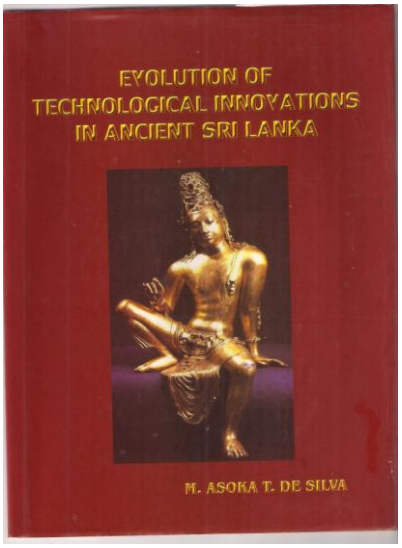

2011

"Evolution of Technological Innovations in Ancient Sri Lanka"

M.Asoka T. de Silva.

CHAPTER 9

SHIPS- AND SHIP-BUILDING IN SRI LANKA

With particular reference to

A VERNACULAR NAVAL ARCHITECTURAL IDIOM

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Introduction

The present paper is another step on my ongoing search for the form and structure of pre-modern Sri Lankan ships. (Devendra: 1987, 1990, 1990b, 1990d, 1993, 1995, 2001, 2002). Up to now, I had tried to widen the scope of my search, to gather as much data as I could find. Now I have narrowed my focus, in the light of new discoveries, and even departed from conclusions I had arrived at earlier. So that the lay reader may be able to follow my argument I have tried to limit the use of technical terms – or, at least, to explain them –, and include, as end notes, longer quotations from sources not readily available: it is for that lay reader, and not an already knowledgeable one, that this paper is presented. I hope I succeed.

(NOTE:I have depended on many sources for relevant photographs and the source of each is acknowledged at the end of the paper)

In the last of my papers I concluded:

"I personally believe that the *yāthrā dhōni* of Dodanduwa is the oldest of the pre-modern craft that survived into this century".

The first part of this paper carries this argument forward, focusing on the particular line of development that produced a vernacular, or homegrown, naval architectural idiom the development of which can be traced in sequence from ancient times to the 20th century. I have drawn heavily on an earlier study (Devendra 1995: 211-238) which dealt with inland watercraft (boats, not ships) as it is there that I first postulated this evolutionary process: here, I extend it to include seagoing craft, which are products of the same evolutionary process as boats. As this true vernacular tradition was completely destroyed by the tsunami of 2004 this is a Requiem of sorts.

The paper begins with **Preliminary Remarks,** which recapitulates the hypothesis I had drawn up as a starting point, the path I followed to test it, and the outcome. Next, **Part 1** deals with the vernacular naval architectural idiom and seeks to describe the evolutionary path followed. **Part 2** explores some lesser known facets of the socio-technological context within which shipbuilding and seafaring were carried on in the country. **Part 3** describes the form and structure of pre-modern ships – both within and outside the vernacular idiom – which had existed and survived into the twentieth century some of which may, arguably, point to another major tradition that we have lost. In my **Concluding Remarks** I draw on new material which leads me to question my earlier conclusions, to arrive at new conclusions and to sketch out a line of inquiry to be followed in the future.

PRELIMINARY REMARKS

A Recapitulation

Based on the evidence of non-modern watercraft surviving up to the time I commenced this study, I started with the following assumptions:

- Northern Sri Lanka and Southern India shared cultural and technological links stretching back to pre-historic times, but this shared naval culture was localized, and did not develop as a mainstream naval technology.

- A vernacular tradition developed in the southern part of the country from the dual element craft (dugout *plus* outrigger and the twin-hulled dugout configurations). This form arose from an interaction of the inshore maritime environment with the biological resources available. When, vessels ventured beyond coastal waters, the basic forms changed to meet the new challenges.
- In coastal areas contact with foreign ships and sailors proliferated and Sri Lankans encountered ships types that had been developed in other regions. Techniques and features seen on them, and thought to be useful to us, were superimposed on our original base form without changing its essential identity.

However, at the time my studies began, neither the form of the most advanced ships of this vernacular idiom nor the sequence of its evolution had been identified. I needed to develop a methodology.

Designing a testing mechanism

I had, first, to gather all available references to actual ship construction or, at least, to particular structural features. Since most written records of ships are in poetic language which provides little specific detail, they could not be taken at face value. For this study they would have to be specific and credible. Some of these references, notably those of Onesicritus and Pliny, met these requirements. Strabo, for example, quotes Onesicritus as observing that the ships seen by him sailed badly "since their sailing gear is inefficient and they are built without belly bolts on either side". Again, Pliny says: "The sea…is shallow, not more than six yards deep but in certain channels so deep that no anchors touch the bottom. For this reason ships have prows at either end so they do not need to turn about in the narrows of the channel" (Weerakkody: 1997). The former demonstrates a sailor's sharp eye for details of structure and rigging. The latter observes the utility of the double-ended form – yet evident in our fishing craft - which make it unique among sailing craft. But even such references could not be accepted without testing, and had to be compared along with both the hard evidence available (however meager), and an objective framework of reference, before being accepted.

What I considered "hard" evidence was:

(1) visual, graphic and three-dimensional representations i.e. paintings or carvings by competent artist-craftsmen who were not unfamiliar with ships and boats;

(2) models of ships (preferably those made by seamen);

(3) technical drawings;

(4) non-technical drawings, by artists with a knowledge of perspective and an eye for detail;

(5) early photographs;

(6) existing craft of pre-modern design.

Such evidence was, naturally, scarce in respect of ancient and medieval craft, but there was a surprising amount concerning the last 200 years, and it was this material I had to collect and assess. If the exercise revealed a common and technologically feasible 'basket' of characteristics, I could move on to the next step where they could be tested against evolutionary and analytical models of watercraft, designed by accepted authorities and based upon structural characteristics. Only if they passed the tests could I assume that the identified characteristics were the product of a specific, coherent line of development. Carrying the argument further, if development had followed a straight line I could expect the common characteristics would have been present, even if in a less developed form, in craft older than 200 years. Further, if the craft were already technically advanced 200 years ago, then they may have represented the apogee of Sri Lankan ship-building. On the other hand, if they showed a lowering of standards and sophistication, then the apogee would have been passed, and a technological decline from a "high" to a "folk" technology would have occurred during the last 200 years.

I had, therefore, to search for common characteristics, analyze them, and project the search backward in time from the known to the unknown.

I expected the Test to yield the following results:

(1) a typology of surviving traditional watercraft with pre-modern characteristics;

(2) define the basic characteristics of both seagoing and inland watercraft; and

(3) point towards a likely evolutionary path.

Searching for the 'hard' evidence

The 'hard' evidence I preferred has been listed above, and my search in libraries and museums from around the world, and latterly from the Internet, yielded satisfactory results. The available technical drawings were good, notably those by Paris (1841) and Edye (1834), but few. Models were the best source as they could be studied in the round. Those built by sailors were very accurate. Old photographs were also objective if well preserved. Engravings, sketches and paintings were better preserved, but could be less accurate

Other evidence that was to prove very useful was the remains of sunken boats in rivers and waterways. Their value was that they were not only actual artifacts, but also as scientific studies had been done on some of them.

There were, of course, the fishing craft that were yet in use when I began my study. Since then, most were destroyed by the tsunami of 2004 but the study and recording of the last of them by Gerhard Kapitän (2009) in the 1985-1995 period, with measured drawings, photographs and a classification was published. I was convinced that this work was of immense value and would – as it has – afford the necessary objective recording that I needed and, therefore, assisted in its publication as the author himself was physically constrained and unable to complete it. I would like to place on record and acknowledge my debt to his hard work and hands-on knowledge.

Finally, there was the evidence from traditional ships that survived into this century, on some of which I had had some 'hands on' experience.

Unfortunately, my greatest loss was a very important and definitive piece of evidence. That was the "technical manuals". They did exist in Sri Lanka. None, it appears, were written down but the possibility that they could have been exists. In neighbouring India Raut and Tripati, citing a personal communication, say

> "The Department of Archaeology, Govt. of Orissa, … collected a number of palm-leaf manuscripts mentioning the details of such as how to lay the keel, stern, stem, ribs and cabins. The manuscript also mentions the time to start the building work, technical terms of each part and other details". (Raut & Tripathi: 1993)

What did survive in Sri Lanka, till at least the 1930s was the older oral tradition. All Sri Lankan learning and technology (including the *Mahavamsa*

and the *Tripitakas*) was passed down the generations via the apprenticeship system of training; either through a father-son link or the *Guru-Shishya Paramparāwa* (teacher-pupil continuum). The late Mr.C.D.S.Siriwardena, Attorney and sometime Ambassador to the U.S.S.R., related an experience in the late 1930s when, with a group of Colombo schoolboys on a field trip to Panadura, he had visited a boat-yard where 3-masted schooners were being built using traditional technology. When asked about the rules followed regarding size, proportions, form, etc. the master craftsman had recited a series of Sanskrit *Ślokas* (Sanskrit was the language of science and technology in those days and *Ślokas* are metric verses designed for learning by rote). In a *déjà vu* scenario, about eighteen years ago, I asked the same question in a traditional Arab Dhow yard. The answer was that there was nothing written down: the keel-log, which was the most valuable item, set the proportions. After its ends had been squared-off, its useable length determined the rest of the dimensions, with the design and proportions borne in the eye of the builder.

A tool for the test: a framework of reference.

I now required a framework against which I could test my hypothesis. In fact, I needed two: one which analyzed watercraft as an artifact and another which would trace the evolution of watercraft. Since my study was to be analytical rather than merely historical these frameworks had to be non-specific to Sri Lanka, or even the region, to possess a universal validity; and be the work of authorities recognized as definitive.

The first model I selected deals with the structural classification scheme for watercraft, first proposed by Sean McGrail (diagram by the National Maritime Museum, Greenwich) which is given below as Fig.1.(below) This analyses all forms of water transport by posing questions and, according to the "yes" or "no" answers, selecting the mainstream of development from the generic form of "Water Transport" to the specific form of "Boats". In the process, "Floats" (where buoyancy is applied directly to the man using the device) and "Rafts" (where buoyancy is derived from the flotation characteristics of its individual elements) are differentiated from "Boats" (where buoyancy is

derived from their construction as a hollow structure with a continuous outer surface).

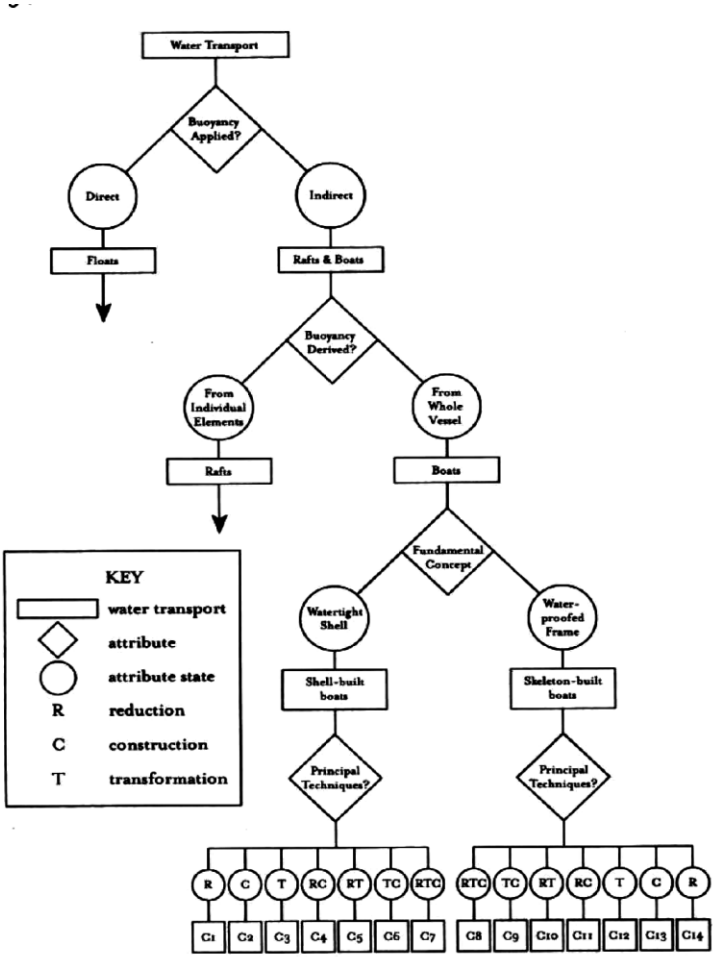


Fig.1. Structural classification scheme for water craft – mainly boats.

The model further divides "boats" into two classes: "Shell built" (i.e. 'a watertight shell') or "Skeleton built" (i.e. 'a waterproofed frame') Each of these classes can be further modified by one or more of three processes called "Reduction" (i.e. by reducing the volume, such as by hollowing a log), "Construction" (i.e. by adding on other elements, such as planks and outriggers) and "Transformation" (i.e. by altering the natural form of the base material, such as by warping, or "twisting", the planks etc.). There are seven variations possible for each, and are numbered from C1 to C14.

The next model (Fig. 2, below), devised by Phillips-Birt (1979), is akin to a "genealogical tree" of watercraft. It recognizes four stages in development, namely, "Floats" (which includes Rafts), "Primitive Boats", "Wood Planked Boats" and "Boats of Metal or Plastic".

This model is easily understood and its function, alone, needs to be explained. It is used to compare the forms and constructional techniques identified in traditional Sri Lankan craft against those that are common elsewhere. This helps trace the path followed by us from among the several alternatives that existed. The path we did follow begins with a "log", which is transformed into a primitive boat as a "dugout" (example: *pilā–oru* of inland waters), from where it divides into a "dugout + planks" (example: sea-going *oru*) and a "multi-hull dugout" (example: *añgula*). The "dugout + planks" eventually develops into "shell construction carvel" (example: *yāthrā dhōni*) while the "multi-hull dugout" develops into a "multi-hull, planked" (examples: *pāru* and *mā-däl-pāru*) beyond which it does not develop. We have also had "rafts" which developed into "shaped raft, log" (*theppam, kattumaram)* and "shaped log, bamboo" (*pahura)*, neither of which progressed any further.

[NOTE: As the term "carvel" appears here it is necessary to explain that it means that the planking of a boat are placed edge-upon-edge. Where the planks overlap each other, the term used is "clinker"]

Results of the Test

The first result that emerged from the search was that there was only one base form in the vernacular idiom: the dugout log.

Common characeristics

The next was the identification of common characteristics (Devendra: 1990). The hard evidence collected pointed to the following features as being common to all existing craft (not including removable fixtures):

The dugout log was the basic unit of construction

The dugout itself was extended vertically by planks sewn-on to the gunwale

A single outrigger balance log was attached to the dugout

Evolutionary paths

Using Fig. 8.2 as an evolutionary framework, it was possible to trace two separate paths:

Path # 1(*designation: PARU):*

Log –> dugout log –> multi-hulled dugout –> multi-hull, plank and dugout

Path # 2 *(designation: YATHRA)*:

Log –> dugout log –> dugout with plank extensions plus single outrigger –> shell construction, carvel

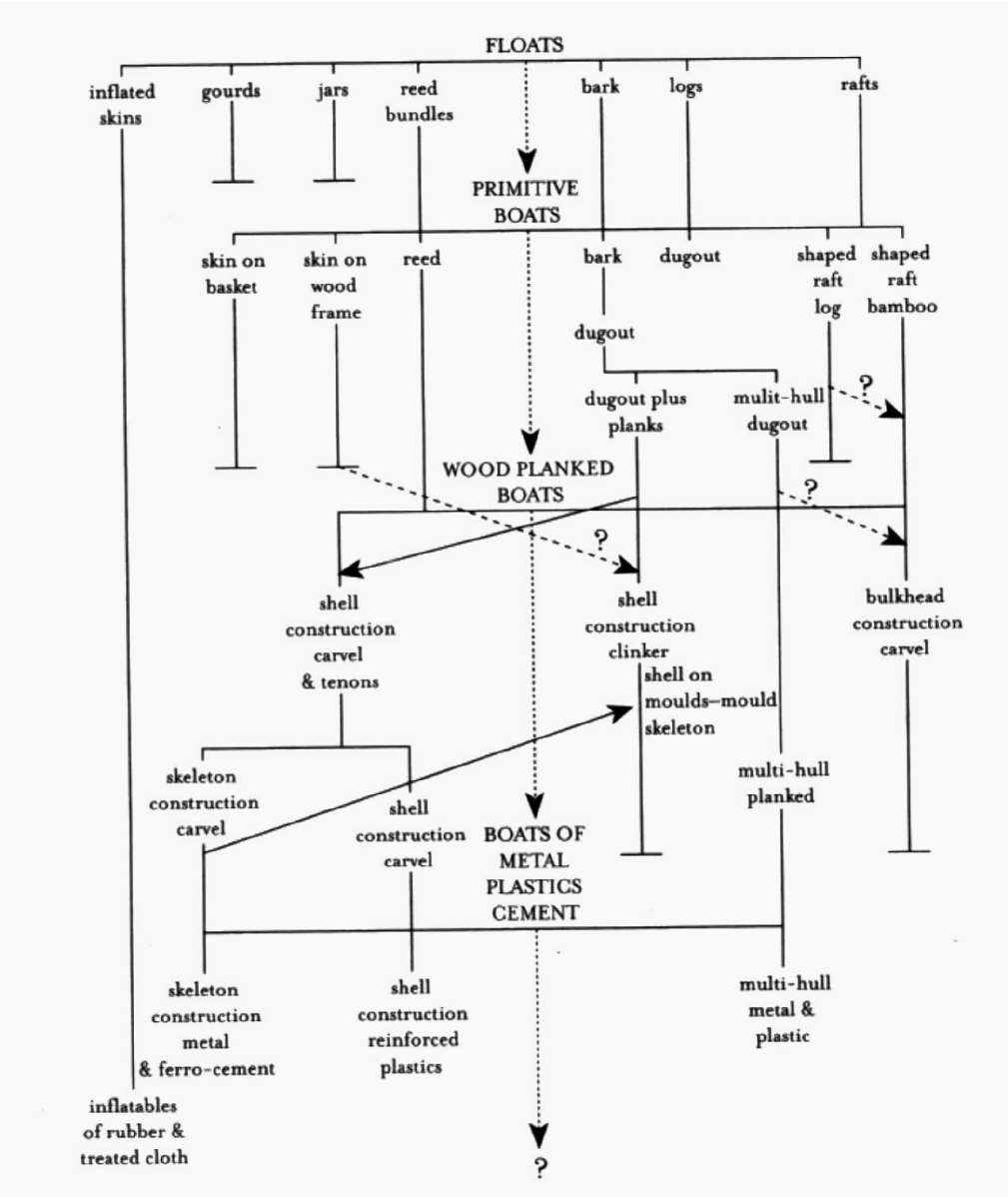


Fig.2. Evolution of constructional techniques

The resultant composite hull was shell-built, of carvel construction

These paths were common to both sea-going and inland craft, save for the last stage of Path # 2, which was found only in sea-going craft.

I concluded that:

1. Pre-modern craft were carvel built of shell construction, using sewn plank technology.
2. Hulls were double-ended, fitted with outriggers and square rigged.
3. Even after fore-and-aft rig and rudders were adopted later, the outrigger and the double-ended form were retained
4. The evolution of watercraft in Sri Lanka can be traced in sequence from the *orukañda* + *kollääwa* (i.e. dugout + outrigger) to the *pāru* and the *yāthrā dhōni,* all of which are dual element craft.
5. The *mā-däl-pāru* (an inshore seining boat) and the uncannily similar river *pāru* evolved in parallel, though with some differences dictated by environmental and functional concerns.

Structural characteristics

All known Sri Lankan boats (not rafts) were shell-built. The basic log was modified by the 'reduction' and 'construction', while the 'transformation' process was used more sparingly. Accordingly, they all fell into the categories C1, C2, C3, C4 and C6 of that model (i.e. Fig.1).

PART 1

The development of a vernacular idiom

Environmental factors

Two authorities, from two disciplines, provided me with guidelines. One is the Architect Walter Gropius (1962) whose dictum *"Form follows function"* is simplicity itself and particularly apt in the field of naval architecture. The other is Seán McGrail (1987), seaman turned archaeologist, who said:

> "How a boat is conceived as a three-dimensional object, and how the builder translates the idea into artifact (the 'design' of the boat) are both probably culturally determined; as also is the choice of manufacturing techniques used to convert raw materials into boatbuilding elements. These attributes are thus fundamental to an archaeological or ethnographic inquiry and furthermore may be culturally diagnostic."

The function of a ship was to ride the waves. The environmental and cultural factors that determined its form were:

- Availability of resources and skills: both natural and human
- Knowledge of the marine environment: coastal and oceanic
- Navigational skills

1. Availability of resources and skills: natural and human

Constructional material was easy to find as Sri Lanka has a wealth of suitable timbers. The south-west quarter of the island was, until a hundred and fifty years or so ago, largely under heavy rain forest cover which afforded builders a wide spectrum of timbers. Vitharana (1992), speaking of the last surviving *oruwa* fishing craft, lists twenty-eight different types of wood used for eleven different parts of the craft. Iron and steel were produced locally, and steel adzes used to hollow-out the log boats. But, importantly, iron nails were not used to fasten parts of the boat to each other; coconut-fibre rope being the preferred alternative. Since this palm grew all around the coast of the island there was no shortage of rope. Coconut timber and fibre were widely used elsewhere in the Indian Ocean region, too. Gunawardana (1990), quoting al-Idrisi, says that Arab ships from Oman came here to obtain rope, coconut tree trunks for masts and spars and timber for planking, as well as to place orders for ships which were constructed here. Coconut plantation for commercial purposes, including for the production of rope, had been known from the early years of the Christian era. The first reference is an inscription from the reign of King Mahadathika Mahanaga (9-21 A.D.). That foreigners knew about this is borne out by Aelian, (170-235 A.D) who says that:

> "…this island in the Great Sea which they call Taprobane has palm trees wonderfully planted in rows, just as in lush parks the park keepers plant shady trees." (Weerakkody: 1997)

The form and structure of ships were directly influenced by the availability of resources and skills.

- Timber of large size was freely available and building large ships a viable option
- Coconut rope used, by choice, for 'sewing' the elements together and the tree itself were cultivated commercially for naval use and export

2 a. The marine environment: coastal waters

The coastal waters being the working environment for early seagoing craft, the nature of the coastline and problems specific to these waters influenced ship design. In the micro context these factors were comparatively shallow inshore waters, shelving beaches, off-shore reefs, heavy surf close to land, a negligible tidal range, and prevailing currents and counter-currents. The *West Coast of India Pilot 1975* says.

> "Currents are strong, up to 5-6 knots, abrupt changes occur within short periods or distances, and the major current systems flow parallel to the shore while inshore currents may flow in an opposite direction."

To navigate these waters, the craft had to be of shallow draught and hardy construction with a bottom sturdy enough to withstand abrasion in the sandy shallows and the shelving beaches on which the craft were beached in fair weather. It had also to be able breast or ride the surf while remaining a workboat in form: not a surfboat. The answer was the dual element form of the shallow draught *oru* (the dugout + single outrigger configuration), with no keel. Without an in-built keel hampering the craft, it could cross the reefs without difficulty; the absence also mitigated the effect of winds and currents. Being a shell-built dugout hull with 'sewn-on' extensions, it was a 'flexible' craft able to cope with the torque experienced in the surf. Thus the dual element craft, whether dugout +outrigger *(oru)*, or the large twin-hulled beach seine fishing craft, (*mā-däl-pāru*) were capable of dealing with most of the problems experienced in coastal waters. Neither of them depended on displacement to stay afloat, being of very shallow draught; and the *oru* almost skimmed over the water under sail. The *oru* fast and reasonably stable, but both the *oru* and *pāru* could only be fishing boats: no more. The *pāru* in fact, was a technological dead-end, and the *oru* destined to follow suit.

For the dual element form to progress, it had to overcome a technological barrier: it could not become larger and beamier unless it was radically 'transformed'. In the south, the dugout hull was not transformed, and remained narrow and blunt-ended. This form appears to have been culturally determined as there were no technical constraints to transformation. In the north, for instance, log hulls underwent the process of 'transformation' into the larger *vallam* form using various techniques (Hornell: 1946). In South East Asia there was the double-outrigger configuration (a three element form), which

crossed the Indian Ocean to reach Madagascar and East Africa, (Fig.3) but it left no imprint in Sri Lanka.

Fig.3 The Replica of the "Borobudur ship"

Fig.4 The ship's track across the Indian Ocean

Certainly, this configuration was a very successful one: hence, why was it not adopted – nor emerge – here? While this, too could have been cultural determined, it is also possible that there was practical reason. A double-

outrigger configuration called for a central, deep-draught hull with outriggers on either side. The central hull was of the displacement type that would not have met the requirements of our inshore environment: hence, we persisted with the single outrigger form, suitable for our coastal, or inshore, marime environment. As long as this environment dictated design the dual element form would remain unchanged. Change would come only when form became dependant on the needs of deep-sea sailing.

The most important question for the smaller (fishing) craft was that of securing at an anchorage. These craft did not "drop anchor" in most places, as there was no "anchorage" in the sense the word is used in northern latitudes where great tidal ranges were experienced. Instead, they were hauled up the shelving beaches and beached. With the dual element construction, both elements being made of tough wood, this was easy. The booms attaching the two elements were convenient for the crew to manhandle the boat up the beach. In larger craft, thwarts (or beams) with ends projecting outboard, also served this purpose. This is also seen in many traditional Indian and Arab craft even today. Once on the beach, the dual element craft did not keel over but stood upright on shore, the two elements (hull and outrigger) giving them bi-pedal stability.

There was another hazard the boats had to face: that of the sand spits constantly forming across the entrance to rivers and lagoons. The single outrigger craft were equally at home in, and used along rivers and lagoons. In fact, many of the deep-water fishing fleets, depending on their size, sought shelter either just within the river's mouth or inside the lagoon. Due to reasons dealt with elsewhere (Devendra: 1993), sand spits would form across the entrances, making it difficult for any but the shallowest draught vessels to cross them. Here, again, the round-bottomed dugouts, without a keel or displacement hull, could enter and leave the inland haven by skimming over them at high tide, scraping their tough bottoms in the process.

The form and structure of ships were thus directly influenced by the inshore marine environment.

- A dual element form evolved that enabled "skimming", beaching with bi-pedal stability and crossing the sandpits for work up-river (eliminating the need for different craft for use at sea and on river).

- Use of tough wooden dugout hulls, which could withstand regular abrasion on sand bars and reefs, became the most important element.
- "Sewing" was persisted with to make the craft stand up to the torque experienced in surf conditions.
- Three-element double outrigger craft, though available as an alternative was not adopted as it was not suited to the inshore waters.

2 b. Knowledge of the marine environment: the ocean

The Indian Ocean is characterized by alternating monsoons, inter-monsoonal cyclones, island chains, reefs and shallows, bays, inlets and narrows, and the two Indian Ocean current systems – namely those of the Arabian Sea and the Bay of Bengal – that meet and diverge just south of the island. In pre-modern times oceanic sailing took place largely north of the equator.

Were the Sri Lankan ships that first ventured into the ocean larger versions of the same fishing craft that evolved in inshore waters? The inability of the *oru* to develop any further has been noted. Their development into something more seaworthy would have depended on the ability of the base form to adapt to the new environment and to assimilate features from other shipbuilding cultures.

Sri Lankan seamen, ships or travelers have been referred to in many parts of the landmass that was then world – Asia, Europe and North Africa. From earliest times, Sri Lankans were familiar with voyaging by sea. Sri Lanka was aware that it was but one country in a complex of peoples and cultures. Within neighbouring India, alone, there were many seafaring groups. Both Sinhala and Tamil races believe they are descendents of Indian settlers who came here by ship. Within the country itself many communities lived side-by-side. This awareness of being part of a wider world was common to all communities rimming the Ocean, giving rise to early navigation of this Ocean. It seems safe to assume that Sri Lankan seafarers were aware of other ways of building ships than their own and that they adopted features from ships of other cultures, incorporating them in their own craft (Devendra: 1987, 1990b).

Did the basic form of the Sri Lankan o*ru*, with its sewn fastenings, lend itself to long oceanic passages? In the form they exist today *oru* are certainly

not meant for such voyaging. Yet (single and double) outrigger craft were in use from the farther reaches of Oceania and Austranesia west to Madagascar, off east Africa. Double outrigger craft reached Madagascar from south-east Asia (as noted earlier) some time during the first millennium C.E. The bas-reliefs of 9th.century Borobudur (Indonesia) show ships fitted with outriggers: a few years ago, a replica (cf. Fig.4) was built in Indonesia using indigenous knowledge, materials and craftsmen – a less sturdily built vessel than in the bas-reliefs but definitely within the same tradition – and sailed across the Indian Ocean and beyond, making very good time (cf. www.borobudurshipexpedition.com). It had a displacement hull with outriggers on either side which provided limited living space but certainly very little for cargo: in other words, they were good for voyaging but not for trade.

Single outrigger craft sailed even earlier than these. The peopling of the countless islands 65 million square miles of the Pacific Ocean was accomplished in several waves believed to have taken place between 30,000 B.C. and 1,000 A.D. In the absence of any remains of the craft used – and the long period of time involved – one cannot say what the early craft were like (Smith: 2008). The fact remains, though, that unlike in the Indonesian seas, single-outrigger craft are yet very much in use in those islands: I have seen them myself in Hawaii. (Fig.5)

Fig.5. A single outrigger boat from Hawaii

The motive for travel and exploration, as in the case of the double-outrigger craft, was voyaging in search of new homes; and not regular trade with known settlements and ports. These boats, to judge from the surviving traditional voyaging craft, were double-hulled craft like the *añgula* , but much larger and designed for ocean sailing under sail.

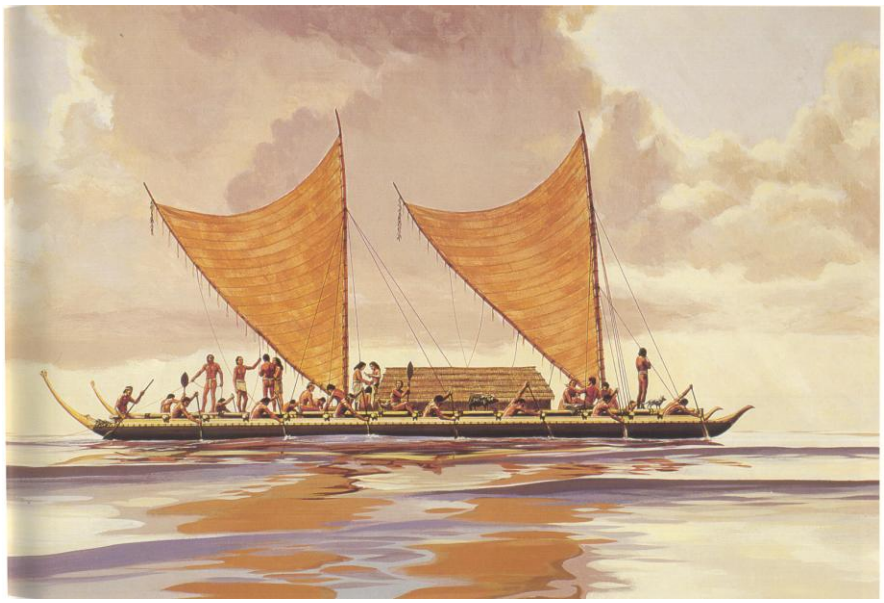


Fig. 6. A Voyaging boat from Oceania

Perhaps, in time, an awareness arose that plank hulled ships contributed to the development of a larger outrigger craft suitable for voyaging by sea. There is ample hard evidence of the survival, into the 20th.century, of a large sewn-plank, shell-built, two-masted, single-outrigger class of cargo ship (Vitharana: 1993, Vosmer: 1994). These, the *yāthrā dhōni* referred to earlier, are described elsewhere in the paper. They were used in this century in, and between Sri Lanka, the Malabar and Coromandel coasts of South India, the Maldives and Malacca. They have many features in common with surviving *oru* – sewn construction using coconut-fibre, single-outrigger, double-ended configuration, and plank extensions – but the hull was not a dugout log. It was a plank one. Could this craft be genealogically linked to the *oru* form? To be considered so, evidence is necessary of the sequence of development, namely, how and why the dugout hull was phased out in favour of a plank hull.

I have argued elsewhere (Devendra: 1995) that the *pāru* form (large, punt-shaped, sewn-plank seining-boats on the coast and cargo boats on river and canal) incorporating twin vestigial dugouts, was a double-hulled craft: the

largest craft that was possible within the limits of a strictly logboat culture. I had drawn upon a reference to a similar transformation elsewhere where the description fits both the river and *mā-däl-pāru.* (Note 1). My argument was that the *pāru,* too, could not evolve into a seagoing cargo ship and therefore it marked the end of a line of development in our log-based culture: another dead-end.

How did the log-based tradition then produce the plank hull *yāthrā dhōni*? As noted earlier, such a transformation could take place only when the needs of deep-sea sailing took precedence over those of coastal sailing. Trade, perhaps, was the spur: the desire for a low-tech approximation to the large cargo ships from India and elsewhere that called at our ports. This is an example of transformation through interaction. The technological barriers still existed and some giant steps had to be taken before this became possible. They were, however, taken and the process is described below.

The transformation of the dugout log to a planked hull was a process that I feel that I can now spell out step-by-step. But why was so convoluted a process followed? Elsewhere, for instance in India, plank hulled ships had been built outside a logboat tradition. Indian ships were quite active on the seas long before this and even our own settlement legends – such as the 'Vijaya legend' and the 'Valahassa Jataka' – are based on the existence of such ships (mono-hulls) and international trade. On the contrary, one does not encounter the *yāthrā dhōni* (an outrigger equipped ship) in any written work, legend or pictorial representation. It occurs only in records, drawings, models and actual ships of the last 200 years. The earliest representation of a plank hulled ship with a single outrigger to port (with a roofed deckhouse and a single forward raking mast) known to me is from the sketchbook of Jan Brandes, dated 20th. January 1786. (Wagenaar:1994) and it is clearly one version of a *yāthrā* . The *yāthrā* existed, but only among builders and users of ships: not among scholars and writers. The *yāthrā dhōni* is an example of how an indigenous, log-based folk tradition could produce a plank hulled cargo ship – and one that carried its distinctive thumbprint: the outrigger.

The form and structure of ships were thus directly influence by the oceanic environment.

- The dual-element construction was persisted with – successfully, in keeping with our priorities – in preference to double-outrigger craft which was a form that successfully coped with long voyages.
- Encounters with other shipbuilding traditions nudged Sri Lankan builders to adapt foreign features, which they did, but without departing from the base form.
- Sri Lankan ship-builders awoke to the economic and commercial requirement of ships with space for cargo and passengers.
- Displacement hulls yet wedded to the outrigger arose out of the need for, cargo carrying craft.

3. Navigational skills

"Sailing the Indian Ocean" involved much more than shipbuilding. A knowledge of navigation, the movement of stars and constellations, wind, current and tides patterns, and the ability to determine your position with to an acceptable degree of accuracy were also needed. Presumably this knowledge was acquired through experience. But it is difficult to overestimate the likelihood of borrowing and adaptation of foreign technologies and practices.

Among the many borrowed and adapted features were the fore-and-aft rig featuring Arab-Indian lateen sails and the rudder for long distance voyaging. Originally, Sri Lankan craft had square sails and were double-ended. They could change direction and sail upwind, but not by tacking as one does with lateen sails. Keeping the outrigger to windward, the boat would "change ends" by changing the set of the sail and the position of the rudder and leeboards, thereby making the bow the stern and *vice versa*. This was quite satisfactory for smaller, shallow draught craft, but not so for larger ships: hence "changing ends" would have been another factor that restricted the size and form of the vessel. A rudder, which changed the double-ended hull into one with a fixed bow and stern, gave a ship the ability to tack, instead of changing ends. A new sailing rig completed the change. However, old practices die hard and even the last *yāthrā dhōnis* did not have a transom stern (which would have been logical) but retained the double-ended hull (even with a rudder) and also the outrigger (which was, by definition, no longer necessary). These retained features had the effect of, once again, "freezing" the evolutionary

process at a particular point. The *yāthrā dhōni* – as we know it – did not evolve beyond this point. If there had been larger ships built in Sri Lanka – of which we can conceive, but have no material evidence – they would have resulted from either the abandonment of the outrigger, the last vestige of the vernacular idiom or from a different line of development altogether, as will be argued further down.

As in the case of ship-building, navigation, reading of the stars, knowledge of tides, pilotage etc. appear to have been maintained and passed on, at least by oral tradition. The knowledge resided in the master of the vessel (*nāvika*) or the sailing master (*marakkäälehe* – which yet survives as the family name "Marakkalage") of fishing communities ashore. Vitharana quotes a verse sung by outrigger boatmen as "sailing directions" for putting out to sea from Hambantota.

"Unfurl the sails and make them fast at *Hambantota*
Ibbagala cannot be seen at the *Valave ganga's* mouth
So, keeping your outrigger towards the *niyanda kaputa** (i.e. to windward)
Take your bearings from *Vatagala* and sail to deeper waters"
(*a particular rocky outcrop on the sea)

Even as late as Dutch times, the Persian term for "pilot" (*sambandar*) was in use and later became a personal name "*Sahabandu*" which is yet in use: Indian texts, though, describe pilots and their knowledge in the early centuries of the Christian era. There is no evidence of maps or charts. Stars were known and recognized and Vitharana (1992) has documented fifteen names of stars used by the present-day fishermen. They are, however, only a fraction of what their fathers and grandfathers would have been familiar with. The knowledge has all but died out and his sources could not always agree on the identity of the stars they were naming. This is not surprising: with the advent of GPS, even this will disappear.

We do know that the Sri Lankan ambassadors to the Roman Court of Claudius had commented on the unfamiliar star configuration over Rome, particularly remarking on the difference in the position of the Great Bear and Pleiades, that Canopus was much brighter in the Sri Lankan sky, that shadows

in the Roman latitudes always pointed north as the sun was always to the south. (Weerakkody:1997). Coming, as they did, from a country where astrology, the study of the rising and setting of stars, was a serious one, this is not surprising. Astrologers yet keep alive the tradition: it is the loss of the application of the knowledge of star movements to navigation that we feel.

Fishermen have, however, retained certain types of knowledge. Vitharana has documented twenty-four separate words to identify features of the sea, twelve to denote prevailing drifts, and twelve for different winds. Some of them are words used in different parts of the island and cannot be considered as part of a lost tradition. Since the craft in use today are small, the special names for crew members have been lost: only the special names for the master and the look-out are retained along with one collective noun to denote "crew". Viewed against this background of lost knowledge it is comforting to note that the navigational knowledge of the Arabs, Indians, Chinese and others with whom we had much to do, has been documented (Tibbets:1981, Bellec:1993). Sailors, being pragmatic, look out for whatever is helpful and there was an ongoing exchange of ideas and technology among those of different nations. They picked up from each other, by observation or other means, all the knowledge necessary to navigate the Indian Ocean. It is reasonable to assume that some of this common pool of knowledge was available to, and used by Sri Lankans, as they, too, were long-distance sailors.

This, then, was the ocean Sri Lankan ships and seamen sailed in. It cannot be claimed we were in control of the seas, or any part thereof, at any given time. But it is safe to assume that we were participants in a multi-user environment, and that our ships – in common with all ships that sailed this ocean – incorporated structural features, adopted from various sources, that had been proved in blue-water sailing. These features, superimposed on the basic forms evolved in coastal waters, made these craft as suited as any other to undertake oceanic passages.

Stages in the evolution of the vernacular idiom

It was Hornell (1943) who remarked that:

"No greater contrast can be found in small craft designing than that between the types used on opposite sides of the Gulf of Mannar, South of

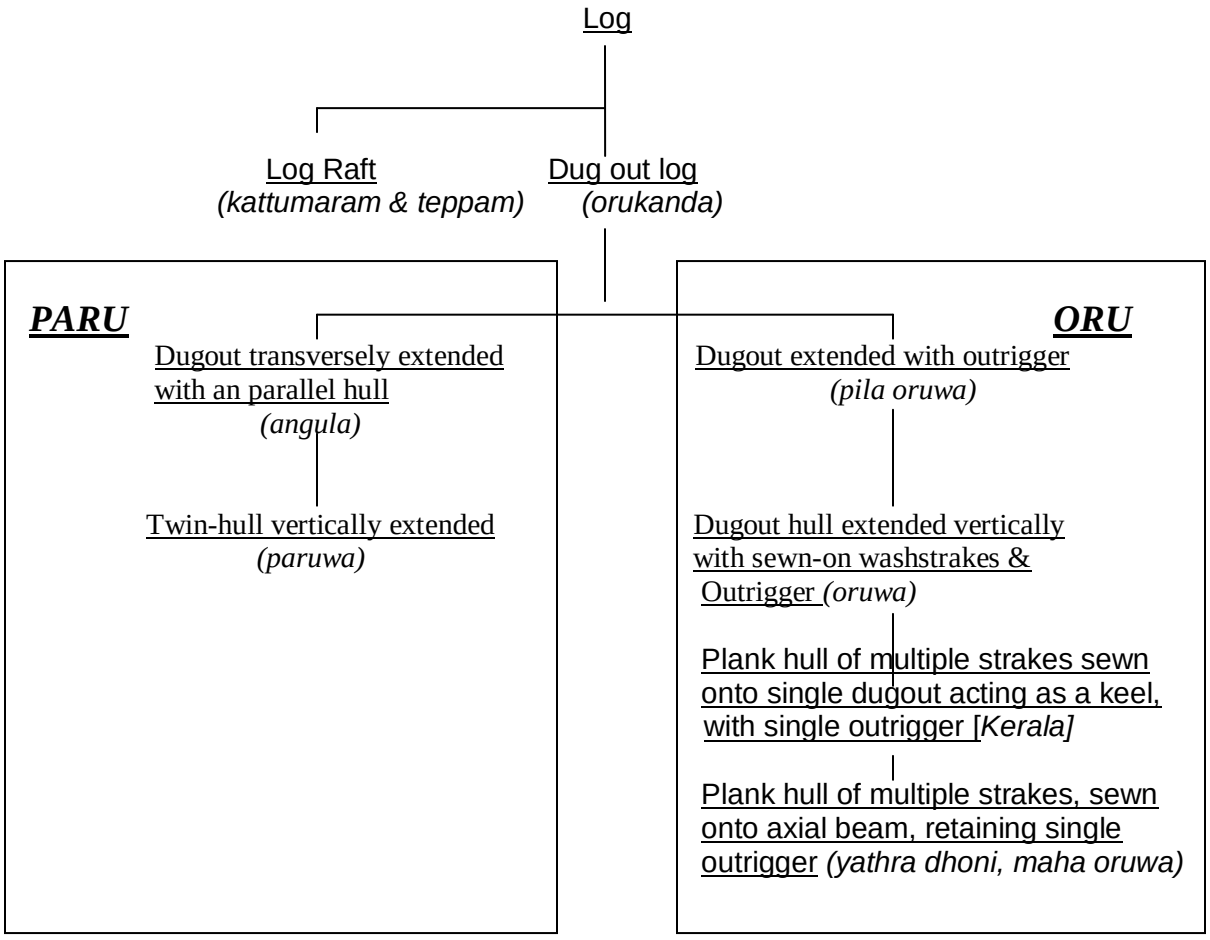
latitude 9 degrees .On the Indian, or Tamil, side the catamaran and the boat-canoe alone are employed; on the Sinhalese side, the outrigger canoe is the national and dominant design, the catamaran being only used in the northern, or non-Sinhalese part of the island and by Tamil migrant fishermen in Colombo, with the dugout restricted to its proper sphere of usefulness on rivers and inland waters."

Now it has become possible to trace the evolution of the vernacular idiom – Hornell's "national and dominant design" – on a stage-by-stage basis from dugout craft (*oru*) to seagoing cargo craft (*yāthrā dhōni*). The twin-dugout-hull forms (*añgula , pāru*) evolved in parallel. All were to end as evolutionary dead-ends, leading to nothing more advanced, unless the possible line if development proposed below did actually take place

The stages passed have been identified as –

Stage No.	*Description and name*
1	the **log** (*kañda*),
2	the **raft** (*pahura*)
3	the **dugout *oruka**ñda* (Stages 2-3 follow the "Reduction" process)
4	the **dugout with outrigger** (*pilā –oru)*
5	the **vertically extended dugout with outrigger** (*oruwa = orukañda+ kollääwa)*
6	the **transversely extended twin-hulled** (*añgula*) form which becomes
7	the **extended vertically** (*pāru)*
8(a)	(Conjectural) **single dugout with plank strakes sewn on to gunwale, flaring outwards and upwards**
8(b)	the **timber keeled, plank hulled cargo ships with outrigger** (*yāthrā dhōni)* (Stages 4-8 follow the "Construction" process)

The Diagram below traces these steps and an explanation follows:



Stages 1 ***(Kañda)*** and 2 (***Pahura***):

The **log** and **raft** are floatation devices common to many cultures, and yet in use and thus need no comment. However it is possible that the **log-raft** (as different from the **bamboo-raft**) did, in fact, influence the transverse extension of the dugout, seen in stages 4 and 6. Log rafts are usually made of several logs lashed side-by-side with two or more smaller timbers lashed across them to secure them. This configuration could, by simplification, become two parallel logs set apart from each other but joined by two or more spars. While it is not suggested that this did take place, is possible that this could have been the inspiration behind the dual-element form

.

Fig.6. A log raft

Fig.7. A bamboo raft

Stage 3 (***Oru kañda***)

The **dugout log** – is especially interesting in the evolution of the vernacular idiom. Though a stage in the evolution of almost all watercraft, in this particular vernacular idiom it persists as narrow as, and no wider than the log of which it is formed. In India, and northern Sri Lanka, transformation of the dugout does take place: in the *vallam* form the dugout is treated with heated stones and water and flared out into an almost flat underbody, and other planks are attached vertically to form the sides: all timbers being secured to each other by half-frames

inserted internally. This gives the *vallam* a flat bottom (unlike the round bottom of an *oru*), greater beam and stability in shallow waters. In the south, the log remains unchanged. Stability is sought through other means. (Stage5)

Fig.8. An *orukanda* (of a *vallam oru*)

Stage 4 (***Pilā Oru***)

The **dugout extended transversely with outrigger** is an example of expansion by transverse extension. Instead of changing its narrow profile, the *oru* seeks stability through construction: extending transversely, using a balance log (possibly a simplification of a log-raft) . This makes the craft the basic *oru*, the type found in inland waters. When this dual-element craft enters the marine environment the archetypal *oru* type emerges (Stage 5). In inland waters the process continues further, giving rise to twin-hulled craft (Stage 6)

Fig. 9. – A *pila oru*.

Stage 5 (Sea-going **Oru**)

The **dugout hull extended vertically with sewn-on washstrakes, with outrigger** sees a further extension using the construction process. The hull section of the transversely extended dual-element craft is now vertically extended to meet the needs of the marine environment. The basic *oru* form, of calm inland waters cannot cope with wave and wind: it is liable to take in water and be swamped. As a protection against this possibility plank washstrakes are sewn along gunwales and the two ends are extended beyond the ends of the dugout hull and "closed" so that a plank superstructure is built atop the dugout hull. The vertically extended hull now rides higher above the turbulent water than the outrigger, leading to changes in the booms. In the inland *oru* the outrigger was connected to the dugout hull by simple struts as there was little difference in height above water level between the dugout and the outrigger. But the booms of the vertically extended sea-going *oru* curves downwards from the higher hull to the lower outrigger. Greater stress is placed on the booms which now become composite structures rather than mere spars becoming, structurally, the most important part of this craft, as it absorbs the torsion generated by the sea.

Fig.10. A seagoing oru

Stage 6 ***(Añgula)***

The **transversely extended twin hulled dugout** (related to Stage 7) is an inland water craft where the outrigger has been supplanted by another dugout, with the booms/spars being decked over, providing space for goods and passengers.

Fig.11. An *angula*

This configuration proves versatile and a large number of variations result. One such – the example shown is a modern one – is the linking of two hulls in parallel with spars, which are not decked over, thus making it easier to paddle it in confined waters as the paddle can be used on either side of the main hull. While this configuration could, technologically, have emerged before the *palu oru*, it would have become a reality only with the availability of off-the-shelf fiberglass hulls.

Fig.12. A fiberglass twin-hull, undecked

Stage 7 *(Pāru)*

The **vertically and transversely extended twin hulled dugouts** represent the largest craft that could have been built using one or more untransformed dugout hulls. In Stage 6, the craft acquires the capacity to carry cargo: a capability that could have earlier existed only in the log raft, the *angula*. At some point in time the need to carry cargo in quantities by river arises, and existing forms of craft respond in various ways. The twin hulled form responds by extending itself vertically into an open decked, scow-ended, watertight box firmly based upon the twin dugout hulls. These become the workhorses of the rivers and, later, of the river-canal network from the foot-hills to the sea-coast, largely in the broad rivers of the densely forested west and south of the island

Fig.13. A *paru* of river and canal

At sea, the same change takes place but the craft is meant to operate close inshore laying out a large net – weighing over a ton – for beach seine fishing.

Fig. 14. A *madel paru*

Stage 8 *(Yāthrā dhōni)*

The **timber keeled, plank hulled cargo ships with outrigger** brings us to the last stage of all. In this stage two important structural changes take place, one being the adoption of a shell-built plank hull and the other being the abandonment of the dugout element. These changes, in fact, create a craft that has only one feature in common with the earlier forms: the outrigger. Just as Stage 7 results from a requirement to move cargo in bulk along rivers, a requirement to carry bulk cargo by sea leads to the evolution of this craft. To assume that both structural changes referred to above took place simultaneously would presuppose a conscious design process. As no evidence of such a process in the evolution of traditional craft can be expected, it is suggested that two distinct processes took place, Stages 8(a) and 8(b).

Fig.15. A *yathra dhoni* hauled up on the beach

Stage 8(a) involves the dugout hull. It now progresses a step beyond the seagoing *oru* (Stage 5). Instead of a single line of washstrakes sewn vertically to the gunwale, now multiple vertical strakes flaring outwards at an angle are sewn on to the gunwales: thus, a hull that is V-shaped in section is achieved. In Sri Lanka, we have no surviving evidence of a craft that fits this description but, in Dawki and Kerala in India, this transitional form has been noted and recorded by Phillips-Birt (1979) and Hawkins *(1980)*

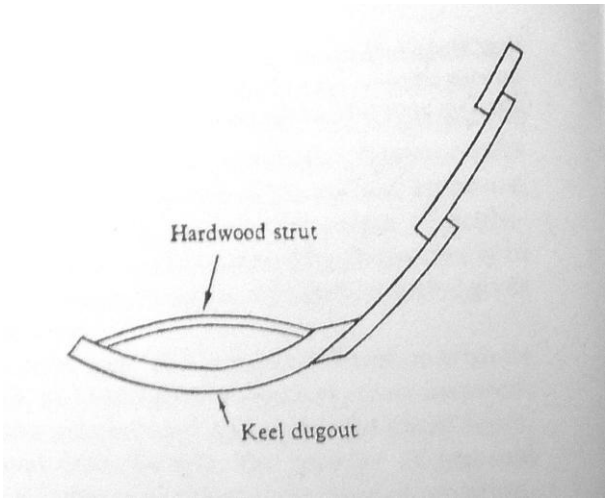


Fig.16. Section of plank hull built on a single dugout keel

Phillips-Birt shows a boat with the blunt fore-end formed of a single plank which is a characteristic of the *oru.* The rest of the hull of this *"ballam"* is of upright planks, not strakes.

Fig.17. Plank hulled boat with single dugout keel, blunt-ended.

Hawkin's illustration, on the other hand, is of boat with conventional strakes, and a sharp bow: with a striking similarity to the more advanced Arab *Dhow* and the *Uru* of Kerala.

Fig.18. Plank hulled boat with single dugout keel, with sharp bows.

Since both the *Dhow* and the *Uru* have keel logs (Hornell's "axial beams"), this point is worth noting. Neither of these two examples, however, have outriggers. (This argument may seem speculative as there are no

examples from Sri Lanka: however it fits well into the logic of the vernacular idiom and its regional extent.)

With the broader beam being thus achieved, a way of stepping the mast has also to evolves: in early versions, the mast is a rounded timber footed on the keel beam at a midpoint of the centerline but, like in the *oru* it is lashed to the main outrigger boom

Fig.19. Museum model of an early *yathra*

In later versions the masts are sturdy and straight and stand upright with no lateral support from the booms.

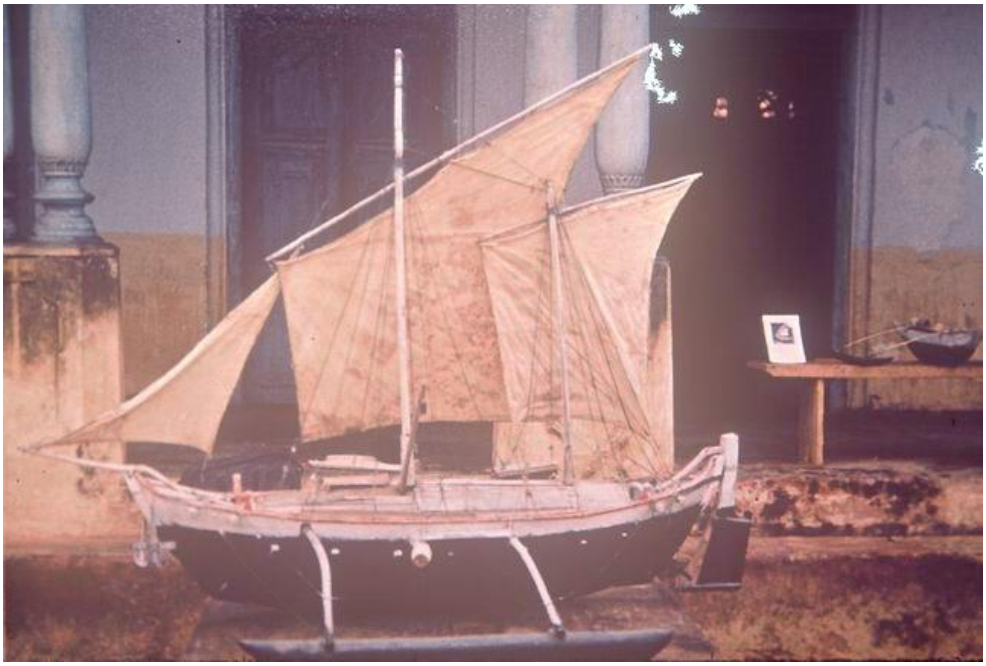


Fig.20. Kumarakanda Pirivena model of a *yathra* in its last form

Stage 8(b) involved the replacement of the dugout hull by an axial beam, or keel log.

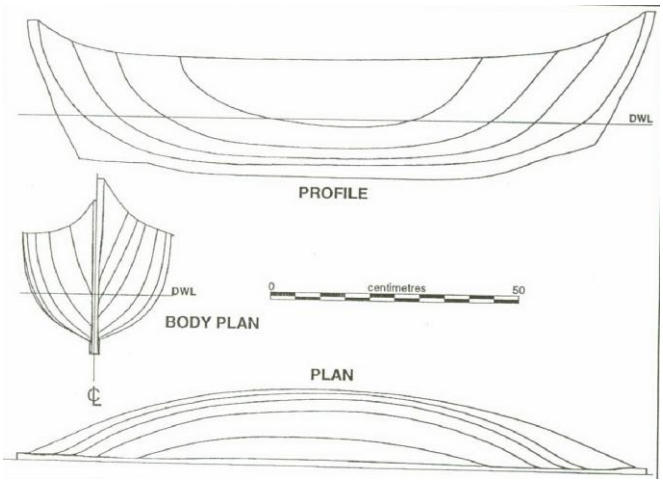


Fig.21. Naval architectural lines of a *yathra* hull

If Stage 8(a) had been followed, builders would have soon realized that, with the watertight integrity inherent in the new hull form, it was not necessary to hollow the log to serve as the keel. A squared-off log, or beam, would be simpler to sew the plank strakes on. This is exactly how it is done on Arab craft and Hornell (1946) rightly commented:

> "The final stage in the conversion of the dugout into a fully plank-built boat is attained when the dugout under-body is reduced to a keel-like axial beam, with sides raised upon its edges by numerous strakes of sewn-on planking. This was the method of construction employed by Persian and Arab shipwrights...and the Sinhalese coaster of the Gulf of Mannar ..."

Fig.22. Shipbuilding in a traditional Arab shipyard

Unlike in India, it should be noted, the outrigger was persisted with in Sri Lanka making it, arguably, the most characteristic feature of the vernacular idiom.

The stages above trace the growth of what I call the "vernacular naval architectural idiom" sequentially from log to cargo ship. This idiom persisted into the 20th.century in its multifarious forms, but ended in a dead-end: that is to say, it did not lead to any craft more sophisticated than the *oru, paru* and *yathra dhoni*. In Part 3 of this paper other, more sophisticated ships types used in this country are described – some of which may shed light into another process about which we have insufficient information. Arguably, this lost process was the more successful but any further comment would, in the absence of sufficient information, take me beyond Fact to Conjecture.

I close this part of the paper with the observation that the marriage of the dugout and outrigger into a single dual element craft was at the heart of this vernacular idiom and the oldest and longest surviving feature of the vernacular idiom is the outrigger, which persisted even when the dugout was phased out.

PART 2

The socio-technological context

Before I deal with the "lost process" I think it necessary to look at the social and technological context within which the pre-modern ship-builder practised his craft. I shall deal with only certain facets of this context, mainly those which have not been dealt with elsewhere such as identifying the builders, the technological context within which they worked and how seafaring was regulated in the country. The areas I deal with are:

Ship-building, ports and regulations.

Interaction with regional shipbuilding traditions

Multiple shipbuilding cultures within the country

1.Ship-building, Ports and Regulations

At the time I commenced my study, the only traditional craft being built were fishing craft – mainly the *oru* in its many variations. Today, the situation is worse: none are being built in the Sinhala-dominant parts of the country after the tsunami (I doubt any traditional craft are being built in the north). Only factory-built fibreglass versions are now in use and there are no traditional ship-builders left to practice their craft. Upto the last days when traditional craft were yet being built, (i.e. up to and including the 1980s) they were built by the very people who used them: artisans of various sub-specializations, most of whom belong to one major caste, the *Karawa* caste. While this caste is noted for being active in fishing, it is not a "Fisher caste", though often wrongfully so-called. It embraces several crafts and skills, but traces its origins to a group which came here from India around the second millennium C.E, - the late medieval period – and carved a niche for themselves as soldiers in the Kings' service. These shipbuilding carpenters, therefore, were not the carpenter-builders of ancient times or heirs to a craft tradition which excelled in artistry. This, perhaps, is why the *oru* – while being very well-built – is not ornamented in any way, nor does it have any features like oculii, figureheads, shipboard shrine etc. that can be traced to a religious origin. The workmanship is good and the vessels sea-worthy in every way, but they are, essentially, work boats and retain a "no-nonsense" look. The picture is different in India (and, to an extent in north Sri Lanka). There, many craft are built by traditional builders: be they Hindu, Muslim or Christian. Among the Hindu (who are culturally most akin to Sri Lanka), they have been variously referred to as *mestris* (Kunhali1993: 57), *mestas* and a*charis* (Sunderesh 1993: 30), and *biswakaramas* (Raut & Tripati 1993: 52). The two latter names (a*chari* and *biswakarama*) are, in Sri Lanka, specific to the artisan caste. The other two (*mestri* or *mesta*) are variations of one and used to denote a master of his trade. The word is derived from Portuguese and is not specific to artisans. This name, based upon a title, also occurs in the *Karawa*. Carpentry is practiced by both by the *Viswakarma* (artisan) and *Karawa* castes as well as others and is therefore not caste-specific. Ship-builders were, thus, of the same caste as the people who used the craft. A clue is the family name, specific to this caste, of *Galappathi*, which derives from the technical term "to caulk". In spite of having

– like India – a caste system, we have this major difference: which is probably due to the difference between the two caste systems.

Ports were plentiful as they needed only to satisfy only certain basic criteria. Deep water and quays were not a requirement. Chittick (1980) has commented that, in much of the Indian Ocean region, a narrow tidal range made deep-water anchorages unnecessary. (Note 2) The basic requirements were a fringing coral reef to quiet the waves, an offshore island or headland to afford shelter from prevailing winds, fresh water and, of course, a community of traders engaged in international trade. Ports were the interface between traders afloat and ashore and, perhaps, only some warehouses for storage would have to be built. Early ports would have been at river mouths; with ships sailing up-river to sheltered ports inland and goods being carried farther inland in smaller craft. There is material evidence that this did take place and that communities of foreign merchants had settled in suitable locations. Other than the many ports referred to in the Mahavamsa and other chronicles, references are also found in foreign sources: the most important being Arab sources which locate thirty positions known to them between Kalutara and Trincomalee.

Fig. 8.23. Map showing positions recorded by Arab sailors

Arab and other traders were aware of the alternating monsoons. Cross Indian Ocean shipping made regular use of them by sailing one way using one monsoon and returning with the other. Between monsoons, trade was carried on ashore. Ships also sought shelter in the many lagoons, during inter-monsoonal cyclonic periods, sheltered from the winds and refitted for the rest of the journey. Arabs called such havens "Gobbs" which, according to a Turkish naval manual, means "gulf full of shallows, shoals and breakers". Tennant(1859) quotes Abou-zeyd's "The tale of two Mohamedans" (dated to 851 CE) with an explanatory note by Edrisi, where the lagoons are described as valleys full of gardens and forests into which merchants sailed their ships to ride out the monsoons in perfect safety and agreeable surroundings.

I was not in any position to carry out field research in the dominantly Tamil and Muslim north and east. At that time only some archival research was possible. It was the Fishing caste of Jaffna which produced the sailors of the north. In Jaffna ships larger than off-shore fishing craft were built (the *Jaffna thonis* and the "v*attai / vattal*" – see Part 3). As in India here, too, ship-building activity was carried on by different communities. Johnston (1824), drawing on his experience of Admiralty laws prevailing in or about 1802 speaks of four classes of "maritime laws and usages", all influenced either by Hindu or Muslim "tenets" (Note 3)

Johnston's remarks show that commercial shipping between Sri Lanka and other Indian Ocean countries, carried on by local entrepreneurs operating under traditional legal systems, was yet healthy even under British rule (since 1796). British rule had been preceded by some 300 years of Portuguese and Dutch control of the coastal provinces which had resulted in the choking of indigenous commerce and trade. As late as the 13th.century, King Bhuvenekabahu had sent an emissary to the Caliph (then in Egypt) with proposing two-way trade: among the items Sri Lanka offered to supply was thirty ships per year (Quaremère: Vol II) (Note 4). But in later times, even before the arrival of European power, the waning power of the central government had weakened the hold of the Sri Lankan kings on the major ports. The ineffectuality of the King was offset by foreign merchants, who used the ports

and administered them according to their own laws. Major ports became foreign enclaves. The "Galle Tri-lingual Inscription" – indited in China with the date corresponding to 2nd. February, 1409, and set up in the port-city of Galle some two years later by Zheng He – is inscribed in Chinese, Tamil and Persian (in Arabic characters): a clear indication of the cosmopolitan nature of the city (Devendra:1990c). On the eastern coast, in Trincomalee, the site of an Arab settlement in an eminently suitable inlet (Nicholson's Cove) has been attested by the discovery of a graveyard containing tombstones bearing 13th and 14th century dates (Devendra:1990a). Johnston (1827) had already discovered one in Colombo, dated to mid 10th century. Ibn Batuta, visiting Sri Lanka in the 13th century, speaks of a "Prince of the sea", named Jalasti, who held sway over Colombo commanding a force of 500 Ethiopians. Jalasti has been variously described as a powerful trader and a pirate. Other pirates have also been written about.

In earlier times, however, when a strong central government had prevailed, laws administering ports and matters maritime were promulgated on inscribed tablets set up in the vicinity of the relevant ports. An inscription in Devundara (Dondra) in the South refers to abuses of Customs Laws (Note 5). Another inscription, at Nayinativu in the extreme North, refers to Salvage Law. (Note 6)

The *Culavamsa*, the continuation of the earlier *Mahavamsa* (historical chronicles that record Sri Lankan history from 543 B.C.,) carries a most illuminating account of the logistics of a punitive raid to Burma, stemming from a dispute involving the trade in elephants. The incident in question is supported by a contemporary inscription recording the grant of land and privileges to the leaders of the expedition. It makes reference to *Hatan Nav,* (lit. "Warships") but, as we lack any details of shape and size, it is uncertain whether they were a kind of ship specially fitted out for war, or ships constructed for the expedition. The latter is more likely, following the *Culavamsa* description of their construction (Note 7) This description, which indicates knowledge of the requirements for storing ship for an offensive action, is more important for the reference to the "ships of various kinds" being built.

It also points to the ability to mobilize a large work-force capable of undertaking the building of a large fleet. Even leaving room for exaggeration, this account rings true in terms of the building of an expeditionary force. The account continues, and even records the loss at sea of the majority of the fleet. A footnote to this incident is that the *casus belli* for this expeditionary force was a trade dispute between the kingdoms relating to the export of elephants from Sri Lanka: which presupposes that there were ships on which elephants were carried as live cargo. There are other, equally credible accounts of battles between warring factions involving the use of ships and of intervention in south Indian politics using sea-borne troops. All of these indicate knowledge of naval strategy in offensive operations.

The activity of shipbuilding was, as indicated in the Culavamsa account, carried out all around the coast. This was the pattern till quite recently. A Dutch map, in fact, shows boat-building being conducted up-river, in Mahiyangana. Purpose-built shipyards were not necessary: I have recently seen a photograph of a large, European-style sailing ship being built (in the early 20th. century) on the beach in Velvettiturai. It would appear that ships were built as and when one was commissioned. The builders, however, could be readily mustered whenever an order was placed and this presupposes the existence of ship-building communities and community organizations. Such communities did exist till the 20th.century in Velvettiturai and Kayts (in the north), Panadura and Dodanduwa (in the south-west and Kinniya (in the east). John Still (1930), a one-time Assistant Commissioner of Archaeology, published an eye-witness account of ships being built in Kayts. (Note 8)

2. Interaction with regional shipbuilding traditions

The ships that sailed the Indian Ocean had evolved in their home waters and were all sea-worthy craft. Within the Indian Ocean, several technology zones existed:

The Dhow zone

The Sewn-boat zone

The Single outrigger zone

The Double outrigger zone

The Hybrid craft zone

The Shaped-log-raft micro-zone.

While the first four zones above are well known (Hornell: 1946 and MacPherson: 1990), I have interpolated the other two on the basis of research and interpretation. These are technological zones, and the different technologies require some explanation.

Dhow technology.

Characteristics: carvel built plank boats, sewn, prominent rudder, forward raking mast carrying large Indo-Arab lateen sails on a long boom hoisted using a sheave (a kind of pulley block) on the masthead.

Evolution and use: largely (but not exclusively) in the Red Sea, Arabian Gulf, west coast of India and generally in the Arabian Sea.

Fig.24. An old Arab *Dhow*

Outrigger technology.

Characteristics: the monoxylon, or dugout log, as the main unit of construction (with/without plank extensions), very shallow in draught, with attached outrigger (single or double) in place of a keel, sewn throughout, double-ended, with square or lug sails (later fore-and aft on larger craft).

Evolution and use: originated in East Asian seas and spread cross-ocean westwards to Sri Lanka, Madagascar and East Africa and eastwards to all the

Pacific islands. Hornell (1946) places the single outrigger in Sri Lanka and the Bay of Bengal islands (in the Indian Ocean) and the Pacific Ocean islands, and the double outrigger to east Africa, Madagascar, and South-East Asia. I have indicated above that the double outrigger did not appear in Sri Lanka.

Fig.8.25 A single outrigger craft

Fig.8.26 A double outrigger craft

Hybrid technology.

Characteristics: No common characteristics by definition.

Evolution and use: This zone, which I proposed in 1990, covers the old Erythrean Sea and its limits are (subject to correction) the lands and seas referred to in the *'Periplus of the Erythrean Sea'*. By definition, this is the area where East and West met and exchanged ideas and knowledge, and where the

technological peculiarities of one type was adopted and adapted by another to create the greatest number of hybrid types. This cross-pollination process continued until the Indian Ocean became a "British Lake": examples are the craft of the Malbar coast, the Jaffna *Thoni and* the Maldivian *baggala*.

Fig.8.27 A Maldivian *baggala*

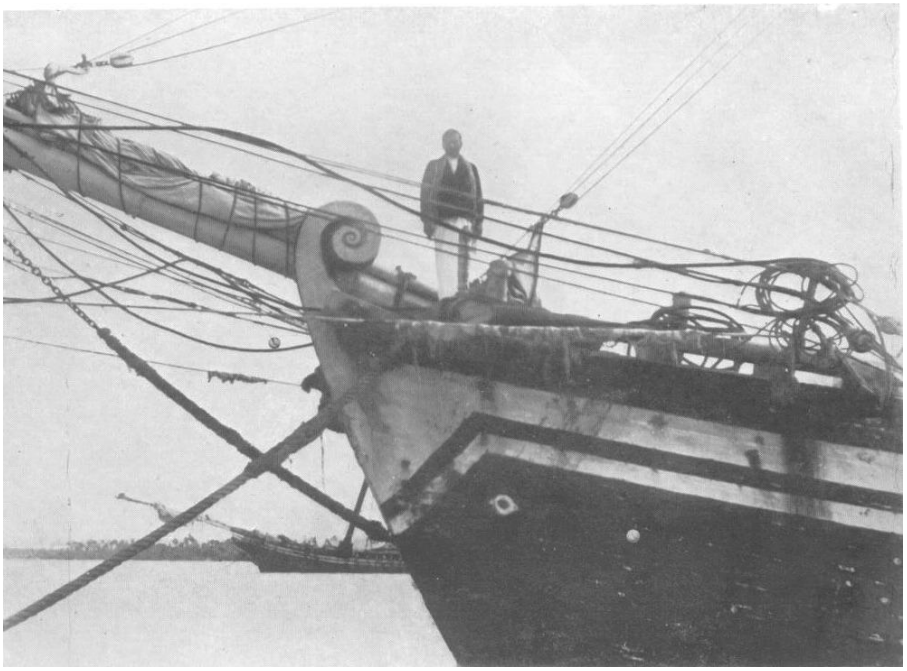


Fig.8.28 A Jaffna *Thoni*

Shaped-log-raft technology.

Characteristics: Unlike all other technologies, this is a Raft.

Evolution and use: South Indian and Sri Lankan waters, where it was possible to sail the ocean on a raft, with barest minimum of comfort (Thivakaran and Rajamanickam: 1992) The author of the *Periplus* and both Hornell and Paris noted these craft. They were the first to be depicted in a rock carving in pre-

C.E. Sri Lanka, and are still in use on both sides of the Palk Strait. The logs are either fastened with wooden pegs, or lashed (not sewn) with rope, and can be sailed or (sometimes) used with a temporary, easily shipped outrigger. Unlike the dhow and the outrigger, this craft is extremely limited in its area of use, being confined to India and Sri Lanka only. A second century B.C.E. Sri Lankan chronicle, the *Sammohavinodani*, describes rafts that were sailed from the port of *Jambukolapattana* (commonly identified with Kankesanturai in the north) to the Coromandel coast. These had three decks: the lowest was awash, the passengers occupied the second and the third carried goods. The passengers, it is said, were unhappy to sail in them as they appeared unsafe. The description fits the shaped-log-rafts (*Kattumaram* and *theppam*) of today.

Fig.8.29 A *theppam* raft

Fig.8.30 A *kattumaram* raft

Sewn Boat technology. This was common to all the above zones, but retained until late only in the outrigger and dhow zones.

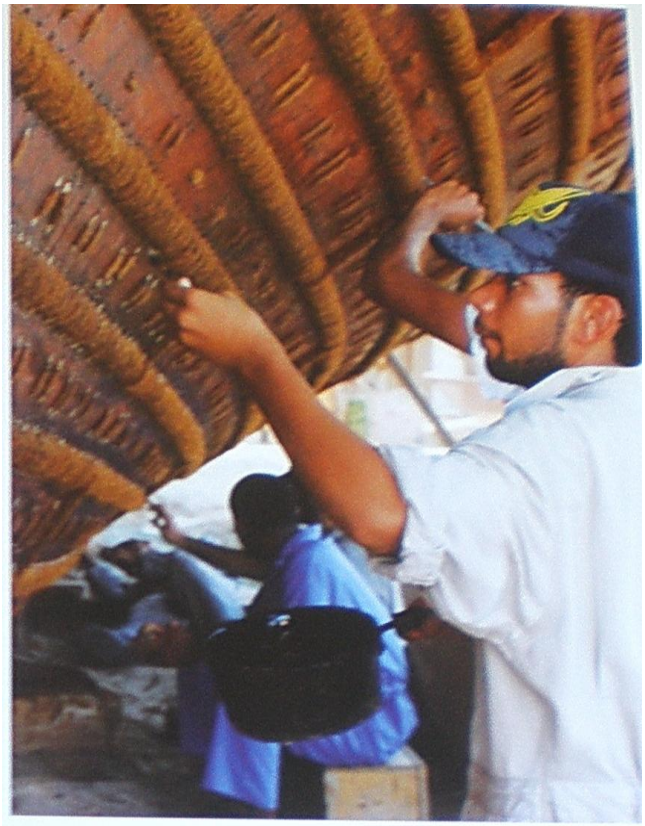


Fig.31. Sewing of planks on a modern replica of a 9th. century Arab ship

When all these zones are marked on a map of the Indian Ocean it is seen that Sri Lanka is the only location which falls into five of the six technologies mentioned: dhow, sewn-boat, hybrid, single outrigger and shaped-log-raft.

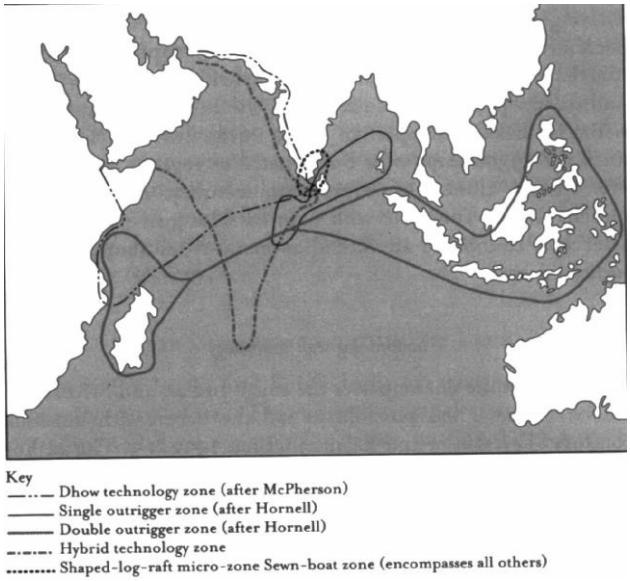


Fig.8.32 Technological zones in the Indian Ocean

Dhow technology must have affected Sri Lankan ships, but the evidence of any survival is scant. The double-outrigger zone, alone, by-passes Sri Lanka completely. Constructional elements of all these zones are seen in Sri Lankan craft, either in pure form or in admixture.

3. Different shipbuilding cultures within the country

Apart from the technological zones with the Indian Ocean, within Sri Lanka, itself, we can trace more than one shipbuilding culture. From the evidence so far available, we can trace two separate cultures that existed in the north and the south of the country, and it is not impossible that there were more. Hornell's comments on the contrasting boat designs of the north and south – between the *oru* and *pāru* of the south and the *vallam, theppam* and *kattumaram* of the north – has been quoted earlier. In the north, Sri Lanka and South India are geographically and culturally very close and the types of watercraft used by them were also closely related. A case in point is the shaped-log rafts referred to above, which belong to the northern nautical culture.

Hornell correctly uses the word “catamaran” (from Tamil *kattu-maram* a type of shaped-log rafts) to mean “log raft”, and not in the corrupted modern sense of “double-hulled craft” (*oru*). Hornell’s geographical differentiation is substantially correct. A Fisheries Department map of 1958 (Fisheries Department:1958) gives the distribution of *oru* as follows: western coast (Kalpitiya to Galle) – 4000; southern coast (Galle to Hambantota) – 1900 [*a grand total of 5900*]; and eastern Coast (Kuchchaveli to Akkaraipattu) – 1500. The west and south were, therefore, the heartland of the *oru.* The same map shows that *kattu-maram* are largely used in the North and North-East of the island, with a diminishing scatter even as far South as north Colombo, and, on the East coast, diminishing south of Trincomalee. This type of craft is also used in South India, particularly on the Coromandel Coast where a wider variety of forms are in use. In Sri Lanka, there are but two: the smaller pegged-log rafts (*theppam*) and the larger lashed rafts (*kattumaram*), which can be fitted with a sail and, occasionally, with an outrigger. In India, in addition to these, the log rafts are also converted to virtual boats by the addition of baulks of logs, vertically attached, to provide a degree of freeboard: these are constructed entirely of shaped logs, or baulks of wood and not planks.

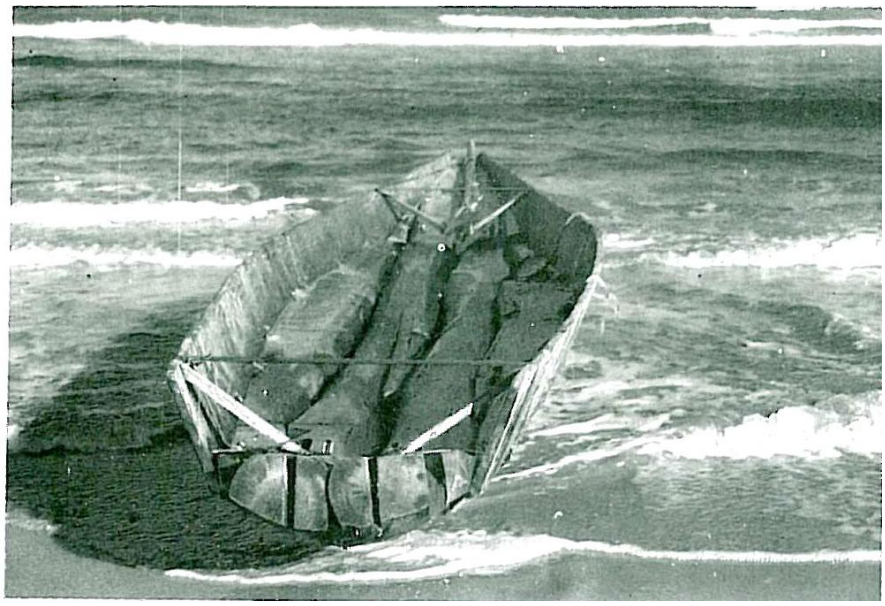


Fig.8.33 A Coromandel coast boat of logs

These shaped-log rafts, ranging from seven to twenty one feet in length and two to five feet in breadth, are among the most primitive craft that sail, even in coastal waters but, if their antiquity is taken as an index of a successful design, they have proven themselves. In Sri Lanka, a second century B.C.

inscription at Duvegala, at Polonnaruwa, shows an inscribed picture of one (Paranavitana 1970: Pl.XXIX) complete with mast topped by a *Nandipada* (Taurine) symbol. (Note 9). It is likely that this represents a craft that was in use between India and Sri Lanka for more than two millennia.

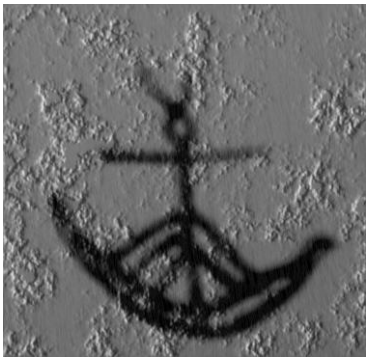


Fig.8.34 Boat from a rock inscription at Duvegala

The other, or southern, culture is characterized by the dual element *oruwa*, the origins of which are lost in antiquity, although a link between that, the Andaman Islands and that of Oceania cannot be entirely ruled out. This type has already been described as the vernacular idiom and is mentioned here only to record the second shipbuilding culture within the country.

In this part of the paper I have tried to describe the environment in which shipbuilding and seafaring took place. It has been defined as being bounded by (a) the technical and regulatory structures within the country and the changing political scene, (b) the shipbuilding technologies existing in the Indian Ocean and (c) the existence of different shipbuilding cultures within the country. It is not a comprehensive description of the context but only of those facets that bear upon the craft of the shipbuilder.

PART 3

Ships in pre-modern Sri Lanka

Part 1 of this paper dealt with the evolution of ships in Sri Lanka and Part 2 with facets of the socio-technological context in which shipbuilding was carried on. Part 3 now deals with the actual ships that survived from pre-modern times to the 20th.century.

Before the evidence presented hereunder was available to researchers, the exact – or even approximate – appearance of the ships, their size, and types were unknown or insufficiently known. In this atmosphere of uncertainty, conflicting points of view had been advanced. In 1966, for instance, Toussaint (1966) wrote:

> 'The Sinhalese people never looked towards the sea and the navigators whom history records were always foreigners. The outriggers themselves are of foreign origin, and it is not in Ceylon that we shall really comprehend the ocean's story'

On the other hand, Gunawardena and Sakurai (1990), translating and commenting on an extract from a ninth century Chinese literary work, say that the original work, referring to the ships from the Southern Sea which arrive each year at An-nan and Kuang Chou, states:

> 'Among these, the ships from the Lion Kingdom are the largest, with stairways for loading and unloading which are several tens of feet in height.'

Here we have two recent and very divergent views, typical of the kind of research that was carried out without considering material evidence.

I feel that Toussaint is too rigid, that Gunawardena and Sakurai are open to question (on the basis of an alternative reading of the text) and I will not try to reconcile these – and other similar views based on conjecture and archival evidence – in the light of my own findings. My research, based on hard evidence revealed the form and structure of pre-modern ships that did, in fact, survive into the 20th.century. Apart from the *yāthrā dhōni* (the product of the vernacular idiom referred to above) they were the *thoni* and *vattai/vattal* of Jaffna and the *battal* of Muttur in the east. I shall now proceed to describe each.

<u>The Jaffna *thonis*</u>

The first photographs of a traditional ship I came across were Hornell's of the Jaffna *thoni,* which belongs to the 'hybrid technology' covering (more or less) the waters between the west coast of India and the eastern shores of Africa, touching the north of Sri Lanka and going southwards to the Maldives. I have, since, come across a good photograph on the Internet: (http:/www/imagesofceylon.com)

Fig.8.35 Jaffna *thoni* in Colombo port

In these waters Mediterranean, Arab, Indian and later, Portuguese, Dutch, French and British ships met and left their imprint on each other. The Jaffna *thoni* is a fine example of this process. While basically a very South Asian craft in the way it is configured inboard, its lines are very reminiscent of European ships of a century or more ago. Hornell commented on this in 1943 (Note 10).

Europeans discovered, in the Indian Ocean countries, every material and skill required to build ships. They first built smaller European designs modified by the incorporation of local elements successfully proven in these

waters. Later, larger ships of European design were built of teak wood in India, and proved very successful: this led to resentment amongst shipping interests back home. (Note 11)

> Phillips-Birt, speaking of tenth century Arab ships, (1979) comments:
> '…the teak often used for planking the better craft is ideal for iron fastening, containing as it does an oil that preserves the metal, unlike oak, with its acid content, which attacks it.'

As eastern shipbuilders built ships to European standards, European designs began to leave their thumbprints on indigenous craft, as the Jaffna *thoni* demonstrates. Even before the British period, the Maldivians had picked up the lines of the Portuguese Caravels and built them late into the 20th.century: when Captain Allan Villiers (a Master of sailing ships) was preparing himself to sail the *Mayflower II* across the Atlantic, it was on these Maldivian vessels – and Arab dhows – that he refreshed his small ship sailing skills. Old European forms, like those that resulted in the *buggalow* and the *thoni,* continued to be used in the Indian Ocean long after they had been abandoned in the countries which had given them birth. The process of borrowing and adopting goes back further than even the Portuguese times: Johnston (1824), who has been quoted earlier, says that he was informed by Muslim priests and merchants that, for some hundred years, they had been using Arab translations of Ptolemy but had sold them to merchants who were sailing the Sri Lanka-South East Asian route.

In Jaffna, *thonis* were owned and built by both Hindus and Muslims. There was only one point of difference between their, as far as design and decoration are concerned, which depended on the owner. In the Hindu-owned ships the sharply raked stem ends in an inwardly coiled ornamental head called a *surul,* marked with three horizontal bars to represent the three ash-streaks that a Hindu wears on his forehead. In the forepeak is the ship's shrine. In addition, on either bow a neat *oculus* is nailed (not painted) on, to represent the eye of the god, who will guide the ship through the seas. The

Muslim-owned ships do not have either of these features. Hornell (1943) describes the inboard configuration:

> "At each end of the vessel is a short decking, ending in each case in a high transverse breakwater, 2 ½ - 3 ft. in height, sloped towards midships. The waist is undecked but is covered by a penthouse roofing of palm-leaves overlaid by closely set palmyra-palm reepers or battens tied down with coir. The after decking is the longer; on it is a small cooking galley or rather firebox and several water breakers find accommodation. At the centre is a small hatchway. There is no poop."

This very same arrangement is found in the *yāthrā dhōni* (below) the river *pāru* (the largest of the inland watercraft) and the Tuticorin coasters of even today. In the last, tarpaulin sheets now protect the deck cargo instead of a roofed penthouse. Notwithstanding the *thoni's* superficial similarity to European craft, its interior was that of a typical Asian cargo ship.

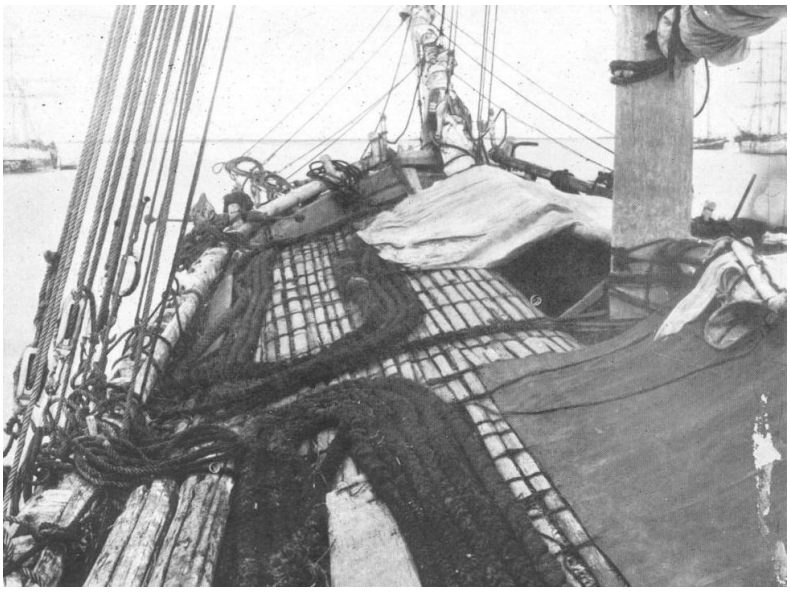


Fig.8.36 *Thoni* – inboard configuration

Its rig, on the other hand, is very nineteenth century British in appearance but rather individualistic, and not conforming to any standard.

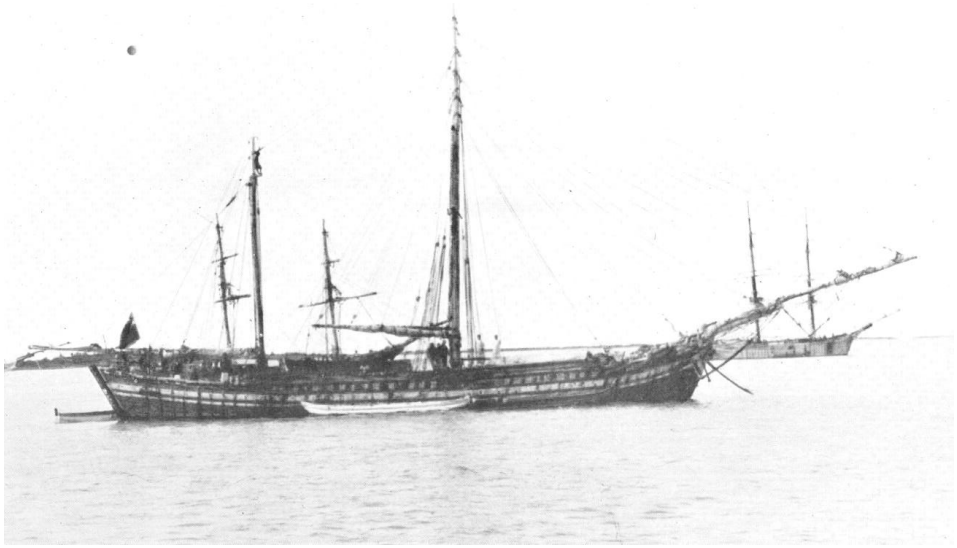


Fig.8.37 *Thoni* – broadside view

Hornell's photographs are invaluable. He has also given typical dimensions: length between perpendiculars, 100 ft.; beam amidships, 21 ft. 2 ins.; depth from gunwale to keel, 14 ft., carrying capacity, 100 tons.

From sources that were recently made available to me it is evident that there were several shipbuilding communities in Jaffna, those of Kayts and Velvettiturai being the most active, with the larger ships built at Kayts and the smaller at Velvettiturai, the smaller port. In Velvettiturai shipbuilding and seafaring were a community calling and were practiced in the 19th. and 20th.centuries. The vessels built were hybrids, in terms of technology and had no specific features to merit their classification as traditional ships. Many were entirely western in form. Others were ships that had run aground and been abandoned, and later salvaged and rebuilt to their original form.

வல்வையில் கடைசியாகக் கட்டப்பட்ட பர்வதபத்தினி என்னும் கப்பல் பொருட்களை ஏற்றிக் கொண்டு
வல்வை நோக்கி வந்து கொண்டிருக்கையில்

வல்வை ச. பாலசுப்பிரமணியம் மேஸ்திரியாரால் கட்டப்பட்டு வல்வை சி. குமாரசாமி வசமிருந்த
பர்வதபத்தினி என்னும் பாய்க்கப்பல் (கட்டப்பட்ட வருடம் 1943) 2700 மூடை

Fig.8.38 European type sailing vessel built in Velvettiturai

I have yet to get these Tamil sources translated but the photographs, by themselves, are revealing of the shipbuilding skill of the region. (Note 12) There is a list of 114 ships with the names of the owners (mostly Chettiars from Tamilnadu) and the Captains (all from Velvettiturai) which is ample evidence of a healthy seafaring community. The ships traded between ports, from Colombo to Rangoon.(Muthkumarasami:1982 and Meenadchisundaram:2006)

Perhaps the most famous of them was the '*Annapurani'*, a two-masted ship with beautiful lines, which caught the fancy of an American, William A.Robinson, who bought her, re-named her the *'Florence C.Robinson'* and sailed her with a crew of six seamen from Velvettiturai to Boston in 1938. (Fig.39)

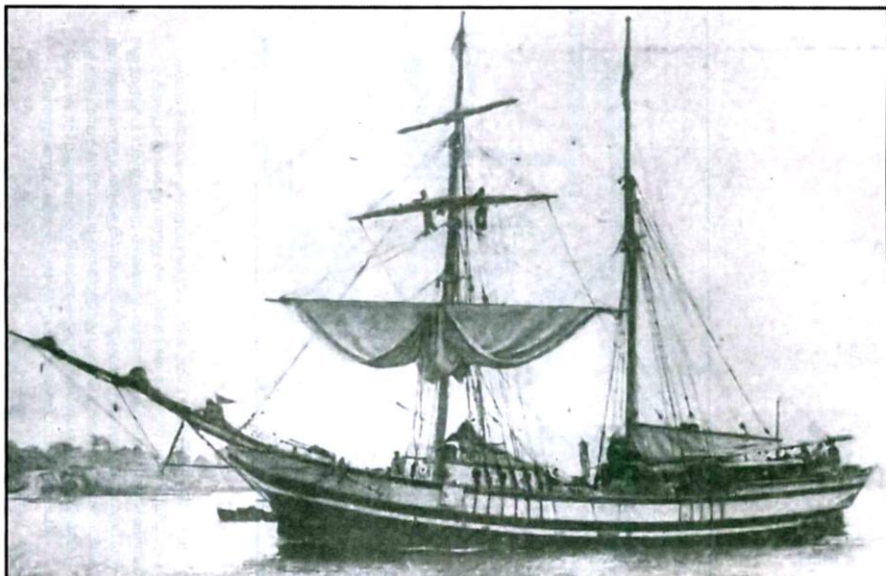


Fig.8.39 The '*Annapurani*'/'*Florence C.Robinson*'

I have published an account of the voyage (Devendra: 2009 a) of the "…89-foot brigantine *Florence C. Robinson* – the last windship of her kind that, in all probability, will ever cross the Western Ocean under canvas alone…" (*The Boston Globe,* August 2nd. 1938) and shall not repeat it here.

The *yathra dhoni*

This, the end-result of the vernacular idiom, is the most ancient indigenous sailing craft that we have been able to study in some detail. It was a fore-and-aft rigged, outrigger-equipped vessel and was last built at Dodanduwa, a village about ten miles north of Galle. Till the 1930s they, operated from this port, sailing largely to coastal ports of India and Sri Lanka, the Maldives and South East Asia. The find was, in every sense of the word, serendipitous. That such a craft existed was known from a published note by an eyewitness to the sailing of the last of its kind, and an account by Hornell (1943) who had not photographed it but merely given a line drawing.

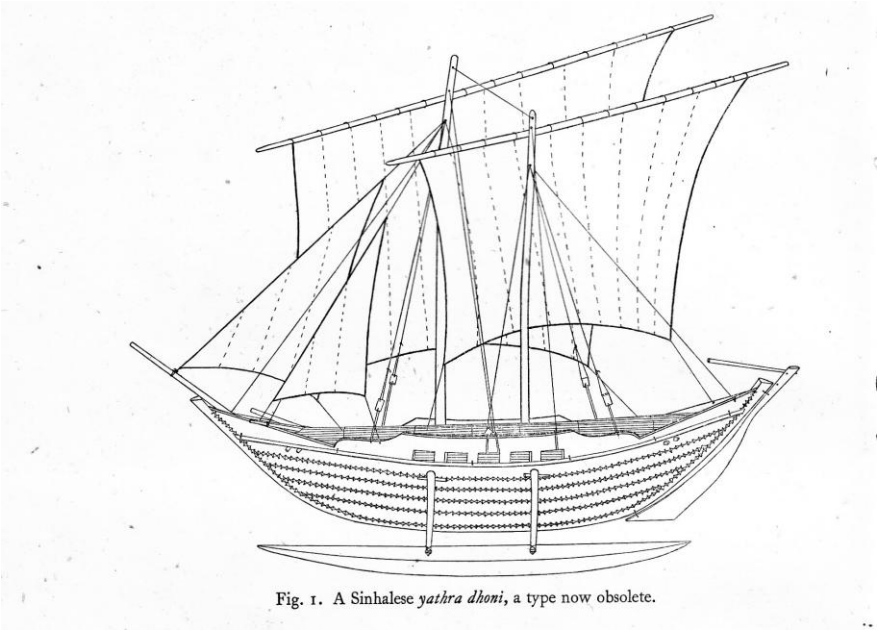


Fig. 1. A Sinhalese *yathra dhoni*, a type now obsolete.

Fig.8.40 Hornell's line drawing of a *yathra*

By some strange chance he seems not to have seen them but says the last of them were seen in 1903 and 1908, adding:

> "Their survival, or rather their presence on the Ceylon coast until recent years, is of great ethnological interest in view of the representation of ships related to the outrigger design among the sculptures on the great Buddhist shrine of Boro Budur in Java, dating back to between A.D. 750 and 900"

Paris (1841-3), has produced a much superior description and drawing than Hornell and added that this craft was common to both Sri Lanka and the Coromandel coast of India: he shows a rounded penthouse roof unlike the Sri Lankan ridged roof. All other details, however, tally.

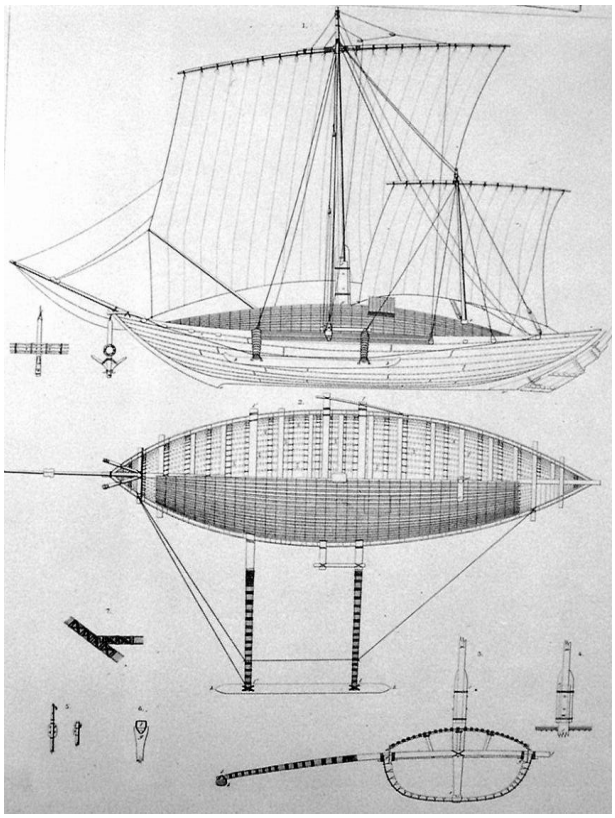


Fig.8.41 Paris' drawing of a *yathra*

There is also a published photograph of one, referred to by Lewis (1913) as a surviving type of a "Calpentyn Coaster".

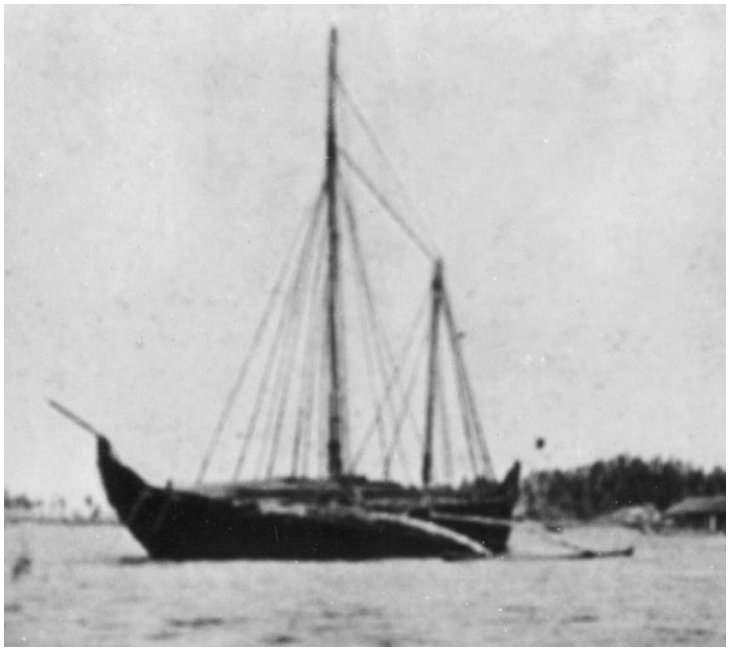


Fig.8.42 Lewis' "Calpentyn Coaster"

A much better photograph is found on the Internet: http:/www/images of Ceylon.com which shows a *yāthrā* beached (cf. Fig.15). Alwis (1936) describes the final voyage of the last of these ships:

> '…it seems as if it was yesterday that I saw the last schooner of Dodanduwa lying in the harbour. However the ship…left her native harbour for Hambantota never to return. That was in the year One-thousand nine-hundred and thirty.'

He goes on to relate the story of the wrecking of the craft off the Maldives and the rescue and return of the crew years later.

It is indeed puzzling how Hornell, who served in Ceylon, missed seeing these ships, though he has says that the very memory of these ships is passing away. On what sources he based his fine line drawing of the craft in profile is also unknown. He was also aware that the craft sailed up the eastern coast to India.

I was more fortunate than Hornell. Not only had I heard of the *yāthrā* from much written and oral evidence in Sinhala, but I had also heard of a very faithful large model of one in a Buddhist temple at Dodanduwa. The family of the senior monk, Ven. Dodanduve Dharmasena, had owned these vessels and the venerable monk had a considerable interest in ethnography, oral history, and archival matters. He had preserved the model in a glass case, as it had been built by his father while the latter was yet a child, around 1892, when it had been awarded a gold-medal at a Craft Exhibition. He allowed me to take it out of its case, photograph it and make notes. I was later able to persuade him to lend it to the National Museums for an Exhibition held in connection with the UNESCO Expedition of the Silk Routes of the Sea in 1990.

In 1992 I found the model yet with the Galle Maritime Museum. We had with us Tom Vosmer of the Western Australian Maritime Museum, a boat ethnographer and builder. Treating the model as a real ship – as he recognized that it was a faithful replica – he measured the model meticulously, and recognized that it, too, showed evidence of borrowings from several Indian Ocean technologies. (Vosmer:1993). (Note 11). The data was then computer

tested using “MacSurf” software for boat design and analysis. It was able to generate an acceptable hull shape based on the data given in the form of a table of offsets. The computer-generated pre-fit lines were worked on to manipulate the hull shape to the best fit of the original measurements. He was thus able to take the lines off, make detailed technical drawings and arrive at the sailing characteristics of the craft

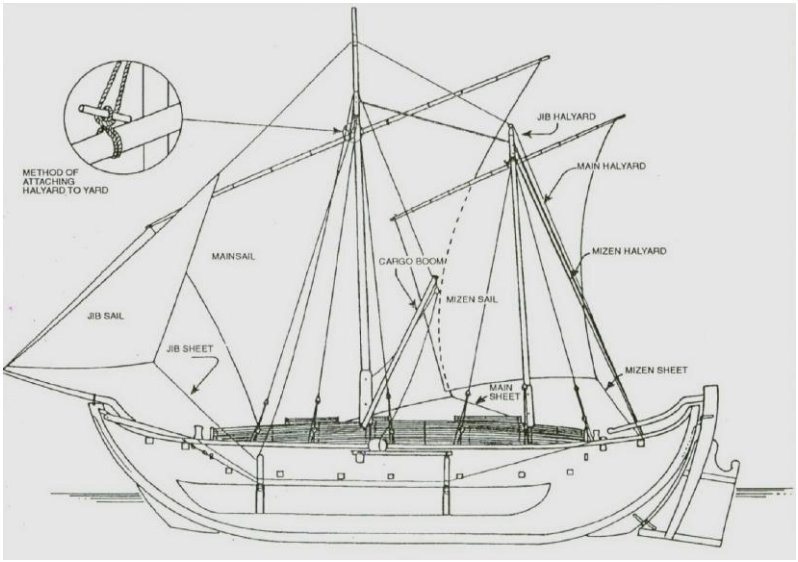


Fig.8.43 Lines taken off *yathra* model by Vosmer

The size of the model, now in the Colombo Musem, is 150 cm in length, 32 cm at the point of its greatest beam and 20 cm from keel to gunwale. Vosmer says the craft ranged in size from 50-60 ft. in length to 100 ft. according to his references. (Note: 12)

Among a host of features described by Vosmer the following are particularly relevant. The use of an outrigger, he comments, as ‘curious’ as the hull rig configuration is stable, with hydrostatic analysis showing the hull form to be seaworthy even without an outrigger. He describes the rig as common to the Indian subcontinent, it being ketch-rigged with square-headed lug sails and a jib set on a short bowsprit. He considers the rudder as ‘enormous by most standards’ and reminiscent of some on Chinese Junks and draws attention to a much narrower one shown in Hornell’s sketch. Concerning the cabin he notes that it is of a style common to Indonesian water. In Sri Lanka, roofs were either of ‘cadjan’ (woven coconut leaf) or split bamboo: Vosmer remarks the same practice prevailing in Indonesian waters. He also comments

on the hatches, with slightly raised coamings along their sides, being located on the starboard side. The cargo handling gear, however, is clearly located on the port side.

I have referred to the comments on the Cabin and Hatches to show the similarity to the Jaffna *thoni* and river/canal *pāru*: all three craft are large cargo carriers and the stowage arrangements are similar and Hornell's description of the layout of a *thoni* applies to all. None have any cabins: the thatched roof covered the entire cargo hold and the crew slept among the cargo whilst at sea. *Paru*, on the other hand, did not sail after dark but secured at a regular stop on the river bank and the crew slept ashore. The references to the rig, rudder and outrigger need more comment. In my searches I came upon two more *yathra* models. A photograph of the first one is available, in the London Science Museum. It shows a well-constructed model, which conforms to the model we studied. The other, (cf.Fig.19) which I examined at the Museum of Mankind ten years ago, is much more interesting and revealing. It is described as a "Cingalee model boat 'Yathrawa' or 'Dhoney', freight and passenger boat used between India and Ceylon". It had originally been presented to a Museum in 1854. It is a smaller craft, double-ended, showing sewing on the outside, with a mast amidships lashed to the main outrigger boom carrying a single square sail. In its present condition it appears undecked, and has no rudder: but two holes on the ship's side, aft, may have been for steering oars. (Fig. 44, a 2nd. Century BCE potsherd from Anuradhapura, shows a line drawing of a ship with such oars: but this cannot be considered supporting evidence.)

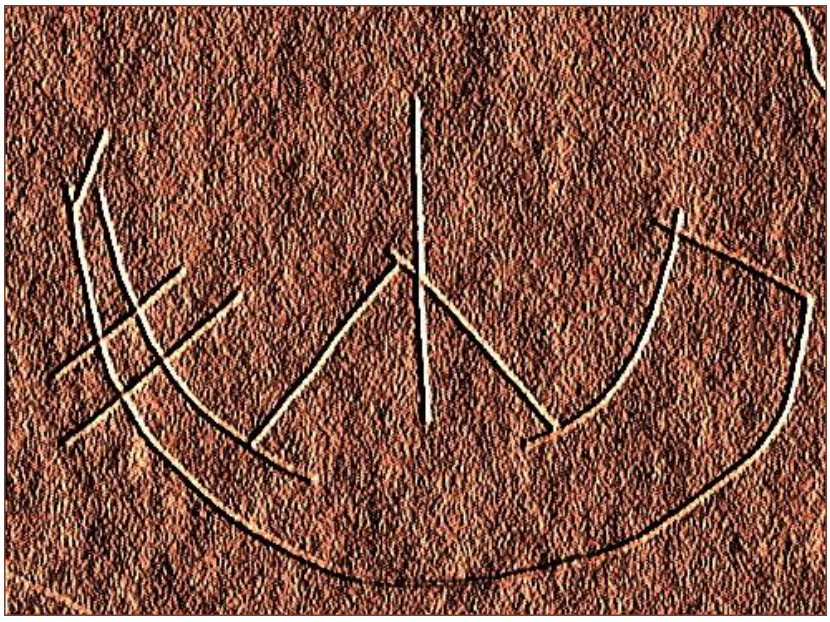


Fig.44. Potsherd showing ship with steering oars, aft.

If we accept that these holes in the hull of the model were be meant for steering oars, then it should follow that the craft had a fixed bow and stern. It had a single outrigger, slightly abaft of midships to starboard, (unlike in the Dodanduwa model, where it is to port) entering the hull below the gunwales and continuing across the breadth of the hull. The model is damaged and has a loose bundle of what looks like split-bamboo matting: probably the remains of the penthouse roof. This model is interesting as its rig is different from the Dodanduwa model and there is no fixed rudder. Like the Dodanduwa model its form is double-ended and, though it appears to have a fixed bow and stern, there is no skeg or gripe to reduce leeway and help in helm balance. From the presence of a fixed stern and the fact that outrigger is to starboard, the craft that this model represents did 'tack', and not 'change ends' as outrigger *oru* still do. It is likely that this model shows an earlier version of the *yāthrā* which survived into the 19th.century as a small craft.

Vosmer's detailed analysis is available in print. However his concluding remarks bear repetition, even though they may be open to question:

> "The *yathra* hull alone was found to be reasonably stable as indicated by the transverse GM and RM figures (Garrett, 1987). The addition of the outrigger, however, increased the righting moment (RM) by a factor of

approximately 100. It also, of course, added to the drag created and, therefore, (the) powering requirements of the vessel."

The *battal*

The *battal* is included in the list of Sri Lankan ocean-going vessels, not because it was ocean going but to illustrate the multitude of influences that touched Sri Lankan shipping. The craft is essentially of Indo-Arab form, about 50-60 ft. long, completely undecked, with a single forward raking mast carrying a huge sail on a boom hoisted by means of a sheave atop. It was in use among the Muslim villagers of Mutur, in Koddiyar Bay, just south of Trincomalee harbour. Till the mid-1970s they used to regularly ferry the rice harvest from Mutur to the Trincomalee Town pier and were seen daily.

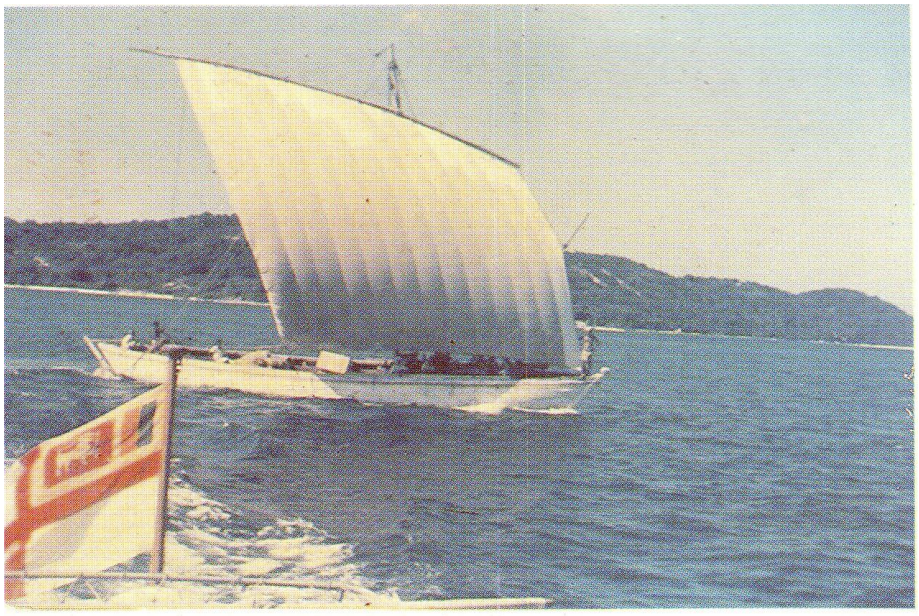


Fig.8.45 Trincomalee *battal*

By 1988, however, they had disappeared. The area of Mutur, has been noted as "Matura" in Ahmed bin Majid al Najdi's treatise (Tibbets: 1981). In the inner harbour of Trincomalee is a sheltered cove, presently marked as "Nicholson's cove" in Admiralty charts, which was the site of an Arab settlement about eight centuries ago. I had the good fortune to discover the burial ground and rescue some gravestones (Devendra: 1970, 1990 a, and 2009 c).

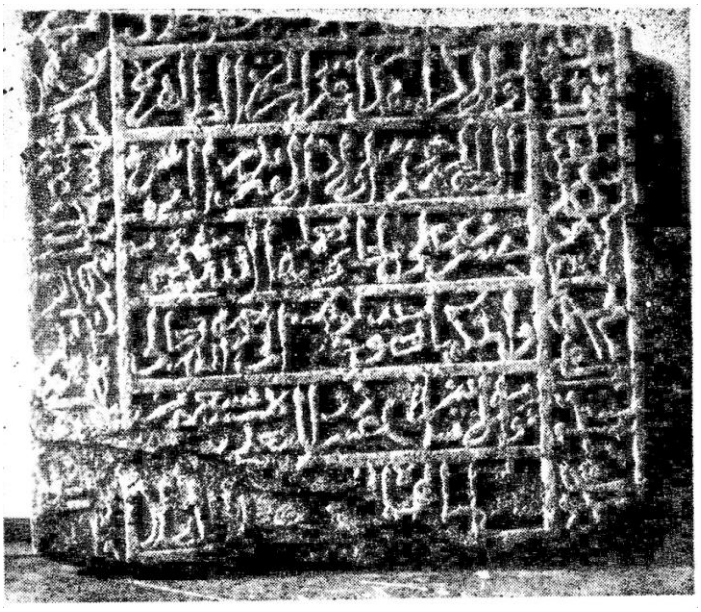


Fig.8.46 Arabic gravestone from Nicholson's Cove

On a later occasion, I identified and photographed an ancient well.

Fig.8.47 Ancient well from Nicholson's Cove

Unfortunately, I was too late on the field to study the craft themselves, which are no more. Lionel Cassons (1964) has a picture of an Arab *būm*, which is remarkably similar to the *battal*. I have only one photograph of a *battal* (cf Fig.8.45) and, if we take the man in the bows to be 5'4" in height, we can calculate that the vessel was 70 ft. from stem to stern and the boom was 42 ft. long. It was, indeed, an impressive vessel. With matters now more settled in Muttur, it is hoped that we can collect more data about this craft.

The *vattai / vattal.*

The *vattai* or *vattal* is the Jaffna version of the *battal*, as the name implies. These broad and beamy boats have the distinctive *surul* decoration and were generally painted a bright blue or green. The sail itself is smaller than the Mutur *battal* and lacks the massive boom, but there is a sheave atop the mast to raise and lower sail. Hornell (1943), who had seen many of this type in Jaffna, says these craft were in demand during the pearling season due to their broad beam, but gives us no idea of size.

A very well-made model is available at the London Science Museum, where its catalogue description is 'Jaffna Dhoni (c,1800). Rigged model.'

Fig.8.48 Model of a *vattai*

Edye (1833) was not very impressed with the craft although he gives a very good drawing of one.(Note 14) His photographs of the pearling fleet at anchor also gives an idea of the craft.

Parts 1, 2 and 3 of this paper summarize the results of my search into the form and structure of pre-modern Sri Lankan ships. The search led me in many more directions than I expected. Looking at the evidence I had gathered I was convinced that Sri Lanka had built and sailed its own ships: that the indigenous form, while undergoing change with the incorporation of adopted features, yet retained the base form of the dual element craft and that their

development had been, by and large, linear though being selectively influenced by exotic technologies.

I was also convinced that, while seafaring had been an ancient occupation, Sri Lanka could lay no claim to have been a major maritime power. She had been only another player in a multi-user maritime environment. By the time the Europeans arrived on the scene, our naval tradition had flowered and faded, with the highest levels of sophistication being reached in the twelfth to fourteenth centuries. Other Indian Ocean maritime nations also experienced this phenomenon. With the collapse of central power around the end of this period, ports and coastal areas came under the control of foreign merchants and mariners. The link with seafaring became tenuous and the "high" technology was reduced to a "folk" technology. Gunawardana (1986-87) expresses this very clearly:

> "Thus the traditions of shipbuilding of an era long past did survive right into modern times, but in a vitiated and diminished form. It is abundantly clear that an involution had set in, pushing back the level of naval technology in Sri Lanka to what it had been long before the eighth."

The country retained elements of ship design from all over the Indian Ocean which may have disappeared from the countries of their origin. Sri Lanka is thus a palimpsest: layer upon layer of development and adoption can be traced and it is, indeed here, that the search for the history of the ocean can well begin.

CONCLUDING REMARKS

Looking back and ahead

By the time I started on this paper, I had gained access to new material in the light of which I have had to revise some earlier conclusions. It now appears that the vernacular idiom was neither the only, nor even the dominant technology in pre-modern Sri Lanka. Certainly it is of great importance, as we can trace it from its beginnings to its finest flowering as an indigenous product:

showing that Toussaint (quoted at the beginning of Part 3), for one, had misdirected himself. The *yathra,* in fact, had reached the apogee of its development but it was a dead-end, from which nothing more sophisticated emerged – at least, from the evidence so far available. As a player in a multi-user maritime environment, could Sri Lanka have competed with Indian, Arab and Chinese ships with only a fleet of *yathras* which – to judge from their role in the last century – could not sail beyond India, the Maldives and Malacca? But compete she did and, thus, there must have been better, more seaworthy ships in the fleet, capable of extended voyages on a fairly regular basis. This is, I realize, argumentative: it calls for hard evidence in support of it.

I have, so far, not paid sufficient attention to the other ship types I have described above: ships that did not carry an outrigger. The *thoni* of Jaffna, the *battal* of Muttur, the shipbuilders (and sailors) of Velvettiturai – who preserved their skills while not building traditional craft – show us that there was an alternative model that developed alongside the *yathra.* This model, which belonged to the "hybrid technology" zone, was not purely Sri Lankan in form and design but the product of superimposing exotic features on the base form, or variations thereof: a process which has been recognized above. If freed from the umbilical cord that bound them to the outrigger *yathra* hulls could develop in any way required: into large craft like the *thoni* or smaller craft like the *battal/vattai*. Hornell (1920) makes a perspicacious comment, speaking of the sailing ships built in Velvettiturai.

> "The Sinhalese outrigger coaster or *yathra*..... shows a great family resemblance to the *padagu*; probably this Sinhalese type is the original of the latter, the great outrigger having been eliminated by the northerners as they passed the unskillful and timid stage of long voyage coasting wherein the Sinhalese still remain." (Emphasis mine)

Ships built in this atmosphere of technological freedom were, probably, those that formed the backbone of the Sri Lankan merchant fleet. Two sources have been quoted so far – al-Idrisi, and the letter of Bhuvanekabahu to the Caliph – referring to Sri Lanka building ships for export. It is difficult to believe

that *yathras* were the ships that are referred to: if an export market existed the product must have resembled ships in common use or, at least, that we were considered as having the skills to build such ships.

Does that mean that our pre-modern ships were like the *thoni*? Perhaps, but not necessarily so. Technologically the *yathra* could, at some point, have dropped the outrigger altogether, and developed along the same lines as other wooden ships. This is not a mere possibility, as Vosmer's computer simulation has already indicated that the *yathra* hull could sail well without an outrigger: the outrigger gave it greater stability but slowed it down, thereby making greater sail area necessary for greater power. In other words, a *yathra* hull without an outrigger would have sailed faster, with no further change to the hull or rigging. Given sailors' proclivity to adopting useful features from other craft (noted earlier) it is entirely feasible that at least some *yathra* builders opted to drop the outrigger while others continued to use it. A mind that could conceive of acquiring a fixed rudder and exchanging a dug-log keel for an axial beam would have been capable of contemplating such a step. Why, then, did only the *yathra* with the outrigger survive into the 20th.century while those without an outrigger disappear without a trace? Elsewhere (Devendra: 1995), writing on inland watercraft, I noted:

> "The disappearance, in the face of competition from cheaper and more readily available substitutes is the fate of the more sophisticated traditional craft, anywhere. In this country, faced with mechanization, the expansion of the road-rail network, the dwindling forest cover and the scarcity of timber (crucial to a logboat culture), early colonial regulation of the commercial use of 'native craft', etc., the more sophisticated craft succumbed early on…"

It is entirely feasible that, in the case of the *yathra*, too, the ships without outriggers – the more sophisticated craft – succumbed to these factors and that the *yathra* with the outrigger was able to carry on till 1930 or so, performing a limited role in a limited arena. The exploration of this line of thought is one of the tasks for the future

The next question that suggested itself is: did the art of seafaring survive only in Velvettiturai and Kayts? Again, perhaps; perhaps not. Baldeus gives an account of how the Dutch (in the 17th.century) assembled a fleet of warships in Koddiyar Bay (Trincomalee), captained by Sinhalese, which sailed into waters frequented by the Portuguese to harass their shipping. The names of the ships and the captain are revealing. Again, in the 18th.century, when the Dutch made a ship available to the King of Kandy for a diplomatic mission, one of the King's officials submitted a report on his return critical of Dutch seamanship. Thus while, by this time, the Kandyan kingdom had no seagoing capability, the knowledge of the craft had persisted. But we have no evidence that the craft of the deep-sea sailor persisted in the south of the island. As far as the north is concerned History tells us that, while the Jaffna kingdom came under colonial rule long before Kandy, Kandyan kings lost control over ships and seamen : and the sailors and fishermen of Jaffna never lost their link with seagoing. It is tempting to think that the Jaffna shipbuilders and seafarers forged a link "special relationship" with the Portuguese and Dutch masters and to neighbouring Tamilnadu, thus acquiring benefactors from both the government and non-government sectors and thereby ensuring their own survival, and that of their craft. The exploration of this line of thinking is the other task for the future.

In the south, however, the craft of the sailor, like the watercraft themselves survived, in a very modest form, only among the fishermen. Vitharana (1992) and Kapitan (2009) have already documented their craft and skills and more work will follow from that. And so, to these humble people, must go our thanks.

NOTES

1. "..(a) cargo boat on the Mosquito coast rivers was a *bateau,* built be cutting a large *pitpan* (punt ended flat bottomed logboat) lengthwise into two equal halves. Flat bottom boards were inserted, the two halves rejoined and then further planks inserted to raise the sides". (Roberts & Shackleton: 1983)

2. “Under the influence of the modern model, we tend to think of the ideal port as a largely enclosed expanse of deep water, suitable for the construction of quays alongside which ships were moored. This is a type evolved in north-western Europe, originally because of the heavy swells found there and the nature of the beaches…..In much of the Indian Ocean region…..the circumstances are different. The winds are comparatively moderate, steady and predictable…..The beaches, at least in the west…..have an almost flat foreshore below a steep, sandy beach. Boats can therefore be conveniently beached at high tide on the foreshore, unloaded onto men’s shoulders and carried up the beach when the tide recedes. Vessels are consequently built in a fashion to make such beaching possible. Quays and lighters are, in general unnecessary. Only when there is inadequate shelter is it necessary for ships to anchor and unload cargoes into small boats. Such adequate shelter is, however, available in long stretches of the coast…..provided either by a coral fringing reef or an off-shore island or an inlet or creek, or even by a headland, used on either side, according to the duration of the monsoon….”(Chittick:1980)

3. “The maritime laws and usages, which prevail amongst the Hindu and Mohammedan mariners and traders who frequent Ceylon, of which I made a complete collection while presiding in the Vice-Admiralty Court of that island, may be classed under four heads: First, those that carry on trade in small vessels between the coasts of Malabar, Coromandel, and the island of Ceylon; secondly, those which prevail amongst the Mohammedan mariners and traders of Arab descent between the coasts of Malabar, Coromandel and the island of Ceylon; thirdly, those which prevail amongst the Arab mariners and traders who carry on trade in very large vessels between the eastern coasts of Africa, Arabia, the Persian Gulf, and the island of Ceylon; fourthly, those which prevail amongst the Malay mariners who carry on trade between the coasts of Malacca, the eastern islands, and Ceylon.

“The first are in some degree modified by the tenets of the Hindu religion and by Hindu law. The second, the third, and the fourth are modified in a great degree by the tenets of the Mohammedan religion, and Mohammedan law.” (Johnstone:1827)

4. *Extract from Quaremère's "Mémoires sur l'Égypte", Volume II, p.284 (English translation)*

"The ambassador to the court of Egypt from the prince of Ceylon, King of India, was al-Háj Abú'Uthman who was accompanied by several others. According to them they had embarked on a Ceylon vessel and having touched at this Island came to the port of Hormuz, where they stayed ten days. They then went up the Persian Gulf and passing Basrah and Wásit came to Baghdad, then under the Persian Mongols. The ambassador having being admitted into the Sultan's presence presented a letter, which he said he had been written by his master's hand. It as enclosed in a gold box and wrapped up in some stuff resembling tuz (the inner bark of a tree), which was made, it was said from the bark of a palm. As no one could be found to read the letter, its contents were explained by the ambassador as follows:

> *Ceylon is Egypt and Egypt is Ceylon. I desire that an Egyptian ambassador accompany mine on his return and that another be sent to reside in the own of Aden……I have vessels, elephants, muslins and other stuffs, wood of baqam (Brazil wood), cinnamon, and all the objects of commerce, which are brought to you by the banian merchants. My kingdom produces trees, the wood of which is fit for making spears. If the Sultan asks me for twenty vessels yearly, I shall in a position to supply them……I have received an ambassador from the prince of Yemen, who is come on the part of his master to make me proposals of alliance. But I have sent him away through my affection for the Sultan……"*

M.Quaremère's "Histoire de Sultans Mamalouks", Translated from Maqrìzì, under the reign of al-Manşűr Sayf'd-dín Qaláún. (Volume II, Part 1. pp 59-60) gives the date of the embassy as AH 682 = April AD 1283. *(The King of Ceylon has, since, been identified as Bhuveneka Bahu I of Yapahuwa 1272-1284 CE)*

5. "….apart from the levying of such imposts as have been approved by the Maha-Pandithe, illegal imposts shall not be levied. To those coming from

foreign countries, means shall not be afforded to avoid the payment of imposts and duties that are due, which they do by establishing places of business, corrupting royal officers by means of presents and keeping with friends the merchandise smuggled from their own countries…'"(Paranavitana: 1953)

6. "…the foreigners should come and stay at Uratturai (Uratota), that they should be protected and that foreigners from many ports should come and gather at our ports; as we like elephants and horses, if the vessels bringing elephants and horses to us get wrecked, a fourth (share of the cargo) should be taken by the treasury and the (other) three parts should be left to the owner; if vessels with merchandise get wrecked, an exact half should be left to the owner…." (Indrapala: 1953)

7. "….gave the order without delay to make ready *ships of various kinds,* many hundreds in number. Now all the country round about the coast was one great workshop occupied with the building of the ships taken in hand. When within five months he had all the ships well built he assembled them…(at) Pallava-vanka…….he had provisions supplied for a whole year…..and abundant weapons of war such as armour……gokanna arrows…for defence against elephants, also different kinds of medicines preserved in cow-horns for dealing with venomous wounds caused by poisoned arrows…remedies for curing the poison of infected water…iron pincers for extracting iron arrow-heads, ….lastly also skilful physicians…" (*Emphasis in italics mine*) (Geiger: 1921)

8. "…in the roadstead there more than thirty sailing ships were lying. They were of Eastern rig, of Eastern build, and manned and owned by Eastern men; not a single European sailed on them in any capacity. Some had three masts and some only two, but all were sea-going ships, and between them they visited the coasts of far Arabia and the Persian Gulf, as well as the ports of India and Ceylon. Some, they told me, traded with the remote coral islands in the middle of the Indian Ocean. On the shore two stout ships were being built, and I went aboard one, and was shown around by the designer and head carpenter, a Tamil who knew no English: and as we talked to that well-

informed and practical man, it seemed to me that here was a short cut to archaeology…" (Still: 1930)

9. Prof. Sudarshan Seneviratna, commented in a personal communication, in 1987:

   'The symbol depicting a vessel carrying a *nandipada* (taurine) symbol at the helm of its mast is engraved along with an early Brahmi inscription at Duvegala in the Polonnaruwa District. The inscription records an endowment made by a Barata to the *Sangha*.

   'The *nandipada* symbol is commonly found on the Early Historic coins of South central Asia. The vessel symbol (without the *nandipada*) occurs on the Proto Historic Black and Red Ware of Peninsular India as a post-firing graffti mark. During the Early Historic period a similar symbol is found on the coins of the early Pandyas and the Andhra Satavahanas.

   'This type of vessel was used in the deltaic region of Peninsular India and it sailed along coastal sea-routes linking Peninsular India with Sri Lanka. It is known as the Negapattanam seven log – type boat and until recent times such vessels sailed between Negapattanam (in South India) and the north-west coast of Sri Lanka.

   'The Baratas (Paratavar) are known to the early inscriptions and the texts as merchant-mariners, who conducted a lucrative luxury trade linking coastal areas of Penensular India and Sri Lanka. Their trade items included horses, gems, salt, pearls, chank, spices and paddy. The Baratas were ship-owners and they are known to have controlled port-towns during the Early Historic period.'

10. "The larger type of schooner is of purely European design. It diverges in no detail from the small wooden schooners employed in English coasting trade in the nineteenth century except in one detail. No Jaffna schooner would be considered shipshape unless a row of imitation square black ports were painted along each side, simulating the appearance of the gun ports of Armed East Indiamen of the eighteenth century." (Hornell: 1943)

11. "The India built ships traded with U.K. and between June and August, 20 such ships took rice from India and returned with cargoes. Then the English builders and owners protested. Before a select committee (1814) of the House of Commons (Chaired by Sir Robert Peel), John Hillman a builder expressed that India built ships will kill their industry. 'An India built teak ship, after she had performed 6 cargoes is equal to one of ours after she has performed three' " (Gill: 1993)

12. Meenadchisundaram (2006) says that the last sailing ship built in Velvettiturai was the one at Figure 38. Names "Parvati Pattini" it could carry a cargo of 2700 sacks of one hundredweight each. The builder was S. Balasubramanian *mestri* and was owned by C.Cumarasamy. Muthkumarasami (1982), from whom these details have been obtained, gives the name of the *Tandal* (Master) of the vessel – T.Subramanium. The Blue Ensign (of Britain and her colonies) flown on the jackstaff indicates she had been registered as a merchant ship.

13. "The model examined and recorded appears to exhibit a hybrid of influences including, Arabian, Indian, local Sri Lankan traditions as well as Southeast and East Asian. As the model had been built by a boat-builder, it exhibited hallmarks of his care. For example, it was noted that the four hooked scarf joints in the keel-stem and stern-post were made exactly as they would have been on the real vessel. Other details were also done with attention to detail…In view of this attention to detail, it was thought the accuracy of the model, both in scale and detail would make a fairly reliable source for documentation." (Vosmer: 1993)

14. "The *yathra* are large outrigger craft, ranging to 100 ft (30m) in length but normally about 50-60 ft (15-18.3 m), carrying 25-75 tonnes of cargo usually averaging of 50 tons (Hornell 1943). Mukherjee mentions yathra *dhonis* as being about 60 ft. (18.3 m) in length with a beam of 15 ft (4.6 m). They are sewn craft, planked from domba (*Callophyllum inophyllum*), at least two inches thick (Vitharana, 1992:69). In recent

times (from 50-100 years ago to 1930) the *yathra dhoni* was used as a coastal trader and for voyages to India and the Maldives. However the type appears to be of ancient lineage, with Pliny (AD 23-79) reporting outrigger craft of large size west of Taprobane [Sri Lanka]……..

"The *yathra* can be described as double ended, with slack bilges but full mid-sections. The forward sections are only just slightly more fine than the aft sections, displaying a subtle hollow entry at the bows. The forefoot is extended forward by a gripe attached to the keel-stem and there is also a skeg aft to which the rudder is fitted. Both these devices would be aids to lateral stability, helping to reduce leeway and balancing the helm while sailing. It should be noted that at least one drawing of a *yathra* (Hornell, 1943:44) does not show these additions. The form of the hull shows affinities with ancient Arab and Indian craft illustrated by Paris (1841)" (*ibid*)

15. "'The single mast is stepped vertically, a little forward of midships. The rig is a short, broad lug, little removed from the original square sail. A rectangular two-sheave block is fitted horizontally on the masthead. Through one sheave hole runs the main halyard, man-handled without the assistance of any tackle; through the other peak is rove, running direct to the other end of the yard, where the end of a vang is also attached….This two-sheave pulley truck is a notable characteristic of these small *dhonis*….

'Whenever a pearly fishery is held in Ceylon waters, these local craft furnish the major part of the diving fleet; the divers like them best of all the craft available; their broad beam offers comfortable accommodation, the low freeboard facilitates diving operations and their light draft makes it easy to row them when the divers change their pitch in their search for a rich patch of oysters." (Hornell: 1943)

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Acknowledgements of photographs

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Kane, Herb Kawainui (1991."Voyagers", Washington)	Fig.6
Kapitan, Gerhard(2009)	Figs.6,7,8, 9, 10,11,14,.25,30
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