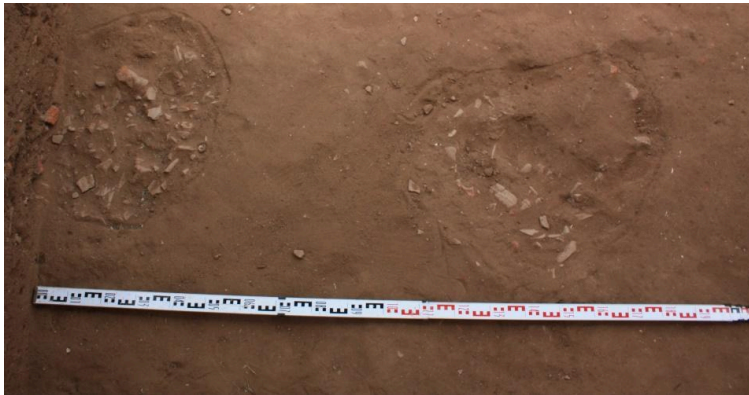


Figure 24. View of pits 1 and 2 (Photo V. Cicolani).

Pit 1 (9c_10f)

This pit is ovoid, in the shape of a flat-bottomed basin and measures 74 cm x 52 cm x 18 cm. It is located in the south-western corner of the lower part of Layer 4, and was excavated into layer 7. It is visible in the southern part of the pit. Its fill (layer 10) is sandy and moderately loose, and includes numerous terracotta fragments, sherds from storage jars, a bead, two medium-sized stones, and a coral block (at the bottom of the pit). Given its stratigraphic position and fill, pit 1 is contemporary with pit 2.

Pit 2 (11c_12f)

This pit is also ovoid and flat-bottomed, with an irregular profile. It measures 83 cm x 65 cm x 24 cm. It is filled with loose sand and contains a few fragments of terracotta and sherds of storage jars. As both pits contained domestic waste, they could belong to an early phase of settlement, i.e., layer 4.

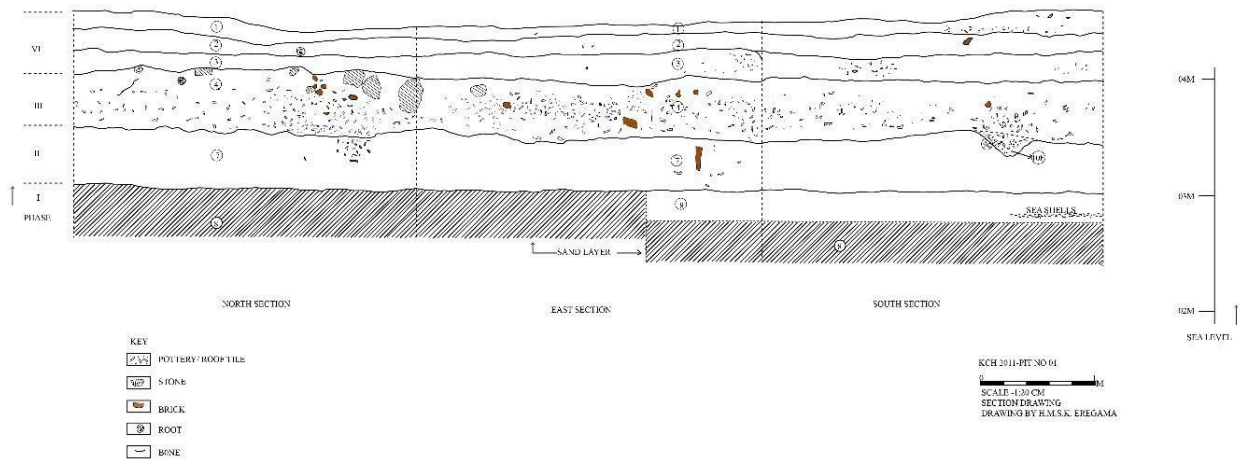


Figure 25. Section drawing of test pit 1 (Drawing by H.S.M.K. Eregama and S. Garusinghe).

Interpretation

The cultural sequence observed during the excavation of test pit 1 suggests an initial chronology, which will need to be specified once the archaeological material (pottery, terracotta, glass and special objects) has been studied.

The first archaeological deposit (layer 7) is located on natural soil made of sand either from the sea or the lagoon, and the pottery suggests a date between the 2nd and 3rd centuries AD. This first phase is followed by a long period of settlement corresponding to layer 4, from the 5th to the 8th century. This first phase was followed by a long period of settlement, corresponding to layer 4, from the 5th to the 8th century. The two structures (pits 1 and 2) could therefore be part of an initial domestic use in layer 4. Other structures, such as the stone lines discovered in the upper part of this same layer, in the north-east corner, could correspond to another phase of occupation. Finally, layers 3, 2 and 1 belong to the most recent period, which is disturbed by human and natural activity (roots and sand brought in at regular intervals).

Test pit no. 1bis

In front of section 1, to the west of the test pit 1, two sections of ancient walls had come to light during work carried out by the petrol company. They were cleaned up and the section cleared in order to establish their function and chronology.

The cleaning of section 1bis revealed at first a contemporary level of cement foundations, which sealed off and partially damaged the underlying archaeological layers. The archaeological deposit is compact, brown, and lies above the two baked brick walls. The cross-section revealed remains of ancient building materials and a few shards, including a fragment of Chinese pottery. The third and final level consists of the two wall sections, laid on a layer of sterile sand that forms the floor level of the walls. Those are not connected to each other, even though their foundation level is the same.

Interpretation of these structures is therefore difficult due to the lack of stratigraphic links and their different orientations.

Structure W1

This wall (Figure 26) is built of rectangular fired bricks and is located to the south of wall W2. It consists of two rows of bricks, one of which is partially destroyed. The best-preserved row consists of six courses of fired bricks and the mortar used is made of sand and clay. The bricks measure 40 cm x 20 cm x 7 cm. The southern end of the wall has been partially washed away and destroyed by recent activities on the site. Three broken bricks slid down the wall to the south-east.

Measurements: 115 cm (length) x 36 cm (width) x 60 cm (height)

Structure W2

The wall (Figure 27) is located in the northern corner of section 1bis (test pit 1bis). It is also made of fired bricks and consists of two rows of six brick courses. This structure is laid on a sandy layer that corresponds to the ground level of structure W1. The bricks measure 36 cm (width) x 7 cm (height) x 32 cm (maximum retained length). No bricks have been completely preserved in the section. One section of the wall is still preserved.

Measurements: 50 cm (length) x 36 cm (width) x 42 cm (height)



Figure 26. View of wall one (Photo V. Cicolani)



Figure 27. View of wall 2 (Photo V. Cicolani)

Pit 1bis

This rectangular test pit was dug at a distance of 23 cm from the southern end of the structure W1, in order to check the connections between wall W1, its ground level and the recent deposit caused by the alteration work.

The test pit revealed two layers: the first, above which the wall was laid, is sandy, loose, light beige and contains no archaeological material; the second is sandy-clayish, compact, dark brown and contains numerous fragments of bricks, tiles, terracotta nodules, stones, ancient and modern artefacts and natural remains. This layer overlaps the first in a SW/NE direction. It therefore post-dates the level at which wall W1 was laid.

From the stratigraphy of the northern and southern sides of the pit, and from the nature of the two layers, it can be inferred that the first event was the building of the brick wall, on a layer of virgin sand, and then occurred an important digging in the southern part of the area, that partially destroyed the wall W1; finally, the pit has been filled with a deposit from contemporary layers later than the building of the wall.

The understanding of this area is made difficult by recent human activities, which has greatly disturbed it. It would be worth clearing more of these two walls to be able to interpret better their function and the chronology of the area.

Test-pit no. 2

Aims and methodology

The excavations which took place between 1984 and 1986 revealed two heads of Buddha and a torso, as well as the brick walls of a structure interpreted at that time as *pratimāgrha* (image house). In order to check whether any Buddha statue could still be preserved *in situ*, it was decided to open a trench, oriented East-West of 1 m x 16 m, in the middle of the so-called image house.

The discovery of a foundation level made of dolomite blocks and some uncertainties concerning the plan of the building itself led to the opening of a second trench, perpendicular to the first, measuring 1 metre by 14. This trench was extended towards the east on its northern end, near the pit made by the Department of Archeology in 1984, and on its southern part, to verify the extension of a coral stone floor. Thus, the main portions of the foundation level could be highlighted and each wall could be studied in a portion of 1 metre width. The cross-shaped test pit thus obtained (Figure 28) made it possible to suggest a new interpretive hypothesis concerning the function of this structure.



Figure 28. View of the perpendicular trenches.

Context description

Cleaning of the surface revealed a fairly thin (5 to 10 cm) layer of vegetation and sand (locus 1), compared to other sites, due to work undertaken by the Department of Archeology in the 1980s.

The lower layer (locus 13), measuring between 30 and 40 cm, is homogeneous, loose, composed of brown sand, covering the entire surface of the pit, and including common red ware and a few shards of black and red ware. This is the first level of settlement of the pit.

Pits

This layer is disturbed by several recent pits, among which the most important is in *loci* 2c, 3f and 4: this pit is the result of illicit digging up to 140 cm deep, in the centre of

the structure (at the intersection between the two trenches), probably in order to find the reliquary of the monument. This hypothesis is based on the discovery of a small construction made of bricks and tiles at the bottom of the pit (place 4), filled with sand, inside which a two-rupee coin, dated 1996, had been placed. The fill is composed of naval garbage, a layer of charcoal and burned objects showing that the pit was used to burn household and military waste.

Two other pits (loci 11c, 12f and 14c, 15f), smaller in size and depth, are located in the first trench: one in the middle, the other at the eastern end. The first is very shallow (27 cm) and the reasons for the digging are undetermined, while the second (65 cm) seems to have been dug on purpose to serve as a waste pit for the Navy. Both are filled with waste (plastic, glass, fabric, iron, etc.).

The last pit (loci 5c and 6f) coincides with the test-pit made by the Department of Archeology in 1984, outside the monument, on the north side. This is where the Buddha statues were found. The fill was similar to the other pits (naval waste): it was dismantled and the limits of the pit identified (130 cm deep). A small extension-pit was dug towards the east: it did not reveal the missing parts of the statues, but an undisturbed layer between the wall foundations, which requires further investigation to better understand the chronological sequence of the monument.

Structures

As for the structure itself, eight portions of walls have been unearthed. Among the central walls, the two walls located to the south and east of the central pit do not present any layer of ancient bricks but only recent restorations because they were both destroyed on their interior face by illicit excavations.

The two walls located to the east and west of the centre have interesting features. The eastern one (wall no. 4, Figure 29) has two layers of old bricks on the eastern side (height: 16 cm), three on the western side (height: 21 cm), topped with a thin layer of cement and a modern brick wall. The western one (wall no. 2, Figure 30) is composed of two layers of cut coral stone (locus 10, height: 19 cm), surmounted by three layers of restored bricks (locus 8).



Figure 29. Wall no. 4.



Figure 30. Wall no. 2.

Of the four walls of the outer enclosure, the eastern one (wall no. 5) seems to have been completely restored, using ancient materials such as coral stone blocks and bricks: it rests on one thin layer of cement. The western one (wall no. 1) is associated with the entrance to the building, made of two brick steps. The first one is ancient (locus 9), laid on two foundation stones, and measuring 21 cm high. The bricks have been covered with a little mortar and restored on the inside of the step. The second step (locus 7) consists of four layers of restored bricks.

Lastly, two walls (locus 17) have been preserved with a foundation level in dolomite stones and a cut coral block construction: two layers in the north (height: 44 cm), plus one restored (wall no. 6, Figure 31) and three layers in the South (wall no. 8, height: 60 cm, Figure 32).



Figure 31. Wall no. 6.



Figure 32. Wall no. 8.

Two coral stones were found in the brown sand layer (locus 13) on the southern side of the second trench (Figure 33). To check whether it was a wall, the trench was extended eastwards into a new 1.50 m / 1 m pit. The coral stones turned out to constitute a floor level (Figure 34). Further excavations will be necessary to show the full extent of this structure. The base of its level is at 3.15 m, and the top reaches 3,31 m. This data coincides with the level of the coral wall (locus 10), whose base is at 3.18 m.

Beneath this level and layer 13 is a layer of dolomitic stones (locus 18; Figure 35), well distributed over the entire surface of the trenches, inside the enclosure. Garnet and shell beads were found between the stones. Their tops are found between 3.16 m and 3.04 m, and their bases lie between 3.04 m and 2.93 m. To the East, locus 19 seems slightly different, with larger and more angular stones, situated between 2.87 m and 3.02

m. This is slightly higher than the dolomite foundations of the southern and northern walls (locus 17), which lie between 2.77 m and 2.58 m (south) and between 3.00 m and 2.71 m (north). Those structures and layers are situated above a layer of yellowish-brown sand, slightly hard, homogeneous, measuring 25 cm, and including common ware, Black and Red ware (1st c. BC – 2nd c. AD), and lots of shells. Digging reached this layer only on the northern and southern sides, close to the enclosure walls (locus 17). One sample of charcoal and one sherd of Black and Red ware have been taken from under the foundation of the northern wall to obtain a date. Virgin soil (locus 21) has been found around 140 cm, without a clear limit with the layer 20, as it is the same sand, without any inclusion.



Figure 33. Coral stones.



Figure 34. Floor level.



Figure 35. Dolomite stones.

Chronology and interpretation

Phase I : foundations of a bodhigara?

Bearing in mind that no remains of columns or statues have been found within the perimeter of the enclosure or even nearby, that the entrance to the building is not located on the eastern side, and that the presence of ancient walls as an inner enclosure is not very clear, the hypothesis of a pratimāgr̥ha (image house), has been ruled out.

In addition, the presence of a regular level of stones around a central pit that probably contained precious objects (stolen during illicit digging) suggests that these dolomite stones could form the foundation of a circumambulatory path (*pradakṣiṇapatha*) around a bodhi tree. The interpretation of this building as a bodhigara needs to be confirmed by further research, in particular into the existence and layout of the ancient walls, whose location around the possible bodhi tree needs to be clarified. But the outer enclosure shows a regular pattern of foundations and coral walls, which may correspond to the dolomite level inside. This would be the exterior of the bodhigara, with an entrance to the west, which is not unusual for this type of monument.

Phase II : circumambulatory path (*pradakṣiṇapatha*) around the bodhi tree

Above the dolomite level, the discovery of coral stones inserted into the layer of brown sand around the centre of the structure suggests a possible floor dedicated to the circumambulation around the bodhi tree.

This floor and the coral stone wall located to the west on the same level need to be fully illuminated in order to understand their function and their relationship with the rest of the structure, and to know whether they correspond to a second moment of construction in the same phase of activity, or to a second phase of activity. The same question arises for the remains of the brick walls highlighted in the centre of the trenches.

Phase III : 1984-1986, work of the Department of Archaeology

The excavation of the test pit by the Department of Archaeology in 1984 marked the beginning of a new phase of activity, which culminated in the discovery of the torso and heads of the Buddha images. This was followed in 1985 and 1986 by a complete cleaning of the surface of the site, so that the walls could be seen and restored. All the upper parts of the brick and coral walls belong to this phase. This excavation stopped at a depth of less than 50 cm below the surface and did not reach the coral and dolomitic levels. Taking the upper parts into consideration, the structure was then interpreted as a pratimāgr̥ha (image house).

Phase IV : after 1996

The date of the most recent phase of human activity on this site is given by the 2 rupee coin indicating that the looting of the central part of the monument took place after 1996. Its presence in a box suggests that the looters may have found a reliquary or other precious object and constructed it to replace the object of their theft. The pit was left as it was and used by the navy for its waste, like other pits in the area.

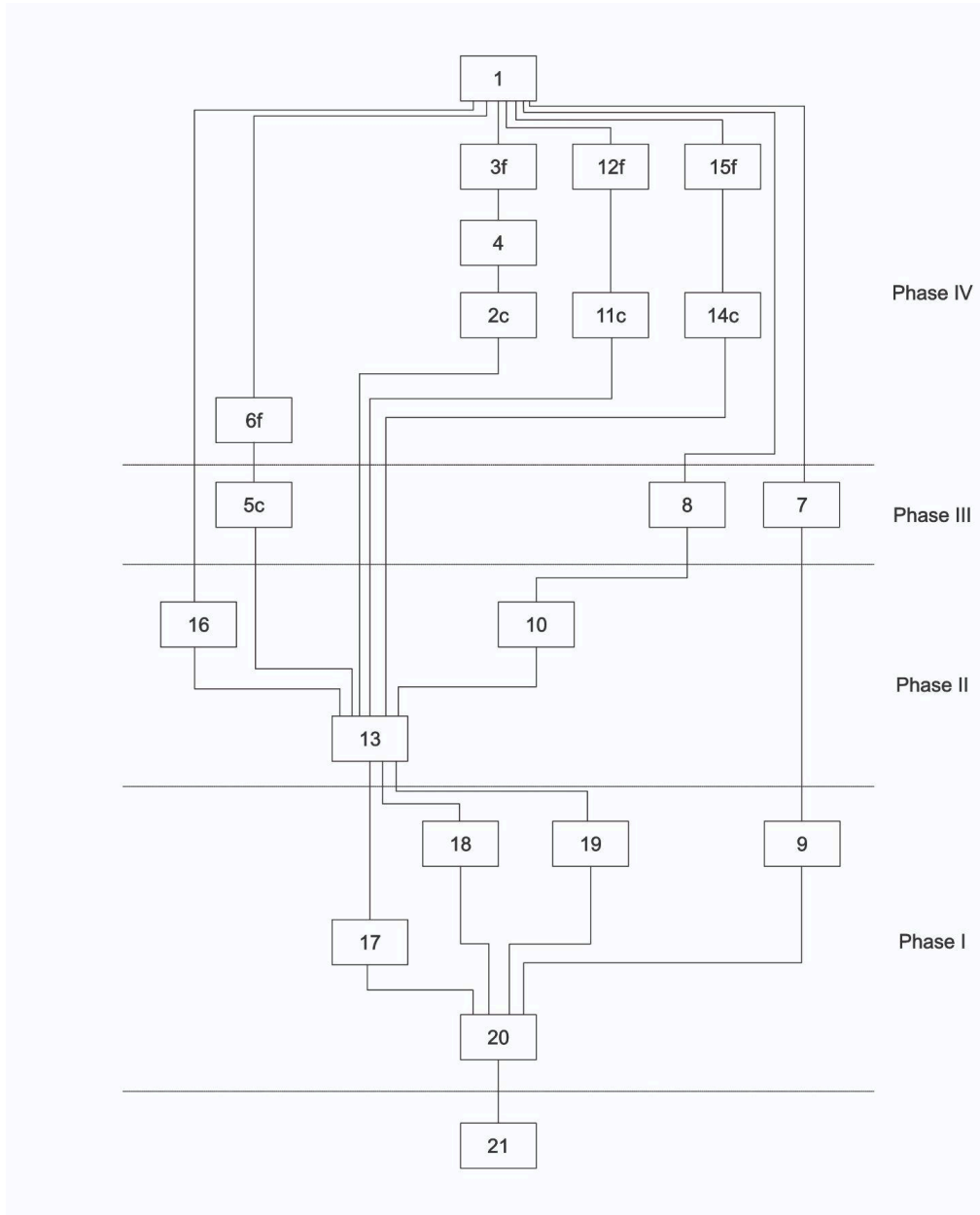


Figure 36. Matrix of Test Pit 2.

Test pits no. 3-6

After the completion of the excavation of the test pit no. 1, and at the same time as the exploration of the test pit no. 2, some other test pits have been opened to the east of pit no.1 and to the south of pit no. 2 in order to evaluate the dimensions of the whole site.

Four pits, each measuring 1 x 1 m, have been dug, inside the Police Station area, to the south of the Rest House and pit no. 2. The aim was to identify other structures related to the Buddhist monastery.

On the first day of excavation, test pit 3 revealed a structure consisting of two brick walls perpendicular to each other. In the other test pits, at least one archaeological deposit appeared between the modern layers and the sandy virgin soil of the lagoon. No other structures were found.

The last week of excavation was therefore devoted to digging test pit no. 3, which was enlarged in order to understand and study the structures that had emerged, and to record the archaeological layers uncovered in the other test pits.

Test pit no. 3

Pit no. 3 was dug a few metres from the main entrance to the Kuchchaveli Police Station. After digging a 1 x 1 m pit, the discovery of the upper layers of two brick walls in the southern part, at a depth of 150 cm, led to the first enlargement of this pit.

The new pit therefore measured 4 x 4 m. This allowed us to examine several archaeological layers located below the level of the modern settlement. Given the interest of the archaeological remains found in these layers, and in order to understand the stratigraphic context of the two interconnected walls, it was decided to widen the pit again, this time to the north. This operation involved excavating both inside and outside the wall structure, in order to establish the various phases of the construction itself, and to understand its links with the archaeological layers located on either side of the walls.

Context description of Test Pit no. 3

Layer 1

This is a modern, very loose layer, due to the high percentage of sand in its composition (80%). This layer, up to 50 cm in thickness, contained modern rubbish and objects such as iron cans, plastic and electric wires, linked to the construction activity that had taken place in this area when the police moved in.

Layer 2

This layer is less thick than the previous one and more compact, due to a majority of silt in its texture. It is separated from the first layer by a thin sandy layer visible on the four sections of the pit. No modern materials were found in this layer, and the ancient remains mainly consisted of baked brick fragments and pottery sherds, with also one precious stone bead and one dark glass slag. A few stones could be noticed at the bottom of the layer, in the transition with the following layer.

Layer 3

This layer (Figure 37) is homogenous, dark yellowish brown in colour, 40 cm thick at maximum, and of a sandy texture (70% of sand), which makes it a little compact. It has a high concentration of medium and large size stone (large local granite pebbles), and fragments of fired bricks. This layer covers the entire surface of the pit, as it can be seen from the stones visible in the four sections. The archaeological remains are not very numerous, but exceed in number from those of layer 2. They are sherds, a bead and a fragment of glass. What is striking is the absence of faunal remains, particularly abundant in test pit 1.



Figure 37. Layer 3 (Photo V. Cicolani).

Layer 5f

This layer (Figure 38) is the fill of the digging (layer 4) made to set the upper courses of the walls W1 and W2, designated by the number 6 (structure 6). The deposit is light brown and composed mainly of sand and small brick fragments. It is less compact than layer 2 and very poor in archaeological material, consisting only of a few sherds and very small brick fragments.



Figure 38. Layer 5 (Photo V. Cicolani)

Layer 7

This is a very thick (76 cm maximum) sandy layer, very loose, and including very little remains, among which some sherds, five beads (three glass beads and one shell bead) and a ring fragment. It is preserved in the south-eastern portion of the pit, outside the upper courses of the wall W1 (structure 6). In the south-east corner of the pit, this layer appears to be deeper: this feature should be verified by more in-depth research during the forthcoming excavation season.

Layer 8 (former layers 5f and 8f)

This thick layer (130 cm maximum; Figure 39) is loose, light yellowish brown, and composed of sand (60%), clay (20%) and silt (20%). It includes a high concentration of brick fragments and medium or big size complete bricks – among which one with a manufacturing stamp – and also a high number of big tiles. This deposit was laid in the northern part of the pit above the area delimited by the lower courses of the walls W1 and W2 (numbered structure 10); it is earlier than the layers 5f, 4c and 3. From the nature of the archaeological remains uncovered in this layer, its position in the pit and the direction of the bricks and tiles found in it, it can be said that this deposit is a thick fill resulting from the destruction of another structure and intended to seal brick structure 10. It is interesting to note that the bricks found in the lower part of the fill appear to be the same size as those used to build walls W1 and W2 of structure 10.



Figure 39. Layer 8 (Photo V. Cicolani).

Layer 9

This is a very loose sandy layer. No archaeological remains were found here, with the exception of a small sherd of pottery that could just as easily have come from layer 8 just above. This layer was excavated on the last day of the dig, so it is not possible to know its full thickness. Its connection with the walls should be clarified during the forthcoming seasons. It could be a level of settlement linked to the structure or its foundation layer, or a third fill. The maximum depth reached on the last day inside the structure – in the north-east corner – was 270 cm, or around 130 cm above current sea level.

Structures: W1 and W2 (structures 6 and 10)

The walls uncovered during this first diagnostic operation (Figure 40) appeared to be approximately 150 cm deep. Made of fired brick, the two walls intersect to form a right angle. The upper courses were built with brick fragments and recycled bricks, whereas the lower courses seem to have been built with much greater care, using standardised bricks. Furthermore, judging by the sequence visible in the northern and eastern sections, the upper courses are included in layer 4c, which could therefore be interpreted either as a foundation dug for the upper part of the walls or as a subsequent weathering work carried out on these two walls (a recycling trench?). That is why the identification of the walls, initially referenced by a single number 6, has been dissociated to create a new number – 10 – which refers to the lower courses of the two walls. The interpretation of these phases still needs to be confirmed during the next excavation.



Figure 40. Walls 1 and 2 (Photo V. Cicolani).

Structure 6: W1

This is an ancient wall made up of four courses of fired bricks laid in a single line. The bricks measure 6 cm high x 26 cm long x 26 cm wide at most. The wall runs east-west. It has been cleared at 194 cm and measures 24 cm wide x 26 cm high. It is located inside layer 4c (excavation). On the outside, the wall is connected to layer 7 and

rests on a sandy layer. The connection between the wall and layer 7 should be clarified by further excavation.

Structure 6: W2

This is an ancient wall made up of one row of fired bricks laid in 6 courses. The bricks are fragmentary and of various sizes; they may have been recycled from another close structure. The best preserved bricks have a medium size of 6 cm high and 26 to 28 cm long. The wall faces south-south-east/north-north-west. It is 200 cm long, 40 cm high and 36 cm wide.

Structure 10: W1

This ancient wall is made up of 27 courses of fired bricks laid in a single row. They measure 6 cm high x 30 cm long x 28 cm wide at maximum. The wall faces east/west and is located under structure W1 6. It has been carefully built by superimposing the courses of bricks in such a way that each one is slightly jutting out from the preceding one in regular stages. The wall 1 is perpendicular to the wall 2.

Structure 10: W2

This ancient wall is made of 22 courses of fired bricks laid in a single row. The bricks measure 6 cm high x 30 cm long x 28 cm wide at maximum. The wall is oriented south-south-east/north-north-west and is situated below the wall 2 structure 6. As the wall 1, it is well preserved and is perpendicular to it.

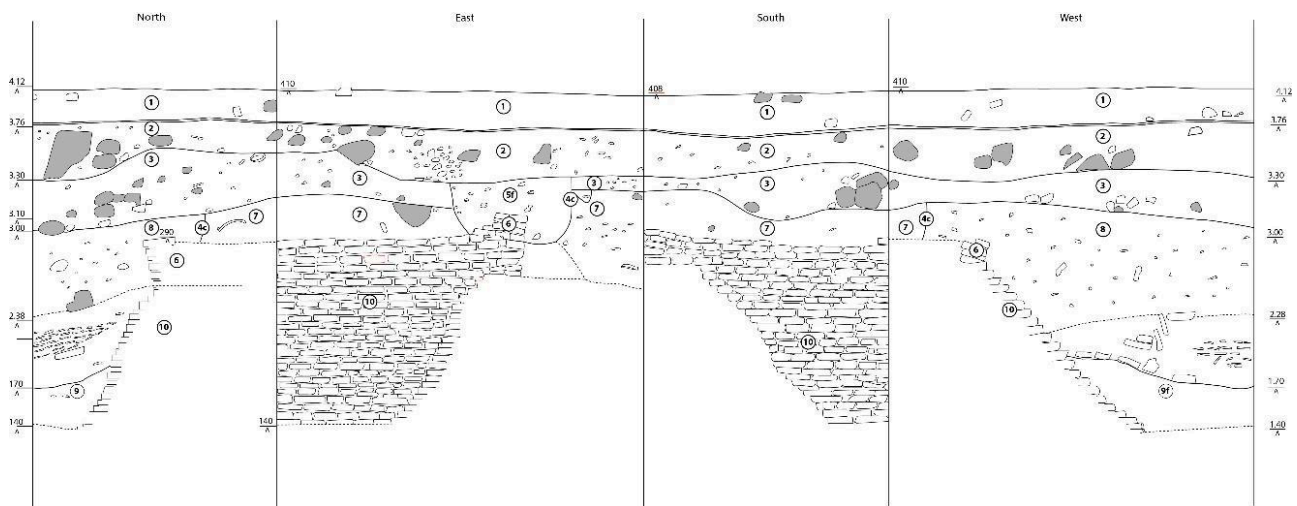


Figure 41. Section drawing of the test pit 3 (Drawing by V. Cicolani and C. Bailly).

Preliminary interpretation

The structures brought to light during this first diagnostic campaign demonstrate the interest of the Kuchchaveli archaeological site. The walls uncovered in the test pit give an initial idea of the extent of the monastic site, which until now had only been known from the stūpa and bodhigara excavated in test pit 2. These two walls form the corner of a large structure, built entirely of brick (Figure 42 and Figure 43).



Figure 42. Final View of the water tank structure.



Figure 43. Final View of the water tank structure.

The location of these remains and the absence of any domestic activity or faunal remains in the levels contemporary or posterior to the structures allow us to assume that this place is inside the monastery perimeter, unlike the walls uncovered in the test pits 1 and 1bis that would be outside this perimeter. The imposing brickwork was concealed by a contemporary level and two archaeological deposits, essentially made up of stones and brick fragments, which covered the entire surface of the pit.

Under these more recent levels, two different archaeological sequences can be distinguished: one inside the walls (northern and western sections) and another one outside the structure (eastern and southern sections). The area delimited by the two walls has been filled presumably in two phases by a thick backfill (layer 8) formed by the rejection within the structure of ancient building materials: bricks, tiles, a few nails and

iron hooks. Beneath this layer is a sterile sandy layer which does not correspond to the bottom of the structure but is the deepest level reached during excavation. The foundations of the structure could not be uncovered this time, as the open space was too narrow and the time available was too short to proceed with a further enlargement of the test pit.

Outside the structure, the stratigraphic sequence shows a phase of reorganisation (layer 4c), which corresponds to the phases that can be observed in the brick courses of the walls. In fact, the upper courses of bricks appear to have been laid or reworked at a time subsequent to the first period of use of the structure, while the lower courses, which have a series of 27 regularly arranged stages, appear to have been laid in a virgin sand, visible in the eastern section below the layers 7 and 4c.

Although only a small part of the structure could be studied, its shape and construction technique suggest that it may have been a water tank for the monks. Several convincing parallels can be observed in other monastic sites in Sri Lanka. However, this interpretation remains to be confirmed and only a precise and exhaustive excavation of the structure and the area will make it possible to determine its function, use and phases, and to clarify the points that could not be specified during this initial diagnostic investigation.

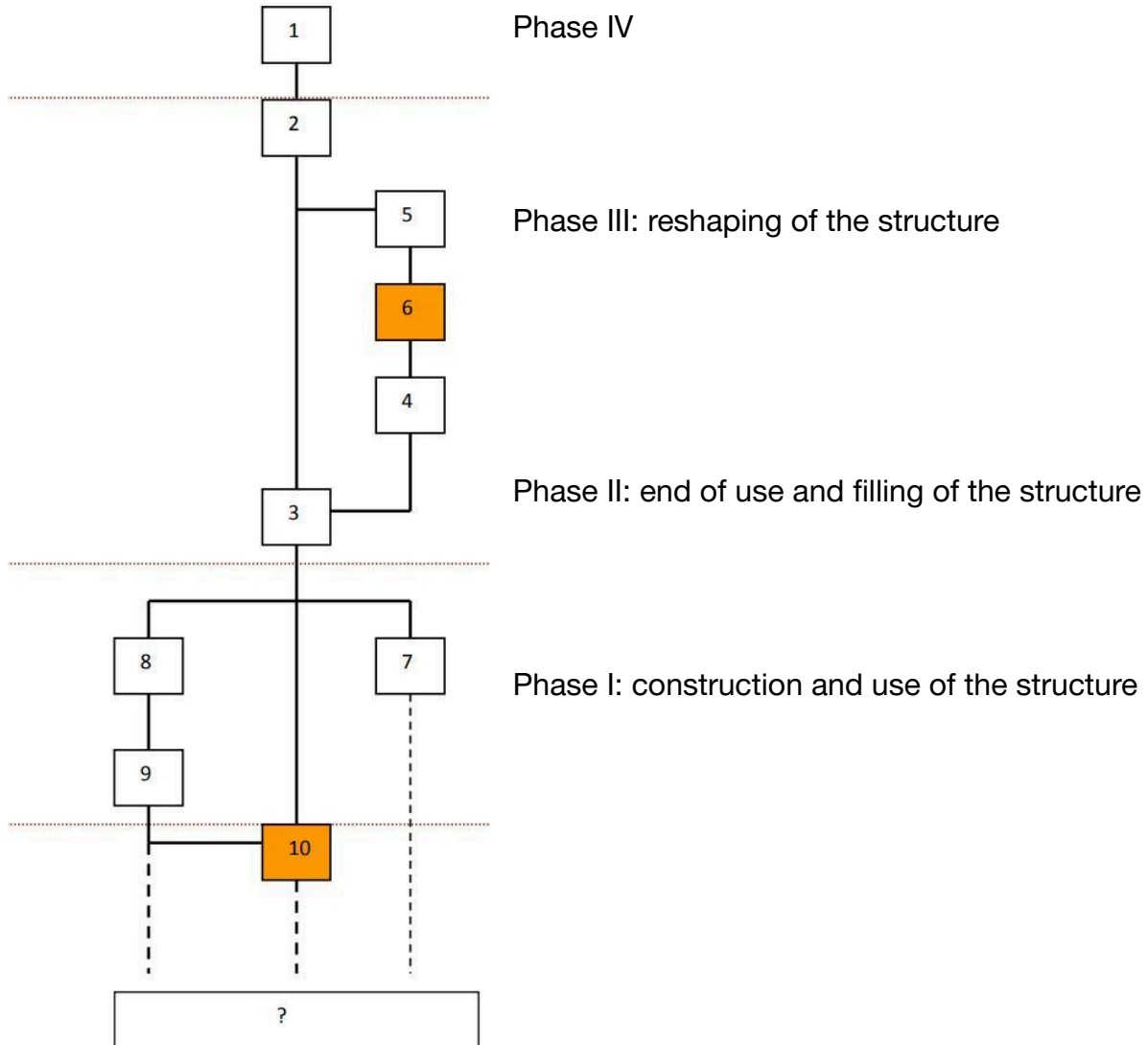


Figure 44. Matrix of test pit 3.

Radiocarbon dating

Poznań, 24-04-2012

Report on C-14 dating in the Poznań Radiocarbon Laboratory

Customer: Dr Ariane de Saxce

INHA, 2 rue Vivienne, 75011- Paris, France

Job no.: 6078/11

Sample name Lab. no. Age 14C Remark

KCH.2011 1 layer 7 Poz-46586 1880 ± 30 BP

Comments: Results of calibration of 14C dates enclosed

Head of the Laboratory

Prof. dr hab. Tomasz Goslar

24-04-2012

Job no.: 6078/11

Page 1 from 1

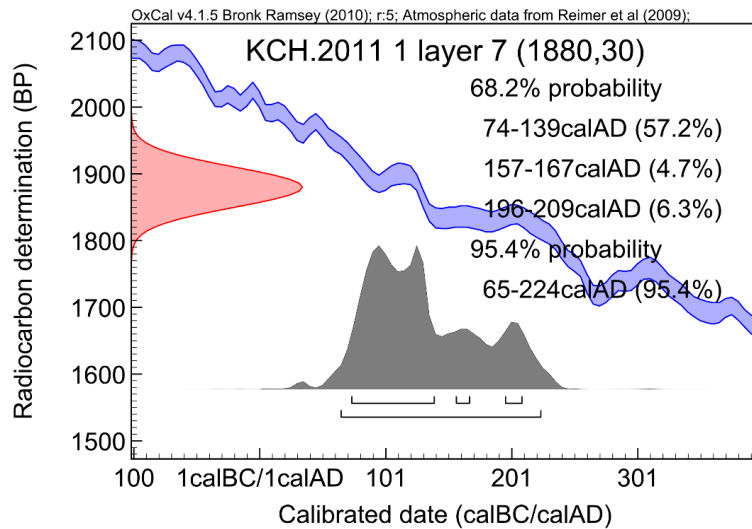


Figure 45. Results of calibration of 14C dates – order 6078/11

Given are intervals of calendar age, where the true ages of the samples encompass probability of ca. 68% and ca. 95%. The calibration was made with the OxCal software. OxCal v4.1.5 Bronk Ramsey (2010), r:5; Atmospheric data from Reimer et al (2009) KCH.2011 1 layer 7 R_Date (1880,30)

68.2% probability:

74 AD - 139 AD (57.2%)

157 AD - 167 AD (4.7%)

196 AD - 209 AD (6.3%)

95.4% probability:

65 AD - 224 AD (95.4%)

Pottery classification and analysis

A large collection of pottery fragments from the context KCH1, KCH3 and KCH6 of the Kuchchaveli excavation 2011 were classified as outlined by S. U. Deraniyagala based on the Anuradhapura Citadel excavation records (Deraniyagala, 1972). The initial pottery classification was conducted on the basis of predominant colour, rim shape, and body shape. Subsequently the results of the classification were compared with the classification system earlier introduced by Deraniyagala for the material from Anuradhapura Citadel (Deraniyagala, 1972; 1986).

The function of the pottery types was determined on the basis of rim shapes. The predominant functional groups found are summarised as follows (see supplementary materials for further details).

| Type | Name | Description |
|------|--|---|
| 1 | <i>Nambili</i> Shallow vessel | Wide open bowls with a round base, the thickness of the rim is set off by a ridge or a carination. Horizontal ridge occurs over the lower body. Exterior sides were often characterised by the presence of potters' marks. This type of pottery has been tentatively dated to between the 3rd and 7th centuries AD. |
| 2 | <i>Atili</i> Neckless jar | This form of a neckless jar with a rounded basin occurs in several varieties (such as Sinhala. Nambili, Karvas, Koppa). These comparisons with Anuradhapura typology allow to determine the dating to the 3rd century BC to 7th century AD. |
| 3 | <i>Atili</i> Small vessel made of red ware | A few specimens of this variety were also reported from the collection. This type can be dated to the 3rd century AD to 7th century AD. |
| 4 | Atili shaped vessel | High grade BRW pottery. BRW Atili types are the dominant categories in this type. On the basis of comparisons from Anuradhapura pottery typology and the radiometric dating, BRW could be dated from the period from 6th century BC to 3rd century AD. However, the specimen recovered from the excavation was observed to be of low grade quality and hence tentatively could be dated between 3rd century AD to 7th century AD. |
| 6 | Wide open bowl with a large belly | Wide open bowl with a large belly. On the basis of stylistics and technological characteristics, this type could be dated to the Middle Historical Period between the 6th and 8th centuries AD. From a technological point of view, this type of pottery is of mediocre quality and often shows potters' marks on the outside. |
| 7 | <i>Hali</i> | Among the assemblage, a few specimens were identified as type 7. Compared to type 06, the type 07 are technically high grade in production. It also could be dated to the 8th century AD on the basis of Anuradhapura typology. |
| 7 | <i>Mutti or Hali</i> | This type could be compared with types 6 and 7 and is tentatively dated to 8th century AD on the basis of Anuradhapura typology. This type predominantly includes Mutti or Hali and were medium grade in production. |
| 10 | | This pottery type is technologically high grade in production. And could be tentatively dated to between 3rd century AD to 7th century AD. Due to the presence of prominent rim indicators, this pottery type was possibly used to take out water from deep wells, and used in the storage of water. |

| | | |
|----|------------------------------|--|
| 14 | <i>Mutti</i> | This type includes Mutti and Kala (Water pot). On the basis of technological features and paste, it can be categorised as low grade pottery and could be tentatively dated to the period between 3rd to 9th century AD. |
| 15 | | This type often has wider rim with a long thick neck and could be compared with type 14 in technological features and shape. |
| 19 | | This type is categorised as Spout Jar or Water Container. A large collection of fragments of this type were reported from the assemblage and could be dated to the 4th to 7th centuries AD. On the basis of its technological and stylistic features. |
| 18 | Spout jar | This type could be compared with type 19. |
| 23 | | This type is generally found in sanitation systems where several are joined together. This is frequently found in sites dating between the 7th to 9th centuries AD. Potters marks visible on the surface. |
| 24 | | Similar to type 19. |
| 26 | Bowl | Similar to 24 and 19. |
| 28 | Bowl | A shallow bowl which can be dated between the 6th to 9th centuries AD. |
| 30 | Bowl | Black-on-Red Ware. A few specimens were reported from the collection. This type has been dated to 6th century BC on the basis of Anuradhapura typology. This specimen was found in association with the Buddha Statue and possibly interpreted as secondary context. |
| 31 | Bowl-type | This type can be compared with type 16/C of the Anuradhapura typology and could be dated to 3rd century AD. |
| 34 | Rouletted Ware bowl fragment | A single fragment of this type is reported from the collection. |
| 36 | Red Ware or Grey Ware bowl | This type could be dated to the 3rd century AD on the basis of the Anuradhapura typology. |
| 37 | Cup | Redware. |
| 38 | | Red Ware and could be dated to the 6th century AD. |
| 56 | Deep bowl | Pointed rim with a deep belly or bowl. This type could be tentatively dated to the 8th to 10th centuries AD. |
| 60 | | A few rims of this pottery type were reported. |
| 62 | Base of pot | It could be dated to the 8th to 12th centuries AD. |
| 65 | Lid | Several lids were reported and could be dated to 8-12 centuries AD. |
| 66 | | Relevant to the description of type 65. |
| 67 | | Relevant to the description of type 65 and 66. |
| 79 | | Disc. |
| 82 | | Clay ball. |

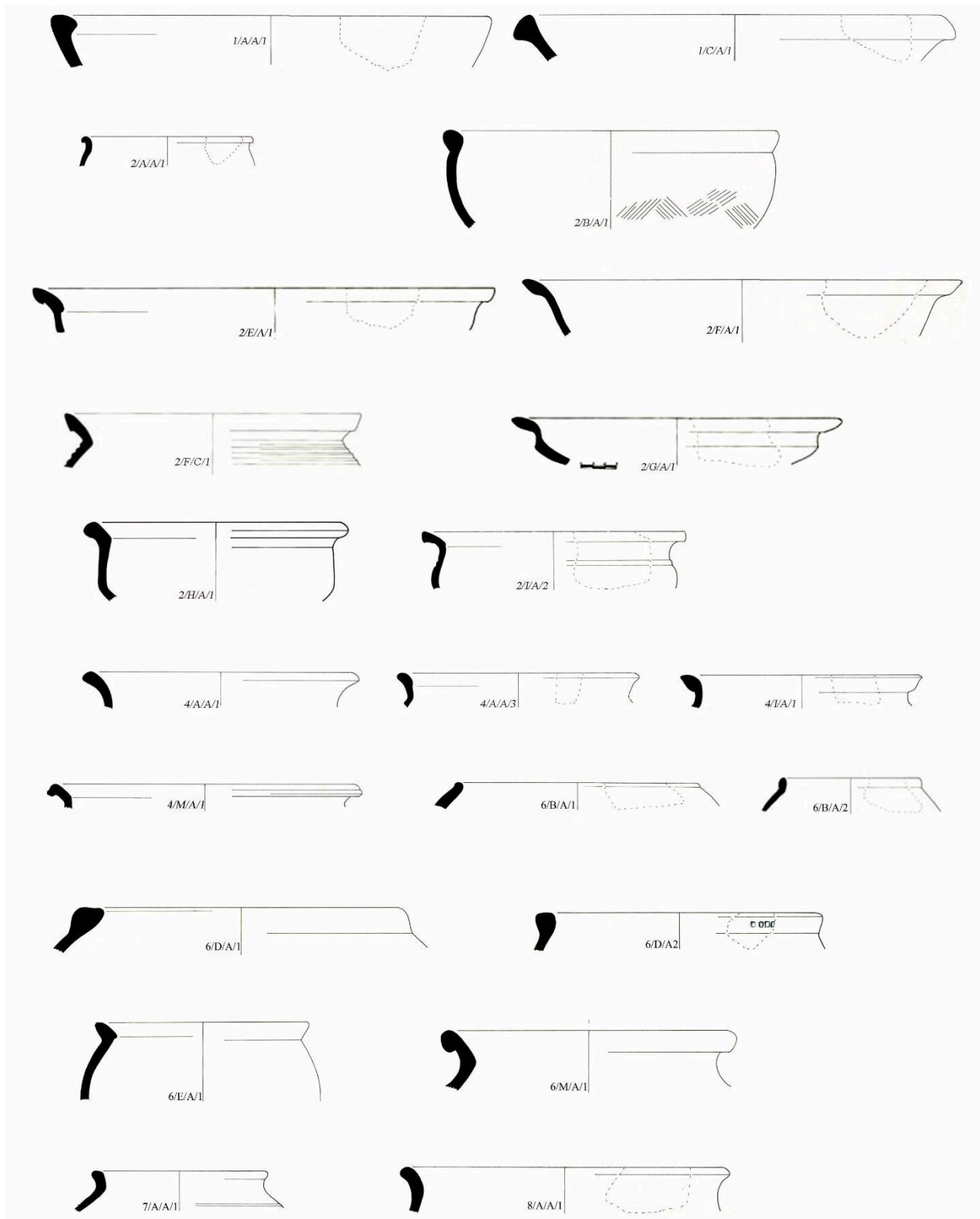


Figure 46. Pottery types from Layer 4

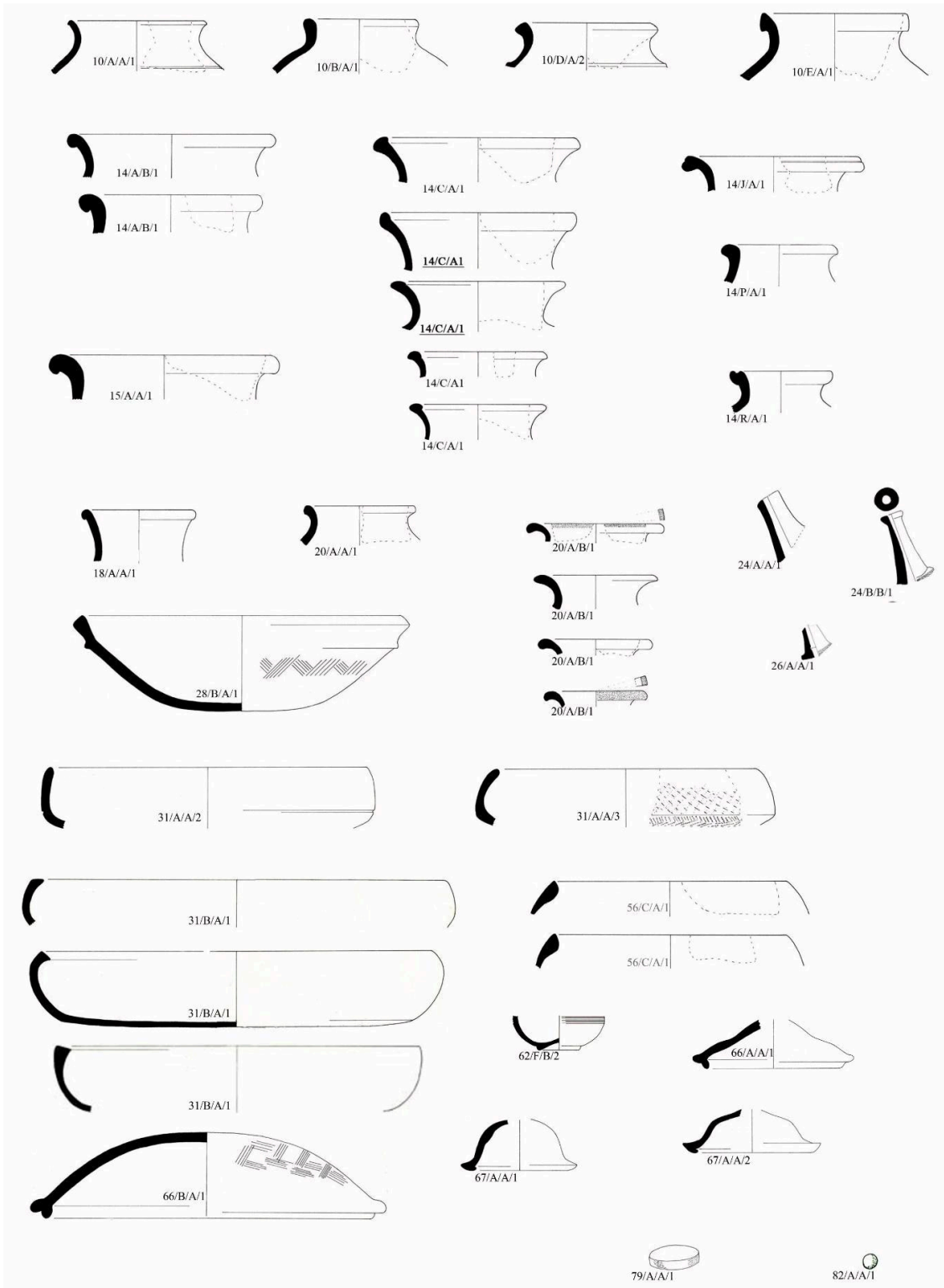


Figure 47. Pottery types from Layer 4 (continued)

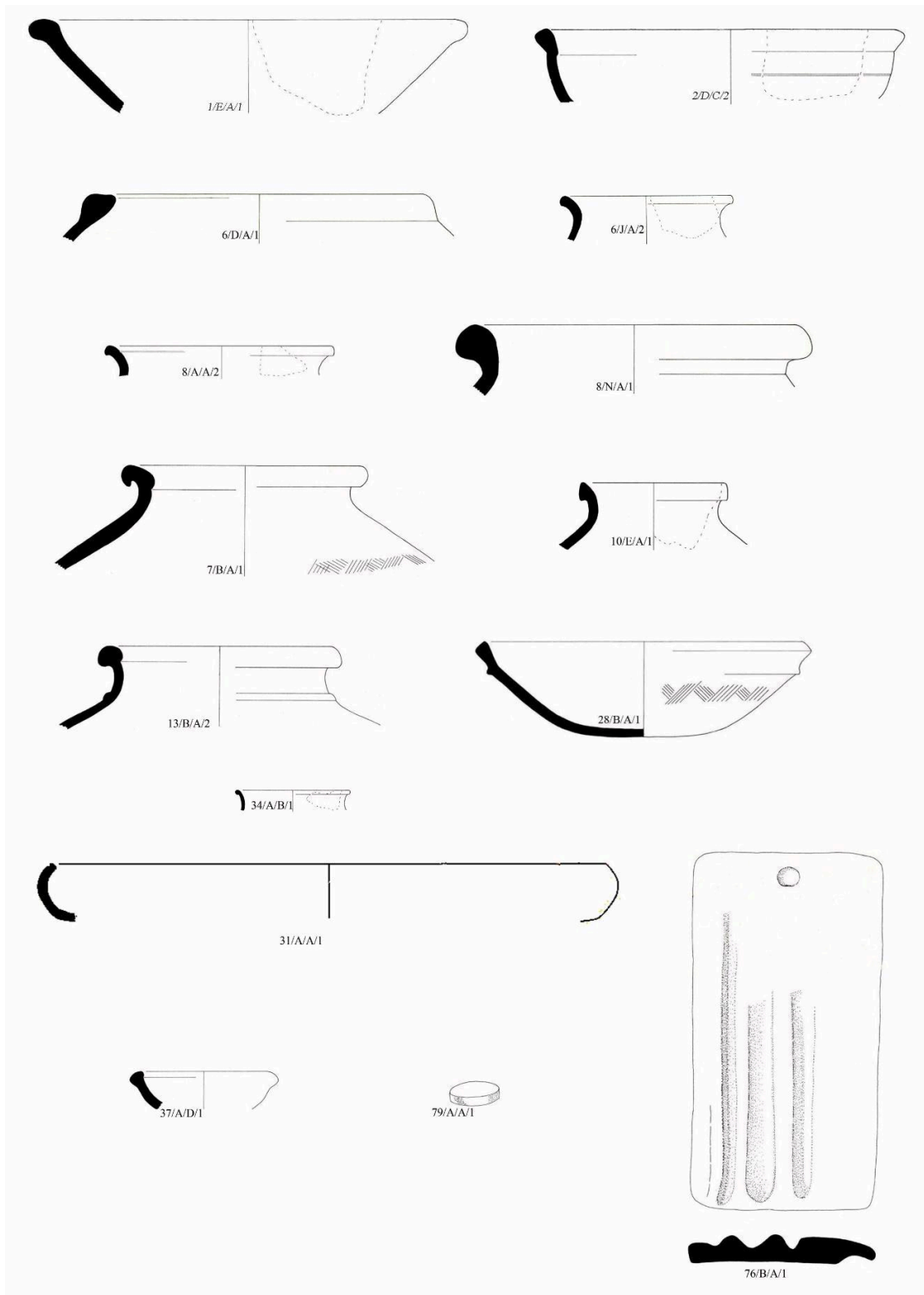


Figure 48. Pottery types from Layer 7

Special wares

Chinese wares (identification Zhao Bing):

Sherd 1: green-glazed stoneware from the Longquan kilns (Zhejiang Province), dish rim with wide lip and inward-turned rim, 14th century.

Sherd 2: blue and white porcelain from the Anxi kilns (Fujian Province), bowl base with a cookie ring on the inside, 18th-19th century.



Figure 49. Green-glazed stoneware.



Figure 50. Blue and white porcelain.



Figure 51. Blue and white porcelain.

Torpedo jars - 4 sherds



Figure 52. Sample torpedo jar fragment.



Figure 53. Sample torpedo jar fragment.



Figure 54. Sample of Red Polished Ware neck, 6th c. CE.



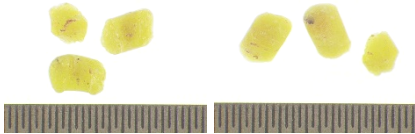
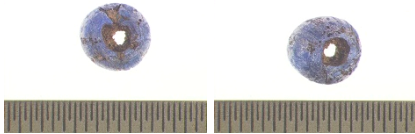

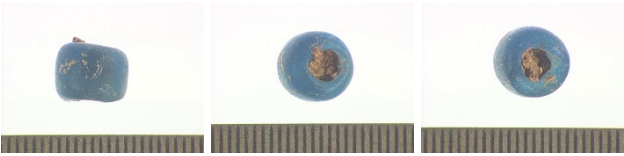
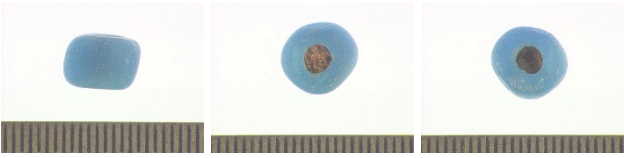
Figure 55. Sample of Red Polished Ware neck, 6th c. CE.

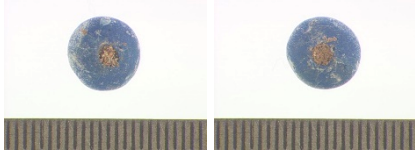
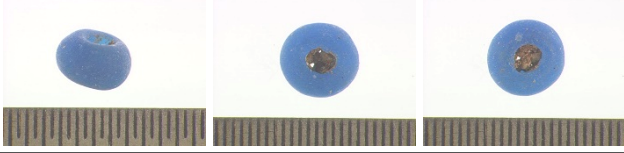
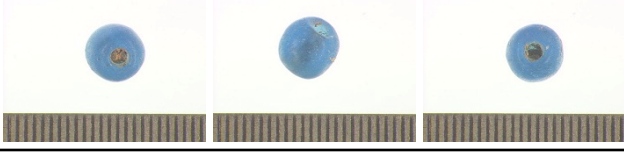
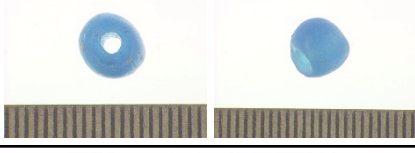
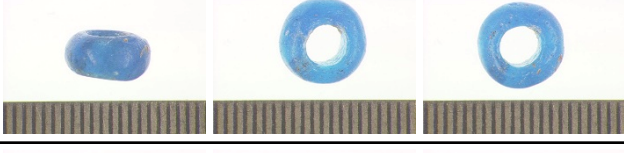
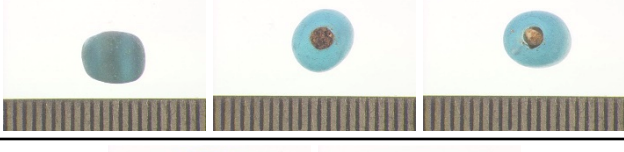
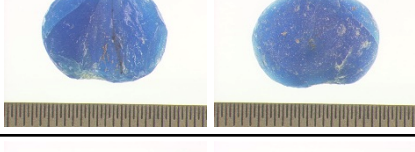
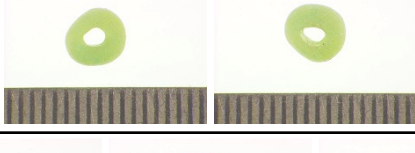
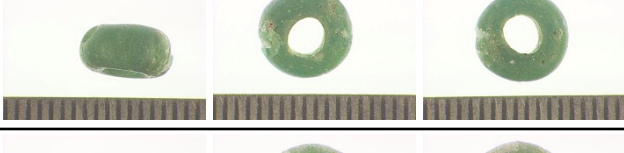

Glass Analysis from Kuchchaveli


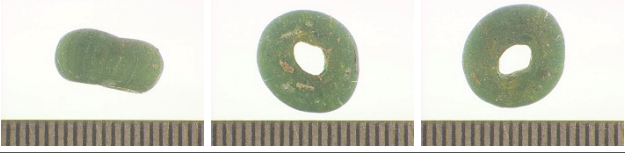
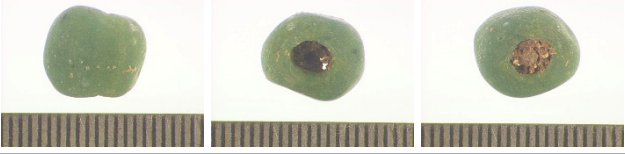
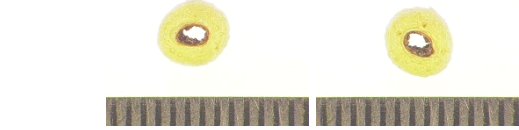
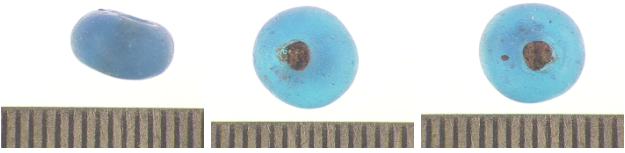
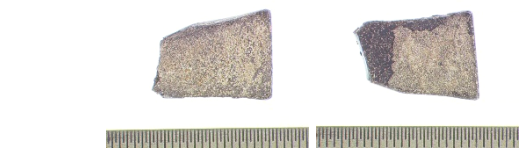
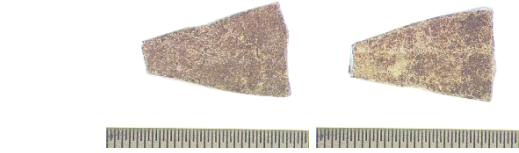
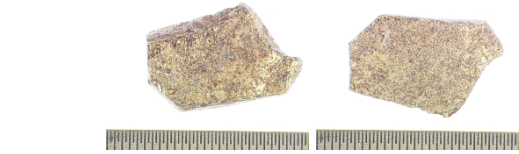
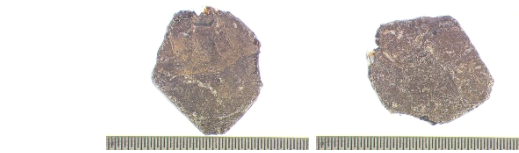
The glass evidence

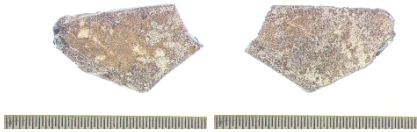

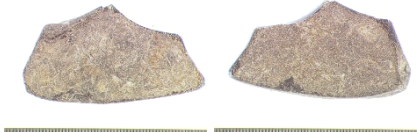
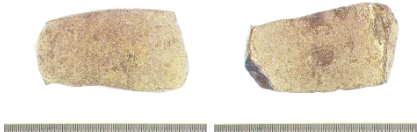
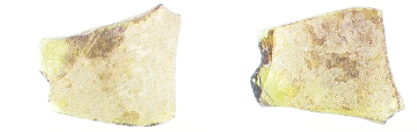
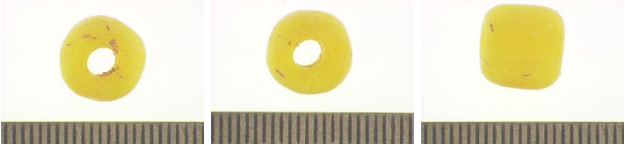
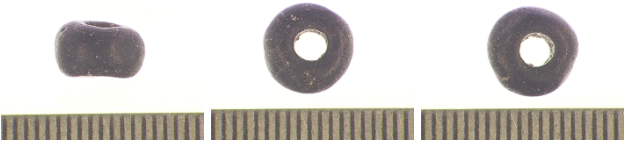
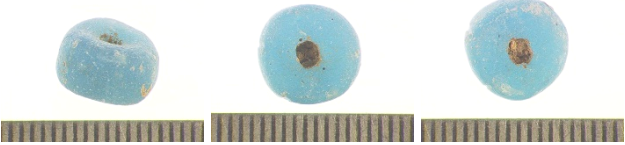

Thirty-nine glass samples recovered from test pit 1 were selected for chemical analysis. Nine of these samples, all vessel fragments, were from layer 3, a disturbed stratum that included both ancient and modern artefacts. Also from layer 3 are two small drawn beads, KCH 2011 L3 1 and 2. The well-preserved archaeological deposits of layer 4 included ten small drawn glass beads, KCH 2011 L4 1-10, that can be dated to the 5th to 8th c. based on associated ceramics. The 18 glass beads from layer 7, KCH 2011 L7 1-18, may be as early as the 2nd to 3rd c. CE based on the single radiocarbon date, although the presence of pottery from the 6th to 7th c. suggests a longer period of occupation. Table 1 includes reference numbers and photographs of the beads and vessel fragments.

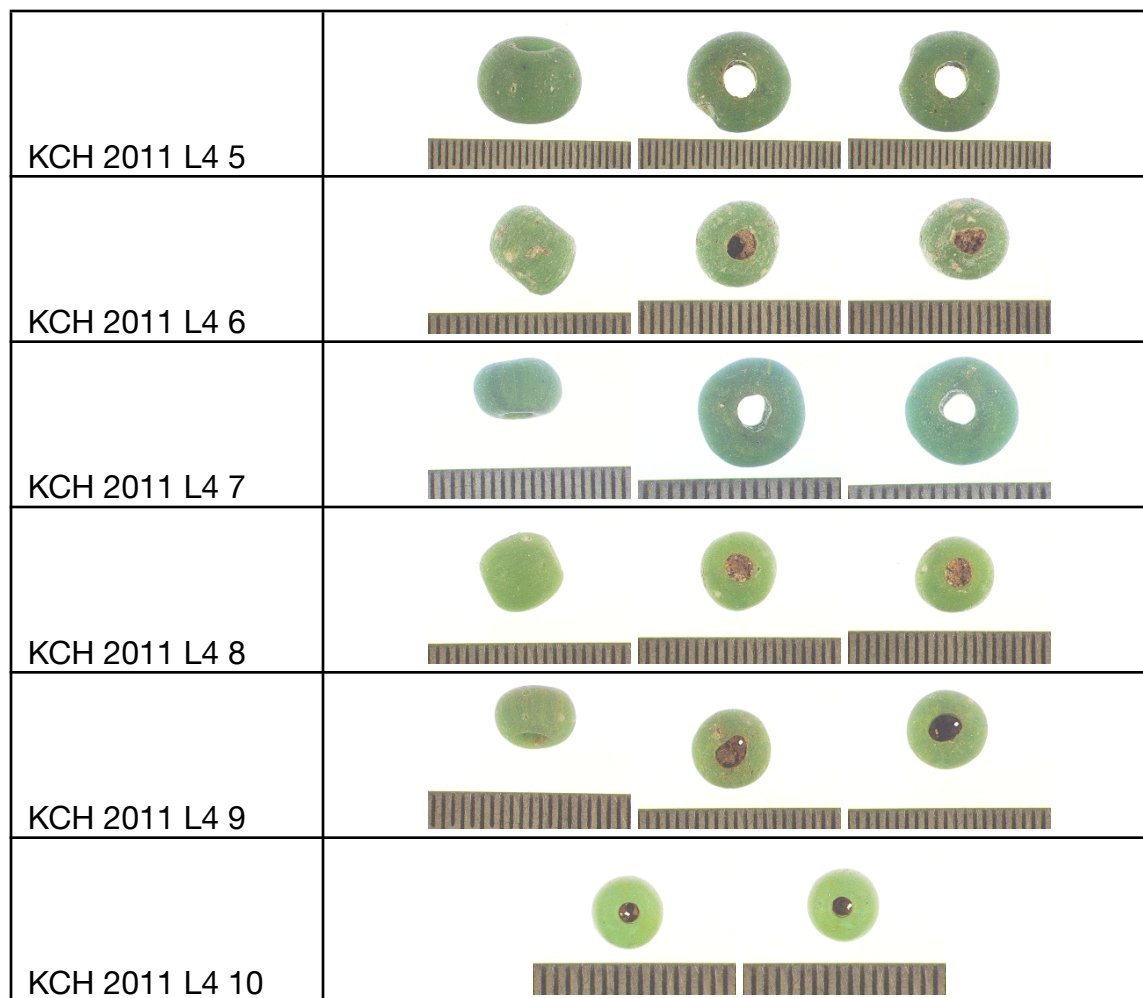
Table 1. Glass material recovered from Kuchchaveli

| Reference | Photo |
|---------------|--|
| KCH 2011 L7 1 |  |
| KCH 2011 L7 2 |  |
| KCH 2011 L7 3 |  |
| KCH 2011 L7 4 |  |
| KCH 2011 L7 5 |  |

| | |
|----------------|--|
| KCH 2011 L7 6 |  |
| KCH 2011 L7 7 |  |
| KCH 2011 L7 8 |  |
| KCH 2011 L7 9 |  |
| KCH 2011 L7 10 |  |
| KCH 2011 L7 11 |  |
| KCH 2011 L7 12 |  |
| KCH 2011 L7 13 |  |
| KCH 2011 L7 14 |  |
| KCH 2011 L7 15 |  |

| | |
|----------------|--|
| KCH 2011 L7 16 |  |
| KCH 2011 L7 17 |  |
| KCH 2011 L7 18 |  |
| | |
| KCH 2011 L3 1 |  |
| KCH 2011 L3 2 |  |
| | |
| KCH 2011 L3 g1 |  |
| KCH 2011 L3 g2 |  |
| KCH 2011 L3 g3 |  |
| KCH 2011 L3 g4 |  |

| | |
|----------------|--|
| KCH 2011 L3 g5 |  |
| KCH 2011 L3 g6 |  |
| KCH 2011 L3 g7 |  |
| KCH 2011 L3 g8 |  |
| KCH 2011 L3 g9 |  |
| | |
| KCH 2011 L4 1 |  |
| KCH 2011 L4 2 |  |
| KCH 2011 L4 3 |  |
| KCH 2011 L4 4 |  |



The glass samples clearly fall into two categories: vessels and beads. We wondered if there were any connection between the two groups, although based on the stratigraphy we suspected that the vessel and bead origins might be different. While all the beads were morphologically similar, being made by the same drawn glass technique employed in South and Southeast Asia from the late centuries BCE until recent times, the types of glass used did vary by both time and place. For this reason, detailed chemical analysis of the beads might provide unique insight into the stories that the glass evidence can relate.

Analytical method

The analyses of the glass beads were conducted at the Centre Ernest-Babelon of the IRAMAT (Orléans) using Laser Ablation High Resolution Inductively Coupled Plasma Mass

Spectrometry (LA-HR-ICP-MS). The spectrometer is an Element XR from Thermofisher Instrument and the ablation device is a VG UV microprobe.

LA-HR-ICP-MS allows a nearly non-destructive analysis of the glass objects, which is invisible to the naked eye. The concentrations of fifty-two elements are determined for each selected sample, among them we find:

- major, (silicon, aluminium, sodium, calcium, potassium, magnesium, phosphorus, chlorine and lead, which allow to distinguish the different glass type),
- minor (copper, iron, manganese, cobalt, antimony and tin, which allow to identify the colouring and opacifying agents)
- and trace elements (such as zirconium, yttrium, niobium, barium, strontium, cerium, lanthanum and titanium which appear to be powerful in order to establish discrimination between glass workshops).

The LA-ICP-MS operates as follows:

The object placed in the ablation cell is sampled by the laser beam, which is generated by a Nd YAG pulsed laser. Its frequency is quadrupled allowing it to operate in the ultraviolet region at 266 nm. The diameter of the ablation crater ranges from 60 μm to 100 μm , and its depth is around 250 μm . An argon gas flow carries the ablated aerosol to the injector inlet of the plasma torch, where the matter is dissociated, atomised and ionised. The ions are then injected into the vacuum chamber of a high-resolution system, which filters the ions depending upon their mass-to-charge ratio. The ions are then collected by a channel electron multiplier or a Faraday cup.

The isotope ^{29}Si was used as an internal standard. Standard Reference Material 610 from the National Institute for Standards and Technology, reference glasses Corning B, C and D (depending on the type of matrices being studied (lime glass, potash glass, lead glass, antimony glass, or tin and lead glass), as well as archaeological glass previously analysed by other methods, were used for external standardisation. An Excel Visual Basic calculation program is used to process the data. The calculation method used is based on the internal standard principle.

Detection limits vary from 0.1 to 0.01 % for major elements and from 20 to 500 ppb (parts per billion) for other elements. Accuracy is roughly 5 to 15 relative% depending on the elements and content levels measured.

Results and discussion

The 39 glass samples analysed by LA-ICP-MS fall into three main compositional groups (Figure 48; Table 2a & b), with full chemical compositional results given in Table 3 (in Supplementary Material).

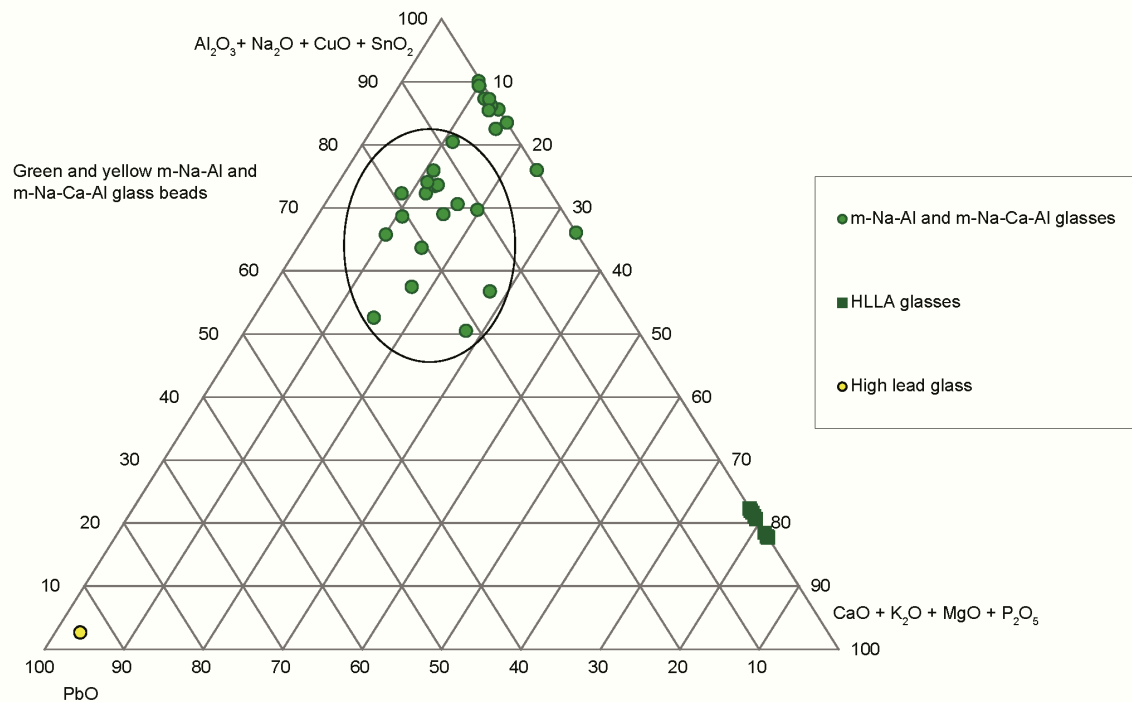


Figure 56: Ternary diagram showing the distribution of the studied Kuchchaveli glass finds according to their contents of lead oxide / lime + potash + magnesia + phosphorus pentoxide / alumina + soda + copper and tin oxides.

The first group, the nine vessel sherds from layer 3, have very similar chemical compositions. They are made with high-lime, low-alkali glass (HLLA glass) corresponding to modern European glass production. According to their typologies and compositions, all these vessel sherds probably represent European glass bottles produced between the seventeenth and the nineteenth centuries.

The second group refers to the small drawn bead found in layer 3, KCH 2011 L3 1, containing mostly lead and silica (PbO 61.5 %, SiO_2 33.8 %). Lead silica glass, probably first made in Southern China, is found throughout the 1st millennium and in the second half of the 2nd millennium CE in China, Japan and Korea. This type of composition spread over the Mediterranean and European world from the ninth century with Islamic lead glasses and lead glass adornments in Eastern Europe between the 10th and 13th

centuries. Although its production was limited, lead-silica glass never ceased in Europe until the 16th century when large-scale production of small beads began. Given the associated material in layer 3, it is highly probable that this small bead refers to this later phase of modern European productions.

All samples in the third group, 29 small drawn glass beads, were made with mineral soda glass containing various amounts of alumina and lime. As above, there was 1 bead found in layer 3, 10 found in layer 4, and 18 found in layer 7. Despite the 2nd to 3rd c. CE radiocarbon date, because of overlap in ceramic types in layers 4 and 7 it is difficult to draw clear chronological distinctions between the various samples. However, it is possible that the beads from layer 7 (latest dates based on ceramic typology 6th to 7th c. CE) may be earlier than those from layer 4 (mainly 7th c. and later).

The second bead from layer 3, KCH 2011 L3 2, is a small, drawn bead coloured greenish blue by dissolved cupric oxide (CuO). The high-alumina (Al₂O₃) glass used in its production was low in both magnesia (MgO) and lime (CaO) due to the combination of a mineral source of soda (Na₂O) with poorly refined granitic sand as the source of silica (SiO₂).

Such high-alumina mineral soda glass, abbreviated m-Na-Al, was produced in South Asia from the mid-1st millennium BCE until recent times. Laure Dussubieux and coworkers have identified at least six types of m-Na-Al glass (Dussubieux et al 2010, Dussubieux 2021), based on the content of Ca, Mg, Sr, Zr, Ba, Cs and U. For the period corresponding to the probable dates at Kuchchaveli the most important type is m-Na-Al 1, characterised by relatively high alumina with Al₂O₃ almost always greater than 5 wt%, relatively low lime with CaO between 0.5 and 5 wt%, and an alumina to lime ratio between 1.7 and 5 but typically 2 or greater. For m-Na-Al 1 glass, U is relatively low while Ba and Sr are high compared to other types of m-Na-Al glass. The composition of KCH 2011 L3 2, with CaO 1.8 wt% and Al₂O₃ 10 wt%, is typical for m-Na-Al 1 glass produced in South India and Sri Lanka during the 1st millennium CE.

The ten small drawn glass beads from layer 4 were also made from mineral soda glass, based on their low magnesium content mostly below 0.5 wt%, with one sample, 2011 L4 10) at 1.4 wt%. Because of the great variability of m-Na-Al 1 compositions, this is still well within the 90% confidence limits calculated from the mean and standard deviation values for the 316 m-Na-Al 1 glasses reported by Dussubieux et al (2010). While seven of the ten samples fit well within the range of m-Na-Al 1 glass, three samples, KCH 2011 L4 5, 6, and 8, all opaque green coloured by a combination of copper and tin, are relatively low in Al₂O₃, with values ranging from 2.9 to 5.1 wt%. These glasses are also lower in Ba and Zr compared to most m-Na-Al 1 samples and are best characterised as m-Na-Ca-Al, a broad and less well-defined group found in both South and Southeast Asia but so far without clear evidence for production zone(s) (Dussubieux 2021).

The eighteen beads from layer 7 are similar in both colour and composition to those in layer 4, with the exception of KCH 2011 L7 2, the one dark blue bead coloured by cobalt. Both this bead and three others, KCH 2011 L7 3, 14, and 15 have an m-Na-Ca-Al composition similar to that found in layer 4, with Al_2O_3 less than 5 wt%. Two of these beads are opaque green coloured by copper and tin, while the third is pale blue, coloured by iron. The remaining beads were made from m-Na-Al 1 glass similar to that found in layer 4.

The compositional variability of m-Na-Al 1 glass reflects production over a long period of time and in several locations. At present there is evidence for primary m-Na-Al 1 production in South India, possibly at several sites, including Giribawa in Sri Lanka, where beehive-shaped furnaces have been found and partially excavated (2022, Department of Archaeology, University of Kelaniya and German Archaeological Institute). We wondered if it might be possible to suggest production areas for the m-Na-Al 1 beads found at Kuchchaveli. In order to do this we compared the Kuchchaveli samples with our own, mostly unpublished, compositional data for 284 m-Na-Al 1 glasses from South India (Manikollai (MKI), Alagankulam (ALG), Porunthal (PTL)) and Sri Lanka (Kuchchaveli (KCH), Jetavana stūpa 3-6c (JTV), Giribawa (GIR), Mantai (MTI)), using the multivariate statistical techniques of Principal Components Analysis (PCA) and Cluster Analysis (CA) applied to the variables MgO, CaO, Al_2O_3 , $\text{Al}_2\text{O}_3/\text{CaO}$, V, Cr, Sr, Y, Zr, Cs, Ba and U. While full results are beyond the scope of this report, Tables 2a and 2b show the sites represented and the distribution of samples from each site. For this comparison we included only those samples with colours like those of the beads from Kuchchaveli, since for m-Na-Al 1 glass the compositions may be influenced by the intended colour. Because of the large number of samples as well as the overall similarities of the compositions, PCA analysis, while suggestive, did not provide clear separation into groups, particularly when viewed with a two-dimensional plot. On the other hand, three-dimensional plots based on the first three principal components did suggest a clear difference between most of the South Indian and Sri Lankan samples.

Cluster Analysis provides another way to look at similarities between samples. We explored the same samples and variables listed above by CA using Minitab 21.4.2 statistical software, set for the same 'average' distance clustering algorithm that we have found helpful for other datasets. At the 80% similarity level most of the samples fall into two large groups. Group 1, the larger of the two, contained most of the South Indian samples while the bulk of the Sri Lankan samples, including most of those from Kuchchaveli, were in group 2. Further definition of the clusters at 85 to 90% similarity levels provided even better separation of the South Indian and Sri Lankan samples. Sample distribution by site and group is shown in Tables 2a and 2b.

While approximately 90% of the glass analysed from Kuchchaveli, Jetavana and Giribawa has more of a Sri Lankan than South Indian composition, Mantai, where 70% of the samples are closer to South Indian glass, is a striking exception. This difference may reflect Mantai's role as a port linking South India with Anuradhapura and the important

role that merchants from Mantai played in international exchange. Giribawa was both a primary production centre and a working centre for making beads and bangles. There were two main groups of samples recovered from Giribawa: reddish-brown glass associated with probable primary production furnaces and finished glass in the form of beads and small fragments. We included only the beads and finished glass in our comparisons since there was no red glass analysed from Kuchchaveli. Even so, only 11% of the beads and glass fragments recovered from Giribawa had a composition more similar to that from South India, indicating that most of the production at Giribawa, whether primary production of glass or secondary production of objects, was based on local material.

Table 2a. Glass sample distribution by site

| site | Group 1 | Group 2 | Total | % Total |
|-------|---------|---------|-------|---------|
| KCH | 2 | 27 | 29 | 9% |
| JTV | 5 | 63 | 68 | 22% |
| GIR | 4 | 34 | 38 | 11% |
| MTI | 55 | 21 | 76 | 24% |
| MKI | 63 | 4 | 67 | 21% |
| ALG | 17 | 3 | 20 | 6% |
| PTL | 19 | 0 | 19 | 6% |
| Total | 201 | 112 | 313 | 100% |

Table 2b. Percent of samples from each site in groups 1 and 2

| Site | Group 1 | Group 2 | Total |
|------|---------|---------|-------|
| KCH | 7% | 93% | 100% |
| JTV | 7% | 93% | 100% |
| GIR | 11% | 89% | 100% |
| MTI | 72% | 18% | 100% |
| MKI | 94% | 6% | 100% |
| ALG | 85% | 15% | 100% |
| PTL | 100% | 0% | 100% |

We looked more closely at the Kuchchaveli beads to see if there might be any relation between the glass type and excavation level. Based on the clustering method and variables used, 18 of the 27 group 2 (probable Sri Lankan origin) beads from Kuchchaveli were very similar (at the 90% similarity level) to beads from Giribawa or Jetavana, both representing possible primary glass production zones. While there was ‘Giribawa’ and ‘Jetavana’-type glass in both levels 4 and 7, only two of the very-similar beads were from Giribawa and the rest were from Jetavana. This result suggests a strong link between Kuchchaveli and Anuradhapura in the mid-1st millennium CE, with a

less direct link to glass coming from Giribawa. The actual dates of the glass production at Giribawa are not well defined, but the Kuchchaveli data may suggest that by the mid-1st millennium glass production at Giribawa was less important.

Group 2 also included the small cobalt-blue glass bead KCH 2011 L7 2. The dark blue cobalt colour is rare to non-existent in m-Na-Al glass, and the higher CaO (6.7 wt%) and lower Al₂O₃ (2.5 wt%) are distinct as well. This m-Na-Ca-Al composition, as well as the cobalt-blue colour, is quite common in glass excavated near the Jetavana stūpa, indicating a probable Sri Lankan origin for this bead as well. In addition, six other Kuchchaveli samples from both levels 4 and 7 share a similar higher-CaO, lower-Al₂O₃ composition, with Al₂O₃/CaO ratios close to or below 2.0, a useful cut-off between m-Na-Al and m-Na-Ca-Al glass types. For this study we did not include m-Na-Ca-Al samples from various sources so it is not possible to determine the source of the Kuchchaveli m-Na-Ca-Al samples, although Anuradhapura would be a good guess since most of the m-Na-Al glass appears to be closely linked to glass found at the Jetavana stūpa.

The similarity of the Kuchchaveli glasses to those from other sites in Sri Lanka highlights the internal circulation of glass beads during the period that Kuchchaveli was an active site. While the high percentage of South India-type glass at Mantai indicates a more direct involvement in Indian trade, the samples from Kuchchaveli may represent either domestic use or a limited glass exchange, perhaps destined for elsewhere in Sri Lanka or even Southeast Asia. Future excavations at the site, with examination of the glass evidence using a similar analytical technique, will help us to better understand the details of glass usage at Kuchchaveli.

Faunal Remains from Kuchchaveli

The following system was used to identify and analyse the faunal remains from Kuchchaveli.

1. NISP i (Number of identified Specimens i) where all the bones could be identified into the species.
2. NISP ii (Number of identified Specimens ii) is the bones which could be identified to the species that are classed as belonging to large animal or smaller ruminant
3. UF (unidentified) the third category is the unidentified bones.

The total number of animal bones and shells found from the Kuchchaveli archaeological excavation site is 5115. Of the total identified remains, 4033 remains were identified as vertebrates whereas 1095 remains were identified as invertebrate remains. Comprising five layers, the maximum number of bones are 2522, maximum number of shells is 1090, and maximum number of crustaceans is 6. Bones identifiable by element is a considerable 1431, whereas the number of unidentifiable fragmented bones may be

due to human and taphonomic activities. Approximately 60 species of animals have been identified, which include mammals, reptiles, birds, molluscs, crustaceans, and fish. There are seven taxa that have been identified as domesticated animals, which include *Capra hircus*, *Canis familiaris*, *Felis catus*, *Equus caballus*, *Equus asinus*, *Bos indicus* and *Gallus domesticus*. These taxa reflect the nature of the economy and life ways of the Middle Historic Kuchchaveli settlement.

Based on the identification process and the nature of the collection we suggest that the majority (75%) of faunal remains were deposited as a result of human activity, highlighting the broad nature of the economy and subsistence patterns during the Middle historic period at Kuchchaveli. It is also observed that both wild and domesticated taxa are represented as food items. Of the identified mammalian fauna in the faunal collection, wild taxa such as *Axis axis ceylonensis*, *Cervus unicolour*, *Sus scrofa* are by far most abundant and these remains represent food items in the presence of cut-mark. It is also evident that the reptiles such as *Melanochelys trijuga* and *Lissemys punctata* hunted for meat. Importantly it is probable that their carapace and plastron had been burnt and crushed as a part of food processing before consumption. Of particular interest is the identification of a fragment of ivory from an elephant, which indicates the Middle Historic trade network and craftsmanship industry based on ivory products.

A large collection of mollusc taxa is reported (*Aulopoma*, *Cypraea*, *Pila globosa*, *Bellomya*) Some mollusc types are still found in the vicinity of the site and are indicative of the natural environment's similarities. Lagoon habitat and brackish water area shells such as *Meretrix casta*, *Donx*, and tropical and warm water dwelling taxa (*Olive*, *Aliger gigas*: and *Neverita sp.*; *Polinices sp.*: found in all coral reefs sandy deep water a dwelling shell (*Turbinella pyrum*). Interestingly, among the mollusc taxa lagoon habitat shell namely *meretrix casta*, and *Donx sp.*: are the most abundant in the collection and these remains represent edible food items. Large quantities of shallow coastal species, especially *Olive sp.*; *cons?conch? sp.*; *Nerta* and *Turbinella pyrum* were identified and quantified. These snails are well known for their colour and selected for their attractiveness. Some of the snails, in particular deep sea water dwelling *Turbinella pyrum*, appear to have been used for making bangles by sawing the body whorl as described by Carswell and colleagues from the Mantai excavation (2013). (See Supplementary Materials for detailed zooarchaeological data and observations)

Photos by Ariane de Saxcé unless otherwise stated.

Acknowledgments

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References

- Bopearachchi, O. (2002). « Les relations commerciales et culturelles entre Sri Lanka et Inde du Sud : Nouvelles données archéologiques et épigraphiques. », *Cahier du cercle d'études et de recherches sri lankaises*, 4,, 2002, pp. 1-1-16.
- Bopearachchi, O. (2006). "Coins." In *Anuradhapura: The British-Sri Lankan Excavations at Anuradhapura Salgaha Watta 2*, British Archaeological Reports (BAR), edited by R. Coningham, Oxford, 2006, pp. 7-26.
- Bopearachchi, O. (2008)., "Sculptures of Amaravati Tradition in Sri Lanka.," *Journal of the Asiatic Society* L, no. 4, 2008: 1–26.
- Bopearachchi, O. (2012). "Andhra-Tamilnadu and Sri Lanka: Early Buddhist Sculptures of Sri Lanka.," in *New Dimensions in Tamil Epigraphy* (Chennai: Cre-A, 2012), 49–68.
- Bopearachchi, O. (2014). Sri Lanka and Maritime Trade: Boddhisattva Avalokiteśvara as the Protector of Mariners. *Asian Encounters, Exploring Connected Histories*, 161–87.
- Bopearachchi, O. (2020). *Roots of Sri Lankan Art*, Colombo: Department of Archaeology.
- Carswell, J., Deraniyagala, S U., Graham, A.H. (2013). *Mantai: City by the Sea*. Aichwald: Linden Soft Verlag.
- Deraniyagala, S.U. (1972)., "The Citadel of Anuradhapura 1969: Excavations in the Gedige Area.," in *Ancient Ceylon* 2, 1972, pp. 48-170.
- Deraniyagala, S. U. (1986). Excavations in the Citadel of Anuradhapura: Gedige 1984, a Preliminary Report. *Ancient Ceylon* 6,39-48.
- Dussubieux, L., Gratuze, B., Blet-Lemarquand, M. (2010). Mineral soda alumina glass: occurrence and meaning. *Journal of Archaeological Science*. <https://doi.org/10.1016/j.jas.2010.01.025>
- Dussubieux, L (2021). Indian Glass in Southeast Asia. In: Kanungo AK, Dussubieux L (eds) *Ancient Glass of South Asia: Archaeology, Ethnography and Global Connections*. Springer, pp 489-510. <https://doi.org/10.1007/978-981-16-3656-1>
- Jayasuriya, M. H. F., Prematilleke, L., Silva, R. (1995). *Mañjuśrī Vāstuvīdyāśāstra: Romanized Transcript with a Tentative Edition, English Translation, and Studies*. Colombo: The Archaeological Survey of Sri Lanka.
- Paranavitana, S. (1933). . Rock Inscription. *Epigraphia Zeylanica* III, 158–61.
- Schenk, H. (2006). The Dating and Historical Value of Rouletted Ware. *Zeitschrift Für Archäologie Außereuropäischer Kulturen* 1,123–52.
- von Schroeder, U. (1990). *Buddhist sculptures of Sri Lanka*. Hong Kong: Visual Dharma Publications.