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**Excavation of a unique sailboat at Kadakkarappally, Kerala**

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Recent archaeological excavations at Kadakkarappally, Kerala have exposed an interesting sailboat in a partly intact condition. The method of construction adopted in the boat, which has no known parallels, and the well-preserved condition of the wood, considering the hostile environmental conditions prevailing in India, make this a unique find. The preliminary findings of the excavations are presented here.

KADAKKARAPPALLY is a sleepy village lying about 1.5 km from the Arabian Sea coast, around 30 km south of Kochi near Taikkal, Cherthala Taluk, Alappuzha District, Kerala (Figure 1). This part of Kerala is well known for backwaters and canals. The Vembanadu Lake, which separates the Alappuzha land-stretch from the mainland, opens to the Arabian Sea close to Kochi (Cochin).

Existence of the boat was first brought to notice by the local people, who dug a paddy field for coconut cultivation in the 1990s. It is reported that the stern end of the boat was destroyed by the local people who dug up this area, expecting some treasure. Subsequent explorations by the Department of Archaeology, Government of Kerala, have ascertained the existence of the boat and excavations were conducted in 2002 and 2003 by the Centre for Heritage Studies, Tripunithura and the Department of Archaeology, Government of Kerala. Two trenches (KPY I and KPY II) were excavated at this site – KPY I (30 m × 12 m) revealed the boat and KPY II (10 m × 5 m) was excavated to study the local stratigraphy (Figure 2). Since the site was completely waterlogged, the excavation progressed slowly and pumps were used to drain the water during the excavations.

The intact portion of the double-mast, flat-bottomed sailboat measures about 18.70 m in length and 4.05 m in width (Figure 3a and b). The double-hulled boat, which is divided into 11 compartments, has a pointed bow, and the stern and upper parts of the hull are damaged. The boat has its maximum width amidships. The shape of the stern is not clear, but it appears to have had a transom. The wooden pieces that formed the stern end are no longer in

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their original position. The actual length of the boat could have been around 21 m. Both the masts have been destroyed, but the mast steps are intact. One mast step is at the centre of the boat and the other is in the bow portion (Figure 4).

The method of construction of the boat is remarkable and unique within the region. The strength within the construction comes from the two chines (L-shaped transition strakes positioned between the floor and the wall). They form the junction of the wall and floor of the boat. Both the chines measure approximately 14.5 m in length. Each of them has been carved out of a single log of wood. The hull of the boat has two layers of planking/strakes. The inner hull is about 8 cm in thickness and the outer is 7 cm. Ten frames, measuring 22 cm in height, 35 cm in width and with varying length, divide the boat into 11 compartments and support the hull. The frames have been inserted into the socket-like features carved into each chine. The wooden planks that separate the compartments have been inserted in the middle of the frames to form bulkheads (a vertical partition, either fore or aft, dividing the hull into separate compartments). Several iron and wooden nails (tree nails) of various dimensions have been used in the construction. Many of the iron nails seem to be a type of clenched nails. They have square roves on the inside of the inner hull, which appear to secure the outer hull to the inner hull. The wooden nails (tree nails) have square sections. At a few places caulking has been done with a kind of cementing material. Several cleats (Figure 5) have been carved into the inner hull of the boat for inserting ropes. The same appear inset into the floor of the boat. The cleats and the inset cleats were perhaps meant for lashing the inner hull with a rope to provide additional strength to the boat. A few rope fragments still remain within the inset cleats. The mast steps are attached to the frames. The mast steps have sockets for fixing the mast, but these are remarkably shallow with a depth of only about 5 cm. Evidence of repair is seen at two places. This indicates that the boat was used for a long time. A large quantity of shells (window pan oyster, Territella and Sunneta) was also recovered from the boat. Shipworms (T. navalis) have extensively eaten the exterior, bow parts of the boat. Shipworm infection is also seen on the interior of the boat, suggesting that it is post-depositional in nature.

A preliminary survey of the contemporary boat-building techniques along the Kerala coast reveals that no exact parallels for the method of construction adopted in the boat are prevalent. According to Greeshmalatha and Victor Rajamanickam, about 51 types of traditional vessels falling into the categories of (i) raft, (ii) dugout and (iii) plank-built (subdivided into stitched plank-built and nailed plank-built) are found in Kerala1. However, we are not sure of the antiquity of these 51 types of traditional boats.
Only a few of them appear to have a longer tradition. Most of the traditional boats of Kerala use the stitching method and the nailed plank-built boats are popular in Ernakulam, Alappuzha and Kollam districts. Maccuva and uru are the important nailed plank-built boats. The former is used for ferry services and transportation, while the latter is a cargo vessel made by Arab traders at Beypore near Calicut. Curulan, iruttukkutti, kovallam, palliyodam, odi and cundan are nailed plank-built boats used for racing.

A large amount of pottery and animal bones were found in the excavations. But stratigraphic evidence reveals that they were intruded materials, deposited during the later periods. The artefacts recovered from the boat include iron nails and rope fragments, which were used in the boat’s construction, and a dressed stone measuring about 83 cm × 34–22 cm × 27–18 cm with a weight of 128 kg (Figure 6). The stone found in the fourth compartment (from the bow end) of the boat, was made out of beach rock or kankar stone. The purpose of the stone, which is narrow at the top and broad at the bottom, is not clear. It could have been used as an anchor. However, it does not have any hole to fasten the rope, like other stone anchors found in the eastern and western coasts of India. Perhaps, the rope was tied around the stone or the part with the hole was broken. It might have served as a ballast, or may not be associated with any specific function of the boat. The raw material of the dressed stone is not exposed in Kerala. The excavations revealed patches of a somewhat similar rock type at a depth of about 3.20 m below the surface level in the trench itself. However, the rock patches found in the trench are younger in age compared to the material used for the dressed stone from the boat, as indicated by the hardness and texture.

Identification of the wood samples from the boat reveals that mostly Artocarpus hirsutus Lamk. (anjily in Malayalam) was used for building the boat. Anjily is a common tree in Kerala and it is even now used for building boats in this region. Of the nine wood samples identified, seven belonged to anjily. One fragment has been identified as Cassia fistula Linn. (kanikonna in Malayalam), and the other, Rhizophora mucronata Poir. (panchikandal in Malayalam). C. fistula has been used for bulkheads, and the last-mentioned species was found in the form of a peg inserted into the perforation in the bulkhead, perhaps post-dating the construction of the boat. The samples were identified by Birbal Sahni Institute of Palaeobotany, Lucknow, and Kerala Forest Research Institute, Peechi (Trissur District, Kerala). As mentioned earlier, the chines indicate that one or more trees with a minimum diameter of around 1 m and a length of 14–15 m were used for making the boat. Anjily trees of such size are common in Kerala. All these species are indigenous, which clearly suggests that the boat was made locally.

Radiocarbon dating of two wood samples from the boat by Birbal Sahni Institute of Palaeobotany and Beta Analytic Lab, USA indicates that the wood used in the boat could be about 700–1000 years old. The first sample (BS-1982) yielded a date of Cal ad 920–1160 average 990 ± 70 years, while the second sample (beta-179729) gave a date of Cal ad 1020–1270. The second sample was taken from the outermost part of the western chine-strake of the boat. It is not known whether the samples are from sapwood or the outer edge of the heartwood. The dates obtained from the sapwood are likely to be later and closer to the time the tree was cut down than those obtained from the heartwood. On an average, an Anjily tree would take at least 40 years to attain the size of 1 m dia-

*Figure 5.* Mast step in the bow.

*Figure 6.* Stone anchor (?).
There is a view that the boat could belong to the port-ru-
period of the 12th and 15th centuries. Dates, the boat can tentatively be placed within the time
of boat building in ancient India. Bhoja, scholars are of the view that nails were not
nails are used extensively in boat making only after con-
guese period, based on the premise that in India, iron
wood, we can provide a margin of 200 years for the con-
struction of the boat. Thus, if the date of the wood falls
between AD 920 and 1270 as indicated by the radiocarbon
dates, the boat can tentatively be placed within the time
period of the 12th and 15th centuries AD.

There is a view that the boat could belong to the Portu-
guese period, based on the premise that in India, iron
nails are used extensively in boat making only after con-
tact with the West. Based on the observations found in
Yuktikalpataru, a medieval literary text ascribed to Raja
Bhoja, scholars are of the view that nails were not used for
boat building in ancient India. This text says the
stones with magnetic properties found in the sea will
attract the iron nails in the boat, and the boat will sink if
iron nails are used. Several works and scholars report that
Indians did not use iron or nails in boat-building activi-
ties (e.g. Fra Pauline da San Bartolomeo, Voyages to East
India). We are not sure how far the statements of these
texts are true with regard to the use of iron nails in ancien-
t Indian boats. There is a possibility that iron nails
were used in some of the Indian boats during the pre-
modern period. Lallanji Gopal suspects the use of nails in
a ship depicted in Cave No 17 at Ajanta. Only further
research can offer us clean evidence about the use of iron
nails in boats in ancient India.

How did the boat come to its present location? It is not
clear why the boat was abandoned. No obvious evidence
for any major damage was noticed from the intact portion
of the boat. Probably, the upper part of the boat, which is
no longer intact, was damaged leading to abandonment of
the boat. Or, perhaps the boat was caught in a storm and
got trapped in an area from where it was not easily
recoverable. In normal circumstances, such a boat left on
the beach or in an accessible area would have been
reused by the local population. The boat might have de-
veloped irreparable multiple leakages before it was aban-
donned. The innumerable nails used for joints could have
also been one possible source of leakage, as most of the
nail heads have traces of cementing material, which
appears to have been applied to prevent seepage of water.

Another issue to be resolved is whether the boat lies
close to the ancient coastline or away from the coast in
the bed of an ancient canal. Kadakkarappally is about
1.5 km away from the present-day sea coast. Most prob-
bly, the coast was further inland when the boat was de-
serted. Geological studies reveal fluctuations in sea levels
over the years. If the boat was indeed abandoned on the
beach, it could have been easily recovered and reused by
the natives. Therefore, it is quite feasible that the boat
was deserted close to the ancient coast, but in a water-
logged, inaccessible area. Most probably, this area was a
backwater when the boat was abandoned. These conge-
nial conditions contributed to the preservation of the
boat. The well-preserved condition of the wood in the
boat suggests that this area has been continuously water-
logged right from the final abandonment of the boat.

The exact purpose and nature of boat could not be as-
certained, as sufficient evidence is not available. How-
ever, from the design of the boat, certain conclusions can
be arrived at. The boat has a flat bottom, which is not
considered suitable for deep-sea voyages. Based on the
design, it can be suggested that the boat was meant for
inland transport and coastal voyages. The Vembanadu
Lake, which is a major inland water body in this region,
is close to the boat site. Thus, it can be concluded that it
could have been used for transportation on the Vemba-
nadu Lake and the adjacent coastal areas.

The Centre for Heritage Studies is conducting further
research on the boat. Probably, no such well-preserved pre-
modern boat has been found anywhere in India. One such
boat is reported to have been found in Orissa. The exact
nature and condition of the boat is not clear. The technol-
ogy used in the boat is unique. Hence, it is an important
find that needs to be conserved for posterity. Efforts are
on to lift the boat and conserve it in a museum. However,
it will be a mammoth task, as the costs of conservation
and maintenance will be considerably high.

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